WenQuanYi Micro Hei [Scale=0.9]WenQuanYi Micro Hei Mono song-WenQuanYi Micro Hei sfWenQuanYi Micro Hei "zh" = 0pt plus 1pt

PaddleRec

Release 2.2.0

PaddlePaddle

Jun 29, 2022

ÉĄŹÇŻŐÈČŇÆŹŘ

- æžŘäžŐéčđæąĺçŤ§æĂĄçŽĎæŘIJçť ćæŐÍè■ŘæÍąåđŃ äÿĂçńŹåijŘåijĂçőśå■şçŤÍåůěåĚů
- éĂĆåŘĹåĹİå■ęèĂĚïijŇåijĂåŘŚèĂĚïijŇçăŤçľ űèĂĚçŽĎæŐÍè■Řçşżçż§åĚÍæţĄçÍŃèğčåEşæŰźæąĹ
- åŇĚåŘńåĘĚåőźçŘĘèğčãĂĄåŇźéĚ■ãĂĄåŘňåŻđãĂĄæŐŠåžŘãĂĄ
  åď Žäżżå Łąã ĂĄéĞ■æŐŠåžŘç■L'åď Žäÿłäżżå ŁąçŽĎåőŇæŢť æŐÍè■ŘæŘIJçť ćçőŮæşŢåžŞ

CHAPTER

ONE

ÆŐĹÈ■ŘÇŞŻÇŻ§ÈČŇÆŹŘÇ§ĚÈŘĘ

æIJňæŰĞæİĕæžŘäžŐäÿłæĂğåŇŰæŐĺè■ŘïijŇè£ŻèąŇäžĘèŁĆéĂĽ'ãĂĆ

æIJňæŰĞäžčçăĄçŻőå¡ŢåIJÍbook/recommender_system,åĹİæňąä¡£çŤÍèŕůæĆÍåŘĆèĂČBookæŰĞæąčä¡£

æŻť'åď'ŽæŢŹçÍŃåŘŁèČŇæŹŕç§ěèŕĘåŘŕäžěæ§ěéŸĚæůśåžęå■ęäźäåőđèůţåžŤçŤÍïijŽäÿłæĂğåŇŰæŐĺè■Ř

1.1 èČŇæŹŕäżŃçż■

åIJÍç¡ŚçżIJæŁĂæIJŕäÿ■æŰ■åŘŚåśŢåŠŇçŤţå■ŘåŢĘåŁąèğĎæĺąäÿ■æŰ■æĽ'ľåď'ğçŽĎèČŇæŹŕäÿŃïijŇåŢ SystemïijĽ'åžŤè£ŘèĂŇçŤ§ãĂĆ

äÿłæĂğåŇŰæŐĺè■Řçşżçż§æŸŕä£ąæĄŕè£Ğæżď'çşżçż§ïijĹInformation Filtering SystemïijĽçŽĎå■ŘéŻĘïijŇåőČåŘŕäżěçŤÍåIJÍå¿Ĺåď'ŽéĆĘå§§ïijŇąęĆçŤţå¡śãĂĄé§şäźŘãĂĄçŤţåŢĘåŠŇ Feed æţĄæŐĺè■Řç■Ľ'ãĂĆäÿłæĂğåŇŰæŐĺè■Řçşżçż§éĂŽè£ĞåĹĘæđŘãĂĄæŇŰæŐŸçŤÍæĹůèąŇäÿžïijŇåŘŚ

1994åźť'æŸŐåřijèŃŘè¿¿åď'ğå■ęæŐĺåĞžçŽĎGroupLensçşżçż§[*1*]äÿĂèĹňèćńèőď'äÿžæŸŕäÿłæĂğåŇŰæŐ

äijăçż§çŽĎäÿłæĂğåŇŰæŐĺè■Řçşżçż§æŰźæşŢäÿżèęĄæIJĽ'ïijŽ

- å■ŘåŘŇè£Ğæżď'æŐĺè■ŘïijĹCollaborative Filtering RecommendationïijĽ'ïijŽèŕěæŰźæşŢæŸŕåžŤçŤÍæIJĂåź£æşŽçŽĎæŁĂæIJŕäźŃäÿĂïijŇéIJĂèęĄæŤűéŻĘåŠŇåĹĘæđŘ ïijĹUser-BasedïijĽçŽĎæŐĺè■Ř[*1*] åŠŇå§žäžŐçĽ'ľåŞĄïijĹItem-BasedïijĽçŽĎæŐĺè■Ř[*2*]ãĂĆèŕěæŰźæşŢçŽĎäÿĂäÿłåĚşéŤőäijŸåŁ£æŸŕåőČäÿ■ä¿ÌèţŰäžŐæIJžåŹĺåŐž
- å§žäžŐåĘĚåőźè£Ğæżď'æŐĺè■Ř[*4*]ïijĹContent-based Filtering RecommendationïijĽ'ïijŽèŕěæŰźæşŢåĹ'çŤÍåŢĘåŞĄçŽĎåĘĚåőźæŘŕè£řïijŇæŁ¡èśąåĞžæIJĽ'æĎŘäźĽçŽĎçĽźå¿Ąïij
- çżĎåŘĹæŐĺè■Ř[*5*]ïijĹHybrid RecommendationïijĽ'ïijŽè£ŘçŤÍäÿ■åŘŇçŽĎè¿ŞåĚěåŠŇæŁĂæIJŕåĚśåŘ

è£ŚäžŻåźť'æİěïijŇæůśåžęå■ęäźäåIJÍå¿Ĺåď'ŽéĆĘå§§éČ¡åŘŰå¿ŮäžĘåůÍåď'ğçŽĎæĹŘåŁ§ãĂĆå■ęæIJŕçŢŇ

1.1.1 YouTubeçŽĎæůśåžęçěđçżŘç¡ŚçżIJäÿłæĂğåŇŰæŐĺè■Řçşżçż§

YouTubeæŸŕäÿŰçŢŇäÿŁæIJĂåď'ğçŽĎèğĘéćŚäÿŁäijăãĂĄåĹĘäžńåŠŇåŘŚçŐřç¡ŚçńŹïijŇYouTubeäÿłæ

åĂŹéĂĽçŤ§æĹŘç¡ŚçżIJïijĹCandidate Generation NetworkïijĽ

åĂŹéĂĽçŤ§æĹŘç¡ŚçżIJåřĘæŐĺè■ŘéŮőéćŸåżżæĺąäÿżäÿĂäÿłçśżåĹńæŢřæđĄåď ğçŽĎåď ŽçśżåĹĘçśżéŮ
tokensïijĽãĂĄäžżåŘčå■ęä£ąæĄŕïijĹåęĆåIJřçŘĘä¡■ç¡õãĂĄçŤĺæĹůçŹżå¡Ţèő¿åď ĞïijĽãĂĄäžŇåĂijçĽźå¿Ąï

éęŰåĚĹïijŇåřĘèğĆçIJŃåŐĘåŘšåŘŁæŘIJçť ćèŕ■èőřå¡Ţè£ŹçśżåŐĘåŘšä£ąæĄŕïijŇæŸäářĎäÿżåŘŚéĞŘåĚ
1]èŇČåŻť ãĂĆæŐěäÿŃæİěïijŇářĘæĽ ĂæIJĽçĽźå¿Ąèąĺçď žæŃijæŐěäÿżäÿĂäÿłåŘŚéĞŘïijŇåźűè¿ŞåĚěçżŹéĺ

æŐŠåžŘç¡ŚçżIJïijĹRanking NetworkïijĽ

æŐŠåžŘç¡ŚçżIJçŽĎçżŞæđĎçśżäijijäžŐåĂŹéĂĽçŤ§æĹŘç¡ŚçżIJïijŇä¡ĘæŸŕåőČçŽĎçŻőæăĞæŸŕåŕźåĂŹ
IDãĂĄäÿŁæňąèğĆçIJŃæŮűéŮť ç■Ľ ïijĽãĂĆè£ŹäžŻçĽźå¿ĄçŽĎåď ĎçŘĘæŰźåijŘåŠŇåĂŹéĂĽçŤ§æĹŘç¡Ś
logistic regressionïijĽ ïijŇáőČåŕźæĽ ĂæIJĽåĂŹéĂĽèğĘéćŚè£ŻèąŇæĽ ŞåĹĘïijŇäżŐéńŸåĹřåžŢæŐŠåžŘåŘŐ

1.1.2 èđ■åŘĹæŐĺè■ŘæĺąåđŃ

æIJňèŁĆäijŽä¡£çŤĺå■ůçğŕçěđçżŘç¡ŚçżIJïijĹConvolutional Neural Network-
sïijĽæİěå■ęäźäçŤţå¡śåŘ■çğŕçŽĎèąĺçď žãĂĆäÿŃéİćäijŽä¿İæňąäžŃçż■æŰĞæIJňå■ůçğŕçěđçżŘç¡ŚçżIJäżěåŘŁ

æŰĞæIJňå■ůçğŕçěđçżŘç¡ŚçżIJïijĹCNNïijĽ

å■ůçğŕçěđçżŘç¡ŚçżIJçżŘåÿÿçŤĺæİěåď ĎçŘĘåĚůæIJĽçśżäijijç¡Śæăijæ ŃŞæĽŚçżŞæđĎïijĹgrid-
like topologyïijĽçŽĎæŢřæ■őãĂĆä¿ŃåęĆïijŇåŻ¿åČŘåŘŕäžěèğĘäÿżäžŇçżť ç¡Śæăijç ŽĎåČŘçť ăçĆźïijŇèĞłçĎ

å■ůçğŕçěđçżŘç¡ŚçżIJäÿżèęĄçŤśå■ůçğŕïijĹconvolutionïijĽåŠŇæśåăŇŰïijĹpoolingïijĽæŞ■ä¡IJæđĎæĹŘ

1.2 åŘĆèĂČæŰĞçŇő

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CHAPTER

TWO

ÅĹĘÅŸČÅIJŔÆŮŚÅŽĘÅ■ĘÄŹĂÄŻŃÇŻ■

2.1 åĹĘåÿČåijŔèő■çżČæęĆè£ř

2.2 åďŽæIJžåďŽå■ąèő■çżČ

2.3 åŔĆæŢřæIJ■åŁąåŹĺèő■çżČ

CHAPTER

THREE

PADDLEREC ÅŁ§ÈČ¡ÄŻŃÇŻ■

3.1 æŐÍè■Řçşżçż§åĚÍæţĄçÍŃæÍąåđŃèęĘçŻŰ

1. åď■çŐřäžĘæŐÍè■Řçşżçż§çŽĎçżŘåĚÿæÍąåđŃïijŇåęĆdeepfmïijŇwide&deepç■Ľ
2. æŘŘä¿ŻäžĘåůěäÿŽçŢŇéłŇèřĄè£ĞçŽĎåőđçŤÍæÍąåđŃïijŇåęĆdnn, lr, dssm, mmoeç■ĽãĂĆ
3. èů§èÿłå■ęæIJŕçŢŇæIJĂæŰřèőžæŰĞæĹŘæđIJïijŇåęĆple, gatednnãĂĆ

3.2 åŁÍéİŹçżŞåŘĹïijŇæŰźä¿£å£ńéĂ§èřČçăŤåŠŇäÿŁçž£éČÍç¡š

æĹŚäžňæŘŘä¿ŻäžĘåŁÍæĂĄåŻ¿åŠŇéİŹæĂĄåŻ¿äÿď'çğ■èő■çżČæÍąåijŘ, æŐÍè■ŘçŤÍæĹůä¡£çŤÍåŁÍæĂĄåŻ¿å£ńéĂ§èřČçăŤïijŇä¡£çŤÍéİŹæĂĄåŻ¿æŘŘå■ĞæĂğèČ¡äÿŁçž£éČÍç¡šãĂĆ

æĹŚäžňæŘŘä¿ŻäžĘåŁÍéİŹäÿĂèĞť'çŽĎæÍąåđŃïijŇåIJÍæŕŘäÿłæÍąåđŃçŻőå¡ŢçŽĎnet.pyäÿ■ãĂĆåŁÍæĂĄ

åŁÍæĂĄåŻ¿çŽĎèő¿èőąæĂİèůŕåŠŇpythonäÿĂèĞť'ïijŇæŤŕæŇĄåőđæŮűæĽŞå■řåŠŇ

3.3 åď'Žçğ■åijĂåŘŚçŐŕåćČæŤŕæŇĄ

- linux/windows/mac
- python2.7.15/3.5/3.6/3.7, æŐÍè■Ří¡£çŤÍpython3.7
- cpu/gpu

3.4 çżŘåĚÿæŢřæ■őéŻĘ

åIJÍdatasetsçŻőå¡ŢäÿŃïijŇæĹŚäžňæŘŘä¿ŻäžĘçżŘåĚÿæŢřæ■őéŻĘçŽĎäżŃçż■åŠŇäÿŃè¡¡åŚ¡äżď'ïijŇæŮ

3.5 åĹĘåÿČåijŕèő■çżČ

æĹŚäżňæŤŕæŇĄåĹĘåÿČåijŕèő■çżČçŤĺäžŐçężçž£èő■çżČåŠŇäÿŁçž£

CHAPTER

FOUR

ÅŁĹÆĂĄÅŻ¿ÆĹĄÅIJŕÄŻŃÇŻ■

Paddle2.0çŽĎçL'źèL'šäźŃäÿĂæŸŕåŔŚåÿČåĚĹæŰřçŽĎåŁĹæĂĄåŻ¿èČ¡åŁŻ, PaddleRecæŐĹè■ŘæĹąåđŃåžŞäź§åŘŇæŮűæŤŕæŇĄäžĘåŁĹæĂĄåŻ¿æĹąåijŔ

4.1 å■şæŮűåŔ■éęĹïijŇå£ńéĂ§èřČçăŤ

çŻÿè¿ČäžŐäźŃåL'■éÍŹæĂĄåŻ¿çŽĎæŰźåijŔïijŇåŁĹæĂĄåŻ¿æŻť'åŁăçĄţæť'żåŠŇè¡żéĞŔåŇŰïijŇæŤŕæ

4.2 å£ńéĂ§ä¡£çŤĹåŁĹæĂĄåŻ¿

èő■çżČåŠŇéćĎæţŃçŽĎçŻÿåĚşéĚ■ç¡őåIJĹæŕŔäÿłæĹąåđŃæŰĞäżűäÿ■çŽĎconfig.yamläÿ■éĚ■ç¡őïijŇèŕęç

4.2.1 åŁĹæĂĄåŻ¿èő■çżČ

æŤŕæŇĄåIJĹäżżæĎŔçŻőå¡ŢäÿŃè£ŘèąŇ, äżěäÿŃåŚ¡äżď'éżŸèőď'åIJĹPaddleRecæăźçŻőå¡Ţäÿ■è£ŘèąŇ

```
python -u tools/trainer.py -m models/rank/dnn/config.yaml
```

åŁĹæĂĄåŻ¿èő■çżČçŽĎçŻÿåĚşäżčçăĄåIJĹtools/trainer.pyïijŇäžŇæňąåijĂåŔŚèĂĚåŔŕäżěåIJĹè£ŹäÿłæŰČ

4.2.2 åŁĹæĂĄåŻ¿éćĎæţŃ

```
python -u tools/infer.py -m models/rank/dnn/config.yaml
```

4.3 åŚ¡äżď'èąŇä£őæŤźéĚ■ç¡ő

æŤŕæŇĄåIJĹåŚ¡äżď'èąŇåŘŕåŁĹæŮűïijŇä¡£çŤĹåŚ¡äżď'äÿ■çŽĎâĂIJ-oâĂİåŔĆæŢřèřČæŢť'yamlæŰĞäżűäÿ■çŽĎéĚ■ç¡õăĆèŃěä¡£çŤĹåŚ¡äżď'äijäåŔĆäÿŐyamlæŰĞäżűæŇĞåőŽå

```
# æšąæIJL'éćİåd'Űä¡£çŤĺ"-o"åŘĆæŢřéĚ■ç¡őçŽĎæČĚåĘţäÿŃïijŇæŇL'çĚğconfig.
↪yamlæŰĞäżűçŽĎéĚ■ç¡őïijŇuse_
↪gpuåŘĆæŢřåĂijäÿžfalseïijŇåřĘä¡£çŤĺcpuè£ŘèąŇãĂĆ
# ä¡£çŤĺ"-o"åŘĆæŢřæŇĞåőžconfig.yamlæŰĞäżűäÿ■use_
↪gpuçŽĎåĂijäÿžtrueïijŇåŻääÿžåŚ¡äżd'èąŇäijäåŘĆçŽĎäijŸåĚĹçžğæŻt'éńŸïijŇåřĘä¡£çŤĺg
python -u tools/trainer.py -m models/rank/dnn/config.yaml -o runner.
↪use_gpu=true
python -u tools/infer.py -m models/rank/dnn/config.yaml -o runner.
↪use_gpu=true
```

CHAPTER

FIVE

ÉİŹÆĂĄÅŻ¿ÆĹĄÅIJŔÄŻŃÇŻ■

éİŹæĂĄåŻ¿çŻÿæŕŤåŁÍæĂĄåŻ¿æĂğèČ¡æŻť'åě¡ïijŇåĹĘåÿČåijŔèő■çżČçŽőåL'■åŘłæŤŕæŇĄéİŹæĂĄåŻ

5.1 å£ńéĂ§ä¡£çŤÍéİŹæĂĄåŻ¿

èő■çżČåŠŇéćĎæţŃçŽĎçŻÿåĚşéĚ■ç¡őåIJÍæŕŘäÿłæĹąåđŃæŰĞäżűäÿ■çŽĎconfig.yamläÿ■éĚ■ç¡őïijŇèŕęç

5.1.1 éİŹæĂĄåŻ¿èő■çżČ

æŤŕæŇĄåIJÍäżżæĎŘçŻőå¡ŢäÿŃè£ŘèąŇ, äżěäÿŃåŚ¡äżď'éżŸèőď'åIJÍPaddleRecæäźçŽőå¡Ţäÿ■è£ŘèąŇ

```
python -u tools/static_trainer.py -m models/rank/dnn/config.yaml
```

éİŹæĂĄåŻ¿èő■çżČçŽĎçŻÿåĚşäżčçăĄåIJÍtools/static_trainer.pyïijŇäžŇæňąåijĂåŘŚèĂĚåŘŕäżěåIJÍè£Źä

5.1.2 éİŹæĂĄåŻ¿éćĎæţŃ

```
python -u tools/static_infer.py -m models/rank/dnn/config.yaml
```

5.2 åŚ¡äżď'èąŇä£őæŤźéĚ■ç¡ő

æŤŕæŇĄåIJÍåŚ¡äżď'èąŇåŘŕåŁÍæŮűïijŇä¡£çŤÍåŚ¡äżď'äÿ■çŽĎâĂIJ-
oâĂİåŘĆæŢřèřČæŢť'yamlæŰĞäżűäÿ■çŽĎéĚ■ç¡õăĂĆèŃěä¡£çŤÍåŚ¡äżď'äijäåŘĆäÿŐyamlæŰĞäżűæŇĞåőŽå

```
# æšąæIJL'éćÍåď'Űä¡£çŤÍ"-o"åŘĆæŢřéĚ■ç¡õçŽĎæČĚåĘţäÿŃïijŇæŇL'çĚğconfig.
↪yamlæŰĞäżűçŽĎéĚ■ç¡õïijŇuse_
↪gpuåŘĆæŢřåĂijäÿžfalseïijŇåřĘä¡£çŤÍcpuè£ŘèąŇãĂĆ
# ä¡£çŤÍ"-o"åŘĆæŢřæŇĞåőŽconfig.yamlæŰĞäżűäÿ■use_
↪gpuçŽĎåĂijäÿžtrueïijŇåżääÿžåŚ¡äżď'èąŇäijäåŘĆçŽĎäijŸåĚÍçžğæŻt'éńŸïijŇåřĘä¡£çŤÍg
```

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(continued from previous page)

```
python -u tools/static_trainer.py -m models/rank/dnn/config.yaml -o␣
↪runner.use_gpu=true
python -u tools/static_infer.py -m models/rank/dnn/config.yaml -o␣
↪runner.use_gpu=true
```

CHAPTER

SIX

ÅĹĘÅŸČÅIJŔÆĹĄÅIJŔÄŻŃÇŻ■

å¡ŞæĹąåđŃãĂĄæŢřæ■őçŽĎèğĎæĹąè¿¿åĹřå■ŢæIJžèő■çżČçŽĎçŞűéćĹäźŃåŘŐïijŇåĹĘåÿČåijŔèő■çżČæ
GPUåď ŽæIJžèő■çżČïijŽåęĆæđIJæĆĹåÿŇæIJŻä¡£çŤĹGPUè£ŻèąŇåď ŽæIJžåď Žå■ąèő■çżČïijŇCollectiveæĹąå
GPUåŘĆæŢřæIJ■åŁąåŹĹïijĹGPUBoxïijL'ïijŽåęĆæđIJæĆĹçŽĎæŐĹè■Řäżżå Łąäÿ■çĹĂçŰŘåŘĆæŢřè¿Čåď ğïijŇ
CollectiveæĹąåijŘåIJĹæĂğèČ¡åŠŇæŸ¿å■ŸäÿŁæŮăæşŢæżąèűşèęĄæśĆæŮűïijŇæŐĹè■Řä¡£çŤĹæIJĂæŰřçŽĎC
æIJňæŢŹçĹŃèőšèğčåęĆä¡Ţä¡£çŤĹäżěäÿŁäÿL'çğ■æĹąåijŘïijŇåęĆæđIJæĆĹåÿŇæIJŻæůśåĚěå■ęäźăpaddleçŽĎåĹ

6.1 çL'ĹæIJňèęĄæśĆ

åIJĹçijŰåĘŹåĹĘåÿČåijŘèő■çżČçĹŃåžŘäźŃåL'■ïijŇçŤĹæĹůéIJĂèęĄçąőä£İåůšçżŘåőL'èčĚpaddlepaddle-2.0.0-rc-cpuæĹŰpaddlepaddle-2.0.0-rc-gpuåŘŁäżěäÿŁçL'ĹæIJňçŽĎéčđæąĺåijĂæžŘæąĘæđűãĂĆ

6.2 ParameterServeræĹąåijŘ

äÿžäžĘæŘŘénŸæĹąåđŃçŽĎèő■çżČæŢĹçŐĞïijŇåĹĘåÿČåijŘèő■çżČåžŤè£ŘèĂŃçŤ§ïijŇåĚűäÿ■å§žäžŐ

æäźæ■őåŘĆæŢřæŻťæŰřçŽĎæŰźåijŘäÿ■åŘŇïijŇåŘŕäżěåĹĘäÿžåŘŇæ■ě/åijĆæ■ě/GeoåijĆæ■ěäÿL'çğ■ï
èő■çżČèŁĆçĆźéČ¡äijŽåřĘæIJňåIJřçŽĎåŘĆæŢřèőąçőŮäÿĂæňąåůőåĂij(StepéŮťéŽŤåÿęæĺěçŽĎåŘĆæŢřåůő

åIJĹPaddleRecäÿŁä¡£çŤĹParameterServeræĹąåijŘåŘŕåŁĺåĹĘåÿČåijŘèő■çżČåŘłéIJĂäÿď æ■ěïijŽ

1. åIJĹyamléĚ■ç¡öäÿ■æůżåŁäåĹĘåÿČåijŘçŻÿåĚşçŽĎåŘĆæŢř
2. åĚşåőŽéIJĂèęĄä¡£çŤĹçŽĎèő■çżČèŁĆçĆźåŠŇæIJ■åŁąèŁĆçĆźæŢřéĞŘïijŇåźűåIJĹåŘŕåŁĺåŚ¡äżď äÿ■è¿

6.2.1 æůżåŁäyamléĚ■ç¡ő

ä¡£çŤĹParameterServeræĹąåijŘçŻÿè¿Čå■ŢæIJžæĹąåijŘéIJĂèęĄæůżåŁääÿĂäžŻçŻÿåĚşéĚ■ç¡öïijŇåIJĹæĹą
yamläÿ■æůżåŁäåęĆäÿŇåćđéĞŘéĚ■ç¡öïijŽ

```
runner:
    # éĂŽçŤĹéĚ■ç¡öäÿ■åĚ■èţŸè£řïijŇæČşäžĘèğčåŘŕæŞěçIJŃè£ŻéŸűæŢŹçĹŃ
    sync_mode: "async" # åŘŕéĂL', string: sync/async/geo
    geo_step: 400 # åŘŕéĂL', int,␣
↪åIJĹgeoæĹąåijŘäÿŃæŐğåĹűæIJňåIJřçŽĎè£■äżčæňąæŢř
```

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```
    split_file_list: False # åŘŕéĂL', bool,␣
↪èŃĕæŕŘäÿłèŁĆçĆźäÿŁéČ¡æŃĕæIJL'åĚĺéĞŘæŢŕæ■őïijŇåĹŹéIJĂèő¿ç¡őäÿžTrue
    thread_num: 1 # åd'Žçž£çĺŃéĚ■ç¡ő

    # readerçśżåđŃïijŇåĹĘåÿČåijŘäÿŃæŐĺè■ŘQueueDataset
    reader_type: "QueueDataset" # DataLoader / QueueDataset /␣
↪RecDataset
    pipe_command: "python benchmark_reader.py" # QueueDataset␣
↪æĺąåijŘäÿŃçŽĎæŢŕæ■őpipeåŚ¡äżd'
    dataset_debug: False # QueueDataset æĺąåijŘäÿŃ ProfileråijĂåĚş
```

6.2.2 å■ŢæIJžæĺąæŃ§åĹĘåÿČåijŘèő■çżČåŘŕåŁĺåŚ¡äżd'

åIJĺæšąæIJL'åd'ŽåŘŕæIJžåŹĺäźŃåL'■ïijŇåŘŕäżěä¡£çŤĺå■ŢæIJžæĺąæŃ§åĹĘåÿČåijŘæĺąåijŘïijŇä¡£çŤĺPar

```
fleetrun --worker_num=1 --server_num=1 tools/static_ps_trainer.py -
↪m models/rank/dnn/config.yaml
```

6.2.3 åĹĘåÿČåijŘèő■çżČåŘŕåŁĺåŚ¡äżd'

- éęŰåĚĹçąőä£ÌåŘĎäÿłèŁĆçĆźäźŃéŮť æŸŕèĄŤéĂŽçŽĎïijŇçŻÿäžŠäźŃéŮť éĂŽè£ĞIPåŘŕèő£éŮő
- åIJĺæŕŘäÿłèŁĆçĆźäÿŁéČ¡éIJĂèęĄæŃĄæIJL'äżčçăĄäÿŐæŢŕæ■ő
- åIJĺæŕŘäÿłèŁĆçĆźäÿŁæL'ğèąŇåęĆäÿŃåŚ¡äżd', äżěäÿŃåŚ¡äżd'éżŸèőd'åIJÍPaddleRecæäźçŻőå¡Ţäÿ■è£

```
fleetrun --workers="ip1:port1,ip2:port2...ipN:portN" --servers=
↪"ip1:port1,ip2:port2...ipN:portN" tools/static_ps_trainer.py -m␣
↪models/rank/dnn/config.yaml
```

6.3 CollectiveæĺąåijŘ

åęĆæđIJæĆĺåÿŇæIJŻåŘŕäżěåŘŇæŮűä¡£çŤĺåd'ŽåijăGPUïijŇå£ńéĂ§çŽĎèő■çżČæĆĺçŽĎæĺąåđŃïijŇåŘŕ
åIJÍPaddleRecäÿŁä¡£çŤĺCollectiveæĺąåijŘåŘŕåŁĺåĹĘåÿČåijŘèő■çżČéIJĂèęĄåŻŻæ■ěïijŽ

1. åIJÍyamléĚ■ç¡őäÿ■æůżåŁäåĹĘåÿČåijŘçŻÿåĚşçŽĎåŘĆæŢř
2. ä£őæŤźreaderåĹŠåĹĘæŢŕæ■őéŻĘ
3. åĘşåőŽéIJĂèęĄä¡£çŤĺçŽĎgpuå■ąæŢŕïijŇåźűèő¿ç¡őçŐŕåćČåŘŸéĞŘ
4. åIJĺåŘŕåŁĺåŚ¡äżd'äÿ■è¿ŞåĚěçŻÿåĚşéĚ■ç¡őïijŇåŘŕåŁĺèő■çżČ

6.3.1 æůżåŁăyamléĚ■ç¡ő

ä¡£çŤÍCollectiveæÍąåijŘçŻÿè¿Čå■ŢæIJžæÍąåijŘéIJĂèęĄæůżåŁääÿĂäžŻçŻÿåĚşéĚ■ç¡őïijŇéęŰåĚĹéIJĂè

```
runner:
  # éĂŽçŤĺéĚ■ç¡őäÿ■åĘ■ètŸè£ř
  ...
  # use fleet
  use_fleet: True
  use_gpu: True
```

6.3.2 ä£őæŤźreader

çŻőåL'■æĹŚäžňpaddlerecæÍąåđŃéżŸèőď'ä¡£çŤÍçŽĎreadereČ¡æŸŕçżğæL'£èĞłpaddle.io.IterableDatasetï paddle.io.DataLoader äÿ■ num_workers > 0 æŮűïijŇæŕŘäÿłå■Řè£ŻçÍŃéČ¡äijŽéĄ■åŐĘåĚĺéĞŘçŽĎæŢřæ■őé num_workers æňąïijŇäź§åřśæŸŕæŕŘåijäå■ąéČ¡äijŽèŐůå¿ŮåĚĺéČÍçŽĎæŢřæ■őãĂĆæĆĺåIJÍèő■çżČæŮűåŘŕèČ

6.3.3 å■ŢælJžåď'Žå■ąæÍąåijŘäÿŃæŇĞåőŽélJĂèęĄä¡£çŤÍçŽĎå■ąåŘů

åIJÍæšąæIJL'è£ŻèąŇèő¿ç¡őçŽĎæČĚåĘţäÿŃåřĘä¡£çŤÍå■ŢæIJžäÿŁæL'ĂæIJL'gpuå■ąãĂĆèŃěéIJĂèęĄæŇ CUDA_VISIBLE_DEVICES=0,1,2,3åĘ■æL'ğèąŇèő■çżČèĎŽæIJňå■şåŘŕãĂĆ

6.3.4 å■ŢælJžåď'Žå■ąèő■çżČåŘŕåŁÍåŚ¡äžď'

äÿŃéĺćäżěwide_deepæÍąåđŃäÿžä¿ŃïijŇåśŢçď'žåęĆä¡ŢåŘŕåŁÍèő■çżČ,æŤŕæŇĄåIJÍäżżæĎŘçŻőå¡ŢäÿŃè

```
# åŁÍæĂĄåŻ¿æL'ğèąŇèő■çżČ
python -m paddle.distributed.launch ../../../tools/trainer.py -m␣
↪config.yaml
# éĺŽæĂĄåŻ¿æL'ğèąŇèő■çżČ
python -m paddle.distributed.launch ../../../tools/static_trainer.
↪py -m config.yaml
```

æşÍæĎŘïijŽåIJÍä¡£çŤÍéĺŹæĂĄåŻ¿èő■çżČæŮűïijŇçąőä£ÌæÍąåđŃstatic_model.pyçÍŃåžŘäÿ■create_optim

```
def create_optimizer(self, strategy=None):
    optimizer = paddle.optimizer.Adam(learning_rate=self.learning_
↪rate, lazy_mode=True)
    # éĂŽè£ĞFleet␣
↪APIèŐůåŘŰåĹĘåÿČåijŘäijŸåŇŰåŹĺïijŇåřĘåŘĆæŢřäijäåĚěéčđæąÍçŽĎåŚžçąĂäijŸåŇŰåŹĺ
    if strategy != None:
        import paddle.distributed.fleet as fleet
        optimizer = fleet.distributed_optimizer(optimizer, strategy)
    optimizer.minimize(self._cost)
```

6.3.5 åďŽæIJžåďŽå■ąèő■çżČåŘŕåŁĺåŚ¡äžď

ä¡£çŤĺåď ŽæIJžåď ŽÅ■ąèő■çżČïijŇæĆĺéIJĂèęĄåŘęåď ŰäÿĂåŘřæĹŰåď ŽåŘřèČ¡åď §äžŠçŻÿpingéĂŽçŽ
2.0.0-rc-gpuåŘŁäžěäÿŁçL'ĹæIJňçŽĎéčđæąĺåijĂæžŘæąĘæđűïijŇåŘŇæŮűåřĘéIJĂèęĄè£ŘèąŇçŽĎpaddlerec

- éęŰåĚĹçąőä£ÍåŘĎäÿłèŁĆçĆźäźŇéŮť æŸŕèĄŤéĂŽçŽĎïijŇçŻÿäžŠäźŇéŮť éĂŽè£ĞIPåŘŕèő£éŮő
- åIJĺæŕŘäÿłèŁĆçĆźäÿŁéČ¡éIJĂèęĄæŇĄæIJL'äžčçăĄäÿŐæŢřæ■ő
- åIJĺæŕŘäÿłèŁĆçĆźäÿŁæL'ğèąŇåęĆäÿŇåŚ¡äžď äžŐå■ŢæIJžåď Žå■ąåĹřåď ŽæIJžåď Žå■ąèő■çżČïijŇåIJĺ

```
# åŁĺæĂĄåŻ¿
# åŁĺæĂĄåŻ¿æL'ğèąŇèő■çżČ
python -m paddle.distributed.launch --ips="xx.xx.xx.xx,yy.yy.yy.yy"␣
↪--gpus 0,1,2,3,4,5,6,7 ../../../tools/trainer.py -m config.yaml
# éĬŹæĂĄåŻ¿æL'ğèąŇèő■çżČ
python -m paddle.distributed.launch --ips="xx.xx.xx.xx,yy.yy.yy.yy"␣
↪--gpus 0,1,2,3,4,5,6,7 ../../../tools/static_trainer.py -m config.
↪yaml
```

6.4 GPUåŘĆæŢřæIJ■åŁąåŹĺ(GPUBox)æĺąåijŘ

åęĆæđIJæĆĺçŽĎæŐĺè■ŘäżżåŁąäÿ■çĺĂçŰŘåŘĆæŢřè¿Čåď ğïijŇä¡£çŤĺGPU Collectiveæĺąåij ŘåIJĺæĂğèČ¡åŠŇæŸ¿å■ŸäÿŁæŮäæşŢæżąèűşèęĄæśĆæŮűïijŇæŐĺè■Řä¡£çŤĺæIJĂæŰřçŽĎGPUåŘ

åIJĺPaddleRecäÿŁä¡£çŤĺGPUBoxæĺąåijŘåŘŕåŁĺåĹĘåÿČåijŘèő■çżČéIJĂèęĄäÿL'æ■ěïijŽ

1. åIJĺyamléĚ■ç¡őäÿ■æůżåŁäåĹĘåÿČåijŘçŻÿåĚşçŽĎåŘĆæŢř
2. ä£őæŤźreaderçśżåđŃ
3. ä£őæŤźç¡ŚçżIJä¡£çŤĺçŽĎembedding
4. åIJĺåŘŕåŁĺåŚ¡äżď äÿ■è¿ŞåĚěçŻÿåĚşéĚ■ç¡őïijŇåŘŕåŁĺèő■çżČ

6.4.1 æůżåŁäyamléĚ■ç¡ő

ä¡£çŤĺGPUBoxæĺąåijŘçŻÿè¿Čå■ŢæIJžæĺąåijŘéIJĂèęĄæůżåŁääÿĂäžŻçŻÿåĚşéĚ■ç¡őïijŇéęŰåĚĹéIJĂèę

```
runner:
  # éĂŽçŤĺéĚ■ç¡őäÿ■åĘ■ètŸè£ř
  ...
  # use fleet
  use_fleet: True
  use_gpu: True
  sync_mode: "gpubox"
```

6.4.2 ä£őæŤźreader

çŻőåĽ■GPUBoxæĺąåijŕäÿŃåŕłæŤŕæŇĄInmemoryDatasetæĺąåijŕïijŇæĆĺåŕŕäżěåIJĺyamléĚ■ç¡őäÿ■ä£ő

```
runner:
  # éĂŽçŤĺéĚ■ç¡őäÿ■åĘ■èţŸè£ř
  ...
  reader_type: "InmemoryDataset"
```

6.4.3 ä£őæŤźç¡ŚçżIJä¡£çŤĺçŽĎembedding

çŻőåĽ■GPUBoxæĺąåijŕä¡£çŤĺçŽĎembeddingæŐěåŕčäÿŐåĚűäżŰæĺąåijŕæŽĆäÿ■åĚijåőźïijŇåŻäæ■ď å

```
def forward(self, sparse_inputs, dense_inputs):

  sparse_embs = []
  for s_input in sparse_inputs:
      if self.sync_mode == "gpubox":
          emb = paddle.static.nn.sparse_embedding(
              input=s_input,
              size=[
                  self.sparse_feature_number, self.sparse_feature_
↪dim
              ],
              param_attr=paddle.ParamAttr(name="embedding"))
      else:
          emb = self.embedding(s_input)
      emb = paddle.reshape(emb, shape=[-1, self.sparse_feature_dim])
      sparse_embs.append(emb)

  # åĚűä¡ŹéČĺåĺĘçIJĄçŢě ....
```

6.4.4 GPUå■ŢæIJžåŘŕåŁĺåŚ¡äżď

äÿŃéİćäżědnnæĺąåđŃäÿžä¿ŃïijŇåśŢçď žåęĆä¡ŢåŘŕåŁĺèő■çżČ,æŤŕæŇĄåIJĺäżżæĎŔçŻőå¡ŢäÿŃè£ŘèąŇ

```
sh tools/run_gpubox.sh
```

åĚűäÿ■run_gpubox.shäÿ■éIJĂèęĄåĚşæşĺåźűèő¿ç¡őçŽĎåŔĆæŢŕæIJL'ïijŽ

```
# set free port if 29011 is occupied
export PADDLE_PSERVERS_IP_PORT_LIST="127.0.0.1:29011"
export PADDLE_PSERVER_PORT_ARRAY=(29011)

# set gpu numbers according to your device
export FLAGS_selected_gpus="0,1,2,3,4,5,6,7"
```

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```
# set your model yaml
SC="tools/static_gpubox_trainer.py -m models/rank/dnn/config_gpubox.
↪yaml"
```

CHAPTER

SEVEN

PADDLEREC ÈŤĄÇŇŐÄŻČÇĂĄ

æIJňçńääżŃçż■åęĆä¡ŢåijĂåŘŚåźűæŘŘäžď'äÿĂäÿłæÍąåđŃïijŇäżěåŁÍæĂĄåŻ¿äÿžä¿Ń

7.1 æŘŘäžď'æŰźåijŘ

PaddleRecåěŮäżűçŽĎåĞĘåĹŹå§žæIJňåŠŇäÿżPaddleçŽĎäÿĂèĞt'ïijŇèřůåŘĆèĂČåőŸç¡ŚæŰĞæąč

èřůä¡£çŤÍPre-commitéŠl'å■ŘïijŇåŘęåĹŹCIäżčçăĄæčĂæţŃäÿ■äijŽéĂŽè£ĞïijĄ

èřůä¡£çŤÍPre-commitéŠl'å■ŘïijŇåŘęåĹŹCIäżčçăĄæčĂæţŃäÿ■äijŽéĂŽè£ĞïijĄ

èřůä¡£çŤÍPre-commitéŠl'å■ŘïijŇåŘęåĹŹCIäżčçăĄæčĂæţŃäÿ■äijŽéĂŽè£ĞïijĄ

7.2 äżčçăĄéčŐæăij

PythonäżčçăĄéčŐæăijïijŇèřůåŘĆèĂČäÿżæţĄçŽĎåijĂæžŘéčŐæăijæŇĞå■Ů

7.3 æÍąåđŃçď'žä¿Ń

äÿĂäÿłåőŇæŢť'çŽĎæÍąåđŃçď'žä¿ŃèřůåŘĆèĂČMMoE

7.4 èő■çżČ/éćĎäijřæL'ğèąŇåŹÍ

éĂŽçŤÍçŽĎæL'ğèąŇåŹÍåIJÍtoolsçŻőå¡ŢäÿŃïijŇåĹĘåĹńåŕźåžŤtrainer.py/infer.py

Tips1: æIJL'äÿĂäžŻçL'źæőŁçŽĎåď'ĎçŘĘéĂżè¿ŚæĹŰèĂĚèřĎäijřæŰźæşŢïijŇåŘŕäżěåIJÍæÍąåđŃçŻőå¡Ţ

Tips2: åęĆæđIJæŸŕèĞłåůśçŽĎæL'ğèąŇåŹÍïijŇæŮěå£ŮèğĎèŇČèřůåŘĆèĂČéĂŽçŤÍæL'ğèąŇåŹÍãĂĆ

7.5 æÍąåđŃçŻőå¡Ţ

åĚůä¡ŞçŽĎæÍąåđŃçŻőå¡ŢåŘŰåĘşäžŐæÍąåđŃçŽĎåžŤçŤÍæŰźåŘŚïijŇæŕŤåęĆrank/recall/multitaskç■L'ï

Tips1: åęĆæđIJäÿ■çąőåőŽåIJÍåŞłäÿłçŻőå¡ŢçŽĎåŘŕäžěåĚĹæŇL'çĚğRankçŻőå¡ŢæŘŘäžd'PRïijŇåŘŐçż

Tips2: åęĆæIJL'æİąäžűåŘŕåŘŇæ■ěä£őæŤźéęŰéąţæÍąåđŃçŻőå¡ŢæŇĞåijŢ

7.6 æŰĞæąčReadme

åĚůä¡ŞèŕůåŘĆèĂČMMoE

éIJĂèęĄèĞşåřŚåŇĚåŘńæÍąåđŃäżŃçż■ïijŇè£ŘèąŇçŐŕåćČïijŇæŢřæ■őåd'ĎçŘĘïijŇå£ńéĂ§åijĂåğŃïijŇ

Tips1: åęĆæđIJæIJL'æİąäžűèŕůåŘŇæ■ěæůżåŁäèŃśæŰĞæŰĞæąčReadme_en.md

Tips2: æŰĞæąčå¿ĹéĞ■èęĄïijŇæŰĞæąčå¿ĹéĞ■èęĄïijŇæŰĞæąčå¿ĹéĞ■èęĄïijĄéĞ■èęĄçŽĎäžŃæČĚè

7.7 æŢřæ■ő

æăůä¿ŃæŢřæ■őçż§äÿĂäžěsample_dataåŚ¡åŘ■ïijŇåIJÍæÍąåđŃçŻőå¡ŢäÿŃéİćïijŇåŘłæŤŕæŇĄåřŘæăůæIJ

åĚÍéĞŘæŢřæ■őèŕůæŤ¿åĹřæäźçŻőå¡ŢäÿŃçŽĎdatasetçŻőå¡ŢïijŇèŕęçżĘèŕťæŸŐåŘĆèĂČè£ŹéĞŇ

Tips1: sample_dataéIJĂèęĄèűşåd'§åřŘïijŇåŘęåĹŹpre-commitäijŽæŁěæŰĞäžűåd'łåd'ğçŽĎéŤŹèŕŕ

Tips2: åĚÍéĞŘæŢřæ■őåęĆéIJĂèęĄå■ŸæŤ¿åIJÍäžŚçńŕïijŇåŘŕèĄŤçşżæĹŚäžň

7.8 æŢřæ■őèŕżåŘŰReader

PaddleRecåŕźäÿżæţĄçŽĎæŢřæ■őéŻĘæŘŘä¿ŻäžĘçŻÿåĚşçŽĎReaderèĎŽæIJňïijŇåŘŕåŘĆèĂČçŻÿåĚşæ
åd'■åĹűåĹřæÍąåđŃçŻőå¡ŢäÿŃ

åęĆéIJĂåijĂåŘŚèĞłåőŽäźL'ReaderïijŇèŕůåŘĆèĂČReader

7.9 æÍąåđŃçżĎç¡Śnet

èĂČèŹŚåĹřåŁĺéİŹçż§äÿĂçŽĎéIJĂæśĆïijŇæĹŚäžňåřĘæÍąåđŃçżĎç¡ŚçŽĎéĂżè¿ŚæŃĘåĹĘæĹŘäÿd'éČÍå
net.py åŠŇ dygraph_model.py(åŁĺæĂĄåŻ¿)

Tips1: æÍąåđŃæŰĞäžűåŘ■å£ĔéążæŸŕnet.pyåŠŇdygraph_model.py

7.9.1 net.py

éĞĞçŤÍClassæŰźåijŔïijŇåţŇåěŮåőŽäźL'æÍąåđŃïijŇClassçśżå£Ěéążçżğæ L'£paddle.nn.Layer

__init__æŰźæşŢåőŽäźL'åŔĆæŢřïijŇforwardæŰźæşŢåőŽäźL'åL'■åŘŚèőąçőŮéĂżè¿Ś

Tips1: åŕźäžŐæŢřçżĎåőŽäźL'èĂŇäÿ■æŸŕselfæŇĞåŘŚçŽĎåŔĆæŢřïijŇéIJĂèęĄæŸ¿çd'žéĂŽè£Ğadd_s

Tips2: çŤśäžŐnet.pyäÿ■æŸŕåŁÍæĂĄåŻ¿åŠŇéĺŹæĂĄåŻ¿éĂŽçŤÍçżĎç¡ŚïijŇæL'Ăäżěèę ĄæśĆä¡£çŤÍçŽĎ
åŘŇæŮűäÿ■èČ¡åĞžçŐŕfluid æŮğçŽĎå■Ůæăů

7.9.2 dygraph_model.py

dygraph_modelåŇĚåŘńäžĘæŢřæ■ŏfeedéĂżè¿ŚïijŇlossèőąçőŮéĂżè¿ŚïijŇäijŸåŇŰåŹÍåőŽäźL'éĂżè¿ŚåŚ

7.10 éĚ■ç¡ŏæŰĞäżűyaml

äÿžäžĘæŻť'æŰźä¿£çŽĎå£ńéĂ§è£ŘèąŇåŠŇåőđçŐřèőžæŰĞçš¿åžęïijŇæĹŚäżňèęĄæśĆéIJĂèęĄæŘŘä¿Ż

yamlçŽĎèŕęçżĘéĚ■ç¡ŏèŕť'æŸŐèŕůåŘĆèĂČconfig.yamléĚ■ç¡ŏèŕť'æŸŐ

Tips1: config_bigdataäÿ■çŽĎæŢřæ■ŏèůŕå¿ĎèŕůéĚ■ç¡ŏdatasetçŽĎçŻÿåŕźèůŕå¿ĎïijŇæŰźä¿£äÿĂéŤŏæL'

7.11 FAQ

CHAPTER

EIGHT

ÈĞŁåŐŽäźĽ'READER

8.1 PaddleRecæŢřæ■őæŤŕæŇĄæŰźåijŔ

8.1.1 åőŽéŢ£æŢřæ■ő

åęĆäÿŃäÿď'æİąæŢřæ■őèąĺçď'žåőŽéŢ£æŢřæ■őïijŇ4äÿłå§§(label, sparse1, sparse2, dense1)çŽĎéŢ£åžęåĹĘåĹńæŸŕåŻžåőŽçŽĎ1,2,1,3

```
line1: label:1 sparse1:2 sparse1:3 sparse2:100 dense1:2.1 dense1:5.
↪8 dense1:8.9
line2: label:0 sparse1:78 sparse1:89 sparse2:999 dense1:0.␣
↪dense1:8.8 dense1:7.8
```

åŕźäžŐåőŽéŢ£æŢřæ■ő(æŕŔäÿłçL'źå¿ĄçŽĎèąĺçď'žæŸŕåŻžåőŽéŢ£åžę)ïijŇåŁĺæĂĄåŻ¿æĺąåijŔåŠŇéĺŹæ

8.1.2 åŔŸéŢ£æŢřæ■ő

åęĆäÿŃæL'Ăçď'žïijŇåŕźäžŐsparse1çŽĎéŢ£åžęäÿ■æŸŕåŻžåőŽçŽĎïijŇåÿÿèğĄäžŐsparseçL'źå¿Ąå§§ïijŇ

```
line1: label:1 sparse1:2 sparse1:3 sparse2:100 dense1:2.1 dense1:5.
↪8 dense1:8.9
line2: label:0 sparse1:78 sparse2:999  dense1:0.0 dense1:8.8␣
↪dense1:7.8
```

åŕźäžŐåŔŸéŢ£æŢřæ■őïijŇäÿĂçğ■æŰźæşŢæŸŕæŸŕéĂŽè£ĞpaddingçŽĎæŰźåijŔèąěé¡ŘæĹŘåőŽéŢ£ïij

çŤśäžŐæŐĺè■Řçşżçż§äÿ■çŽĎåŔŸéŢ£æŢřæ■őå¿ĹåÿÿèğĄïijŇpaddingçŽĎæŰźåijŔäijŽåŕijèĞť'çš¿åžęåŠ

8.2 èĞłåőŽäźĽReaderåőđçŐř

æĹŚäżňæŔŘä¿ŻäžĘäÿď'çğ■ReaderæİěèŕżåŔŰèĞłåőŽäźĽçŽĎæŢřæ■őæŰźåijŔïijŇDataLoaderåŠŇQueu

éżŸèőď'æŸŕDataLoaderæĺąåijŔïijŇåŔŕäžěåIJĺrunner.reader_typeåőŽäźĽäÿď'çğ■æĺąåijŔ:âĂİDataLoader

8.2.1 DataLoader

æĹŚäžňäžěäÿŃéİć10æİąæăůæIJňçżĎæĹŘçŽĎçőĂå■ŢæŢřæ■őéŻĘdata/test.txtäÿžä¿ŃïijŇäžŃçż■åęĆä¡Ţ

```
line1: label:1 sparse1:2 sparse1:3 sparse2:100 dense1:2.1 dense1:5.
↪8 dense1:8.9
line2: label:0 sparse1:78 sparse1:89 sparse2:999 dense1:0.0␣
↪dense1:8.8 dense1:7.8
line3: label:1 sparse1:2 sparse1:3 sparse2:100 dense1:2.1 dense1:5.
↪8 dense1:8.9
line4: label:0 sparse1:78 sparse1:89 sparse2:999 dense1:0.0␣
↪dense1:8.8 dense1:7.8
...
line10: label:0 sparse1:78 sparse1:89 sparse2:999 dense1:0.0␣
↪dense1:8.8 dense1:7.8
```

åŘĆçĚğmodels/rank/dnn çŻőå¡ŢäÿŃçŽĎcriteo_reader.pyçŽĎåőđçŐřæŰźåijŘ

ä£őæŤźxx_reader.py

çŤĺæĹůåŘłéIJĂèęĄä£őæŤźclass RecDatasetäÿ■çŽĎ__iter__åĞ¡æŢř, éĂŽè£ĞpythonèĞłåÿęçŽĎyieldæŰźåijŘè¿ŞåĞžæŕŘæİąæŢřæ■őïijŃçŻőåĽ■æŐĺè■Řä¡£çŤĺnumpyæăijåijŘè¿Ş

äžěline1äÿžä¿Ń æăźæ■őèĞłåőŽäźĽåĞ¡æŢř, åőđçŐřåŕź4äÿłçĽźå¿Ąå§§çŽĎåĹĘåĹńè¿ŞåĞž, yieldçŽĎæăijåijŘæŤŕæŇĄlistãĂĆ

```
yield [numpy.array([1]), numpy.array([2, 3]), numpy.array([100]),␣
↪numpy.array([2.1,5.8,8.9])]
```

Tips1: çŻőåĽ■çŽĎclasså£Ěéążå Ś¡åŘ■äÿžRecDataset, çŤĺæĹůåŘłéIJĂèęĄä£őæŤź__iter__åĞ¡æŢř

Tips2: èřČèŕŢè£ĞçĺŃäÿ■åŘŕäžěçŻťæŐěprint, å£ńéĂ§èřČçăŤ

ä£őæŤźconfig.yaml

èŕęçżEçŽĎyamlæăijåijŘåŘŕäžěåŘĆèĂČè£ŻéŸűæŢŹçĺŃçŽĎyamlæŰĞæąč

yamläÿ■çŽĎrunner.train_reader_path äÿžèő■çżČéŸűæőţçŽĎreaderèůŕå¿Ď

Tips: importlibæăijåijŘ, åęĆtest_reader.pyïijŇåĹŹåĘŹäÿžtrain_reader_path: âĂIJtest_readerâĂİ

8.2.2 QueueDataset

QueueDatasetéĂĆçŤĺäžŐéİŹæĂĄåŻ¿åŕźæĂğèČ¡èęĄæśĆçĽźåĹńéńŸçŽĎäżżåŁąïijŇéİćåŘŚåď ğèğĎæĺą

ä£őæŤźxx_reader.py

åŘĆçĚğmodels/rank/dnn çŻőå¡ŢäÿŃçŽĎqueuedataset_reader.py, çŤÍæĹůéIJĂèęĄä£őæŤźåĞ¡æŢřgenerate_sample

Tips: yieldè£ŤåŻđçŽĎdictçŽĎåžŘåĹŮéIJĂèęĄåŠŇstatic_model.pyäÿ■åőŽäźĽçŽĎcreate_feedsè£ŤåŻđ

ä£őæŤźconfig.yaml

åŘĆçĚğmodels/rank/config_queuedataset.yaml, éIJĂèęĄåřĘrunner.reader_typeä£őæŤźäÿžâĂİQueueDatasetâĂİ, åŘŇæŮűpipe_commandä£őæŤźäÿžâĂİpythonxx_reader.pyâĂİ

Tips: pipe_commandçŽĎæĽğèąŇåŚ¡äżď'éżŸèőď'æŸŕåIJÍconfig.yamlåŕźåžŤçŽĎçŻőå¡ŢäÿŃæĽğèąŇ

CHAPTER

NINE

ÈĞŁÅŐŽÄŹĽÆĹĄÅĐŃ

9.1 åŁÍæĂĄåŻ¿æÍąåđŃ

Tips1: å£ĚéążåIJÍæÍąåđŃçŻőå¡ŢåőđçŐřdygraph_model.pyäÿ■çŽĎclass DygraphModelïijŇäÿ■èČ¡æŻťæŤźpyæŰĞäżűåŘ■äź§äÿ■èČ¡æŻťæŤźclassçśżåŘ■ãĂĆ

Tips2: å£ĚéążåőđçŐřæŰźæşŢcreate_model, create_optimizer, create_metrics, train_forward, infer_forwardãĂĆ

Tips3: create_feedsåŠŇcreate_lossçŤśtrain_forwardåŠŇinfer_forwardåĘĚéČÍèřČçŤÍïijŇåŕŕäżěèĞłåőŽä

9.1.1 create_model

è£ŤåŻđæÍąåđŃçŽĎclass, äÿĂèĹňæŸŕèřČçŤÍnet.pyäÿ■åőŽäźĽçŽĎçżĎç¡ŚãĂĆ

9.1.2 create_feeds

èğčæđŘbatch_data, è£ŤåŻđpaddleçŽĎtensoræäijåijŔïijŇåIJÍdataloaderäÿ■yieldæŸŕäÿĂæİąæŢřæ■őïijŇa

Tips: åŻääÿžåŁÍæĂĄåŻ¿äÿ■éIJĂèęĄå■ää¡■çňędata, è£ŹéĞŇåőđéŹĚè£ŤåŻđçŽĎåřśæŸŕæÍąåđŃçŽĎè¿Ş

9.1.3 create_loss

çŤśäžŐéĞĞçŤÍäžĘåŁÍéİŹäÿĂèĞťçŽĎèő¿èőąçŘĘå£ţåŠŇæŰźä¿£èőąçőŮæŇĞæăĞçŽĎçŃňçńŃïijŇåřĘlo

9.1.4 create_optimizer

åőŽäźĽäijŸåŇŰåŹÍ, è£ŹéĞŇçŤśçŤÍæĹůèĞłåőŽäźĽäijŸåŇŰåŹÍãĂĆ

9.1.5 create_metrics

åőŽäźĽèŕĎäijřæŇĞæăĞïijŇè£ŤåŻđæĽŞå■řçŽĎkeyåĂijåŠŇåčřæŸŐçŽĎæŇĞæăĞ

Tips: è£ŤåŻđçŽĎæŇĞæăĞå£ĚéążæŸŕpaddle.metricäÿ■çŽĎæŇĞæăĞ

9.1.6 train_forward

èĞłåőŽäźĽèő■çżČéŸűæőţïijŇäÿĂèĹňåŇĚåŘńæŢřæ■őèŕżåĚěïijŇèőąçőŮlossæ■§åď śïijŇæŻť æŰřæŇĞa

Tips: è£ŤåŻđ3äÿłåĂijïijŇçňňäÿĂäÿłå£ĚéążæŸŕloss, çňňäžŇäÿłæŸŕmetric_listïijŇåŘŕäżěäÿžçľžlistãĂĆçňňäÿĽäÿłæŸŕæČşéŮť éŽŤæĽŞå■řçŽĎtensor dict, åŘŕäżěè£ŤåŻđNoneãĂĆ

9.1.7 infer_forward

éŹď ažĘäÿ■è£ŤåŻđlossäźŃåď ŰåĚűäżŰåŠŇtrain_forwardçŻÿåŘŇïijŇæŤŕæŇĄåŠŇtrainéŸűæőţäÿ■åŘŇ

9.2 éİŹæĂĄåŻ¿æĺąåđŃ

Tips1: å£ĚéążåIJĺæĺąåđŃçŻőå¡ŢåőđçŐřstatic_model.pyäÿ■çŽĎclass StaticModelïijŇäÿ■èČ¡æŻť æŤźpyæŰĞäżűåŘ■äź§äÿ■èČ¡æŻť æŤźclassçśżåŘ■ãĂĆ

Tips2: å£ĚéążåőđçŐřæŰźæşŢcreate_feeds, net, infer_net, create_optimizer

9.2.1 create_feeds

éİŹæĂĄåŻ¿éĞĞçŤĺgraphçżŞæđĎïijŇéIJĂèęĄçŤĺpaddle.static.dataä¡IJäÿžæŢřæ■őçŽĎå■ăä¡■çňęãĂĆ

Tips1: è£ŤåŻđçŽĎfeed_listçŽĎéążåžŘå£ĚéążåŠŇreaderäÿ■yieldçŽĎæŢřæ■őä£ĺæŇĄäÿĂèĞť ãĂĆ

Tips2: åŘŸéŢ£æŢřæ■őåŘŕäżěçŤĺlod_level=1èąĺçď žïijŇåĚůä¡ŞåŘŕåŘĆèĂČmodels/rank/dnn/static_mod

9.2.2 net

èő■çżČçżĎç¡ŚïijŇèŕůæşĺæĎŘè£ŤåŻđçŽĎæŸŕdict, éŮť éŽŤæĽŞå■řãĂĆ keyæŸŕæĽŞå■řçŽĎåŘ■çğřïijŇvalueæŸŕåŕźåžŤçŽĎåŘŸéĞŘïijŇ

9.2.3 infer_net

éćĎæţŃçżĎç¡ŚïijŇåęĆèŃěåŠŇèő■çżČçżĎç¡ŚçśżäijijïijŇåŘŕèřČçŤĺnetéČĺåĹĘãĂĆ

CHAPTER

TEN

PADDLEREC CONFIG.YAMLÉĚ■Ç¡ŐÈŘŤÆŸŐ

ç˙ŽőåĽ■æŤŕæŇĄrunneråŠŇhyper_parametersçŽĎèŕżåŘŰãĂĆ

10.1 runneråŘŸéĞŘ

10.2 hyper_parametersåŘŸéĞŘ

| åŘ■çğř | çśżåđŃ | åŘŰåĂij | æŸŕåŘęå£Ěéąż | ä¡IJçŤÍæŘŔè£ř | | :âĂŤâĂŤâĂŤâĂŤâĂŤâĂŤâĂŤ: | :âĂŤ-: | :âĂŤâĂŤâĂŤâĂŤ–: | :âĂŤâĂŤ: | :âĂŤâĂŤâĂŤâĂŤâĂŤâĂŤâĂŤâĂŤ-: | | optimizer.class | string | SGD/Adam/Adagrad | æŸŕ | æŇĞåőŽäijŸåŇŰåŹÍçśżåđŃ | | optimizer.learning_rate | float | > 0 | åŘę | æŇĞåőŽå■ęäźăçŐĞ | | reg | float | > 0 | åŘę | L2æ■čåĹŹåŇŰåŘĆæŢřïijŇåŘłåIJÍSGDäÿŃçŤ§æŢĹ | | others | / | / | / | çŤśåŘĎäÿłæÍąåđŃçżĎç¡ŚçŃňçńŃæŇĞåőŽ |

CHAPTER

ELEVEN

ÅŔŕŘèĞĘåŇŰåŁ§èČ¡ÄŻŃÇŻ■

PaddleRecéĂŽè£ĞéčđæąĺçŤ§æĂĄçŽĎåŕŕèğĘåŇŰåĹĘæđŘåůěåĚůVisualDLïijŇæŤŕæŇĄåřĘèő■çżČçŽ

11.1 åŔŕèğĘåŇŰåŁ§èČ¡çŽĎä¿ìèţŰ

åŔŕèğĘåŇŰåŁ§èČ¡ä¿ìèţŰéčđæąĺçŤ§æĂĄçŽĎåŕŕèğĘåŇŰåĹĘæđŘåůěåĚůVisualDLåőŇæĹŘïijŇåęĆæđ

```
python -m pip install visualdl -i https://mirror.baidu.com/pypi/
↪simple
```

11.2 åijĂåŘŕåŔŕèğĘåŇŰåŁ§èČ¡

1. åIJĺåŘĎæĺąåđŃçŽĎyamléĚ■ç¡őæŰĞäżűäÿ■ïijŇrunneréąźäÿŃæůżåŁăæŰřçŽĎåŔĆæŢřâĂIJuse_visual
2. åIJĺæĺąåđŃçŽĎdygraph_model.pyæŰĞäżűäÿ■ïijŇåŔŕäżěéĂŽè£Ğtrain_forwardåĞ¡æŢřçŽĎmetrics_lis
   print_dictäÿď äÿłè£ŤåŻđåĂijæĺěè¿ŞåĞżåŁĺæĂĄåŻ¿è£ŘèąŇæŰűæĆĺéIJĂèęĄæĽŞå■řçŽĎæŇĞæăĞæĹ
3. æĆĺåŔŕäżěæ■čåÿÿçŽĎèő■çżČæĺąåđŃ
4. åŘŕåŁĺVisualDLéĺćæĺ£ïijŇæIJĽäÿĂäÿŃäÿď çğ■æŰźæşŢä¿ŻæĆĺéĂĽæŃľïijŽ

ä¡£çŤĺåŚ¡äżď èąŇåŘŕåŁĺVisualDLéĺćæĺ£ïijŇåŚ¡äżď æăijåijŔåęĆäÿŃïijŽ

```
visualdl --logdir <dir_1, dir_2, ... , dir_n> --model <model_file> -
↪-host <host> --port <port> --cache-timeout <cache_timeout> --
↪language <language> --public-path <public_path> --api-only
```

åŔĆæŢřèŕęæČĚïijŽ

ä¡£çŤĺPythonèĎŽæIJňåŘŕåŁĺVisualDLéĺćæĺ£ïijŇæŐěåŔčåęĆäÿŃïijŽ

```
visualdl.server.app.run(logdir,
                        model="path/to/model",
                        host="127.0.0.1",
                        port=8080,
                        cache_timeout=20,
```

(continues on next page)

(continued from previous page)

```
                                language=None,
                                public_path=None,
                                api_only=False,
                                open_browser=False)
```

èŕůæşĺæĎŕïijŽéŹď logdirůď ŰïijŇůĚűäžŰůŕĆæŢřůİĞäÿžäÿ■ůőŽůŕĆæŢřïijŇäijäéĂŠæŮűèŕůæŇĞæŸ
æŐěůŕčůŕĆæŢřůĚůä¡ŞůęĆäÿŃïijŽ

1. ůIJĺä¡£çŤĺäżżæĎŕäÿĂçğ■æŰźůijŕůřůŕůŁĺVisualDLéİćæİ£ůŘŐïijŇæL'ŞůijĂæţŕèğĹůŹĺèő£éŮőVisualD

11.3 æşĺæĎŕïijŽ

1. ůŕŕèğĘůŇŰůŁ§èČ¡ä¿İèţŰvisualDLůőđçŐřïijŇèŕůůĚĹůőL'èčĚæIJĂæŰřçL'ĹvisualDLůĘ■ůijĂůŘŕyamla
2. çŽőůL'■æĹŚäżňäÿ■æŤŕæŇĄéİŹæĂĄůŻ¿äÿ■datasetæŰźůijŕçŽĎůŕŕèğĘůŇŰ
3. çŽőůL'■ůŕŕèğĘůŇŰůŁ§èČ¡äżĚæŤŕæŇĄçŤ§æĹŘæŁŸçž£ůŻ¿ïijŇůŘŐçż■äijŽéĂŘæ■ěæůżůŁăæŻť'ůď'Žů
4. èŃěůŕźůŁ§èČ¡æIJL'çŰŚéŮőæňćè£ŐæİěçŤĺæĹůç¿ď'äÿ■äžď'æţĄïijŽQQç¿ď'ůŘůçăĄïijŽ861717190ïijŇů

CHAPTER

TWELVE

ÅIJĹÇŽ£SERVINGÉČĹÇ¡Š

PaddleRecèő■çżČåĞžæİěçŽĎæĺąåđŃåŘŕäžěä¡£çŤĺServingéČĺç¡šåIJĺæIJ■åŁąçńŕãĂĆæIJňæŢŹçĺŃäžěwi

12.1 éęŰåĚĹä¡£çŤĺsave_inference_modelæŐěåŘčä£İå■ŸæĺąåđŃ

1. éęŰåĚĹéIJĂèęĄåIJĺæĺąåđŃçŽĎyamléĚ■ç¡őäÿ■ïijŇåŁäåĚěuse_inferenceåŘĆæŢřïijŇåźűæŁŁåĂijèő¿ç
2. çąőåőŽéIJĂèęĄçŽĎè¿ŞåĚěåŠŇè¿ŞåĞžçŽĎécĎæţŃæĺąåđŃåŘŸéĞŘïijŇåřĘåĚűåŘŸéĞŘåŘ■äžěå■Ůçň Advertising ChallengeæĽĂçŤĺçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿď éČĺåĹĘïijŽèő■ç feature>äžčèąĺæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿Ądense_inputïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿Ą feature>äžčèąĺåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄC1~C26ïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆ netïijĹïijĽåĞ¡æŢřäÿ■åřĘaucä¡£çŤĺcastè¡ňæ■ćäÿžfloat32çśżåđŃèŕ■åŘěäÿ■çŽĎcastçőŮå■ŘãĂĆ

```
runner:
  # éĂŽçŤĺéĚ■ç¡őäÿ■åĘ■èţŸè£ř
  ...
  # use inference save model
  use_inference: True  # éİŹæĂĄåŻ¿èő■çżČæŮűä£İå■Ÿäÿžinference model
  save_inference_feed_varnames: ["C1","C2","C3","C4","C5","C6","C7",
↪"C8","C9","C10","C11","C12","C13","C14","C15","C16","C17","C18",
↪"C19","C20","C21","C22","C23","C24","C25","C26","dense_input"] #␣
↪inference model çŽĎfeedåŘĆæŢřçŽĎåŘ■å■Ů
  save_inference_fetch_varnames: ["sigmoid_0.tmp_0"] # inference␣
↪model çŽĎfetchåŘĆæŢřçŽĎåŘ■å■Ů
```

1. åŘŕåŁĺéİŹæĂĄåŻ¿èő■çżČ

```
# è£ŻåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/wide_deep # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

12.2 åőĽ'èčĚ paddle serving

åijžçČĹåżžèőőæĆĺåIJĺæĹŚäżňæŔŘä¿ŻçŽĎDockeråĘĚæđĎåżžPaddle Servingïij Ňèŕůæ§ěçIJŃåęĆä¡ŢåIJĺDockeräÿ■è£ŘèąŇPaddleServing

```
# åőĽ'èčĚ paddle-serving-client
pip install paddle-serving-client -i https://mirror.baidu.com/pypi/
↪simple

# åőĽ'èčĚ paddle-serving-server
pip install paddle-serving-server -i https://mirror.baidu.com/pypi/
↪simple

# åőĽ'èčĚ paddle-serving-server-gpu
pip install paddle-serving-server-gpu -i https://mirror.baidu.com/
↪pypi/simple
```

12.3 åŕijåĞžæĺąåđŃ

æĆĺåŔŕäżěä¡£çŤĺPaddle ServingæŔŘä¿ŻçŽĎåŘ■äÿž`paddle_serving_client.convert`çŽĎåĘĚç¡őæĺąåİÚè£ŻèąŇè¡ňæ■ćãĂĆ

```
python -m paddle_serving_client.convert --dirname ./your_inference_
↪model_dir --model_filename ./your_inference_model_filename --
↪params_filename ./your_inference_params_filename
```

äź§åŔŕäżěéĂŽè£ĞPaddle ServingçŽĎ`inference_model_to_serving`æŐěåŔčè¡ňæ■ćæĹŘåŔŕçŤ
ServingçŽĎæĺąåđŃæŰĞäżűãĂĆ

```
import paddle_serving_client.io as serving_io
serving_io.inference_model_to_serving(dirname, serving_server=
↪"serving_server", serving_client="serving_client",  model_
↪filename=None, params_filename=None)
```

æĺąåİÚåŔĆæŢřäÿŐ`inference_model_to_serving`æŐěåŔčåŔĆæŢřçŻÿåŘŇãĂĆ
| åŔĆæŢř | çśżåđŃ | éżŸèőď åĂij | æŔŘè£ř | |âĂŤâĂŤâĂŤâĂŤ–|âĂŤâĂŤ|âĂŤâĂŤâĂŤâĂŤ–|âĂŤâĂŤâĂŤâĂŤâĂŤâĂŤâĂ
| `dirname` | str | - | éIJĂèęĄè¡ňæ■ćçŽĎæĺąåđŃæŰĞäżűå■ŸåĆĺèůŕå¿ĎïijŇProgramçżŞæđĎæŰĞäżűåŠŇåŔĆ
| `serving_server` | str | `"serving_server"` |
è¡ňæ■ćåŘŐçŽĎæĺąåđŃæŰĞäżűåŠŇéĚ■ç¡őæŰĞäżűçŽĎå■ŸåĆĺèůŕå¿ĎãĂĆéżŸèőď åĂijäÿžserving_server
| | `serving_client` | str | `"serving_client"` |
è¡ňæ■ćåŘŐçŽĎåőćæĹůçńŕéĚ■ç¡őæŰĞäżűå■ŸåĆĺèůŕå¿ĎãĂĆéżŸèőď åĂijäÿžserving_client
| | `model_filename` | str | None | å■ŸåĆĺéIJĂèęĄè¡ňæ■ćçŽĎæĺąåđŃInference
ProgramçżŞæđĎçŽĎæŰĞäżűåŘ■çğřãĂĆåęĆæđIJèő¿ç¡őäÿžNoneïijŇåĹŹä¡£çŤĺ
`__model__` ä¡IJäÿžéżŸèőď çŽĎæŰĞäżűåŘ■ | | `params_filename` | str | None |
å■ŸåĆĺéIJĂèęĄè¡ňæ■ćçŽĎæĺąåđŃæĽĂæIJĽåŔĆæŢřçŽĎæŰĞäżűåŘ■çğřãĂĆå¡ŞäÿŤäżĚå¡ŞæĽĂæIJĽæĺąå
|

äžěäÿŁåŚ¡äžď'äijŽçŤ§æĹŘserving_clientåŠŇserving_serveräÿď'äÿłæŰĞäžűåď'ź

```
âŤIJâŤĂâŤĂ serving_client
    âŤIJâŤĂâŤĂ serving_client_conf.prototxt #␣
↪æĺąåđŃè¿ŞåĚěè¿ŞåĞžä£ąæĄŕ
    âŤIJâŤĂâŤĂ serving_client_conf.stream.prototxt
âŤIJâŤĂâŤĂ serving_server
    âŤIJâŤĂâŤĂ __model__
    âŤIJâŤĂâŤĂ __params__
    âŤIJâŤĂâŤĂ serving_server_conf.prototxt
    âŤIJâŤĂâŤĂ serving_server_conf.stream.prototxt
```

12.4 åŘŕåŁÍPaddleServingæIJ■åŁą

æIJ■åŁąçńŕæĹŚäžňæŘŘä¿ŻrpcåŠŇwebäÿď'çğ■æŰźåijŘïijŇæĆĺåŘŕäžěéĂL'æŃl'äÿĂçğ■åŘŕåŁÍãĂĆ

12.4.1 åŘŕåŁÍrpcæIJ■åŁąçńŕ

```
# GPU
python -m paddle_serving_server_gpu.serve --model serving_server --
↪port 9393 --gpu_ids 0

# CPU
python -m paddle_serving_server.serve --model serving_server --port␣
↪9393
```

12.4.2 åŘŕåŁÍwebæIJ■åŁąçńŕ

è£ŘèąŇPaddleRec/toolsçŻőå¡ŢäÿŃçŽĎwebserer.pyæŰĞäžűïijŇäijäåĚěäÿď'äÿłåŘĆæŢřïijŇçňňäÿĂäÿłåŁ

```
# GPU
python ../../../tools/webserver.py gpu 9393

# CPU
python ../../../tools/webserver.py cpu 9393
```

12.5 æţŃèŕŢéČÍç¡šçŽĎæIJ■åŁą

åIJÍæIJ■åŁąåŹÍçńŕåŘŕåŁÍservingæIJ■åŁąæĹŘåŁ§åŘŐïijŇéČÍç¡šåőćæĹůçńŕéIJĂèęĄæĆÍæL'ŞåijĂæŰřçŽ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/wide_deep # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŘŕåŁĺåőćæĹůçńŕ
python -u ../../../tools/rec_client.py --client_config=serving_
↪client/serving_client_conf.prototxt --connect=0.0.0.0:9393 --use_
↪gpu=true --data_dir=data/sample_data/train/ --reader_file=criteo_
↪reader.py --batchsize=5 --client_mode=web
```

CHAPTER

THIRTEEN

PADDLE INFERENCEÇŽĎä¡£ÇŤĹÆŰŹÆŞŢ

paddlerecçŻőåĽ■æŘŘä¿ŻåIJĺéİŹæĂĄåŻ¿èő■çżČæŮűä¡£çŤĺsave_inference_modelæŐěåŘčä£Ìå■Ÿæĺąåđ

13.1 ä¡£çŤĺsave_inference_modelæŐěåŘčä£Ìå■ŸæĺąåđŃ

åIJĺæIJ■åŁąåŹĺçńŕä¡£çŤĺpythonéČĺç¡šéIJĂèęĄåĚĹä¡£çŤĺsave_inference_modelæŐěåŘčä£Ìå■ŸæĺąåđŃã

1. éęŰåĚĹéIJĂèęĄåIJĺæĺąåđŃçŽĎyamléĚ■ç¡őäÿ■ïijŇåŁäåĚěuse_inferenceåŘĆæŢřïijŇåźűæŁŁåĂijèő¿ç¡
   InferenceçŽĎæŰźæşŢéćĎæţŃïijŇä¡Ęäÿ■æŤŕæŇĄçŻťæŐěä¡£çŤĺpaddlerecåŐ§çŤ§çŽĎçŽĎéćĎæţŃæŰ
2. çąőåőŽéIJĂèęĄçŽĎè¿ŞåĚěåŠŇè¿ŞåĞžçŽĎéćĎæţŃæĺąåđŃåŘŸéĞŘïijŇåřĘåĚűåŘŸéĞŘåŘ■äżěå■Ůçňc
   Advertising ChallengeæĽĂçŤĺçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČĺåĹĘïijŽèő■ç
   feature>äžčèąĺæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿Ądense_inputïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿Ą
   feature>äžčèąĺåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄC1~C26ïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆ
   netïijĹïijĽåĞ¡æŢřäÿ■åřĘaucä¡£çŤĺcastè¡ňæ■ćäÿžfloat32çśżåđŃèŕ■åŘěäÿ■çŽĎcastçőŮå■ŘãĂĆ

```
runner:
  # éĂŽçŤĺéĚ■ç¡őäÿ■åĘ■èţŸè£ř
  ...
  # use inference save model
  use_inference: True  # éİŹæĂĄåŻ¿èő■çżČæŮűä£Ìå■Ÿäÿžinference model
  save_inference_feed_varnames: ["C1","C2","C3","C4","C5","C6","C7",
↪"C8","C9","C10","C11","C12","C13","C14","C15","C16","C17","C18",
↪"C19","C20","C21","C22","C23","C24","C25","C26","dense_input"] #␣
↪inference model çŽĎfeedåŘĆæŢřçŽĎåŘ■å■Ů
  save_inference_fetch_varnames: ["sigmoid_0.tmp_0"] # inference␣
↪model çŽĎfetchåŘĆæŢřçŽĎåŘ■å■Ů
```

1. åŘŕåŁĺéİŹæĂĄåŻ¿èő■çżČ

```
# è£ŽåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/wide_deep # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŃ
# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŃconfig_bigdata.yaml
```

13.2 ä¡£çŤÍto_static.pyèĎŽæIJňè¡ňåŇŰåŁÍæĂĄåŻ¿ä£Íå■ŸäÿŃæÍ

èŃěæĆÍåIJÍä¡£çŤÍåŁÍæĂĄåŻ¿èő■çżČåőŇæĹŘ,åÿŇæIJŻåřĘä£Íå■ŸäÿŃæÍěçŽĎæÍąåđŃè¡ňåŇŰäÿźéÍŹæ

1. éęŰåĚĹæ■čåÿÿä¡£çŤÍåŁÍæĂĄåŻ¿èő■çżČä£Íå■ŸåŘĆæŢř

```
# è£ŻåĚěæÍąåđŃçŽőå¡Ţ
# cd models/rank/wide_deep # åIJÍäżżæĎŘçŽőå¡ŢåÍĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

1. æĽŞåijĂyamléĚ■ç¡őïijŇåćđåŁămodel_init_pathéĂĽéąźto_static.pyèĎŽæIJňäijŽåĚĹåŁăè¡¡mode
2. æŻťæŤźto_staticèĎŽæIJňïijŇæăźæ■őæĆÍçŽĎæÍąåđŃéIJĂæśĆæŤźåĘŹåĚűäÿ■to_staticèŕ■åŘěãĂĆ
   æĹŚäżňäżěwide_deepæÍąåđŃäÿżä¿ŃïijŇåIJÍwide_deepæÍąåđŃçŽĎçżĎç¡Śäÿ■ïijŇéIJĂèęĄä£Íå■ŸåĽ■å
   æĽĂäżěæĹŚäżňåIJÍto_staticèĎŽæIJňäÿ■çŽĎpaddle.jit.to_staticèŕ■åŘěäÿ■æŇĞåőŽinput_specåęĆäÿŃ
   åŁ§èČ¡äżŃçż■ãĂĆ

```
# example dnn and wide_deep model forward
dy_model = paddle.jit.to_static(dy_model,
    input_spec=[[paddle.static.InputSpec(shape=[None, 1], dtype=
↪'int64') for jj in range(26)], paddle.static.
↪InputSpec(shape=[None, 13], dtype='float32')])
```

1. è£ŘèąŇto_staticèĎŽæIJň, åŘĆæŢřäÿżæĆÍçŽĎyamlæŰĞäżűïijŇå■şåŘŕä£Íå■ŸæĹŘåŁ§ãĂĆåřĘæĆÍåIJÍ
   1)çŽőå¡ŢäÿŃãĂĆæşÍïijŽinfer_end_epoch-1æŸŕåŽääÿżepochäżŐ0åijĂåğŃèőąæŢřïijŇåęĆè£ŘèąŇ3äÿłe

```
python -u ../../../tools/to_static.py -m config.yaml
```

1. æĹŚäżňåIJÍä¡£çŤÍinferenceéćĎæţŃåžŞéćĎæţŃæŮűäź§éIJĂèęĄæäźæ■őè¿ŞåĚěåŠŇè¿ŞåĞžåĄŽåĞžåŕź

```
# æŮäéIJĂæŤźåŁÍéČÍåÍĘäÿ■åĘ■èţŸè£ř
# åIJÍæIJĂåŘŐè¿ŞåĞžçŽĎlistäÿ■ïijŇåŐżéŽd'çňňäÿĂäÿłnp.
↪arrayïijŇå■şlabeléČÍåÍĘãĂĆ
  yield output_list[1:]
```

åřĘinferenceéćĎæţŃå¿ŮåĹřçŽĎpredictionéćĎæţŃåĂijåŠŇæŢřæ■őéŽĘäÿ■çŽĎlabelåŕźæŕŤïijŇä¡£çŤÍåŘ

13.3 åřĘä£Íå■ŸçŽĎæÍąåđŃä¡£çŤÍInferenceéćĎæţŃåžŞè£ŻèąŇæIJ

paddlerecæŘŘä¿Żtools/paddle_infer.pyèĎŽæIJňïijŇä¿ŻæĆÍæŰźä¿£çŽĎä¡£çŤÍinferenceéćĎæţŃåžŞéńŸ

éIJĂèęĄåőĽèčĚçŽĎåžŞïijŽ

```
pip install pynvml
pip install psutil
pip install GPUtil
```

1. åŘŕåŁĺpaddle_infer.pyèĎŽæIJňçŽĎåŘĆæŢřïijŽ
1. äžěwide_deepæĺąåđŃçŽĎdemoæŢřæ■őäÿžä¿ŃïijŇåŘŕåŁĺéćĎæţŃïijŽ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/wide_deep # åIJĺäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
python -u ../../../tools/paddle_infer.py --model_file=output_model_
↪wide_deep/2/rec_inference.pdmodel --params_file=output_model_wide_
↪deep/2/rec_inference.pdiparams --use_gpu=False --data_dir=data/
↪sample_data/train --reader_file=criteo_reader.py --batchsize=5
```

CHAPTER

FOURTEEN

BENCHMARK

PaddleRecäÿ■åŘĎæĺąåđŃåIJĺåŘĎçğ■æĺąåijŘäÿŃçŽĎæŢĹæđIJåŘŁæĂğèČ¡æŢřæ■őåřĘéŽŘçĽ'ĹæIJň IssueæŘŘåĞžãĂĆ

14.1 Benchmark CtrDnn

14.2 Benchmark Wide&Deep

14.3 Benchmark Word2Vec

CHAPTER

FIFTEEN

ÆŐĹÈ■ŘÅĚĹÆŢĄÇĹŃ

å§žäžŐæŐĺè■ŘåIJžæŹŕçŽĎæŁĂæIJŕéIJĂæśĆåŠŇéąźçŻőçżŔéłŇïijŇPaddleRecçŻőåĽ■åůšèęĘçŻŰæŐĺè

1. çž£äÿŁæIJ■åŁąäžğçŤ§çŽĎæŮěå£ŮïijŇæŃijæŐěåŘŐèŘ¡çŻŸåĹřå■ŸåĆĺäÿŁå¡ćæĹŘæŢřæ■őæžŘïijŇæ
2. èő■çżČè£ĞçĺŃæŇĄçż■äžğçŤ§çŤĺäžŐçž£äÿŁéćĎæţŃæIJ■åŁąçŽĎåŘŚéĞŔåžŞåŘŁæĺąåđŃãĂĆ
3. çężçž£èő■çżČäžğçŤ§çŽĎåŘŚéĞŔçĄŇåĚěåIJĺçž£æIJ■åŁąåŘŚéĞŔåžŞïijŇæĺąåđŃéĚ■éĂĄåĹřçž£äÿŁïï

15.1 æŢřæ■őåĞĘåď'Ğ

PaddleRecæŤřæŇĄåď'Žçğ■æŢřæ■őæžŘïijŇåŇĚæŃňæŰĞäžűãĂĄkafkaãĂĄodpsãĂĄtf_recordç■L'ïijŇ

15.2 åĹĘåÿČåijŔèő■çżČ

çŤśäžŐåIJĺæŐĺè■Řçşżçż§äÿ■ïijŇäijŽäÿ■æŰ■äžğçŤ§çŤĺäžŐèő■çżČæĺąåđŃçŽĎæŮěå£ŮæŢřæ■őïijŇåŽä

1. åęĆæđIJä¡äæ■čåIJĺåĄŽæŐĺè■Řçşżçż§çŽĎåŔňåŽđæĺąåİŮïijŇåŔŕäžěåŔĆèĂČdssmæĺąåđŃïijŇéŹď'äžĘ
2. åęĆæđIJä¡äæ■čåIJĺåĄŽæŐĺè■Řçşżçż§çŽĎçš¿æŐŠæĺąåİŮïijŇåŔŕäžěåŔĆèĂČslot_dnnæĺąåđŃãĂĆ

15.3 çL'źå¿ĄéĞ■èęĄæĂğ

åIJĺèő■çżČè£ĞçĺŃäÿ■ïijŇåęĆæđIJä¡äæČşèęĄèąąéĞŔæĺąåđŃäÿ■çL'źå¿ĄçŽĎéĞ■èęĄæĂğïijŇåŔŕäžěåŔ

15.4 åIJĺçž£æŐĺçŘĘ

åĹĘåÿČåijŔèő■çżČè£ĞçĺŃäÿ■ïijŇäijŽä£İå■Ÿinference_modelçŤĺäžŐåIJĺçž£æŐĺçŘĘãĂĆ

1. åęĆæđIJä¡äæČşèęĄæŘ■åżžäÿĂäÿłçŃňçńŃçŽĎæŐĺçŘĘæIJ■åŁąïijŇèŕůåŔĆèĂČPaddle ServingéČĺç¡š

2. åęĆæđIJä¡ăåůšçżŘæŃěæIJL'äÿĂäÿłåIJÍçž£æIJ■åŁąïijŇæČşèęĄåIJÍåĚűäÿ■åćđåŁăPaddleçŽĎæŐÍçŘĘål InferenceéČÍç¡š

15.5 åIJÍçž£çężçž£äÿĂèĞťæĂğæčĂæ§ě

åIJÍçž£äÿŁæIJ■åŁąæŘ■åżžåőŇæĹŘïijŇæ■čåijŘæŁŢåĚěä¡£çŤÍäźŃåL'■ïijŇéIJĂèęĄè£ŻèąŇåIJÍçž£çężçž

CHAPTER

SIXTEEN

TAGSPACE (TAGSPACE: SEMANTIC EMBEDDINGS FROM HASHTAGS)

äžčçăĄèřůåŘĆèĂČïijŽtagspaceæŰĞæIJňåĹĘçśżæĺąåđŃåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆÍæIJL'çŤÍïijŇ

16.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐřåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤÍ*
- *FAQ*

16.2 æĺąåđŃçőĂäżŃ

tagspaceæĺąåđŃæŸŕäÿĂçğ■åŕźæŰĞæIJňæL'ŞæăĞç■¿çŽĎæŰźæşŢïijŇæĺěèĞłèőžæŰĞèőžæŰĞTAGSPA
Semantic Embeddings from HashtagsïijŇåőČäÿżèęĄå■ęäźăäżŐç§■æŰĞåĹřçŻÿåĚşäÿżéćŸæăĞç■¿çŽĎæŸăăì
çĎűåŘŐäijŸåŇŰ f(w,t+),f(w,t-)çŽĎèůİçężä¡IJäÿžçŻőæăĞåĞ¡æŢřïijŇå¿ŮåĹřäžĘ
tïijĹæăĞç■¿ïijL'åŠŇdocåIJĺäÿĂäÿłçL'źå¿Ąçl'žéŮť'çŽĎåŘŚéĞŔèąĺè¿¿ïijŇè£ŹæăůåřśåŔŕäżěæL'¿
docçŽĎhashtagsäžĘãĂĆ

16.3 æŢřæ■őåĞĘåď'Ğ

æIJňæĺąåđŃä¡£çŤÍèőžæŰĞäÿ■çŽĎag_newsæŢřæ■őéŻĘïijŇåIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæ

```
2,27 7062 8390 456 407 8 11589 3166 4 7278 31046 33 3898 2897 426 1
2,27 9493 836 355 20871 300 81 19 3 4125 9 449 462 13832 6 16570␣
↪1380 2874 5 0 797 236 19 3688 2106 14 8615 7 209 304 4 0 123 1
2,27 12754 637 106 3839 1532 66 0 379 6 0 1246 9 307 33 161 2 8100␣
↪36 0 350 123 101 74 181 0 6657 4 0 1222 17195 1
```

16.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

16.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/contentunderstanding/tagspace #␣
↪åIJĺäżżæĎŔçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

16.6 æĺąåđŃçżĎç¡Ś

èőžæŰĞTAGSPACE: Semantic Embeddings from Hashtagsäÿ■çŽĎç¡ŚçżIJçżŞæđĎåęĆåŻ¿æĽĂçď žïijŇäÿĂåśĆè¿ŞåĚěåśĆïijŇäÿĂäÿłå■ůçğŕåśĆïijŇäÿĂäÿłpoolingå

16.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď æĆÍå¡ŞåĽ■æĽĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/contentunderstanding/tagspace
2. è£ŻåĚěpaddlerec/datasets/ag_newsçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ

```
cd ../../../datasets/ag_news
sh run.sh
```

1. åĹĞåŻđæÍąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚÍéĞŕæŢřæ■ő

```
cd - # åĹĞåŻđæÍąåđŃçŻőå¡Ţ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŕæŢřæ■ő è£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŕæŢřæ■ő è£ŘèąŇconfig_bigdata.yaml
```

16.8 è£ŻéŸűä¡£çŤÍ

16.9 FAQ

CHAPTER

SEVENTEEN

TEXTCNN (CONVOLUTIONAL NEURAL NETWORKS FOR SENTENCE CLASSICATION)

äżčçăĄèŕůåŘĆèĂČïijŽtextcnnæŰĞæIJňåĹĘçśżæĺąåđŃåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè

17.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢŕæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

17.2 æĺąåđŃçőĂäżŃ

TextCNNç¡ŚçżIJæŸŕ2014åźť'æŘŘåĞżçŽĎçŤĺæİěåĄŽæŰĞæIJňåĹĘçśżçŽĎå■ůçğŕçěđçżŘç¡ŚçżIJïijŇçŤ
çĎűèĂŇçăŤçl'űèŕĄæŸŐïijŇTextCnnåIJĺæŰĞæIJňåĹĘçśżéŮőéćŸäÿŁæIJL'çİĂæŻť'åŁåå■ŞèűŁçŽĎèąĺçŐřãĂ
gramçŽĎçL'źå¿Ąèąĺçď'žãĂĆTextCNNåŕźæŰĞæIJňæţĚåśĆçL'źå¿ĄçŽĎæŁ¡åŘŰèČ¡åŁŻå¿ĹåijžïijŇåIJĺç§■æŰ

17.3 æŢŕæ■őåĞĘåď'Ğ

æČĚæĎ§åĂ¿åŘŚåĹĘæđŘïijĹSentiment ClassificationïijŇçőĂçğřSen-
taïijL'éŠĹåŕźåÿęæIJL'äÿżèğĆæŘŕè£řçŽĎäÿ■æŰĞæŰĞæIJňïijŇåŕŕèĞłåŁĺåĹď'æŰ■èŕěæŰĞæIJňçŽĎæČĚæĎ

```
15.4åŕÿ çňŤèőřæIJň çŽĎ éŤőçŻŸ çąőåőđ çĹ¡ ïijŇ å§žæIJň èůŞ␣
↪åŘřåijŘæIJž åůőäÿ■åd'Ž äžĘ ïijŇ èŻő åŰIJæňć æŢřå■Ů åřŘ éŤőçŻŸ ïijŇ␣
↪è¿Ş æŢřå■Ů çL'ź æŰźä¿£ ïijŇ æäůå■Ř äź§ å¿Ĺ ç¿ŐèğĆ ïijŇ åĄŽåůě äź§␣
↪çŻÿå¡Ş äÿ■éŤŹ    1
èůŞ å£ČçĄţ éÿąæśd' æšą äżĂäźĹ æIJňèt'Í åŇžåĹń åŸŻ ïijŇ èĞşåřŚ æĹŚ␣
↪äÿ■ åŰIJæňć è£Źæäů èŕż çżŘåĚÿ ïijŇ æŁŁ çżŘåĚÿ éČ¡ èğčèŕż æĹŘ␣
↪è£Źæäů æIJL'çĆź åŐż äÿ■åŻ¡ åŇŰ çŽĎ åŚşéĄŞ äžĘ 0
```

17.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

17.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæäůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/contentunderstanding/textcnn #␣
↪åIJĺäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬźæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éĬźæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

17.6 æĺąåđŃçżĎç¡Ś

Yoon KimåIJĺèőžæŰĞ[EMNLP 2014]Convolutional neural networks for sentence classificationæŘŘåĞžäžĘTextCNNåźűçżŹåĞžå§žæIJňçŽĎçżŞæđĎãĂĆåřĘå■ůçğŕçěđçżŘç¡ŚçżIJCNNåžŤçŤĺåĹřæŰ

17.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæĺąåđŃä

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/contentunderstanding/textcnn
2. è£ŻåĚěpaddlerec/datasets/senti_clasçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæ

```
cd ../../../datasets/senti_clas
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

17.8 è£ŻéŸűä¡£çŤÍ

17.9 FAQ

CHAPTER

EIGHTEEN

DSSM (LEARNING DEEP STRUCTURED SEMANTIC MODELS FOR WEB SEARCH USING CLICKTHROUGH DATA)

äżčçăĄèŕůåŔĆèĂČïijŽDSSMæŰĞæIJňåŇźéĚ■æĺąåđŃåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè

18.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢŕæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

18.2 æĺąåđŃçőĂäżŃ

DSSMæŸŕDeep Structured Semantic ModelçŽĎçijľåĘŹïijŇå■şæĹŚäżňéĂŽåÿÿèŕť'çŽĎå§žäžŐæůśåžęç¡S

18.3 æŢŕæ■őåĞĘåď'Ğ

BQæŸŕäÿĂäÿłæŹžèČ¡åőćæIJ■äÿ■æŰĞéŮőåŔěåŇźéĚ■æŢŕæ■őéŻĘïijŇèŕěæŢŕæ■őéŻĘæŸŕèĞłåŁĺéŮőçı
åŐ§åğŃæŢŕæ■őéŻĘæăůä¿ŃïijŽ

```
èŕůéŮőäÿĂåd'l'æŸŕåŘęéČ¡æŸŕéŹŘåőŽåŔłèČ¡è¡ňåĚěæĹŰè¡ňåĞžéČ¡æŸŕäžŤäÿĞãĂĆ␣
↪    å¿őäijŮåd'ŽåřŚåŔŕäżěèţŐåŻđçS■æIJ§çŘĘèt'ć          0
å¿őçšŠåŠÍèŕćçŤţèŕİåŔůçăĄåd'ŽåřŚ  ␣
↪ä¡ääżňçŽĎäžžåůěåőćæIJ■çŤţèŕİæŸŕåd'ŽåřŚ         1
åůšçżŘåIJÍéŞűèąŇæ■ćäžĘæŰřéćĎçŢŹåŘůçăĄãĂĆ        ␣
↪æĹŚçŐřåIJÍæ■ćäžĘçŤţèŕİåŘůçăĄïijŇè£ŹäÿłéIJĂèęĄæżt'æ■ćåŘŮ       1
æŕŘäÿłå■ŮæőţäżětabéŤőåĹĘéŽŤïijŇçňň1ïijŇ2åĹŮèąÍçd'žäÿd'äÿłæŰĞæIJňãĂĆçňň3åĹŮèąÍçd'
```

18.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos 12234

18.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢŕæ■őåŔŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŽåĚěæÍąåđŃçŻőå¡Ţ
# cd models/match/dssm # åIJÍäżżæĎŔçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŔæŢŕæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŔæŢŕæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

18.6 æÍąåđŃçżĎç¡Ś

DSSM çŽĎè¿ŞåĚěéĞĞçŤÍ BOWïijĹBag of wordsïijL'çŽĎæŰźåijŔïijŇçŻÿå¡ŞäžŐæŁŁå■ŮåŘŚéĞŔçŽĎ åŠŇ Doc çŽĎèŕ■äźL'çŻÿäijijæĂĝåŔŕäżěçŤÍè£ŹäÿďäÿłåŘŚéĞŔçŽĎ cosine èůİçężèąÍçď'žïijŇçĎůåŘŐéĂŽè£Ğsoftmax åĞ¡æŢřéĂL'åĞžäÿŐQueryèŕ■äźL'æIJĂçŻÿäijijçŽĎæăůæIJň Doc ãĂĆ

æÍąåđŃçŽĎåĚůä¡ŞçżĘèŁĆåŔŕäżěéŸĚèŕżèőžæŰĞDSSM:

18.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/match/dssm
2. è£ŻåĚěpaddlerec/datasets/BQ_dssmçŻőå¡ŢäÿŃïijŇæĽ ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæ

```
cd ../../../datasets/BQ_dssm
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,çŻť æŐěäÿĂéŤőè£ŘèąŇïijŽbash run.sh
   å■ŞåŘŕå¿ŮåĹřåď■çŐřçŽĎèőžæŰĞæŢĹæđIJ. æĽ ğèąŇèŕěèĎŽæIJňåŘŐïijŇäijŽåijĂåğŃèĞłåŁĺèő■çżČå

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
bash run.sh #åŁĺæĂĄåŻ¿èő■çżČåźűæţŃèŕŢïijŇæIJĂåŘŐå¿ŮåĹřæŇĞæăĞ
```

18.8 è£ŻéŸűä¡£çŤĺ

DSSMä¡IJäÿžæŐĺè■Řçşżçż§äÿ■äÿĂçğ■åŘŚéĞŔåŔňåŻđçŽĎæŰźåijŔïijŇäÿĂèĹňéIJĂèęĄåřĘdocä¿ğçŽĎ

1. äÿžäžĘåŇžåĹĘdumpåĞžçŽĎåŘŚéĞŔïijŇécĎæţŃéŸűæőţä¡£çŤĺçŽĎæŢřæ■őéIJĂèęĄåćđåŁäinsidåŠŇc
2. datasetéĂĽæŃľInmemoryDatasetïijŇåŘŇæŮűèő¿ç¡ő

```
dataset.set_parse_ins_id(True)
dataset.set_parse_content(True)
```

1. åIJĺstatic_model.pyäÿ■éĚ■ç¡őéIJĂèęĄdumpçŽĎåŘŸéĞŔïijĹdocä¿ğæIJĂäÿŁåśĆè¿ŞåĞžïijĽ

```
self.infer_dump_fields = [dssm_model.doc_pos_fc]
```

1. éĚ■ç¡őæŰĞäżűäÿ■ïijŇæĽŞåijĂécĎæţŃéŸűæőţçŽĎdumpåŁ§èČ¡ïijŇåźűéĚ■ç¡ődump_path

```
need_infer_dump: True
infer_dump_fields_dir: "./infer_dump_data"
```

ä£Ìå■ŸæĺąåđŃæŮűïijŇåŘłéIJĂèęĄä£Ìå■Ÿqueryä¿ğç¡ŚçżIJ

1. éĚ■ç¡őæŰĞäżűäÿ■ïijŇæĽŞåijĂèčĄåĽłç¡ŚçżIJåijĂåĚş

```
need_prune: True
```

1. åIJĺstatic_model.pyäÿ■éĚ■ç¡őèčĄåĽłç¡ŚçżIJçŽĎè¿ŞåĚěåŠŇè¿ŞåĞž

```
self.prune_feed_vars = [query]
self.prune_target_var = dssm_model.query_fc
```

18.9 FAQ

CHAPTER

NINETEEN

MATCH-PYRAMID (TEXT MATCHING AS IMAGE RECOGNITION)

äžčçăĄèŕůåŘĆèĂČïijŽmatch-pyramidæŰĞæIJňåŇźéĚ■æĺąåđŃåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJĹ

19.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåd'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåd'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

19.2 æĺąåđŃçőĂäżŃ

åIJĺèőÿåd'ŽèĞłçĎűèŕ■èĺĂåd'ĎçŘĘäżżåŁąäÿ■ïijŇåŇźéĚ■äÿd'äÿłæŰĞæIJňæŸŕäÿĂäÿłå§žæIJňéŮőécŸã TensorFlow/blob/master/model/model_mp.pyïijŇ åőđçŐřäžĘäÿŃè£řèőžæŰĞäÿ■æŘŘåĞžçŽĎMatch-PyramidæĺąåđŃïijŽ

```
@inproceedings{Pang L , Lan Y , Guo J , et al. Text Matching as␣
↪Image Recognition[J]. 2016.,
  title={Text Matching as Image Recognition},
  author={Liang Pang, Yanyan Lan, Jiafeng Guo, Jun Xu, Shengxian␣
↪Wan, Xueqi Cheng},
  year={2016}
}
```

19.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèřŢæŢřæ■őéŻĘéĂĽçŤÍLetor07æŢřæ■őéŻĘåŠŇ embed_wiki-pdc_d50_norm èŕ■åŘŚéĞŘåĹİåğŃåŇŰembeddingåśĆãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňïijŽ1.èŕ■åĚÿæŰĞäżűïijŽa åŠŇdocumentäźŃéŬť'çŽĎåĚşçşżãĂĆä¿ŃåęĆïijŽrelation.train.fold1.txt, relation.test.fold1.txt4.åţŇåĚěåśĆæŰĞäżűïijŽæĹŚäżňåřĘéćĎèő■çżČçŽĎèŕ■åŘŚéĞŘå■ŸåĆĺåIJĺåţŇåĚěæŰĞ pdc_d50_norm

19.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

19.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ pyramidæĹąåđŃçŻőå¡ŢçŽĎå£ńéĂ§æĽğèąŇåŚ¡äżď'åęĆäÿŃïijŽ

```
# è£ŻåĚěæĹąåđŃçŻőå¡Ţ
# cd models/match/match-pyramid # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# å£ĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# å£ĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

19.6 æĹąåđŃçżĎç¡Ś

åŘŮå■ůçğŕçěđçżŘç¡ŚçżIJåIJĺåŻ¿åČŘèŕĘåĹńäÿ■çŽĎæĹŘåŁ§åŘŕåŘŚïijŇçěđçżŘåĚČåŘŕäżěæăźæ■őæŘŘ pyramid:

19.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæÍąåđŃä

1. çąőèőď æĆÍå¡ŞåĽ■æĽĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/match/match-pyramid
2. è£ŻåĚěpaddlerec/datasets/letor07çŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■

```
cd ../../../datasets/letor07
bash run.sh
```

1. åĹĞåŻđæÍąåđŃçŻőå¡Ţ,çŻť æŐěäÿĂéŤőè£ŘèąŇïijŽbash run.sh
   å■ţåŘŕå¿ŮåĹřåď■çŐřçŽĎèőžæŰĞæŢĹæđIJ. æĽğèąŇèŕěèĎŽæIJňåŘŐïijŇäijŽåijĂåğŃèĞłåŁÍèő■çżČå

```
cd - # åĹĞåŻđæÍąåđŃçŻőå¡Ţ
bash run.sh #åŁÍæĂĄåŻ¿èő■çżČåźűæţŃèŕŢïijŇæIJĂåŘŐå¿ŮåĹřæŇĞæăĞ
```

19.8 è£ŻéŸűä¡£çŤÍ

19.9 FAQ

CHAPTER

TWENTY

MULTIVIEW-SIMNET (A MULTI-VIEW DEEP LEARNING APPROACH FOR CROSS DOMAIN USER MODELING IN RECOMMENDATION SYSTEMS)

äżčçăĄèŕůåŔĆèĂČïijŽmultiview-simnetæŰĞæIJňåŇźéĚ■æĺąåđŃåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæI

20.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢŕæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

20.2 æĺąåđŃçőĂäżŃ

åIJĺäÿłæĂğåŇŰæŐĺè■ŘåIJžæŹŕäÿ■ïijŇæŐĺè■Řçşżçż§çżŹçŤĺæĹůæŔŘä¿ŻçŽĎéąźçŻőïijĹItemïijL'åĹŮè

20.3 æŢŕæ■őåĞĘåď'Ğ

BQæŸŕäÿĂäÿłæŹžèČ¡åőćæIJ■äÿ■æŰĞéŮőåŔěåŇźéĚ■æŢŕæ■őéŻĘïijŇèŕěæŢŕæ■őéŻĘæŸŕèĞłåŁĺéŮőçı
åŐ§åğŃæŢŕæ■őéŻĘæăůä¿ŃïijŽ

```
èŕůéŮőäÿĂåd'l'æŸŕåŘęéČ¡æŸŕéŹŘåőŽåŘłèČ¡è¡ňåĚěæĹŰè¡ňåĞžéČ¡æŸŕäžŤäÿĞãĂĆ␣
↪    å¿őäijŮåd'ŽåřŚåŘŕäżěèţŐåŻđçS■æIJ§çŘĘèt'ć          0
å¿őçšŠåŠÍèŕćçŤţèŕİåŘůçăĄåd'ŽåřŚ    ␣
↪ä¡ääżňçŽĎäžžåůěåőćæIJ■çŤţèŕİæŸŕåd'ŽåřŚ          1
åůšçżŘåIJÍéŞűèąŇæ■ćäžĘæŰřéćĎçŢŹåŘůçăĄãĂĆ          ␣
↪æĹŚçŐřåIJÍæ■ćäžĘçŤţèŕİåŘůçăĄïijŇè£ŹäÿłéIJĂèęĄæżt'æ■ćåŘŮ       1
æŕŘäÿłå■ŮæőţäżětabéŤőåĹĘéŽŤïijŇçňň1ïijŇ2åĹŮèąÍçd'žäÿd'äÿłæŰĞæIJňãĂĆçňň3åĹŮèąÍçd'
```

æIJĂçżĹè¿ŞåĞžçŽĎæŢřæ■őæäijåijŘäÿžäÿĂäÿłæăĞèŕĘåŘěå■ŘçŽĎslotïijŇåŘŐèů§äÿĂäÿłåŘěå■Řäÿ■èŕ

```
0:358 0:206 0:205 0:250 0:9 0:3 0:207 0:10 0:330 0:164 1:1144 1:217␣
↪1:206 1:9 1:3 1:207 1:10 1:398 1:2 2:217 2:206 2:9 2:3 2:207 2:10␣
↪2:398 2:2
0:358 0:206 0:205 0:250 0:9 0:3 0:207 0:10 0:330 0:164 1:951 1:952␣
↪1:206 1:9 1:3 1:207 1:10 1:398 2:217 2:206 2:9 2:3 2:207 2:10␣
↪2:398 2:2
```

20.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

20.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ simnetæĹąåđŃçŻőå¡ŢçŽĎå£ńéĂ§æL'ğèąŇåŚ¡äżd'åęĆäÿŃïijŽ

```
# è£ŻåĚěæĹąåđŃçŻőå¡Ţ
# cd models/match/multiview-simnet # åIJÍäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

20.6 æÍąåđŃçżĎç¡Ś

åď ŽèğĘèğŠSimnetæÍąåđŃåŇĚæŃňåď ŽäÿłçijŰçăĄåŹÍæÍąåİŮïijŇæŕŘäÿłçijŰçăĄåŹÍèćńçŤÍåIJÍäÿ■åŘŇç
of-EmbeddingçijŰçăĄåŹÍïijŇTemporal-ConvolutionalçijŰçăĄåŹÍïijŇåŠŇGated-Recurrent-
UnitçijŰçăĄåŹÍãĂĆæĹŚäżňäijŽéĂŘæÿŘåŁăåĚěçÍĂçŰŕçL'źå¿ĄåIJżæŹŕäÿŃæŕŤè¿Čåőđç ŤÍçŽĎçijŰçăĄåŹÍ
rankingæÍąåijŘè£ŻèąŇèő■çżČïijŇå■şéŠĹåŕźäÿĂåŕźåĚůæIJL'åĚşèĄŤçŽĎUser-
ItemçżĎåŘĹïijŇéŽŘæIJżåőđçŤÍäÿĂäÿłItemä¡IJäÿżèť §ä¿Ńè£ŻèąŇæŐŠåžŘå■ęäźżäăĂĆ

æÍąåđŃçŽĎåĚůä¡ŞçżĘèŁĆåŘŕäżěéŸĚèŕżèőżæŰĞMultiView-Simnet:

20.7 æŢĹæđIJåď■çŐř

äÿżäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæÍąåđŃä
åIJÍåĚÍéĞŘæŢřæ■őäÿŃæÍąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď æĆÍå¡ŞåL'■æL'ĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/match/multiview-simnet
2. è£ŻåĚěpaddlerec/datasets/BQ_simnetçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎ

```
cd ../../../datasets/BQ_simnet
sh run.sh
```

1. åĹĞåŻđæÍąåđŃçŻőå¡Ţ,çŻť æŐěäÿĂéŤőè£ŘèąŇïijŽbash run.sh
   å■şåŘŕå¿ŮåĹřåď ■çŐřçŽĎèőżæŰĞæŢĹæđIJ. æL'ğèąŇèŕěèĎŽæIJňåŘŐïijŇäijŽåijĂåğŃèĞłåŁÍèő■çżČå

```
cd - # åĹĞåŻđæÍąåđŃçŻőå¡Ţ
bash run.sh #åŁÍæĂĄåŻ¿èő■çżČåźűæţŃèŕŢïijŇæIJĂåŘŐå¿ŮåĹřæŇĞæăĞ
```

20.8 è£ŻéŸűä¡£çŤÍ

20.9 FAQ

CHAPTER

TWENTYONE

KIM (PERSONALIZED NEWS RECOMMENDATION WITH KNOWLEDGE-AWARE INTERACTIVE MATCHING)

äžčçăĄèŕůåŘĆèĂČïijŽKIM åęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJĽçŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

21.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

21.2 æŢřæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤĺmindæŰřéŮżãĂĄ glove.840B.300d èŕ■åŘŚéĞŘåĹİåğŃåŇŰembeddingåśĆåŠŇç§ěèŕĘåŻ¿èřśæŢřæ■õãĂĆ

21.3 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0 nltk>=3.7 python 3.7

os : windows/linux/macos

21.4 å£ńéĂ§åijĂåğŃ

åijĂåğŃåĽ■çąőä£ÌåůšnltkèŃśæŰĞåĹĘèŕ■æĺąåđŃåĹřäÿłäžžçŻőå¡ŢäÿŃ
æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäžěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŃïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæĽğèa

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/match/kim # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŃ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u trainer.py -m config.yaml -o mode=train #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŃconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u infer.py -m config.yaml -o mode=test
```

21.5 æĺąåđŃçżĎç¡Ś

äÿłæĂğåŃŰæŰřéŮżæŐĺè■ŘçŽĎæăÿå£ČæŸŕåĂŹéĂĽæŰřéŮżåŠŃçŤĺæĹůåĚť èűčäźŃéŮť çŽĎåĞEçąőå
æŰřéŮżèĄŤåŘĹçijŰçăĄåŹĺïijŇäżŐåĂŹéĂĽæŰřéŮżåŠŃçĆźåĞżæŰřéŮżçŽĎç§ěèŕĘåŠŃå§žäžŐæŰĞæIJňçŽ

21.6 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

21.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/match/kim
2. è£ŻåĚěpaddlerec/datasets/kimçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■åŁa

```
cd ../../../datasets/kim
bash run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ

```
python -u trainer.py -m config_bigdata.yaml -o mode=train
python -u infer.py -m config_bigdata.yaml -o mode=test
```

21.8 è£ŻéŸűä¡£çŤÍ

21.9 FAQ

CHAPTER

TWENTYTWO

GRU4REC (SESSION-BASED RECOMMENDATIONS WITH RECURRENT NEURAL NETWORKS)

äžčçăĄèŕůåŘĆèĂČïijŽGRU4RECæÍąåđŃåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆÍæIJL’çŤÍïijŇè£ŸèŕůçĆźäÿł

22.1 åĘĚåőź

- *æÍąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď’Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *èőžæŰĞåď’■çŐř*
- *è£ŻéŸűä¡£çŤÍ*
- *FAQ*

22.2 æÍąåđŃçőĂäżŃ

GRU4RECæÍąåđŃçŽĎäżŃçż■åŘŕäžěåŘĆéŸĚèőžæŰĞSession-based Recommendations with Recurrent Neural NetworksãĂĆ

èőžæŰĞçŽĎèť’ąçŇőåIJÍäžŐéęŰæňąåřĘRNNïijĹGRUïijL’è£ŘçŤÍäžŐsession-basedæŐÍè■ŘïijŇçŻÿæŕŤäijăçż§çŽĎKNNåŠŇç§l’éŸţåĹĘèğčïijŇæŢĹæđIJæIJL’æŸŐæŸ¿çŽĎæŘŘå■ĞãĂĆ

èőžæŰĞçŽĎæăÿå£ČæĂİæČşæŸŕåIJÍäÿĂäÿłsessionäÿ■ïijŇçŤÍæĹůçĆźåĞżäÿĂçşżåĹŮitemçŽĎèąŇäÿžç

session-basedæŐÍè■ŘåžŤçŤÍåIJžæŹŕéİđåÿÿåź£æşŻïijŇæŕŤåęĆçŤÍæĹůçŽĎåŢĘåŞĄæţŘèğĹãĂĄæŰŕéŮż

æIJňæÍąåđŃéĚ■ç¡őéżŸèőď’ä¡£çŤÍdemoæŢřæ■őéŻĘïijŇèŃěè£ŻèąŇçš¿åžęéłŇèŕĄïijŇèŕůåŘĆèĂČ*èőžæŰ*

æIJňéąźçŻőæŤŕæŇĄåŁ§èČ¡

èő■çżČïijŽå■ŢæIJžCPUãĂĄå■ŢæIJžå■Ţå■ąGPUãĂĄæIJňåIJřæÍąæŃ§åŘĆæŢřæIJ■åŁąåŹÍèő■çżČãĂĄå
åŘŕåŁÍèő■çżČ

éćĎæţŃïijŽå■ŢæIJžCPUãĂĄå■ŢæIJžå■Ţå■ąGPUïijŻéĚ■ç¡őèŕůåŘĆèĂČPaddleRec çężçž£éćĎæţŃ

22.3 æŢřæ■őåďĎçŘĘ

æIJňçďžä¿Ńäÿ■æŢřæ■őåďĎçŘĘåĚśåŇĚåŘńäÿĽæ■ĕïijŽ

- Step1: åŐ§åğŃæŢřæ■őæŢřæ■őéŻĘäÿŃè¡¡

```
cd data/
python download.py
```

- Step2: æŢřæ■őéćĎåďĎçŘĘåŘŁæăijåijŘè¡ňæ■ćãĂĆ
  1. äžěsession_idäÿžkeyåŘĹåźűåŐ§åğŃæŢřæ■őéŻĘïijŇå¿ŮåĹřæŕŘäÿłsessionçŽĎæŮěæIJ§ïijŇåŘŁé
  2. è£Ğæżďæ0L'éŢ£åžęäÿž1çŽĎsessionïijŻè£Ğæżďæ0L'çĆźåĞżæňąæŢřåřŘäžŐ5çŽĎitemsãĂĆ
  3. èő■çżČéŻĘãĂĄæţŃèŕŢéŻĘåĹŠåĹĘãĂĆåŐ§åğŃæŢřæ■őéŻĘéĞŇæIJĂæŰřæŮěæIJ§äÿČåď'l'åĘĚ

```
python preprocess.py
python convert_format.py
```

è£ŹäÿĂæ■ěäźŃåŘŐïijŇäijŽåIJÍdata/çŽőå¡ŢäÿŃå¿ŮåĹřäÿď'äÿłæŰĞäżűïijŇrsc15_train_tr_paddle.txtäÿž

```
214536502 214536500 214536506 214577561
214662742 214662742 214825110 214757390 214757407 214551617
214716935 214774687 214832672
214836765 214706482
214701242 214826623
214826835 214826715
214838855 214838855
214576500 214576500 214576500
214821275 214821275 214821371 214821371 214821371 214717089␣
↪214563337 214706462 214717436 214743335 214826837 214819762
214717867 21471786
```

- Step3: çŤ§æĹŘå■ŮåĚÿåźűæŢť'çŘĘæŢřæ■őèůŕå¿ĎãĂĆè£ŹäÿĂæ■ěäijŽæăźæ■őèő■çżČåŠŇæţŃèŕŢæŰ

```
mkdir raw_train_data && mkdir raw_test_data
mv rsc15_train_tr_paddle.txt raw_train_data/ && mv rsc15_test_
↪paddle.txt raw_test_data/
mkdir all_train && mkdir all_test

python text2paddle.py raw_train_data/ raw_test_data/ all_train all_
↪test vocab.txt
```

æŰźä¿£èţůèğĄïijŇæĹŚäžňæŘŘä¿ŻäžĘäÿĂéŤőåijŘæŢřæ■őçŤ§æĹŘèĎŽæIJňïijŽ

```
sh data_prepare.sh
```

22.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=1.7.2

python 2.7/3.5/3.6/3.7

PaddleRec >=0.1

os : windows/linux/macos

22.5 å£ńéĂ§åijĂåğŃ

22.5.1 å■ŢælJžèő■çżČ

åIJĺconfig.yamlæŰĞäżűäÿ■èő¿ç¡őåě¡èő¿åď ĞïijŇepochsç■L'ãĂĆ

```
runner:
- name: cpu_train_runner
  class: train
  device: cpu  # gpu
  epochs: 10
  save_checkpoint_interval: 1
  save_inference_interval: 1
  save_checkpoint_path: "increment_gru4rec"
  save_inference_path: "inference_gru4rec"
  save_inference_feed_varnames: ["src_wordseq", "dst_wordseq"] #␣
↪feed vars of save inference
  save_inference_fetch_varnames: ["mean_0.tmp_0", "top_k_0.tmp_0"]
  print_interval: 10
  phases: [train]
```

22.5.2 å■ŢælJžéćĎæţŃ

åIJĺconfig.yamlæŰĞäżűäÿ■èő¿ç¡őåě¡èő¿åď ĞïijŇepochsç■L'ãĂĆ

```
- name: cpu_infer_runner
  class: infer
  init_model_path: "increment_gru4rec"
  device: cpu  # gpu
  phases: [infer]
```

22.5.3 è£ŘèąŇ

```
python -m paddlerec.run -m models/recall/gru4rec/config.yaml
```

22.5.4 çżŞæđIJåśŢçď ž

æăůä¿ŃæŢřæ■őèő■çżČçżŞæđIJåśŢçď žïijŽ

```
Running SingleStartup.
Running SingleRunner.
2020-09-22 03:31:18,167-INFO:   [Train],  epoch: 0,  batch: 10,␣
↪time_each_interval: 4.34s, RecallCnt: [1669.], cost: [8.366313],␣
↪InsCnt: [16228.], Acc(Recall@20): [0.10284693]
2020-09-22 03:31:21,982-INFO:   [Train],  epoch: 0,  batch: 20,␣
↪time_each_interval: 3.82s, RecallCnt: [3168.], cost: [8.170701],␣
↪InsCnt: [31943.], Acc(Recall@20): [0.09917666]
2020-09-22 03:31:25,797-INFO:   [Train],  epoch: 0,  batch: 30,␣
↪time_each_interval: 3.81s, RecallCnt: [4855.], cost: [8.017181],␣
↪InsCnt: [47892.], Acc(Recall@20): [0.10137393]
...
epoch 0 done, use time: 6003.78719687, global metrics: cost=[4.
↪4394927], InsCnt=23622448.0 RecallCnt=14547467.0 Acc(Recall@20)=0.
↪6158323218660487
2020-09-22 05:11:17,761-INFO:   save epoch_id:0 model into:
↪"inference_gru4rec/0"
...
epoch 9 done, use time: 6009.97707605, global metrics: cost=[4.
↪069373], InsCnt=236237470.0 RecallCnt=162838200.0␣
↪Acc(Recall@20)=0.6892988086157644
2020-09-22 20:17:11,358-INFO:   save epoch_id:9 model into:
↪"inference_gru4rec/9"
PaddleRec Finish
```

æăůä¿ŃæŢřæ■őéćĎæţŃçżŞæđIJåśŢçď ž:

```
Running SingleInferStartup.
Running SingleInferRunner.
load persistables from increment_gru4rec/9
2020-09-23 03:46:21,081-INFO:   [Infer] batch: 20, time_each_
↪interval: 3.68s, RecallCnt: [24875.], InsCnt: [35581.],␣
↪Acc(Recall@20): [0.6991091]
Infer infer of epoch 9 done, use time: 5.25408315659, global␣
↪metrics: InsCnt=52551.0 RecallCnt=36720.0 Acc(Recall@20)=0.
↪698749785922247
...
Infer infer of epoch 0 done, use time: 5.20699501038, global␣
↪metrics: InsCnt=52551.0 RecallCnt=33664.0 Acc(Recall@20)=0.
↪6405967536298073
PaddleRec Finish
```

22.6 èőžæŰĞåď■çŐř

çŤĺåŐ§èőžæŰĞçŽĎåőŇæŢť æŢřæ■őåď■çŐřèőžæŰĞæŢĹæđIJéIJĂèęĄåIJĺconfig.yamlä£őæŤźèűĚåŘĆ

- batch_size: ä£őæŤźconfig.yamläÿ■dataset_trainæŢřæ■őéŻEçŽĎbatch_sizeäÿž500ãĂĆ
- epochs: ä£őæŤźconfig.yamläÿ■runnerçŽĎepochsäÿž10ãĂĆ
- æŢřæ■őæžŘïijŽä£őæŤźconfig.yamläÿ■dataset_trainæŢřæ■őéŻEçŽĎdata_pathäÿžâĂİ{workspace}/data

ä¡£çŤĺgpuèő■çżČ10è¡ő æţŃèŕŢçżŞæđIJäÿž

ä£őæŤźåŘŐè£ŘèąŇæŰźæąĹïijŽä£őæŤźconfig.yamläÿ■çŽĎâĂŹworkspaceâĂŹäÿžconfig.yamlçŽĎçŻőâ

```
python -m paddlerec.run -m /home/your/dir/config.yaml
↪#èřČèŕŢæĺąåijŘ çŻt'æŐěæŇĞåőŽæIJňåIJřconfigçŽĎçżĬåŕźèůŕå¿Ď
```

22.7 è£ŻéŸűä¡£çŤĺ

22.8 FAQ

CHAPTER

TWENTYTHREE

DEEPWALK (DEEPWALK: ONLINE LEARNING OF SOCIAL REPRESENTATIONS)

äżčçăĄèŕůåŘĆèĂČïijŽDeepwalkåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

23.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

23.2 æĺąåđŃçőĂäżŃ

DeepwalkæŸŕäÿĂäÿłçŤĺäžŐåŻ¿å¡ćèąĺå¿Ąå■ęäźăçŽĎçőŮæşŢãĂĆåőČçŽĎçŻőçŽĎæŸŕåŻ¿åţŇåĚěïijŇåŠ
èŁĆçĆź-æŸäářĎåĹřäÿĂäÿłåŘŚéĞŘçl'žéŮť'äÿ■ïijŇä¡£åŘŚéĞŘçl'žéŮť'äÿ■çŽĎåţŇåĚěçŽĎæŕŘäÿłèŁĆçĆźäÿ
label classificationäżżåŁąäÿŁè¿¿åĹřäžĘäÿŐèőžæŰĞçŻÿåŘŇçŽĎæŇĞæăĞæřť'åźşãĂĆ

23.3 æŢřæ■őåĞĘåď'Ğ

BlogCatalogæŢřæ■őéŻĘæŸŕäÿĂäÿłçd'¿äijŽåĚşçşżç¡ŚçżIJïijŇåŻ¿æŸŕçŤśå■ŽäÿżåŘŁåĚűçd'¿äijŽåĚşçşż

23.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

pgl>=2.0

æşĺæĎŔïijŽæIJňæĺąåđŃéIJĂèęĄåőL'èčĚpglæL'■èČ¡æ■čåÿÿè£ŘèąŇ,åőL'èčĚæŰźåijŔïijŽ

```
pip install pgl
```

os : windows/linux/macos

23.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/recall/deepwalk # åIJĺäżżæĎŔçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# äÿŃæÿÿæIJžåŹĺå■ęäźăäżżåŁą
cd  multi_class
# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../../tools/static_infer.py -m config.yaml
# èőąçőŮ MacroF1
python macrof1.py
```

23.6 æĺąåđŃçżĎç¡Ś

Bryan PerozziåIJĺèőžæŰĞDeepWalk: Online Learning of Social RepresentationsæŔŘåĞžäžĘDeepwalkåźűçżŹåĞžå§žæIJňçŽĎçżŞæđĎãĂĆåęĆäÿŃåŻ¿æŸŕåŐ§æŰĞäÿ■åŕźäžŐèĞłåůśçŐ

23.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŔäÿłæĺąåđŃä

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡Ţäÿžmodels/recall/deepwalk
2. è£ŻåĚědeepwalk_trainèő■çżČåŻ¿åţŇåĚě

```
cd deepwalk_train
python -u ../../../../tools/static_trainer.py -m config_bigdata.yaml
cd ..
```

1. è£ŻåĚěmulti_class,è£ŻèąŇäÿŃæÿÿäżżåŁąèő■çżČ

```
cd  multi_class
# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../../tools/static_trainer.py -m config_bigdata.yaml
python -u ../../../../tools/static_infer.py -m config_bigdata.yaml
# èőąçőŮ MacroF1
python macrof1.py
```

23.8 è£ŻéŸűä¡£çŤÍ

23.9 FAQ

CHAPTER

TWENTYFOUR

MIND (MULTI-INTEREST NETWORK WITH DYNAMIC ROUTING FOR RECOMMENDATION AT TMALL)

äžčçăĄèŕůåŘĆèĂČïijŽMINDåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆÍæIJL'çŤÍïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

24.1 åĘĚåőź

- *æÍąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æÍąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤÍ*
- *FAQ*

24.2 æÍąåđŃçőĂäżŃ

æIJňä¿ŃåőđçŐřäžĘå§žäžŐåŁÍæĂĄèůŕçŤśçŽĎçŤÍæĹůåď'ŽåĚť'èűčç¡ŚçżIJïijŇåęĆäÿŃåŻ¿æL'Ăçď'žïijŽ

æŐÍè■ŘåŘĆèĂČèőžæŰĞ:http://cn.arxiv.org/abs/1904.08030

24.3 æŢřæ■őåĞĘåď'Ğ

åIJÍæÍąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆÍåĞĘåď'ĞäžĘå£ńéĂ§è£ŘèąŇçŽĎçď'žä¿ŃæŢřæ■őïijŇèő■ç data/testæŰĞäżůåď'źäÿ■ãĂĆèŃěéIJĂèęĄä¡£çŤÍåĚÍéĞŘæŢřæ■őåŘŕäžěåŘĆèĂČäÿŃæŰźæŢĹæđIJåď'■çŐřéČ

èő■çżČæŢřæ■őçŽĎæăijåijŘåęĆäÿŃïijŽ

```
0,17978,0
0,901,1
0,97224,2
0,774,3
0,85757,4
```

åĹĘåĹńèąĺçď žuidãĂĄitem_idåŠŇçĆźåĞżçŽĎéąžåžŘ(æŮűéŮť æĹş)

æţŃèŕŢæŢřæ■őçŽĎæăijåijŘåęĆäÿŃïijŽ

```
user_id:487766 target_item:0 hist_item:17784 hist_item:126 hist_
↪item:36 hist_item:124 hist_item:34 hist_item:1 hist_item:134 hist_
↪item:6331 hist_item:141 hist_item:4336 hist_item:1373 eval_
↪item:1062 eval_item:867 eval_item:62
user_id:487793 target_item:0 hist_item:153428 hist_item:132997 hist_
↪item:155723 hist_item:66546 hist_item:335397 hist_item:1926 eval_
↪item:1122 eval_item:10105
user_id:487805 target_item:0 hist_item:291025 hist_item:25190 hist_
↪item:2820 hist_item:26047 hist_item:47259 hist_item:36376 eval_
↪item:260145 eval_item:83865
user_id:487811 target_item:0 hist_item:180837 hist_item:202701 hist_
↪item:184587 hist_item:211642 eval_item:101621 eval_item:55716
user_id:487820 target_item:0 hist_item:268524 hist_item:44318 hist_
↪item:35153 hist_item:70847 eval_item:238318
user_id:487825 target_item:0 hist_item:35602 hist_item:4353 hist_
↪item:1540 hist_item:72921 eval_item:501
```

åĚűäÿ■`hist_item`åŠŇ`eval_item`åİĞæŸŕåŘŸéŢ£åžŘåĹŮïijŇèŕżåŘŰæŰźåijŘåŘŕäżěçIJŃ`mind_i`
`py`

24.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : linux/macos

24.5 å£ńéĂ§åijĂåğŃ

åIJÍmindæÍąåđŃçŻőå¡ŢçŽĎå£ńéĂ§æL'ğèąŇåŚ¡äżď åęĆäÿŃïijŽ

```
# åőL'èčĚfaiss
# CPU
pip install faiss-cpu
# GPU
# pip install faiss-gpu
```

(continues on next page)

(continued from previous page)

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/recall/mind # åIJĺäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u infer.py -m config.yaml -top_n 50
↪#åŕźæţŃèŕŢæŢřæ■õè£ŻèąŇécĎæţŃïijŇåźűéĂŽè£ĞfaissåŘňåŻđåĂŹéĂL'çżŞæđIJèŕĎæţŃReacll

# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■õè£ŘèąŇconfig_bigdata.yaml
# éĬŹæĂĄåŻ¿écĎæţŃ
python -u static_infer.py -m config.yaml -top_n 50
↪#åŕźæţŃèŕŢæŢřæ■õè£ŻèąŇécĎæţŃïijŇåźűéĂŽè£ĞfaissåŘňåŻđåĂŹéĂL'çżŞæđIJèŕĎæţŃReacll
```

24.6 æĺąåđŃçżĎç¡Ś

çżĘèŁĆèğĄäÿŁéĬćæĺąåđŃçőĂäżŃéČĺåĹĘ

24.6.1 æŢĹæđIJåď■çŐř

çŤśäžŐåŐ§åğŃèőžæŰĞæšąæIJL'æŘŘä¿ŻåőđéłŇçŽĎåď■çŐřçżĘèŁĆïijŇäÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡å

åIJĺåĚĺéĞŘæŢřæ■õäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | batch_size | epoch_num| Recall@50 | NDCG@50 | HitRate@50 |Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | | mind | 128 | 20 | 8.43% | 13.28% | 17.22% | 398.64s(CPU) |

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/recall/mind
2. è£ŻåĚěpaddlerec/datasets/AmazonBookçŻőå¡ŢäÿŃæL'ğèąŇrun.shèĎŽæIJňïijŇäijŽäÿŃè¡¡åď'ĎçŘĘåőŇ

```
cd ../../../datasets/AmazonBook
sh run.sh
```

1. åőL'èčĚä¿ÌèţŰïijŇæĹŚäżňä¡£çŤĺfaissæĬěè£ŻèąŇåŘŚéĞŘåŘňåŻđ

```
# CPU-only version(pip)
pip install faiss-cpu

# GPU(+CPU) version(pip)
#pip install faiss-gpu

# CPU-only version(conda)
#conda install -c pytorch faiss-cpu
```

(continues on next page)

(continued from previous page)

```
# GPU(+CPU) version(conda)
#conda install -c pytorch faiss-gpu
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata
python -u infer.py -m config_bigdata.yaml -top_n 50 #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata
```

24.7 è£ŻéŸűä¡£çŤĺ

24.8 FAQ

24.9 åŔĆèĂČ

æŢřæ■őéŻĘåŔŁèő■çżČäżżåŁąåŔĆèĂČäžĘComiRec

CHAPTER

TWENTYFIVE

NCF (NEURAL COLLABORATIVE FILTERING)

äžčçăĄèŕůåŘĆèĂČïijŽNCFåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

25.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

25.2 æĺąåđŃçőĂäżŃ

å¿Ĺåď'ŽåžŤçŤĺåIJžæŹŕïijŇåźűæšąæIJL'æŸ¿æĂğåŘ■éęĹçŽĎå■ŸåIJĺãĂĆåŻääÿžåď'ğéČĺåĹEçŤĺæĹůæŸí
Collaborative Filtering ãĂŃä¡IJèĂĚåĹl'çŤĺæůśåžęå■ęäźäæİěåŕźuseråŠŇitemçL'źå¿Ąè£ŻèąŇåżžæĺąïijŇä¡£æĺa
itemäžď'äžŠåĞ¡æŢřïijŇæŘŘåĞžäžĘäÿĂçğ■éŽŘæĂğåŘ■éęĹå■ŘåŘŇè£Ğæżď'èğčåĘşæŰźæąĹãĂĆ

25.3 æŢřæ■őåĞĘåď'Ğ

æIJňæĺąåđŃä¡£çŤĺèőžæŰĞäÿ■çŽĎæŢřæ■őéŻĘml-1mïijĹå■şMovieLensæŢřæ■őéŻĘïijL'åŠŇpinterest-
20ïijĹå■şPinterestæŢřæ■őéŻĘïijL'åIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆĺåĞĘåď'ĞäžĘå£ńéĂ§è£ŘèąŇ
+ \t + item_id + \t + rating(çŤĺæĹůèŕĎåĹĘ) + \t + times-
tamp(æŮűéŮť'æĹş)åIJĺtest.negativeäÿ■çŽĎæŢřæ■őæăijåijŘäÿžïijŽ(userID,itemID) + \t +
negativeItemID1 + \t + negativeItemID2 âĂę(åŇĚåŘń99äÿłnegativeæăůæIJň)

25.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

25.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/recall/ncf # åIJĺäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éĬŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

25.6 æĺąåđŃçżĎç¡Ś

èőžæŰĞNeural Collaborative Filtering äÿ■çŽĎneumfç¡ŚçżIJçżŞæđĎåęĆåŻ¿æL'Ăçd'ž:

25.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/recall/ncf
2. è£ŻåĚěpaddlerec/datasets/movielens_pinterest_NCFçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ

```
cd ../../../datasets/movielens_pinterest_NCF
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
#␣
↪åŁĺæĂĄåŻ¿èő■çżČåźűå¿ŮåĹřæŇĞæăĞ(è£ŹéĞŇéIJĂèęĄä¡£çŤĺbashåŘřåŁĺèĎŽæIJň)
bash run.sh
```

25.8 è£ŻéŸűä¡£çŤĺ

25.9 FAQ

CHAPTER

TWENTYSIX

WORD2VEC (DISTRIBUTED REPRESENTATIONS OF WORDS AND PHRASES AND THEIR COMPOSITIONALITY)

äżčçăĄèŕůåŘĆèĂČïijŽword2vecåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJĽçŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

26.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

26.2 æĺąåđŃçőĂäżŃ

æIJňä¿ŃåőđçŐřäžĘskip-gramæĺąåijŘçŽĎword2vectoræĺąåđŃïijŇåęĆäÿŃåŻ¿æĽĂçď'žïijŽ

æŐĺè■ŘçŤĺæĹůåŘĆèĂČÂăIPython Notebook demoæŢŹçĺŃèŐůåŘŰæŻť'èŕęçżEçŽĎä£ąæĄŕãĂĆ

26.3 æŢřæ■őåĞĘåď'Ğ

åIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆĺåĞĘåď'ĞäžEå£ńéĂ§è£ŘèąŇçŽĎçď'žä¿ŃæŢřæ■őïijŇèő■ç
data/test, data/dictæŰĞäżűåď'źäÿ■ãĂĆèŃěéIJĂèęĄä¡£çŤĺåĚĺéĞŘæŢřæ■őåŘŕäżěåŘĆèĂČäÿŃæŰźæŢĹæđIJå

```
45 8 71 53 83 58 71 28 46 3
59 68 5 82 0 81
61
```

èŕ■èąĺçŽĎæăijåijŘåęĆäÿŃïijŽ

```
and 6
all 48
because 64
just 72
per 63
when 59
is 9
year 43
some 55
it 20
```

26.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

26.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■ŏåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻŏå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻŏå¡Ţ
# cd models/recall/word2vec # åIJĺäżżæĎŘçŻŏå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■ŏè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■ŏè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u static_infer.py -m config.yaml
```

26.6 æĺąåđŃçżĎç¡Ś

æĹŚäżňéĂŽè£ĞèŕŒçśżæŕŤïijĹWord AnalogyïijL'äżżåŁąæİěæčĂéłŇ-word2vecæĺąåđŃçŽĎèőŒçżČæŢĹæđIJãĂĆè¿ŞåĚěåŻŻäÿłèŕŒAïijŇBïijŇCïijŇDïijŇåĄĞèő¿å■ŸåIJĺäÿĂçğ■åĚä¡£å¿Ůrelation(A, B) = relation(CïijŇ D)ïijŇçĎűåŘŐéĂŽè£ĞAïijŇBïijŇCåŐżéćĎæţŃDïijŇemb(D) = emb(B) - emb(A) + emb(C)ãĂĆçżĘèŁĆèğĄäÿŁéİć*æĺąåđŃçőĂäżŃ*éČĺåĹĘ

26.6.1 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃäåIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | acc | batch_size | epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | word2vec | 0.579 | 100 | 5 | – |

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/recall/word2vec
2. è£ŻåĚěpaddlerec/datasets/one_billionçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎa

```
cd ../../../datasets/one_billion
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂąåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u infer.py -m config_bigdata.yaml # åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_
↪bigdata.yaml
```

26.7 è£ŻéŸűä¡£çŤĺ

26.8 FAQ

CHAPTER

TWENTYSEVEN

ENSFM (EICIENT NON-SAMPLING FACTORIZATION MACHINES FOR OPTIMAL CONTEXT-AWARE RECOMMENDATION)

äżčçăĄèŕůåŘĆèĂČïijŽENSFMåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

27.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

27.2 æĺąåđŃçőĂäżŃ

ENSFM æŸŕäÿĂäÿłåŘłæIJL'äÿĂåśĆécĎæţŃåśĆçŽĎæţĚ FM æĺąåđŃïijŇèů§ DeepFM, CFM çŻÿæŕŤåIJĺåď'■æİĆåžęåŠŇåŘĆæŢřéĞŘäÿŁéČ¡æŻť'åřŚïijŇå■ť'åIJĺæĺąåđŃæŢĹæđIJäÿŁèąĺçŐřæŸ¿èŚŮ Non-Sampling Factorization Machines for Optimal Context-Aware RecommendationçŽĎèğĆçĆźïijŽèť'§éĞĞæăůç■ŰçŢěåźűäÿ■èűşäżěä¡£æĺąåđŃæŤűæŢŻåĹřæIJĂäijŸãĂĆäÿŐäźŃçŻÿæŕŤïij Top-N æŐĺè■ŘäżżåŁąæŸŕéİđåÿÿæIJL'æŢĹçŽĎãĂĆ

27.3 æŢřæ■őåĞĘåď'Ğ

æIJňæĺąåđŃä¡£çŤĺèőžæŰĞäÿ■çŽĎæŢřæ■őéŻĘml-1mïijĹå■ţMovieLensæŢřæ■őéŻĘïijL'ãĂĄlastfmåŠŇ

27.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

27.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/recall/ensfm # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u infer.py -m config.yaml
```

27.6 æĺąåđŃçżĎç¡Ś

æĺąåđŃçŽĎæĂżä¡ŞçżŞæđĎåęĆäÿŃïijŽ

27.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/recall/ensfm
2. è£ŻåĚěpaddlerec/datasets/ml-1m_ensfm
3. æĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■åŁąåŹĺäÿŁäÿŃè¡¡æĹŚäżňéćĎåď ĎçŘĘåőŇæĹŘç

```
cd ../../../datasets/movielens_pinterest_NCF
sh run.sh
```

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
#␣
↪åŁĺæĂĄåŻ¿èő■çżČåźűå¿ŮåĹŕæŇĞæăĞ(è£ŹéĞŇéIJĂèęĄä¡£çŤĺbashåŘŕåŁĺèĎŽæIJň)
python -u ../../../tools/trainer.py -m config_bigdata.yaml
python -u infer.py -m config_bigdata.yaml
```

27.8 è£ŻéŸűä¡£çŤÍ

27.9 FAQ

CHAPTER

TWENTYEIGHT

TISASREC-PADDLE (TIME INTERVAL AWARE SELF-ATTENTION FOR SEQUENTIAL RECOMMENDATION)

äżčçăĄèŕůåŘĆèĂČïijŽTiSASRecåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

28.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

28.2 æĺąåđŃçőĂäżŃ

äijăçż§çŽĎåžŘåĹŮåŇŰæŐĺè■ŘæĺąåđŃéČ¡åřĘäžď'äžŠåŐĘåŘšèğĘäÿžäÿĂäÿłæIJL'éąžåžŘçŽĎåžŘåĹŮïi
Interval Aware Self-Attention for Sequential Recommenda-
tionåřĘäžď'äžŠäÿ■çŽĎæŮűéŮť'æĹşåżžæĺąè£ŻåžŘåĹŮæĺąåđŃæąĘæđűäÿ■ïijŇäżěæŐćçť'ćäÿ■åŘŇçŽĎæŮűéŮ

28.3 æŢřæ■őåĞĘåď'Ğ

æIJňæĺąåđŃä¡£çŤĺèőžæŰĞäÿ■çŽĎæŢřæ■őéŻĘml-1mïijĹå■ąMovieLensæŢřæ■őéŻĘïijL'åIJĺæĺąåđŃçŻő

28.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

28.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæĺąåđŃçŽőå¡Ţ
# cd models/recall/ncf # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u infer.py -m config.yaml
```

28.6 æĺąåđŃçżĎç¡Ś

æĺąåđŃæŢť'ä¡ŞçżŞæđĎåęĆäÿŃïijŽ

28.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď'æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/recall/tisas
2. æĽğèąŇèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■åŁąåŹĺäÿŁäÿŃè¡¡æĹŚäżňéćĎåď'ĎçŘĘåőŇæĹŘçŽĎ

```
sh download.sh
```

1. åĹĞåŻđæĺąåđŃçŽőå¡Ţ,æĽğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŽőå¡Ţ
#␣
↪åŁĺæĂĄåŽ¿èő■çżČåźűå¿ŮåĹřæŇĞæăĞ(è£ŹéĞŇéIJĂèęĄä¡£çŤĺbashåŘŕåŁĺèĎŽæIJň)
python -u ../../../tools/trainer.py -m config_bigdata.yaml
python -u infer.py -m config_bigdata.yaml
```

28.8 è£ŻéŸűä¡£çŤÍ

28.9 FAQ

CHAPTER

TWENTYNINE

BST (BEHAVIOR SEQUENCE TRANSFORMER FOR E-COMMERCE RECOMMENDATION IN ALIBABA)

äżčçăĄèŕůåŘĆèĂČïijŽbståęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆÍæIJL'çŤÍïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

29.1 åĘĚåőź

- *æĹąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĹąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĹ*
- *FAQ*

29.2 æĹąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐÍè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{chen2019behavior,
  title={Behavior sequence transformer for e-commerce␣
↪recommendation in alibaba},
  author={Chen, Qiwei and Zhao, Huan and Li, Wei and Huang, Pipei␣
↪and Ou, Wenwu},
  booktitle={Proceedings of the 1st International Workshop on Deep␣
↪Learning Practice for High-Dimensional Sparse Data},
  pages={1--4},
  year={2019}
}
```

29.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèřŢæŢřæ■őéŻĘéĂĽçŤÍ(http://snap.stanford.edu/data/amazon/productGraph/categoryFile
AmazonæŢřæ■őéŻĘãĂĆèřěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèřŢéŻĘãĂĆ
æřŘäÿĂèąŇæŢřæ■őæăijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <userid> <history> <cate> <position> <target> <target_cate>
↪<target_position>
```

åĚűäÿ■<label>èąĺçďžåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąĺçďžïijŇæIJłçĆźåĞżçŤÍ0èąĺçďžã

29.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

29.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/bst # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

29.6 æĺąåđŃçżĎç¡Ś

29.6.1 åŢĘåŞĄçĽźå¿ĄéČĺåĹĘ

BSTæĺąåđŃçŽĎçżĎç¡ŚæIJňèťĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäžčçăĄåŘĆèĂČbst1.8.5çĽĹæIJňçŽĎm
pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕçž£æĂğåśĆéČĺåĹĘ, trans-
formeréČĺåĹĘäžěåŘŁçŻÿåžŢçŽĎåĹĘçśżäżżåŁąçŽĎlossèőąçőŮåŠŇaucèőąçőŮãĂĆbståřĘçŤĺæĹůçĆźåĞżçŽĎ

æŐěçİĂæŸŕSelf-Attentionèőąçő̊ůåĚňåijŔ:

çĎűåŘŐæŸŕåĽ■éęĹç¡ŚçżIJéČĺåĹĘïijŽ

29.6.2 çŤĺæĹůçĽźå¿ĄéČĺåĹĘ

åŕźäžŐçŤĺæĹůçĽźå¿ĄïijŇèőžæŰĞäÿ■åřĘèŕěçĽźå¿Ąè£ĞåőŇembeddingåśĆäźŃåŘŐïijŇåŔłæŸŕäÿŐçżŔ

æIJĂåŘŐäÿĂåśĆäÿžè¿ŞåĞžçżť åžęäÿž1çŽĎfcåśĆïijŇæŰźä¿£èőąçő̊ůéćĎæţŃåĂijãĂĆ

29.6.3 LossåŔŁAucèőąçő̊ů

- éćĎæţŃçŽĎçżŞæđIJçŤśæIJĂåŘŐäÿĂåśĆåĚĺè£đæŐěåśĆéĂŽè£Ğæ£Ăæť żåĞ¡æŢřsigmoidçżŹåĞžïijŇä
- æŕŔæİąæăůæIJňçŽĎæ■§åď śäÿžèť §åŕźæŢřæ■§åď śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď śavg_costæŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçő̊ůéćĎæţŃçŽĎaucæŇĞæăĞãĂĆ

29.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŔäÿłæĺąåđŃä
åIJĺåĚĺéĞŔæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size | epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | BST | 0.77+ | 256 | 7 | çžę0.55åřŔæŮűŕ |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/bst
2. è£ŻåĚědataçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäÿŃè¡¡amazonåĚĺéĞŔæŢřæ■őéŻĘïijŇåźűèğčå

```
cd ./data
sh data_process.sh
python build_dataset.py
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äźď è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

29.8 è£ŻéŸűä¡£çŤÍ

29.9 FAQ

CHAPTER

THIRTY

DCN (DEEP & CROSS NETWORK FOR AD CLICK PREDICTIONS)

äžčçăĄèŕůåŘĆèĂČïijŽdcnåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

30.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

30.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{DeepAndCross,
  title={DeepAndCross: Deep & Cross Network for Ad Click␣
↪Predictions},
  author={Ruoxi Wang, Bin Fu, Gang Fu, Mingliang Wang},
  year={2017}
}
```

30.3 æŢřæ■őåĞĘåďĞ

30.3.1 æŢřæ■őæİěæžŘ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘæŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçďžåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçďžïijŇæIJłçĆźåĞżçŤÍ0èąÍçďžãĂ<categorical feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categorical feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŽÿéĆżäÿďäÿ

30.3.2 äÿĂéŤőäÿŃè¡¡èő■çżČåŘŁæţŃèŕŢæŢřæ■ő

åĚÍéĞŘæŢřæ■őéŻĘèğčæđŘè£ĞçÍŃ:

1. çąőèőďæĆÍå¡ŞåĽ■æĽĂåIJÍçŽőå¡ŢäÿžPaddleRec/models/rank/dcn
2. è£ŻåĚěpaddlerec/datasets/criteoçŽőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■åĚ/slot_train_data_fullïijŇåĚÍéĞŘæţŃèŕŢæŢřæ■őæŤ¿ç¡őäžŐ./slot_test_data_full

```
cd ../../../datasets/criteo
sh run.sh
```

30.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

30.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŃïijŇåIJÍpaddlerecæÍąåđŃçŽőå¡ŢâĂİ

åŁÍæĂĄåŻ¿èő■çżČïijŽ

```
python ../../../tools/trainer.py -m ./config.yaml
```

éİŹæĂĄåŻ¿èő■çżČïijŽ

```
python ../../../tools/static_trainer.py -m ./config.yaml
```

åŁÍæĂĄåŻ¿æŐÍçŘĘ

```
python ../../../tools/infer.py -m ./config.yaml
```

éİŹæĂĄåŻ¿æŐÍçŘĘ

```
python ../../../tools/static_infer.py -m ./config.yaml
```

æşÍæĎŘèő■çżČ-éćĎæţŃïijŇæÍąåđŃå■ŸåĆÍæŰĞäżűä¡■ç¡őçŽĎäÿĂèĞť æĂğïijŻåŁÍæĂĄåŻ¿æÍąåđŃäÿŐ

30.6 æÍąåđŃçżĎç¡Ś

deepAndCrossæÍąåđŃçŽĎçżĎç¡ŚæIJňèť ÍæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇæÍąåđŃäżčçăĄåŘĆèĂČâĂIJ static_model.pyâĂİïijŇçżĎç¡Śäżčçă ĄåŘĆèĂČnet.pyãĂĆæÍąåđŃäÿżèęĄçżĎæĹŘæŸŕäžď åŘL'éąźCrosséČ 256, 128]ïijŇæŕŘåśĆFCéČ¡åŘŐæŐěäÿĂäÿłreluæ£Ăæť żåĞ¡æŢřïijŇæŕŘåśĆFCçŽĎåĹİåğŃåŇŰæŰźåijŘäÿżç

30.6.1 LossåŘŁAucèőąçőŮ

- éćĎæţŃçŽĎçżŞæđIJåřĘçŽĎcrosséČĺåĹĘäżěåŘŁdnnéČĺåĹĘè¿ŞåĞżçŽĎéŽŘåŘŚéĞŘçL'źå¿Ąconcatïij
- æŕŘæİąæăůæIJňçŽĎæ■§åď śäÿżèť §åŕźæŢřæ■§åď śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿżfloa
- èŕěbatchçŽĎæ■§åď śavg_costæŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŻèőąçőŮéćĎæţŃçŽĎaucïijŇaucçŽĎçżŞæđIJçŤśpaddle.static.auc()çżŹåĞżïijŇèŕěåśĆçŽĎè£ŤåŻđåĂijæIJL'äÿL'äÿłïijŇåĹĘåĹńæŸŕåĚĺåśĂauc: auc_varïijŇå¡ŞåL'■batchçŽĎauc: batch_auc_varïijŇäżěåŘŁauc_states: _ïijŇauc_statesåŇĚåŘńäžĘbatch_stat_pos, batch_stat_neg, stat_pos, stat_negä£ąæĄŕãĂĆ åőŇæĹŘäÿŁè£řçżĎç¡ŚåŘŐïijŇæĹŚäżňæIJĂçżĹåŘŕäżěéĂŽè£Č

30.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/dcn
2. åIJĺâĂİcriteo dataâĂİåĚĺéĞŘæŢřæ■őçŻőå¡ŢäÿŃïijŇè£ŘèąŇæŢřæ■őäÿĂéŤőåď ĎçŘĘèĎŽæIJňïijŇåŚ¡ä

```
cd ../../../datasets/criteo
sh run.sh
```

1. éĂĂåŻđdcnçŻőå¡Ţäÿ■ïijŇéĚ■ç¡őæŤźäÿžä¡£çŤĺconfig_big.yamläÿ■çŽĎåŘĆæŢř
2. è£ŘèąŇåŚ¡äżď ïijŇæĺąåđŃäijŽè£ŻèąŇäÿď äÿłepochçŽĎèő■çżČïijŇçĎůåŘŐéćĎæţŃçňňäžŇäÿłepochïij

```
python ../../../tools/trainer.py -m ./config_big.yaml
```

éİŹæĂĄåŻ¿èő■çżČïijŽ

```
python ../../../tools/static_trainer.py -m ./config_big.yaml
```

1. çżŕè£ĞåĚíéĞŕæŢřæ■őèő■çżČåŘŐïijŇæL'ğèąŇæŐÍçŘĘïijŽ åŁÍæĂĄåŻ¿æŐÍçŘĘ

```
python ../../../tools/infer.py -m ./config_big.yaml
```

éİŹæĂĄåŻ¿æŐÍçŘĘ

```
python ../../../tools/static_infer.py -m ./config_big.yaml
```

æşÍæĎŕèő■çżČ-écĎæţŃïijŇæÍąåđŃå■ŸåĆÍæŰĞäżűä¡■ç¡őçŽĎäÿĂèĞť'æĂğïijŻ

30.8 è£ŻéŸűä¡£çŤÍ

30.9 FAQ

CHAPTER

THIRTYONE

DEEPFEFM (FIELD-EMBEDDED FACTORIZATION MACHINES FOR CLICK-THROUGH RATE PREDICTION)

äżčçăĄèŕůåŘĆèĂČïijŽdeepfefmåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

31.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

31.2 æĺąåđŃçőĂäżŃ

`CTR(Click Through Rate)`ïijŇå■ąçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçążçż§/èőąçőŮåź£åŚŁâĂİç■

```
@article{pande2020field,
  title={Field-Embedded Factorization Machines for Click-through␣
↪rate prediction},
  author={Pande, Harshit},
  journal={arXiv preprint arXiv:2009.09931},
  year={2020}
}
```

æIJňæĺąåđŃæİěèĞłéčđæąĺèőžæŰĞåď'■çŐřæŇŚæĹŸèţŻïijĹçňňåŻŻæIJ§ïijL'DeepFEFMåĘăåĘŻæŰźæąĹ

31.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèřŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèřěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèřŢéŻĘæřŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçďžåź£åŚŁæŸřåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçďžïijŇæIJłçĆźåĞżçŤÍ0èąÍçďžãź feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categoric feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŽÿéĆżäÿďäÿ

31.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

31.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæÍąåđŃçŻőå¡Ţ
# cd models/rank/deepfefm # åIJÍäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

31.6 æÍąåđŃçżĎç¡Ś

èŕěæÍąåđŃæŸŕFMçśżæÍąåđŃçŽĎåŘĹäÿĂåŘŸçğ■ãĂĆæÍąåđŃæđűæđĎåęĆäÿŃïijŽ

æÍąåđŃçŽĎæăÿå£ČFEFMåĚňåijŘåęĆäÿŃïijŽ

åĚűäÿ■äÿŐFFMïijŇFwFMæĺąåđŃçŽĎæăÿå£ČåŇžåĹńåřśæŸŕä¡£çŤĺäÿĂäÿłåŕźçğřç§l'éŸţ Field pair matrix embeddings `$W_{F(i),F(j)}$` åŕźäÿ■åŘŇfield-çŽĎåĚşçşżè£ŻèąŇåżżæĺąãĂĆ

31.6.1 äÿĂéŸűéąźéČĺåĹĘ

äÿĂéŸűéąźéČĺåĹĘçśżäijijäžŐæĹŚäżňrankäÿŃçŽĎlogistic_regressionæĺąåđŃãĂĆäÿżèęĄçŤśembedding éęŰåĚĹäżŃçż■EmbeddingåśĆçŽĎæŘ■åżżæŰźåijŔïijŽ`Embedding`åśĆçŽĎè¿ŞåĚěæŸŕ`feat_idx`ïijŇshap

31.6.2 äžŇéŸűéąźéČĺåĹĘ

äžŇéŸűéąźéČĺåĹĘäÿżèęĄåőđçŐřäžĘåĚňåijŔäÿ■çŽĎäžď'åŔL'éąźéČĺåĹĘïijŇäź§åřśæŸŕçL'źå¿ĄçŽĎçżĎ

31.6.3 DNNéČĺåĹĘ

çŻÿæŕŤfmæĺąåđŃïijŇæĹŚäżňåŐżéŹď'äžĘfmæĺąåđŃäÿ■çŽĎåĄŕçğżéĞŔïijŇèĂŇåŁäåĚěäžĘdnnéČĺåĹĘ

31.6.4 LossåŔŁAucèőąçőŮ

- éćĎæţŃçŽĎçżŞæđIJåřĘFMçŽĎäÿĂéŸűéąźéČĺåĹĘïijŇäžŇéŸűéąźéČĺåĹĘäżěåŔŁdnnéČĺåĹĘçŻÿåŁäïij
- æŕŔæİąæăůæIJňçŽĎæ■§åď'śäÿžèť'§åŕźæŢřæ■§åď'śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď'ś`avg_cost`æŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď'śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucæŇĞæăĞãĂĆ

31.7 æŢĹæđIJåď'■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď'§å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŔäÿłæĺąåđŃä
åIJĺåĚĺéĞŔæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size | epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | deepfefm | 0.8028 | 5120 | 1 | çžę4.5åřŔæŮűˇ |

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/deepfefm
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

1. éćĎèő■çżČæĺąåđŃ æĆĺäź§åŕŕäżěäÿŃè¡¡æĹŚäżňçŽĎéćĎèő■çżČæĺąåđŃè£ŻèąŇä¡ŞéłŇãĂĆéŞ¿æŐě: https://pan.baidu.com/s/1CftnEt0nl1V6w6ApDzqkKA æŕŘåŕŰçăĄ: dyvf

31.8 è£ŻéŸűä¡£çŤĺ

31.9 FAQ

CHAPTER

THIRTYTWO

DEEPFM (DEEPFM: A FACTORIZATION-MACHINE BASED NEURAL NETWORK FOR CTR PREDICTION)

äžčçăĄèŕůåŘĆèĂČïijŽdeepfmåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJĽçŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

32.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

32.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ąçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçążçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{guo2017deepfm,
  title={DeepFM: A Factorization-Machine based Neural Network for␣
↪CTR Prediction},
  author={Huifeng Guo, Ruiming Tang, Yunming Ye, Zhenguo Li and␣
↪Xiuqiang He},
  booktitle={the Twenty-Sixth International Joint Conference on␣
↪Artificial Intelligence (IJCAI)},
  pages={1725--1731},
  year={2017}
}
```

32.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèřŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèřěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèřŢéŻĘæřŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçď žåź£åŚŁæŸřåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçď žïijŇæIJłçĆźåĞżçŤÍ0èąÍçď žãĂ feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categoric feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŻÿéĆżäÿďäÿ

32.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

32.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/deepfm # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

32.6 æĺąåđŃçżĎç¡Ś

deepFMæĺąåđŃçŽĎçżĎç¡ŚæIJňèťĺæŸřäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄåŘĆèĂČmodel.pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸřäÿĂéŸűéąźéČĺåĹĘïijŇäžŇéŸűéąźéČĺåĹĘ,dnnéČĺåĹĘäżěåŘŁçŻÿåžŤçŽĎ

32.6.1 äÿĂéŸűéąźéČĺåĹĘ

äÿĂéŸűéąźéČĺåĹĘçśżäijijäžŐæĹŚäżňrankäÿŃçŽĎlogistic_regressionæĺąåđŃãĂĆäÿżèęĄçŤśembedding

32.6.2 äžŇéŸűéąźéČĺåĹĘ

äžŇéŸűéąźéČĺåĹĘäÿżèęĄåőđçŐřäžĘåĚňåijŘäÿ■çŽĎäžď åŘĽéąźéČĺåĹĘïijŇäź§åřśæŸŕçĽźå¿ĄçŽĎçżĎ

V çŽĎçňň i åĹŮä¿£æŸŕçňň i çżť çĽźå¿ĄçŽĎéŽŘåŘŚéĞŘãĂĆçĽźå¿ĄåĹĘéĞŘXiäÿŐXjçŽĎäžď åŘĽéą wij=â§Ívi,vjâ§l' äžď åŘĽéąźçŽĎåśŢåijĂåijŘåęĆäÿŃïijŽ

32.6.3 dnnéČĺåĹĘ

çŻÿæŕŤfmæĺąåđŃïijŇæĹŚäżňåŐżéŹď äžĘfmæĺąåđŃäÿ■çŽĎåĄŘçğżéĞŘïijŇèĂŇåŁäåĚěäžĘdnnéČĺåĹĘ

32.6.4 LossåŘŁAucèőąçőŮ

- écĎæţŃçŽĎçżŞæđIJåřĘFMçŽĎäÿĂéŸűéąźéČĺåĹĘïijŇäžŇéŸűéąźéČĺåĹĘäżěåŘŁdnnéČĺåĹĘçŻÿåŁäïij
- æŕŘæİąæăůæIJňçŽĎæ■§åď śäÿžèť §åŕźæŢřæ■§åď śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď śavg_costæŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮécĎæţŃçŽĎaucæŇĞæăĞãĂĆ

32.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size |
epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | |
deepFM | 0.78 | 512 | 1 | çžę2åřŘæŮűź |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/deepfm
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĽ ğèąŇèŕěèĎŽæIJňïijŇäijŽäžŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽ ğèąŇåŚ¡äžď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

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32.8 è£ŻéŸűä¡£çŤÍ

32.9 FAQ

CHAPTER

THIRTYTHREE

DIEN (DEEP INTEREST EVOLUTION NETWORK FOR CLICK-THROUGH RATE PREDICTION)

äžčçăĄèŕůåŘĆèĂČïijŽdienåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç ĆźäÿłstaråŢŁ~

33.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

33.2 æĺąåđŃçőĂäżŃ

`CTR(Click Through Rate)`ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■ŘçŞżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{
  title={Deep Interest Evolution Network for Click-Through Rate
↪Prediction},
  author={Guorui Zhou, Na Mou, Ying Fan, Qi Pi, Weijie Bian, Chang
↪Zhou, Xiaoqiang Zhou, Kun Gai},
  year={2019}
}
```

DIENæĺąåđŃåijŢåĚěGRU-AttentionåĚť'èűčå■ęäźăæIJžåĹűïijŇèő¿èőąåśĂéČĺæ£Ăæť'żå■ŢåĚČïijŇåĹżçŤ
äżŐçŤĺæĹůåĚşäžŐæ§Řäÿłç L'ľ'åŞĄçŽĎåŐĘåŘšèąŇäÿžæŢřæ■őäÿ■ïijŇå■ęäźăçŤĺæĹůçŽĎåĚť'èűčèąĺè¿¿ãĂĆ
äÿ■åŘŇçŽĎåŢĘåŞĄ/åź£åŚŁåĚť'èűčåŘŚéĞŘäÿ■åŘŇïijŇäżŐèĂŇæŘŘéńŸæĺąåđŃçŽĎèąĺè¿¿èČ¡åŁŻãĂĆ

æ■ďåďŰïijŇæIJňæŰĞæŘŘåĞžåřŘæĽźéĞŘæ■čåĹŹäÿŐæŢřæ■őèĞłéĂĆåžŤæ£Ăæťżå£§èČ¡ïijŇæŘŘénŸäžĘåůěäÿŽçžğçŹ¿äž£çžğæŢřæ■őæĺąåđŃèő■çżČéĂ§åžęãĂĆ

33.3 æŢřæ■őåĞĘåďĞ

æ■ďæĺąåđŃèő■çżČåŠŇéćĎæţŃæűĽåŘŁïijŽçŤĺæĹůåŐĘåŘšçĆźåĞżåŢĘåŞĄåžŘåĹŮãĂĄçŤĺæĹůåŐĘåŘšçĆźåĞżåŞĄçśżäžěäÿŁ5éąźçŤĺåĹĘåŘůåĹĘåĽšïijŽçŤĺæĹůåŐĘåŘšçĆźåĞżåŢĘåŞĄåžŘåĹŮäÿ■ïijŇåŢĘåŞĄéŮťçŤĺçľžæăijéŽçŤĺæĹůåŐĘåŘšçĆźåĞżåŞĄçśżåžŘåĹŮäÿ■ïijŇåŞĄçśżéŮťçŤĺçľžæăijéŽŤåijĂïijŽ

æŢřæ■őåďĎçŘĘäÿ■ïijŇ åŕźäžŐåžŘåĹŮæŢřæ■őïijŇæĹŚäżňäżěæIJĂéŢ£åžŘåĹŮéŢ£åžęäÿžåĞĘïijŇåřĘåŘŇæŮűïijŇéĞĞçŤĺmaskç§ľéŸţïijŇåŕźäžŐèąěé¡ŘçŽĎç¡Śæăijé ČĺåĹĘïijŇåĹłåğŇåŇŰäÿž-INFïijŇäżŐèĂŇåIJĺsigmoidåŘŐïijŇä¡£äźŇåď śæŢĹäÿž0ïijŽ

åIJĺæĺąåđŃçżőå¡ŢçŽĎdata/train_data/sample_data.txtçżőå¡ŢäÿŃäÿžæĆĺåĞĘåď ĞäžĘå£ńéĂ§è£ŘèąŃçŽ

33.4 è£ŘèąŃçŐŕåćČ

PaddlePaddle>=2.0

python 3.5/3.6/3.7

os : windows/linux/macos

33.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺdienæĺąåđŃçżőå¡ŢçŽĎå£ńé

```
# è£ŻåĚěæĺąåđŃçżőå¡Ţ
cd models/rank/dien
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĺźæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml
# éĺźæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

åĚűäÿ■yamlæŰĞäżűçŽĎèűĚåŘĆæŢřèğčéĞŁåęĆäÿŃïijŽ

```
item_emb_size: åŢĘåŞĄçŽĎembeddingçżt'åžę
cat_emb_size:  åŞĄçśżçŽĎembeddingçżt'åžę
```

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```
item_count: åŢĘåŞĄçŽĎçğ■çśżæŢřçŻő
cat_count:  åŞĄçśżçŽĎçğ■çśżæŢřçŻő
```

33.5.1 LossåŘŁAccèőąçőŮ

- æIJňæŰĞéĞĞçŤÍAUGRUåŘŁæÍąåđŃçżĎç¡ŚïijŇéĞĞçŤÍsigmoidæ£Ăæť żåĞ¡æŢř
- écĎæţŃçŽĎçżŞæđIJäÿžäÿĂäÿłsigmoidåŘŚéĞŘïijŇèąÍçď žæŐÍè■ŘçŽĎåŢĘåŞĄåź£åŚŁèćńçŤÍæĹůçĆź
- æăůæIJňçŽĎæ■§åď śåĞ¡æŢřåĂijçŤśCTR_lossåŠŇAuxiliary_lossåŘäåŁăçżĎæĹŘïijŇåŘŇæŮűèőąçőŮ

33.6 æŢĹæđIJåď■çŐř

33.6.1 æŢřæ■őéŻĘèŐůåŘŰåŘŁécĎåď ĎçŘĘ

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæÍąåđŃä eletronics datasetåĚÍéĞŘæŢřæ■őéŻĘåźűè¡ňæ■ćäÿžæÍąåđŃèČ¡æŐěåŘŮçŽĎ è¿ŞåĚěæäijåijŘãĂĆ

- åď ĎçŘĘåě¡çŽĎåŐ§åğŃæŢřæ■őéŻĘäÿŃè¡¡æĽğèąŇæŰźæşŢïijŽ

```
cd ./PaddleRec/datasets/amazonElec_Din
sh run.sh
```

- æĹŰèĞłèąŇè£ŻèąŇåŐ§åğŃæŢřæ■őäÿŃè¡¡écĎåď ĎçŘĘïijŇæĽğèąŇæŰźæşŢåęĆäÿŃïijŽ

```
cd ./PaddleRec/datasets/amazonElec_Din
sh data_process.sh
python build_dataset.py
# èĎŽæIJňè£ŘèąŇåőŇæĹŘåŘŐïijŇæĽ'ŞåijĂconfig.
↪txtïijŇåřĘåĚűäÿ■çŽĎåŢĘåŞĄçŽĎçğ■çśżæŢřçŻőïijĹçňňäžŇèąŇæŢřåĂijïijĽ'ãĂĄåŞĄçśżçŽĎç
# copyåĹřconfig_bigdata.yamléĞŇïijŇæŽ£æ■ćèűĚåŘĆæŢřitem_count cat_
↪count
```

33.6.2 æÍąåđŃèő■çżČåŘŁæŢĹæđIJåď■çŐř

åIJĺåĚÍéĞŘæŢřæ■őäÿŃæÍąåđŃçŽĎæŃĞæăĞåęĆäÿŃïijŽ | æÍąåđŃ | auc | batch_size | epoch_num| Time of each epoch| | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | DIEN | 0.826 | 32 | 10 | çžę2åřŘæŮűˇ |

```
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml
# éĺźæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config_bigdata.yaml
```

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```
# åŁÍæĂĄåŻ¿éćĎæţŃ
python -u ../../../tools/infer.py -m config_bigdata.yaml
# éİŹæĂĄåŻ¿éćĎæţŃ
python -u ../../../tools/static_infer.py -m config_bigdata.yaml
```

CHAPTER

THIRTYFOUR

DIFM (A DUAL INPUT-AWARE FACTORIZATION MACHINE FOR CTR PREDICTION)

äžčçăĄèŕůåŘĆèĂČïijŽdifmåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

34.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

34.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■DIFM æĺąåđŃïijŽ

```
@inproceedings{lu2020dual,
  title={A Dual Input-aware Factorization Machine for CTR␣
↪Prediction.},
  author={Lu, Wantong and Yu, Yantao and Chang, Yongzhe and Wang,␣
↪Zhen and Li, Chenhui and Yuan, Bo},
  booktitle={IJCAI},
  pages={3139--3145},
  year={2020},
  url={https://www.ijcai.org/Proceedings/2020/0434.pdf}
}
```

34.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤÍ Display Advertising Challenge æĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘãĂĆè æŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçď žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçď žïijŇæIJłçĆźåĞżçŤÍ0èąÍçď žã feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŽÿéĆżäÿď äÿ

34.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

34.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŽőå¡ŢäÿŃåİĞåŘŕæ difm æĺąåđŃçŽőå¡ŢçŽĎå£ńéĂ§æĽğèąŇåŚ¡äżď åęĆäÿŃïijŽ

```
# è£ŽåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/difm # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇ config_bigdata.yaml
# åŁĺæĂĄåŽ¿éćĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇ config_bigdata.yaml
# éİŹæĂĄåŽ¿éćĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

34.6 æĺąåđŃçżĎç¡Ś

DIFM æĺąåđŃçŽĎçżĎç¡ŚæIJňèťĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄąåŘĆèĂČ net.pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕ Embedding åśĆïijŇDual-FEN åśĆïijŇReweighting

åśĆïijŇ FM çĽźå¿ĄäžďåŕľåśĆäžěåŕŁçŻÿåžŤçŽĎåĹĘçśżäżżåŁąçŽĎlossèőąçőŮåŠŇaucèőąçőŮãĂĆ

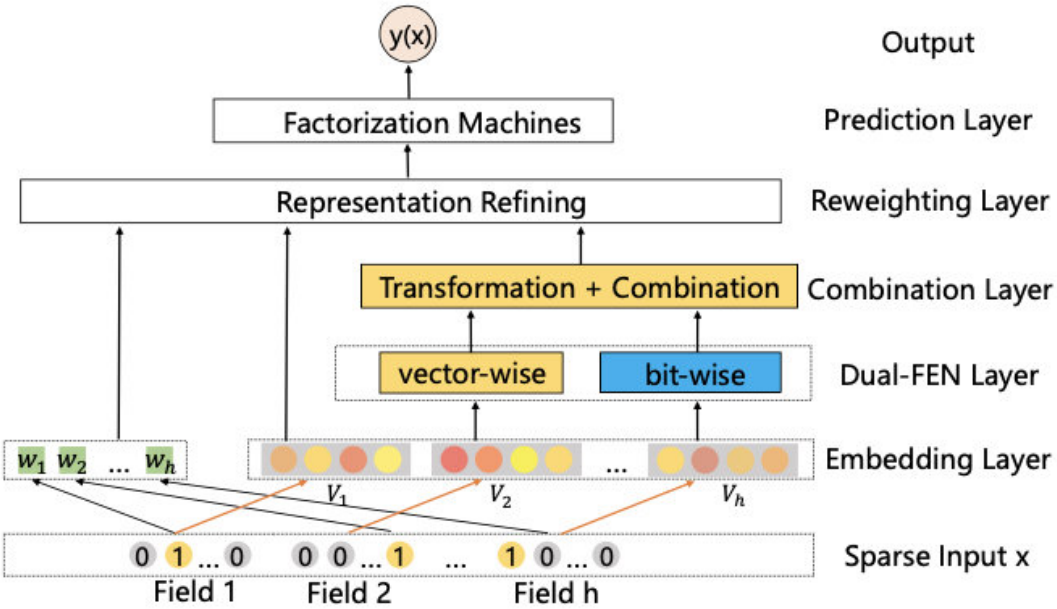

Figure 1: The network structure of the proposed Dual Input-aware Factorization Machines model.

DIFM

34.6.1 äÿżèęĄæţĄçÍŃ

äÿŁåŻ¿äÿž DIFM çŽĎç¡ŚçżIJçżŞæđĎåŻ¿ïijŇpaper éćŸçŻőäÿ■æĽĂæŇĞçŽĎ Dual-FEN äÿž `vector-wise` åŠŇ `bit-wise`äÿďäÿł Input-aware Factorization æÍąåİŮ, äÿĂäÿłæŸŕ bit-wise, äÿĂäÿłæŸŕ vector-wiseãĂĆåŕłæŸŕçżťåžęäÿŁäÿ■åŘŇïijŇåőđçŐřçŽĎçŻťèğĽæŸŕäÿĂæăůçŽĎãĂĆbit-wise çżťåžęäijŽåŕźæ§ŘäÿĂäÿł sparse embedding åŘŚéĞŕåĘĚéČÍå¡ijæ■ďè£ŻèąŇäžďåŕĽïijŇèĂŇ vector-wise äżĚäżĚåďĎçŘĘ embedding åŘŚéĞŕåśĆæňąäžďåŕĽãĂĆæŁŁ vector-wise FEN æÍąåİŮåŐżæŐĽïijŇDIFM åřśéĂĂåŇŰäÿž IFM æÍąåđŃäžĘïijŇèŕěçőŮæşŢäź§æŸŕèőžæŰĞä¡IJèĂĚåőđéłŇçżĎçŽĎåď ğä¡IJïijŇåĚűçżŞæđĎåŻ¿åęĆäÿŃïijŽ

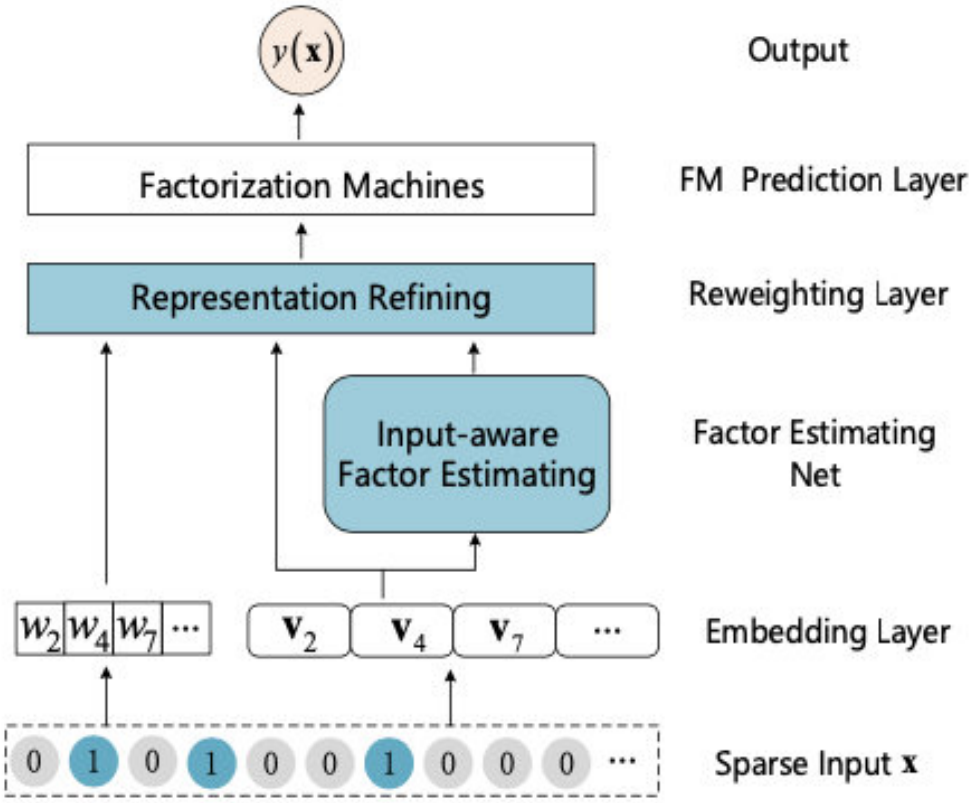

Figure 1: The network architecture of our proposed Input-aware Factorization Machines model

IFM

äÿď'çśżäÿ■åŘŇçżť'åžęçŽĎ FEN(Factor Estimating Net) ä¡IJçŤĺéČ¡æŸŕäÿĂèĞť'çŽĎïijŇå■şè¿ŞåĞž Embedding Layer çŻÿåžŤåŘŚéĞŘçŽĎæĺČéĞ■ãĂĆäÿ¿äÿłä¿Ńå■ŘïijŇåĄĞèő¿äÿŁæÿÿæIJL' n äÿł sparse featuresïijŇ åĹŹ FEN è¿ŞåĞžçżŞæđIJäÿž [a1, a2, âĂę, an]. åIJÍ Reweighting Layer äÿ■ïijŇåŕźåŐ§åğŃè¿ŞåĚěè£ŻèąŇæĺČéĞ■èřČæŢť'ãĂĆæIJĂåŘŐè¿ŞåĚěåĹř FM åśĆè£ŻèąŇçL'źå¿Ąäžď'åŘL'ïijŇè¿ŞåĞžéćĎæţŃçżŞæđIJãĂĆåŻäæ■ď'ïijŇæĂżçżŞäÿď'çŕĞèőžæŰĞæ■ěéłď'åęĆ

- sparse features çżŘçŤś Embedding Layer æ§ěèąĺå¿ŮåĹř embedding åŘŚéĞŘïijŇdense features çL'źå¿ĄåęĆä¡Ţåď'ĎçŘĘäÿď'çŕĞèőžæŰĞéČ¡æšąæŘŘåŘŁïijŻ
- sparse features åŕźåžŤçŽĎäÿĂéŸŰæĺČéĞ■äź§åŘŕäżěéĂŽè£Ğ 1 çżť' Embedding Layer æ§ěæL'¿ïijŻ
- sparse embeddings è¿ŞåĚě FEN (bit-wise or vector-wise)ïijŇå¿ŮåĹřçL'źå¿ĄåŕźåžŤçŽĎæĺČéĞ■ [a1, a2, âĂę, an]ïijŻ
- Reweighting Layer æăźæ■őäÿŁäÿĂæ■ěéłď'äÿ■çŽĎçL'źå¿ĄæĺČéĞ■ïijŇåŕź sparse embeddings è£ŻäÿĂæ■èřČæŢť'ïijŻ
- FM Layer è£ŻèąŇçL'źå¿Ąäžď'åŘL'ïijŇè¿ŞåĞžéćĎæţŃæęĆçŐĞïijŻ

34.6.2 Loss åŘŁ Auc èőąçőŮ

- äÿžäžĘå¿ŮåĹřæŕŘæİąæăůæIJňåĹĘåśđäžŐæ■čèť§æăůæIJňçŽĎæęĆçŐĞïijŇæĹŚäžňåřĘéćĎæţŃçżŞæđ
  1-predict åŘĹåźűèţůæİěå¿ŮåĹř predict_2dïijŇäžěä¿£æŐěäÿŃæİěèőąçőŮ
  aucãĂĆ
- æŕŘæİąæăůæIJňçŽĎæ■§åď śäÿžèť§åŕźæŢřæ■§åď śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èřěbatchçŽĎæ■§åď ś avg_cost æŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď śäźŃåŠŇ
- æĹŚäžňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucæŇĞæăĞãĂĆ

34.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäžňåIJĺæŕŘäÿłæĺąåđŃä
README äÿ■çŽĎæŢĹæđIJ,èřůæŇL'åęĆäÿŃæ■ěéłď ä¿İæňąæŞ■ä¡IJå■şåŘŕãĂĆ
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡Ţäÿž PaddleRec/models/rank/difm
2. è£ŻåĚě PaddleRec/datasets/criteo çŻőå¡ŢäÿŃïijŇæL'ğèąŇèřěèĎŽæIJňïijŇäijŽäžŐåŻ¡åĘĚæ
   criteo åĚĺéĞŘæŢřæ■őéŻĘïijŇåźűèğčåŐŃåĹřæŇĞåőŽæŰĞäžűåď źãĂĆ

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äžď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

34.8 è£ŻéŸűä¡£çŤĺ

34.9 FAQ

CHAPTER

THIRTYFIVE

DIN (DEEP INTEREST NETWORK FOR CLICK-THROUGH RATE PREDICTION)

äžčçăĄèřůåŘĆèĂČïijŽdinåęĆæđIJæĹŚäžňçŽĎäžčçăĄåřźæĆĺæIJL'çŤĺïijŇè£ŸèřůçĆźäÿłstaråŢŁ~

35.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåd'Ğ*
- *è£ŘèąŇçŐřåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåd'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

35.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ęçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçężçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{
  title={Deep Interest Network for Click-Through Rate Prediction},
  author={Guorui Zhou, Chengru Song, Xiaoqiang Zhu, Ying Fan, Han␣
↪Zhu, Xiao Ma, Yanghui Yan, Junqi Jin, Han Li, Kun Gai},
  year={2019}
}
```

DINæĺąåđŃåijŢåĚěAttentionæęĺæĎŘåŁŻæIJžåĹűïijŇèő¿èőąåśĂéČĺæ£Ăæť'żå■ŢåĚČïijŇåĹżçŤżçŤĺæĹů
äżŐçŤĺæĹůåĚęäžŐæ§ŘäÿłçL'l'åŞĄçŽĎåŐĘåŘšèąŇäÿżæŢřæ■őäÿ■ïijŇå■ęäźäçŤĺæĹůçŽĎåĚť'èűčèąĺè¿¿ãĂĆ
äÿ■åŘŇçŽĎåŢĘåŞĄ/åź£åŚŁåĚť'èűčåŘŚéĞŘäÿ■åŘŇïijŇäżŐèĂŇæŘŘéńŸæĺąåđŃçŽĎèąĺè¿¿èČ¡åŁŻãĂĆ
æ■d'åd'ŰïijŇæIJňæŰĞæŘŘåĞžåřŘæL'źéĞŘæ■čåĹŹäÿŐæŢřæ■őèĞłéĂĆåžŤæ£Ăæť'żåŁ§èČ¡ïijŇ
æŘŘéńŸäžĘåůěäÿŽçžğçŹ¿äž£çžğæŢřæ■őæĺąåđŃèő■çżČéĂ§åžęãĂĆ

35.3 æŢřæ■őåĞĘåďĞ

æ■ďæĺąåđŃèő■çżČåŠŃéćĎæţŃæűĽåŘŁïijŽçŤĺæĹůåŐĘåŘšçĆźåĞżåŢĘåŞĄåžŘåĹŮãĂĄçŤĺæĹůåŐĘåŘšçĆźåĞżåŞĄçśż

æŕŘèąŃçŽĎæăijåijŘäÿžïijŽçŤĺæĹůåŐĘåŘšçĆźåĞżåŢĘåŞĄåžŘåĹŮãĂĄçŤĺæĹůåŐĘåŘšçĆźåĞżåŞĄçśż

æŢřæ■őåď ĎçŘĘäÿ■ïijŃ åŕźäžŐåžŘåĹŮæŢřæ■őïijŃæĹŚäżňäżěæIJĂéŢ£åžŘåĹŮéŢ£åžęäÿžåĞĘïijŃåřĘ
åŘŃæŮűïijŃéĞĞçŤĺmaskç§ľéŸţïijŃåŕźäžŐèąěé¡ŘçŽĎç¡Śæăijé ČĺåĹĘïijŃåĹĺåğŃåŃŰäÿž-
INFïijŃäżŐèĂŃåIJĺsigmoidåŘŐïijŃä¡£äźŃåď śæŢĹäÿž0ïijŻ

åIJĺæĺąåđŃçŻőå¡ŢçŽĎdata/train_data/sample_data.txtçŻőå¡ŢäÿŃäÿžæĆĺåĞĘåď ĞäžĘå£ńéĂ§è£ŘèąŃçŽ

35.4 è£ŘèąŃçŐŕåćČ

PaddlePaddle>=2.0

python 3.5/3.6/3.7

os : windows/linux/macos

35.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŃïijŃåIJĺdinæĺąåđŃçŻőå¡ŢçŽĎå£ńéĂ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
cd models/rank/din
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml
# éĬŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

åĚűäÿ■yamlæŰĞäżűçŽĎèűĚåŘĆæŢřèğčéĞŁåęĆäÿŃïijŽ

```
item_emb_size: åŢĘåŞĄçŽĎembeddingçżt'åžę
cat_emb_size:  åŞĄçśżçŽĎembeddingçżt'åžę
item_count: åŢĘåŞĄçŽĎçğ■çśżæŢřçŻő
cat_count:  åŞĄçśżçŽĎçğ■çśżæŢřçŻő
```

35.5.1 LossåŘŁAccèőąçőŮ

- æIJňæŰĞAttentionåŘŁæĺąåđŃçżĎç¡ŚïijŃéĞĞçŤĺsigmoidæ£Ăæť żåĞ¡æŢř

- écĎæţŃçŽĎçżŞæđIJäÿžäÿĂäÿłsigmoidåŘŚéĞŘïijŇèąĺçď žæŐĺè■ŘçŽĎåŢĘåŞĄåź£åŚŁèćńçŤĺæĹůçĆź
- æăůæIJňçŽĎæ■§åď śåĞ¡æŢřåĂijçŤśäžď åŘĹ'çĘţçżŹåĞžïijŇåŘŇæŮűèőąçőŮécĎæţŃçŽĎauc

35.6 æŢĹæđIJåď■çŐř

35.6.1 æŢřæ■őéŻĘèŐůåŘŰåŘŁécĎåď ĎçŘĘ

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
eletronics datasetåĚĺéĞŘæŢřæ■őéŻĘąźűè¡ňæ■ćäÿžæĺąåđŃèČ¡æŐěåŘŮçŽĎ
è¿ŞåĚěæăijåijŘãĂĆ

- åď ĎçŘĘåě¡çŽĎåŐ§åğŃæŢřæ■őéŻĘäÿŃè¡¡æĹ'ğèąŇæŰźæşŢïijŽ

```
cd ./PaddleRec/datasets/amazonElec_Din
sh run.sh
```

- æĹŰèĞłèąŇè£ŻèąŇåŐ§åğŃæŢřæ■õäÿŃè¡¡écĎåď ĎçŘĘïijŇæĹ'ğèąŇæŰźæşŢåęĆäÿŃïijŽ

```
cd ./PaddleRec/datasets/amazonElec_Din
sh data_process.sh
python build_dataset.py
# èĎŽæIJňè£ŘèąŇåőŇæĹŘåŘŐïijŇæL'ŞåijĂconfig.
↪txtïijŇåřĘåĚűäÿ■çŽĎåŢĘåŞĄçŽĎçğ■çśżæŢřçżőïijĹçňňäžŇèąŇæŢřåĂijïijL'ãĂĄåŞĄçśżçŽĎç
# copyåĹřconfig_bigdata.yamléĞŇïijŇæŻ£æ■ćèűĚåŘĆæŢřitem_count cat_
↪count
```

35.6.2 æĺąåđŃèő■çżČåŘŁæŢĹæđIJåď■çŐř

åIJĺåĚĺéĞŘæŢřæ■õäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc | batch_size | epoch_num| Time of each epoch| | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | DIN | 0.83 | 32 | 7 | çžę30åĹĘéŠ§ |

```
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml
# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config_bigdata.yaml
# éĬŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config_bigdata.yaml
```

CHAPTER

THIRTYSIX

DLRM (DEEP LEARNING RECOMMENDATION MODEL FOR PERSONALIZATION AND RECOMMENDATION SYSTEMS)

äżčçăĄèŕůåŘĆèĂČïijŽdlrmåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

36.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

36.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ąçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçążçż§/èőąçőŮåź£åŚŁâĂİç■DLRM æĺąåđŃïijŽ

```
@article{DLRM19,
  author    = {Maxim Naumov and Dheevatsa Mudigere and Hao{-}Jun␣
↪Michael Shi and Jianyu Huang and Narayanan Sundaraman and Jongsoo␣
↪Park and Xiaodong Wang and Udit Gupta and Carole{-}Jean Wu and␣
↪Alisson G. Azzolini and Dmytro Dzhulgakov and Andrey Mallevich␣
↪and Ilia Cherniavskii and Yinghai Lu and Raghuraman␣
↪Krishnamoorthi and Ansha Yu and Volodymyr Kondratenko and␣
↪Stephanie Pereira and Xianjie Chen and Wenlin Chen and Vijay Rao␣
↪and Bill Jia and Liang Xiong and Misha Smelyanskiy},
```
(continues on next page)

(continued from previous page)

```
  title     = {Deep Learning Recommendation Model for␣
↪Personalization and Recommendation Systems},
  journal   = {CoRR},
  volume    = {abs/1906.00091},
  year      = {2019},
  url       = {https://arxiv.org/abs/1906.00091},
}
```

36.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèřŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèřěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèřŢéŻĘæřŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçď žåź£åŚŁæŸřåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçď žïijŇæIJłçĆźåĞżçŤÍ0èąÍçď žã
feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori
feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŽÿéĆżäÿďäÿ

36.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

36.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŽőå¡ŢäÿŃåĬĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/dlrm # åIJĺäżżæĎŘçŽőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬŽæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

(continues on next page)

(continued from previous page)

```
# éİźæĂĄåż¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

36.6 æĺąåđŃçżĎç¡Ś

DLRM æĺąåđŃçŽĎçżĎç¡ŚæIJňèť ĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄąåŔĆèĂČ net.pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕ Bottom-MLP åśĆïijŇEmbedding åśĆïijŇçL'źå¿Ąäžď'åŔL'éČĺåĹĘïijŇTop-MLP åśĆäżěåŔŁçŻÿåžŤçŽĎåĹĘçśżäżżåŁąçŽĎlossèőąçőŮåŠŇaucèć

36.6.1 äÿżèęĄæţĄçĺŃ

DLRM æĺąåđŃçŽĎçL'źå¿Ąè¿ŞåĚěïijŇäÿżèęĄåŇĚæŃň dense æŢřåĂijåđŃåŠŇ sparse çśżåĹńåđŃäÿď'çğ■çL'źå¿ĄãĂĆdense features çŻť'æŐěè£đæŐě MLPïijĹåęĆåŻ¿äÿ■çŽĎèŞÍèL'šäÿL'èğŠå¡ćïijL'ïijŇ sparse features çżŔçŤś embedding åśĆæ§ěæL'¿å¿ŮåĹřçŻÿåžŤçŽĎ embedding åŘŚéĞŔãĂĆInteractions åśĆè£ŻèąŇçL'źå¿Ąäžď'åŔL'ïijĹåŇĚåŘń dense features åŠŇ sparse features çŽĎäžď'åŔL'åŔŁ sparse featuresäźŃéŮť'çŽĎäžď'åŔL'ç■L'ïijL'ïijŇäÿŐåŻäå■ŘåĹĘèğčæIJž FM æIJL'äžŻçśżäijijãĂĆ

DLRM æĺąåđŃäÿ■æL'ĂæIJL'çŽĎ sparse features çŽĎ embedding åŘŚéĞŔéŢ£åžęåİĞæŸŕçŻÿç■L'çŽĎïijŇäÿŤdense features çżŔçŤś MLP äź§è¡ňåŇŰæĹŘçŻÿåŘŇçŽĎçżť'åžęãĂĆè£ŹçĆźæŸŕçŘĘèğčèŕěæĺąåđŃäżčçăĄçŽĎåĚşéŤőãĂĆ

- dense features çżŔè£Ğ MLP (bottom-MLP) åď'ĎçŘĘäÿžåŘŇæăůçżť'åžęçŽĎåŘŚéĞŔ
- spare features çżŔçŤś lookup èŐůå¿Ůçż§äÿĂçżť'åžęçŽĎ embedding åŘŚéĞŔïijĹåŔŕéĂL'æŃľ'æŕŔäÿĂçL'źå¿ĄåŕźåžŤçŽĎ embedding æŸŕåŘęçżŔè£Ğ MLP åď'ĎçŘĘïijL'
- dense features & sparse features çŽĎåŘŚéĞŔäÿď'äÿď'äźŃéŮť'è£ŻèąŇ dot product äžď'åŔL'
- äžď'åŔL'çżŞæđIJåĘ■åŠŇ dense åŘŚéĞŔ concat äÿĂèţůè¿ŞåĚěåĹřéąűåśĆ MLP (top-MLP)
- çżŔè£Ğ sigmoid åĞ¡æŢřæ£Ăæť'żå¿ŮåĹřçĆźåĞżæęĆçŐĞ

36.6.2 Loss åŔŁ Auc èőąçőŮ

- äÿžäžĘå¿ŮåĹřæŕŔæİąæăůæIJňåĹĘåśđäžŐæ■čèť'§æăůæIJňçŽĎæęĆçŐĞïijŇæĹŚäżňåřĘéćĎæţŃçżŞæđ 1-predict åŘĹåźűèţůæİěå¿ŮåĹř predict_2dïijŇäžěä¿£æŐěäÿŃæİěèőąçőŮ aucãĂĆ
- æŕŔæİąæăůæIJňçŽĎæ■§åď'śäÿžèť'§åŕźæŢřæ■§åď'śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď'ś avg_cost æŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď'śäźŃåŠŇ

- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucæŇĞæăĞãĂĆ

36.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
README äÿ■çŽĎæŢĹæđIJ,èŕůæŇL'åęĆäÿŃæ■ěéłď'ä¿İæňąæŞ■ä¡IJå■şåŘŕãĂĆ
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡Ţäÿž `PaddleRec/models/rank/dlrm`
2. è£ŻåĚě `PaddleRec/datasets/criteo` çŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæ

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

36.8 è£ŻéŸűä¡£çŤĺ

36.9 FAQ

CHAPTER

THIRTYSEVEN

DMR (DEEP MATCH TO RANK MODEL FOR PERSONALIZED CLICK-THROUGH RATE PREDICTION)

äžčçăĄèŕůåŘĆèĂČïijŽdmråęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆÍæIJL'çŤÍïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

37.1 åĘĚåőź

- *æÍąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æÍąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤÍ*
- *FAQ*

37.2 æÍąåđŃçőĂäżŃ

äÿď'äÿłdeepå■Řç¡ŚçżIJèŐůåŘŰuserçŽĎäÿď'çğ■æŁ¡èśąèąÍè¿¿ïijŇå¿ŮůÍřUåŠŇtarget itemçŽĎscoreïijŇçżŞåŘĹåĚűäżŰçL'źå¿ĄéĂĄåĚěMLPèőąçőŮctr scoreãĂĆDeep Match to Rank Model for Personalized Click-Through Rate PredictionæŰĞçńäéĂŽè£Ğ User-to-Item å■Řç¡ŚçżIJåŠŇ Item-to-Item å■Řç¡ŚçżIJæĺěèąÍå¿Ą U2I çŻÿåĚşæĂğïijŇåĘ■çżŞåŘĹäijäçż§çŽĎrec model featuresïijŇæŘŘå■ĞæÍąåđŃçŽĎèąÍè¿¿èČ¡åŁŻãĂĆæIJňæÍąåđŃæĺěèĞłéčđæąÍèőžæŰĞåď'■çŐřæŇŚæĹŸèţŻïijĹç

37.3 æŢřæ■őåĞĘåď'Ğ

æIJňæÍąåđŃä¡£çŤÍèőžæŰĞäÿ■çŽĎæŢřæ■őéŻĘAlimama DatasetïijŇåIJÍæÍąåđŃçŻőå¡ŢçŽĎdataçŻőå¡Ţä

37.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 3.5/3.6/3.7

os : windows/linux/macos

37.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/dmr # åIJĺäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éĬŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

37.6 æĺąåđŃçżĎç¡Ś

èőžæŰĞDeep Match to Rank Model for Personalized Click-Through Rate Predictionäÿ■çŽĎç¡ŚçżIJçżŞæđĎåęĆåŻ¿æĽĂçď ž:

37.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/dmr
2. è£ŻåĚěpaddlerec/datasets/Ali_Display_Ad_ClickçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĽ

```
cd ../../../datasets/Ali_Display_Ad_Click
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

37.8 è£ŻéŸűä¡£çŤĺ

37.9 FAQ

CHAPTER

THIRTYEIGHT

DNN (-)

äžčçăĄèŕůåŘĆèĂČïijŽdnnåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

38.1 åĘĚåőź

- *æĹąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĹąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

38.2 æĹąåđŃçőĂäżŃ

`CTR(Click Through Rate)`ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■ŘçŞżçż§/èőąçőŮåź£åŚŁâĂİç■

38.3 æŢřæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂL'çŤÍDisplay Advertising ChallengeæL'ĂçŤĺçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿď'éČĺåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘ æŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæL'Ăçď'žïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąĺçď žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤĺ1èąĺçď žïijŇæIJłçĆźåĞżçŤĺ0èąĺçď žã
feature>äżčèąĺæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori
feature>äżčèąĺåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŻÿéĆżäÿď äÿ

38.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

38.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/dnn # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

38.6 æĺąåđŃçżĎç¡Ś

38.6.1 æŢřæ■őè¿ŞåĚěåčřæŸŐ

æ■čåęĆæŢřæ■őåĞĘåď Ğçńäè ŁĆæĽ ĂäżŃçż■ïijŇCriteoæŢřæ■őéŻĘäÿ■ïijŇåĹĘäÿžè£đçż■æŢřæ■őäÿŐçę
DNNæĺąåđŃçŽĎæŢřæ■őè¿ŞåĚěåśĆåŇĚæŃňäÿĽäÿłïijŇåĹĘåĹńæŸŕïijŽdense_inputçŤĺäžŐè¿ŞåĚěè£đçż

38.6.2 CTR-DNNæĺąåđŃçżĎç¡Ś

CTR-DNNæĺąåđŃçŽĎçżĎç¡ŚæŕŤè¿ĎçŻť èğĆïijŇæIJňèť ĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄåŔĆè
pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕäÿĂäÿłEmbeddingåśĆïijŇåŻŻäÿłFCåśĆïijŇäżěåŔŁçŻÿåžŤçŽĎåĹĘçśż

EmbeddingåśĆ

éęŰåĚĹäżŃçż■EmbeddingåśĆçŽĎæŘ■åżžæŰźåijŘïijŽEmbeddingåśĆçŽĎè¿ŞåĚěæŸŕsparse_inpu

åŘĎäÿłçÍĂçŰŘçŽĎè¿ŞåĚěéĂŽè£ĞEmbeddingåśĆåŘŐïijŇåřĘåĚűåŘĹåźűèţůæÍěïijŃç¡őäžŐäÿĂäÿłlistål

```
self.embedding = paddle.nn.Embedding(
            self.sparse_feature_number,
            self.sparse_feature_dim,
            sparse=True,
            weight_attr=paddle.ParamAttr(
                name="SparseFeatFactors",
                initializer=paddle.nn.initializer.Uniform()))
```

FCåśĆ

åřEçężæŢčæŢřæ■őéĂŽè£Ğembeddingæ§ěèąĺå¿ŮåĹřçŽĎåĂijïijŇäÿŐè£đçż■æŢřæ■őçŽĎè¿ŞåĚěè£Żèą

```
sizes = [sparse_feature_dim * num_field + dense_feature_dim
            ] + self.layer_sizes + [2]
acts = ["relu" for _ in range(len(self.layer_sizes))] + [None]
self._mlp_layers = []
for i in range(len(layer_sizes) + 1):
    linear = paddle.nn.Linear(
        in_features=sizes[i],
        out_features=sizes[i + 1],
        weight_attr=paddle.ParamAttr(
            initializer=paddle.nn.initializer.Normal(
                std=1.0 / math.sqrt(sizes[i]))))
    self.add_sublayer('linear_%d' % i, linear)
    self._mlp_layers.append(linear)
    if acts[i] == 'relu':
        act = paddle.nn.ReLU()
        self.add_sublayer('act_%d' % i, act)
        self._mlp_layers.append(act)
```

LossåŘŁAucèőąçŐŮ

- éćĎæţŃçŽĎçżŞæđIJéĂŽè£ĞäÿĂäÿłè¿ŞåĞžshapeäÿž2çŽĎFCåśĆçżŹåĞžïijŇèŕěFCåśĆçŽĎæ£Ăæť żåĞ
- æŕŘæĺąæăůæIJňçŽĎæ■§åď śçŤśäžď åŘĽçĘţçżŹåĞžãĂĆ
- æĹŚäžňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucãĂĆ

38.6.3 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäžňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc | batch_size |

epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | dnn | 0.795+ | 512 | 4 | çžę3åřŔæŮűł

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/dnn
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

38.7 è£ŻéŸűä¡£çŤĺ

38.8 FAQ

CHAPTER

THIRTYNINE

FGCNN (FEATURE GENERATION BY CONVOLUTIONAL NEURAL NETWORK FOR CLICK-THROUGH RATE PREDICTION)

äżčçăĄèŕůåŘĆèĂČïijŽfgcnnåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

39.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

39.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■şçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{FGCNN,
  title={Feature Generation by Convolutional Neural Network for
↪Click-Through Rate Prediction},
  author={Bin Liu, Ruiming Tang, Yingzhi Chen, Jinkai Yu, Huifeng
↪Guo, Yuzhou Zhang},
  year={2019}
}

Jieming Zhu, Jinyang Liu, Shuai Yang, Qi Zhang, Xiuqiang He. [Open
↪Benchmarking for Click-Through Rate Prediction](https://arxiv.org/
↪abs/2009.05794). *The 30th ACM International Conference on
↪Information and Knowledge Management (CIKM)*, 2021.
↪[[Bibtex](https://dblp.org/rec/conf/cikm/ZhuLYZH21.html?
↪view=bibtex)]
```

(continues on next page)

(continued from previous page)

```
Jieming Zhu, Kelong Mao, Quanyu Dai, Liangcai Su, Rong Ma, Jinyang␣
↪Liu, Guohao Cai, Zhicheng Dou, Xi Xiao, Rui Zhang. [BARS: Towards␣
↪Open Benchmarking for Recommender Systems](https://arxiv.org/pdf/
↪2205.09626.pdf). *The 45th International ACM SIGIR Conference on␣
↪Research and Development in Information Retrieval (SIGIR)*, 2022.␣
↪[Bibtex]
```

åćđåŁääžžåůěçŽĎçL'źå¿ĄéĂŽåÿÿäijŽæŘŘå■ĞæŢĹæđIJïijŇä¡ĘæŸŕäžžåůěèő¿èőąçL'źå¿Ąäžčäžůå¿ĹéńŸ
Generation by Convolutional Neural Network (FGCNN)æĺąåđŃèğčåĘşèŕěéŮőéćŸãĂĆ FGCN-
NæIJL'äÿď'äÿłæĺąåİŮïijŽ Feature Generation åŠŇ Deep ClassifierãĂĆ åĚűäÿ■Feature Genera-
tionåĹľçŤĺCNNåŐżçŤ§æĹŘlocal patternsåźűäÿŤçżĎåŘĹçŤ§æĹŘæŰřçŽĎçL'źå¿ĄãĂĆ Deep
ClassifieråĹŹéĞĞçŤĺIPNNçŽĎçżŞæđĎåŐżå■ęäźäåćđåijžçL'źå¿Ąçľ'žéŮť'äÿ■çŽĎäžď'äžŠãĂĆ
èŕěåůěä¡IJèąĺæŸŐCTRéćĎæţŃçŽĎäÿĂäÿłæŰřæŰźåŘŚïijŽéĂŽè£Ğåď'ŰéČĺçŽĎæĺąåđŃåĞŘåřŚDNNéČĺåĹĘ

39.3 æŢřæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂL'çŤĺDisplay Advertising Challengeæ L'ĂçŤĺçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿď'éČĺåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘ
æŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæL'Ăçď'žïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąĺçď'žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤĺ1èąĺçď'žïijŇæIJłçĆźåĞżçŤĺ0èąĺçď'žã
feature>äżčèąĺæŢřåĂijçL'źå¿ĄïijĹè£đçż■çL'źå¿ĄïijL'ïijŇåĚśæIJL'13äÿłè£đçż■çL'źå¿ĄãĂĆ<categori
feature>äżčèąĺåĹĘçśżçL'źå¿ĄïijĹçężæŢčçL'źå¿ĄïijL'ïijŇåĚśæIJL'26äÿłçężæŢčçL'źå¿ĄãĂĆçŻÿéĆżäÿď'äÿ

39.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.1

python 3.5/3.6/3.7

os : windows/linux/macos

39.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺfgcnnæĺąåđŃçŻőå¡ŢçŽĎå£ń

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
cd models/rank/fgcnn
# åŁĺæĂĄåŻ¿èő■çżČ
```

(continues on next page)

(continued from previous page)

```
python -u ../../../tools/trainer.py -m config.yaml
# åŁĺæĂĄåŽ¿éćĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

39.6 æŢĹæđIJåď■çŐř

39.6.1 æŢřæ■őéŻĘèŐůåŘŰåŘŁéćĎåď ĎçŘĘ

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size |
epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | fgcnn
| 0.8022 | 2000 | 2 | çžę 2 åřŘæŮű |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/fgcnn
2. è£ŻåĚěpaddlerec/datasets/criteo_fgcnnçŻőå¡ŢäÿŃïijŇæĽ ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎ

```
cd ../../../datasets/criteo_fgcnn
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
# åĹĞåŻđæĺąåđŃçŻőå¡Ţ
cd -
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

39.7 è£ŻéŸűä¡£çŤĺ

39.8 FAQ

CHAPTER

FORTY

FFM (FIELD-AWARE FACTORIZATION MACHINES FOR CTR PREDICTION)

äžčçăĄèŕůåŘĆèĂČïijŽffmåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

40.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

40.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{juan2016field,
          title={Field-aware factorization machines for CTR␣
↪prediction},
            author={Juan, Yuchin and Zhuang, Yong and Chin, Wei-
↪Sheng and Lin, Chih-Jen},
                  booktitle={Proceedings of the 10th ACM conference␣
↪on recommender systems},
                    pages={43--50},
                          year={2016}
}
```

40.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘæŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçďžåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçďžïijŇæIJłçĆźåĞżçŤÍ0èąÍçďžãĂ
feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categoric
feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŻÿéĆżäÿďäÿ

40.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

40.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæåůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/ffm # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

40.6 æĺąåđŃçżĎç¡Ś

FFMæĺąåđŃçŽĎçżĎç¡ŚæIJňèťĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄąåŘĆèĂČnet.pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕäÿĂéŸűéąźéČĺåĹĘïijŇField-aware äžŇéŸűéąźéČĺåĹĘäżěåŘŁçŽÿäžŢçŽĎåĹĘçśżäżżåŁąçŽĎlossèőąçőŮåŠŇaucèőąçőŮãĂĆæĺąåđŃçŽĎçżĎç¡Śå

40.6.1 äÿĂéŸűéąźéČĺåĹĘ

äÿĂéŸűéąźéČĺåĹĘçśżäijijäžŐæĹŚäżňrankäÿŃçŽĎlogistic_regressionæĺąåđŃãĂĆäÿżèęĄçŤśembedding

40.6.2 Field-awareäžŇéŸűéąźéČĺåĹĘ

è£ŹéČĺåĹĘäÿżèęĄåőđçŐřäžĘåĚňåijŘäÿ■çŽĎäžď åŘĽéąźéČĺåĹĘïijŇäź§åřśæŸŕçĽźå¿ĄçŽĎçżĎåŘĹéČĺ

40.6.3 LossåŘŁAucèőąçőŮ

- éćĎæţŃçŽĎçżŞæđIJéĂŽè£ĞçŻť æŐěéĂŽè£Ğæ£Ăæť żåĞ¡æŢřsigmoidçżŹåĞžïijŇäÿžäžĘå¿ŮåĹřæŕŘæ
- æŕŘæİąæăůæIJňçŽĎæ■§åď śäÿžèť §åŕźæŢřæ■§åď śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď śavg_costæŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucæŇĞæăĞãĂĆ

40.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size | epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | FFM | 0.79 | 4096 | 10 | çžę14.3åřŘæŮű |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/ffm
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

40.8 è£ŻéŸűä¡£çŤĺ

40.9 FAQ

CHAPTER

FORTYONE

FM (-)

äžčçăĄèŕůåŘĆèĂČïijŽfmåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

41.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

41.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■ŘçŞżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{
  title={Factorization Machines},
  author={Rendle},
  booktitle={The 10th IEEE International Conference on Data␣
↪Mining(ICDM)},
  year={2010}
}
```

41.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘæŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçď žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçď žïijŇæIJłçĆźåĞżçŤÍ0èąÍçď žã
feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori
feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŽÿéĆżäÿďäÿ

41.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

41.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæÍąåđŃçŽőå¡Ţ
# cd models/rank/fm # åIJÍäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

41.6 æÍąåđŃçżĎç¡Ś

FMæÍąåđŃçŽĎçżĎç¡ŚæIJňèťÍæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄåŘĆèĂČnet.pyãĂĆæÍąåđŃäÿżèęĄçżĎæĹŘæŸŕäÿĂéŸűéąźéČÍåĹĘïijŇäžŇéŸűéąźéČÍåĹĘäżěåŘŁçŽÿåžŤçŽĎåĹĘçśżäżżå

41.6.1 äÿĂéŸűéąźéČĺåĹĘ

äÿĂéŸűéąźéČĺåĹĘçśżäijijäžŐæĹŚäżňrankäÿŃçŽĎlogistic_regressionæĺąåđŃãĂĆäÿżèęĄçŤśembedding

41.6.2 äžŇéŸűéąźéČĺåĹĘ

äžŇéŸűéąźéČĺåĹĘäÿżèęĄåőđçŐřäžĘåĚňåijŘäÿ■çŽĎäžď åŘĽéąźéČĺåĹĘïijŇäź§åřśæŸŕçĽźå¿ĄçŽĎçżĎ

V çŽĎçňň i åĹŮä¿£æŸŕçňň i çżť çĽźå¿ĄçŽĎéŽŘåŘŚéĞŘãĂĆçĽźå¿ĄåĹĘéĞŘXiäÿŐXjçŽĎäžď åŘĽéą wij=â§Ívi,vjâ§l' äžď åŘĽéąźçŽĎåśŢåijĂåijŘåęĆäÿŃïijŽ

41.6.3 LossåŘŁAucèőąçőŮ

- éćĎæţŃçŽĎçżŞæđIJéĂŽè£ĞçŻť æŐěéĂŽè£Ğæ£Ăæť żåĞ¡æŢřsigmoidçżŹåĞžïijŇäÿžäžĘå¿ŮåĹřæŕŘæ
- æŕŘæİąæăůæIJňçŽĎæ■§åď śäÿžèť §åŕźæŢřæ■§åď śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď śavg_costæŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucæŇĞæăĞãĂĆ

41.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size |
epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | FM |
0.78 | 4096 | 10 | çžę2.5åřŘæŮűź |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/fm
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äžď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

41.8 è£ŻéŸűä¡£çŤÍ

41.9 FAQ

CHAPTER

FORTYTWO

GATENET (GATENET: GATING-ENHANCED DEEP NETWORK FOR CLICK-THROUGH RATE PREDICTION)

äžčçăĄèřůåŘĆèĂČïijŽgatenetåęĆæđIJæĹŚäžňçŽĎäžčçăĄåřźæĆĺæIJL'çŤĺïijŇè£ŸèřůçĆźäÿłstaråŢŁ~

42.1 åĘĚåőź

- *æĹąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåd'Ğ*
- *è£ŘèąŇçŐřåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĹąåđŃçżĎç¡Ś*
- *æŢĹæđIJåd'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

42.2 æĹąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ąçĆźåĞżçŐĞïijŇæŸřâĂIJæŐĺè■Řçążçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{
  title={GateNet: Gating-Enhanced Deep Network for Click-Through␣
↪Rate Prediction},
  author={Huifeng Guo, Ruiming Tang, Yunming Ye, Zhenguo Li and␣
↪Xiuqiang He},
  year={2020}
}
```

åĚűäÿ■çŽĎembedding_gateåőđçŐřéĞĞçŤĺäžĘèőžæŰĞäÿ■éżŸèőd'çŽĎprivate fieldåŠŇvec-wise model. embedding_gateåŠŇhidden_gateçŽĎåijĂåĚąåĹĘåĹńåřźåžŤyamléĚ■ç¡őæŰĞäżűåĘ
éżŸèőd'æČĚåĘţäÿŃ2äÿłåijĂåĚąåİĞåd'ĎäžŐæL'ŞåijĂçŁűæĂĄïijŇèŃěéIJĂèęĄåĚąéŮ■æ§Řäÿłåij ĂåĚąïijŇåĚ

42.3 æŢřæ■őåĞĘåďĞ

åŘŕåŘĆèĂČDNNæÍąåđŃreadmeâĂŹæŢřæ■őåĞĘåď ĞâĂŹéČÍåĹĘïijŇåIJÍæÍąåđŃçŻőå¡ŢçŽĎdataçŻőå¡Ţ

```
click:0 dense_feature:0.0 dense_feature:0.00497512437811 dense_
↪feature:0.05 dense_feature:0.08 dense_feature:0.207421875 dense_
↪feature:0.028 dense_feature:0.35 dense_feature:0.08 dense_
↪feature:0.082 dense_feature:0.0 dense_feature:0.4 dense_feature:0.
↪0 dense_feature:0.08 1:737395 2:210498 3:903564 4:286224 5:286835␣
↪6:906818 7:906116 8:67180 9:27346 10:51086 11:142177 12:95024␣
↪13:157883 14:873363 15:600281 16:812592 17:228085 18:35900␣
↪19:880474 20:984402 21:100885 22:26235 23:410878 24:798162␣
↪25:499868 26:306163
click:1 dense_feature:0.0 dense_feature:0.932006633499 dense_
↪feature:0.02 dense_feature:0.14 dense_feature:0.0395625 dense_
↪feature:0.328 dense_feature:0.98 dense_feature:0.12 dense_
↪feature:1.886 dense_feature:0.0 dense_feature:1.8 dense_feature:0.
↪0 dense_feature:0.14 1:715353 2:761523 3:432904 4:892267 5:515218␣
↪6:948614 7:266726 8:67180 9:27346 10:266081 11:286126 12:789480␣
↪13:49621 14:255651 15:47663 16:79797 17:342789 18:616331␣
↪19:880474 20:984402 21:242209 22:26235 23:669531 24:26284␣
↪25:269955 26:187951
click:0 dense_feature:0.0 dense_feature:0.00829187396352 dense_
↪feature:0.08 dense_feature:0.06 dense_feature:0.14125 dense_
↪feature:0.076 dense_feature:0.05 dense_feature:0.22 dense_
↪feature:0.208 dense_feature:0.0 dense_feature:0.2 dense_feature:0.
↪0 dense_feature:0.06 1:737395 2:952384 3:511141 4:271077 5:286835␣
↪6:948614 7:903547 8:507110 9:27346 10:56047 11:612953 12:747707␣
↪13:977426 14:671506 15:158148 16:833738 17:342789 18:427155␣
↪19:880474 20:537425 21:916237 22:26235 23:468277 24:676936␣
↪25:751788 26:363967
```

42.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

42.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæÍąåđŃçŻőå¡Ţ
# cd models/rank/gatenet # åIJÍäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
```

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(continued from previous page)

```
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿éćĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿éćĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

42.6 æÍąåđŃçżĎç¡Ś

42.6.1 æŢřæ■őè¿ŞåĚěåčřæŸŐ

æ■čåęĆæŢřæ■őåĞĘåď'Ğçńäè£ĆæĽĂäżŃçż■ïijŇCriteoæŢřæ■őéŻĘäÿ■ïijŇåĹĘäÿżè£đçż■æŢřæ■őäÿŐçę
NetæÍąåđŃçŽĎæŢřæ■őè¿ŞåĚěåśĆåŇĚæŃňäÿĽäÿłïijŇåĹĘåĹńæŸŕïijŽdense_inputçŤÍäžŐè¿ŞåĚěè£đçż■

42.6.2 GateNetæÍąåđŃçżĎç¡Ś

GateNetæÍąåđŃäÿżèęAçżĎæĹŘæŸŕäÿĂäÿłEmbeddingåśĆ,äÿĽäÿłFCåśĆïijŇäżěåŘŁçŻÿåžŤçŽĎåĹĘç

EmbeddingåśĆ

éęŰåĚĹäżŃçż■EmbeddingåśĆçŽĎæŘ■åżżæŰźåijŔïijŽEmbeddingåśĆçŽĎè¿ŞåĚěæŸŕsparse_inpu

```
        self.embedding = paddle.nn.Embedding(
            self.sparse_feature_number,
            self.sparse_feature_dim,
            sparse=True,
            weight_attr=paddle.ParamAttr(
                name="SparseFeatFactors",
                initializer=paddle.nn.initializer.Uniform()))
```

åŘĎäÿłçÍĂçŰŔçŽĎè¿ŞåĚěéĂŽè£ĞEmbeddingåśĆåŘŐïijŇåĹĘåĹńäžğçŤ§äÿĂäÿłåŕźåžŤçŽĎembedding
åĹŹåŕźåžŤçŽĎembeddingåŘŚéĞŔåřĘéĂŽè£ĞäÿĂäÿłembedding
gateäžğçŤ§äÿĂäÿłæŰřembeddingåŘŚéĞŔãĂĆæĽĂæIJL'embeddingåŘŚéĞŔäijŽèćńåŘĹåźűèţůæÍěïijŇç¡őäž

```
        if self.use_embedding_gate:
            self.embedding_gate_weight = [paddle.create_
↪parameter(shape=[1], dtype="float32", name='embedding_gate_weight_
↪%d' % i, default_initializer=paddle.nn.initializer.Normal(
```

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(continued from previous page)

```
                                std=1.0)) for i in range(num_field)]

        if self.use_embedding_gate:
            for i in range(len(self.embedding_gate_weight)):
                emb = self.embedding(sparse_inputs[i])
                emb = paddle.reshape(
                    emb, shape=[-1, self.sparse_feature_dim
                                ])  # emb shape [batchSize, sparse_
↪feature_dim]
                gate = paddle.sum(paddle.multiply(
                    emb, self.embedding_gate_weight[i]), axis=-1,␣
↪keepdim=True)  # gate shape [batchSize,1]
                activate_gate = paddle.nn.functional.sigmoid(
                    gate)  # activate_gate [batchSize,1]
                emb = paddle.multiply(
                    emb, activate_gate)  # emb shape [batchSize,␣
↪sparse_feature_dim]
                sparse_embs.append(emb)
```

FCåśĆ

åřĘçężæŢčæŢřæ■őéĂŽè£Ğembeddingæ§ěèąĺå¿ŮåĹřçŽĎåĂijïijŇäÿŐè£đçż■æŢřæ■őçŽĎè¿ŞåĚěè£Żèą

```
        for i in range(len(layer_sizes)):
            linear = paddle.nn.Linear(
                in_features=sizes[i],
                out_features=sizes[i + 1],
                weight_attr=paddle.ParamAttr(
                    initializer=paddle.nn.initializer.Normal(
                        std=1.0 / math.sqrt(sizes[i]))))
            self.add_sublayer('linear_%d' % i, linear)
            self._mlp_layers.append(linear)
            act = paddle.nn.ReLU()
            self.add_sublayer('act_%d' % i, act)
            self._mlp_layers.append(act)
```

èŃěèő¿ç¡őèűĚåŘĆæŢřuse_hidden_gate=TrueïijŇåĹźéĂŽè£Ğæ£Ăæťżåĝ¡æŢřåŘŐçŽĎåŘŚéĞŔäijŽçżğ

LossåŘŁAucèőąçőŮ

- éćĎæţŃçŽĎçżŞæđIJéĂŽè£ĞäÿĂäÿłè¿ŞåĞžshapeäÿž1çŽĎFCåśĆçżŹåĞžïijŇèŕěFCåśĆçŽĎæ£Ăæťżåĝ
- æăůæIJňçŽĎæ■§åďśåĝ¡æŢřåĂijçŤśäžďåŘĽçĘţçżŹåĞž
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎauc

42.7 æŢĹæđlJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæÍąåđŃä
æÍąåđŃ | auc | batch_size | epoch_num| Time of each epoch| GateType|| :âĂŤâĂŤ| :âĂŤâĂŤ
| :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ || gatenet | 0.7974 | 512 | 4 | çžę5åřŘæŮűˇ |
embeddingGate + hiddenGate || dnn | 0.7959 | 512 | 4 | çžę2åřŘæŮűˇ | None |

1. çąőèőď æĆÍå¡ŞåĹ'■æĹ'ĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/rank/gatenet
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĹ'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæÍąåđŃçŻőå¡Ţ,æĹ'ğèąŇåŚ¡äżď'è£ŘèąŇåĚÍéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæÍąåđŃçŻőå¡Ţ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŘæŢřæ■ő è£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŘæŢřæ■ő è£ŘèąŇconfig_bigdata.yaml
```

42.8 è£ŻéŸűä¡£çŤÍ

42.9 FAQ

CHAPTER

FORTYTHREE

LOGISTIC_REGRESSION (-)

äžčçăĄèŕůåŘĆèĂČïijŽlogistic_regressionåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿł

43.1 åĘĚåőź

- *æĹąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĹąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

43.2 æĹąåđŃçőĂäżŃ

`CTR(Click Through Rate)`ïijŇå■şçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

43.3 æŢřæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂL'çŤÍDisplay Advertising ChallengeæL'ĂçŤĺçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿď'éČĺåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘ æŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæL'Ăçď'žïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąĺçď žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤĺ1èąĺçď žïijŇæIJłçĆźåĞżçŤĺ0èąĺçď žã
feature>äżčèąĺæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori
feature>äżčèąĺåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŻÿéĆżäÿď äÿ

43.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

43.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/logistic_regression # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

43.6 æĺąåđŃçżĎç¡Ś

logistic_regressionæĺąåđŃçŽĎçżĎç¡ŚæŕŤè¿ĆçŻť'èğĆïijŇæIJňèť'ĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçą
pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕäÿĂäÿłEmbeddingåśĆïijŇäÿĂäÿłsigmoidåśĆïijŇäżěåŔŁçŻÿåžŢçŽĎ

43.6.1 EmbeddingåśĆ

éęŰåĚĹäżŃçż■EmbeddingåśĆçŽĎæŘ■åżżæŰźåijŔïijŽEmbeddingåśĆçŽĎè¿ŞåĚěæŸŕfeat_idxïijŇ
åŘĎäÿłçĺĂçŰŔçŽĎè¿ŞåĚěéĂŽè£ĞEmbeddingåśĆåŘŐïijŇè£ŻèąŇreshapeæŞ■ä¡IJïijŇæŰźä¿£åŠŇè£đçż■åĂ

43.6.2 sigmoidåśĆ

åřEçężæŢčæŢřæ■őéĂŽè£Ğembeddingæ§ěèąĺå¿ŮåĹřçŽĎåĂijïijŇäÿÓè£đçż■æŢřæ■őçŽĎè¿ŞåĚěè£ŻèąŇ

43.6.3 LossåŘŁAucèőąçőŮ

- éćĎæţŃçŽĎçżŞæđIJéĂŽè£ĞçŻťæŐěéĂŽè£Ğæ£ĂæťżåĞ¡æŢřsigmoidçżŹåĞžïijŇäÿžäžĘå¿ŮåĹřæŕŘæ
- æŕŘæİąæăůæIJňçŽĎæ■§åďśäÿžèťŕ§åŕźæŢřæ■§åďśåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åďś`avg_cost`æŸŕåŘĎæİąæăůæIJňçŽĎæ■§åďśäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮéćĎæţŃçŽĎaucæŇĞæăĞ

43.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/logistic_regression
2. è£ŻåĚěpaddlerec/datasets/criteo_lrçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ

```
cd ../../../datasets/criteo_lr
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

43.8 è£ŻéŸűä¡£çŤĺ

43.9 FAQ

CHAPTER

FORTYFOUR

NAML (NEURAL NEWS RECOMMENDATION WITH ATTENTIVE MULTI-VIEW LEARNING)

äžčçăĄèřůåŘĆèĂČïijŽnamlåęĆæđIJæĹŚäžňçŽĎäžčçăĄåřźæĆĺæIJL'çŤĺïijŇè£ŸèřůçĆźäÿłstaråŢŁ~

44.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåd'Ğ*
- *è£ŘèąŇçŐřåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåd'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

44.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■şçĆźåĞżçŐĞïijŇæŸřâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{
  title={Neural News Recommendation with Attentive Multi-View
↪Learning},
  author={Chuhan Wu , Fangzhao Wu , Mingxiao An , Jianqiang Huang ,
↪Yongfeng Huang , Xing Xie},
  year={2019}
}
```

naml åőđçŐřäžĘäÿĂäÿłnews-encoder, éĂŽè£Ğtextå■ůçğŕæŘŘåŘŰæŰĞçńăçL'źå¿ĄåźűéĞĞçŤĺattention
embedding)ïijŇ ńçŕĞçŤĺæĹůæţŘèğĹè£ĞçŽĎæŰĞçńăçŽĎarticle

embeddingåŘŚéĞŘçżĎåřĘåĘ■æňąéĂŽè£ĞattentionæIJžåĹűèćńè£ŻäÿĂæ■ěåŐŃçijľæĹŘæIJĂçżĹçŽĎuser-behavior-embeddingïijĹåŇĚåŘńäžĘçŤĺæĹůèąŇäÿžçĽźå¿ĄïijĽ æ■ď'user-behavior-embedding åŠŇ äÿĂçŕĞæŰřæŰĞçńăçŽĎarticle embedding çŽĎåŘŚéĞŘåĘĚçğŕåĹŹèąĺçď'žçŤĺæĹůåŕźæ■ď'æŰĞçńăçŽĎåŰIJåě¡çĺŃåžęăĂĆ

44.3 æŢřæ■őåĞĘåď'Ğ

æ■ď'æĺąåđŃèő■çżĆåŠŇéćĎæţŃæűĽ'åŘŁçŤĺæĹůæţŘèğĹæŰĞçńăåŐĘåŘšïijŇäžěåŘŁæŰĞçńăçŽĎåĚůä¡
æŕŘçŕĞæŰĞçńăçŤĺäÿĂèąŇèąĺçď'žïijŇå■ŸæŤ¿åIJĺäÿĂäÿłæĹŰåď'Žäÿłäžěarticle{number}.txtäÿžåŘŐçijĂçŽĎ
article3.txt æŕŘèąŇçŽĎæäijåijŘäÿžïijŽ æŰĞçńäid äÿżçśżid å■Řçśżid
åĹĘèŕ■åŘŐçŽĎæŰĞçńäæäĞéćŸid åĹĘèŕ■åŘŐçŽĎæŰĞçńäå■Ţèŕ■id
äžěäÿŁ5éąźçŤĺtabçňęåŘůåĹĘåĽšïijŇidåİĞäÿžèĞłçĎűæŢřïijŇåĹĘèŕ■åŘŐçŽĎæŰĞçńäæäĞéćŸid
åŠŇ åĹĘèŕ■åŘŐçŽĎæŰĞçńäå■Ţèŕ■id éČ¡çŤĺçľžæäijåĄŽåĹĘéŽŤçňę
åŘęåď'Ůè£ŸéIJĂèęĄæŤűéŻĘçŤĺæĹůçŽĎæţŘèğĹèőřå¡ŢïijŇå■ŸæŤ¿åIJĺäÿĂäÿłæĹŰåď'Žäÿłäžěbrowse{numb
browse3.txt æŕŘäÿłçŤĺæĹůçŽĎå■ŢæňąæţŘèğĹážŘåĹŮçŤĺäÿĂèąŇèąĺçď'žïijŇæäijåijŘäÿžïijŽ
æţŘèğĹè£ĞçŽĎæŰĞçńäidážŘåĹŮ æŐěäÿŃæĺěæţŘèğĹè£ĞçŽĎæŰĞçńäid
æŐěäÿŃæĺěæšąæţŘèğĹçŽĎæŰĞçńäidážŘåĹŮ äžěäÿŁ3éąźçŤĺtabçňęåŘůåĹĘåĽšïijŇidážŘåĹŮäźŃéŮť'çŤĺçľ
ä¡ĘæŸŕæšąæţŘèğĹçŽĎážŘåĹŮidäÿłæŢřäžżèőőåď'gäžŐç■L'äžŐyamléĚ■ç¡őæŰĞäżűäÿ■çŽĎneg_candidate_

åIJĺæĺąåđŃçŻőå¡ŢçŽĎdata/sample_dataçŻőå¡ŢäÿŃäÿžæĆĺåĞĘåď'ĞäžĘå£ńéĂ§è£ŘèąŇçŽĎçď'žä¿ŃæŢř

44.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 3.5/3.6/3.7

os : windows/linux/macos

44.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæäůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺnamlæĺąåđŃçŻőå¡ŢçŽĎå£ńé

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
cd models/rank/naml
# åŁĺæĂĄåŽ¿èő■çżČ
python3 -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python3 -u ../../../tools/infer.py -m config.yaml
```

åĚűäÿ■yamlæŰĞäżűçŽĎèűĚåŘĆæŢřèğčéĞŁåęĆäÿŃïijŽ article_content_size: æŕŘçŕĞæŰĞçńäåŇĚåŘńçŽĎæIJĂåď'gå■Ţèŕ■ïijĹèűĚè£ĞåĹŹæĹłæŰ■ïijĽ article_title_size: æŕŘçŕĞæŰĞçńäæäĞéćŸåŇĚåŘńçŽĎæIJĂåď'gå■Ţèŕ■ïijĹèűĚè£ĞåĹŹæĹłæŰ■ïijĽ browse_size: çŤĺæĹůçŽĎæIJĂåď'gæţŘèğĹážŘåĹŮéŢ£åžęïijĹèűĚè£ĞåĹŹæĹłæŰ■ïijĽ

neg_condidate_sample_size: èť§éĞĞæăůäÿłæŢř word_dimension: æŕŘäÿłå■Ţèŕ■çŽĎembed-
dingçżť åžę category_size: äÿżçśżäÿłæŢřïijĹèŃěè£ŹäÿłæŢřå■ŮäÿžnïijŇåĹŹæŢřæ■őäÿ■çŽĎcategoryèŇČåŻť
1ãĂŚïijĽ sub_category_size: åĽŕçśżäÿłæŢřïijĹèŃěè£ŹäÿłæŢřå■ŮäÿžnïijŇåĹŹæŢřæ■őäÿ■çŽĎcategoryèŇČ
1ãĂŚïijĽ category_dimension: æŕŘäÿłçśżåĹńçŽĎembeddingçżť åžę word_dict_size:
å■Ţèŕ■å■ŮåĚÿçŽĎåď ğåřŘïijĹå■Ţèŕ■èŕ■åĚÿäÿ■åżżèőőçŢŹäÿĂäÿłunkïijŇèąĺçď žçż§èőąè£ĞçĺŃäÿ■æIJłåĞžç

44.5.1 LossåŘŁAccèőąçőŮ

- écĎæţŃçŽĎçżŞæđIJäÿžäÿĂäÿłsoftmaxåŘŚéĞŘïijŇèąĺçď žåőđéŹĚæţŘèğĹæŰĞçńăåŠŇèť §éĞĞæăůæŮ
- æăůæIJňçŽĎæ■§åď śåĞ¡æŢřåĂijçŤśäžď åŘĽçĘţçżŹåĞž
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮécĎæţŃçŽĎauc

44.6 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åŘŇæŮűïijŇæĹŚäżňæŘŘä¿ŻäžĘåĚĺéĞŘæŢřæ■őçŤ§æĹŘçŽĎèĎŽæIJňïijŇåřĘäijŽèĞłåŁĺäÿŃè¡¡microsoft
news datasetåĚĺéĞŘæŢřæ■őéŻĘåźűè¡ňæ■ćäÿžæĺąåđŃèČ¡æŐěåŘŮçŽĎ
è¿ŞåĚěæăijåijŘïijŇæĽğèąŇæŰźæşŢåęĆäÿŃïijŽ

1.è£ŻåĚěèůŕå¿ĎPaddleRec/datasets/MIND/data

2.æĽğèąŇ sh run.sh

3.èĎŽæIJňè£ŘèąŇåőŇæĹŘåŘŐïijŇæĽŞåijĂdict/yaml_info.txtïijŇåřĘåĚűäÿ■çŽĎèŕ■åŘŚéĞŘåď ğåřŘïij
éĞŃïijŇæŻ£æ■ćæIJĂåŘŐ3èąŇçŽĎèűĚåŘĆæŢř category_size
sub_category_sizeword_dict_size

4.è£ŘèąŇïijŽ

```
python3 -u ../../../tools/trainer.py -m config_bigdata.yaml
```

äżěäÿŃäÿžèő■çżČ2äÿłepochçŽĎçżŞæđIJ | æĺąåđŃ | auc | batch_size | epoch_num| Time
of each epoch| | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | naml | 0.66 | 50 | 3 |
çžę4åřŘæŮűˇ |

écĎæţŃ

```
python3 -u ../../../tools/infer.py -m config_bigdata.yaml
```

æIJ§å¿ĚécĎæţŃaucäÿž0.66

å■ŢæIJžåď Žå■ąæĽğèąŇæŰźåijŘ(äżěèő■çżČäÿžä¿Ń) python3 -m
paddle.distributed.launch ../../../tools/trainer.py -m config_bigdata.yaml
åIJĺæ■ď æČĚåĘţäÿŃåřĘä¡£çŤĺå■ŢæIJžäÿŁæĽ ĂæIJĽ gpuå■ąïijŇèŃěéIJĂèęĄæŇĞåőŽéČĺåĹĘgpuå■ąæĽ ğèąŇ
æĺěåőđçŐřãĂĆä¿ŃåęĆå■ŢæIJžäÿŁæIJĽ 8åijäå■ąïijŇåŘłæĽ ŞçőŮçŤĺåĽ■4å■ąåijäèő■çżČïijŇåŘŕäżěèő¿ç¡őexp
CUDA_VISIBLE_DEVICES=0,1,2,3 åĘ■æĽ ğèąŇèő■çżČèĎŽæIJňå■şåŘŕãĂĆ

CHAPTER

FORTYFIVE

WIDE&DEEP (WIDE & DEEP LEARNING FOR RECOMMENDER SYSTEMS)

äżčçăĄèŕůåŘĆèĂČïijŽwide&deepåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJĽçŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ

45.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

45.2 æĺąåđŃçőĂäżŃ

ãĂŁWide & Deep Learning for Recommender SystemsãĂŃæŸŕGoogle 2016åźť'åŘŚåÿČçŽĎæŐĺè■ŘæąĘæđűïijŇwide&deepèő¿èőąäžĘäÿĂçğ■èđ■åŘĹæţĚåśĆïijĹwideïijL'æĺąåđŃåŠ

1. æŢĹæđIJäÿŁïijŇåIJĺGoogle Play è£ŻèąŇçž£äÿŁA/BåőđéłŇïijŇwide&deepæĺąåđŃçŻÿæŕŤéńŸåžęäijŸ
2. æĂğèČ¡äÿŁïijŇéĂŽè£ĞåĹĞåĹĘäÿĂæňąèŕůæśĆéIJĂèęĄåď'ĎçŘĘçŽĎapp çŽĎBatch sizeäÿžæŻť'åřŘçŽĎsizeïijŇåźűåĹl'çŤĺåď'Žçž£çĺŃåźűèąŇèŕůæśĆè¿¿åĹřæŘŘéńŸåď'ĎçŘĘæŢĹçŐĞçŽĎ

45.3 æŢřæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽ'çŤÍDisplay Advertising ChallengeæĽ'ĂçŤĺçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿď'éČĺåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘ

æŕŘäÿĂèąŇæŢřæ■őæăijåijŘåęĆäÿŇæL'Ăçď'žïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąĺçď'žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤĺ1èąĺçď'žïijŇæIJłçĆźåĞżçŤĺ0èąĺçď'žã
feature>äżčèąĺæŢřåĂijçL'źå¿ĄïijĹè£đçż■çL'źå¿ĄïijL'ïijŇåĚśæIJL'13äÿłè£đçż■çL'źå¿ĄãĂĆ<categori
feature>äżčèąĺåĹĘçśżçL'źå¿ĄïijĹçężæŢčçL'źå¿ĄïijL'ïijŇåĚśæIJL'26äÿłçężæŢčçL'źå¿ĄãĂĆçŻÿéĆżäÿď'äÿ

45.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

45.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ
& DeepæĺąåđŃçŻőå¡ŢçŽĎå£ńéĂ§æL'ğèąŇåŚ¡äżď'åęĆäÿŃïijŽ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/wide_deep # åIJĺäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬźæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éĬźæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

45.6 æĺąåđŃçżĎç¡Ś

wide&deepèő¿èőąäžĘäÿĂçğ■èđ■åŘĹæţĚåśĆïijĹwideïijL'æĺąåđŃåŠŇæůśåśĆïijĹdeepïijL'æĺąåđŃè£ŻèąŇ

45.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæĺąåđŃä
åIJÍåĚÍéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď æĆÍå¡ŞåĽ■æĽĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/rank/wide_deep
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚÍéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

45.8 è£ŻéŸűä¡£çŤÍ

45.9 FAQ

CHAPTER

FORTYSIX

XDEEPFM (XDEEPFM: COMBINING EXPLICIT AND IMPLICIT FEATURE INTERACTIONS FOR RECOMMENDER SYSTEMS)

äžčçăĄèŕůåŘĆèĂČïijŽxdeepfmåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

46.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

46.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■

```
@inproceedings{lian2018xdeepfm,
  title={xdeepfm: Combining explicit and implicit feature␣
↪interactions for recommender systems},
  author={Lian, Jianxun and Zhou, Xiaohuan and Zhang, Fuzheng and␣
↪Chen, Zhongxia and Xie, Xing and Sun, Guangzhong},
  booktitle={Proceedings of the 24th ACM SIGKDD International␣
↪Conference on Knowledge Discovery \& Data Mining},
  pages={1754--1763},
```

(continues on next page)

(continued from previous page)

```
  year={2018}
}
```

46.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘæŕŘäÿĂèąŇæŢřæ■őæăijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçď žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçď žïijŇæIJłçĆźåĞżçŤÍ0èąÍçď žã
feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori
feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŻÿéĆżäÿďäÿ

46.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

46.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/xdeepfm # åIJĺäżżæĎŘçŽőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬźæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éĬźæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

46.6 æĺąåđŃçżĎç¡Ś

xDeepFMæĺąåđŃçŽĎçżĎç¡ŚæIJňèť'ĺæŸŕäÿĂäÿłäžŇåĹĘçśżäżżåŁąïijŇäżčçăĄåŘĆèĂČxDeepFM1.8.5äÿ
pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕçž£æĂğåśĆéČĺåĹĘ, cinéČĺåĹĘ,dnnéČĺåĹĘäżěåŘŁçŻÿåžŤçŽĎåĹĘçśżäżż

46.6.1 çž£æĂğåśĆéČĺåĹĘ

çž£æĂğéČĺåĹĘçśżäijijäžŐæĹŚäżňrankäÿŃçŽĎlogistic_regressionæĺąåđŃãĂĆäÿżèęĄçŤśembeddingåśĆ

46.6.2 cinéČĺåĹĘ

cinçżŞåŘĹäžĘrnnåŠŇcnnçŽĎäijŸçĆźïijŇæIJL'åď'Žäÿłå■ůçğŕåśĆæđĎæĹŘïijŇåŕźäžŐéŹď'äžĘåĹİåğŃçŽ

46.6.3 dnnéČĺåĹĘ

æĺąåđŃéĂŽè£ĞåźűèąŇçŽĎæŰźåijŘçżĎåŘĹcinåŠŇdnnäÿď'çğ■æŰźæşŢïijŇäÿď'èĂĚåĚśçŤĺåžŢåśĆçŽĎ

46.6.4 LossåŘŁAucèőąçőŮ

- écĎæţŃçŽĎçżŞæđIJåřĘxDeepFMçŽĎçž£æĂğåśĆéČĺåĹĘïijŇcinéČĺåĹĘäżěåŘŁdnnéČĺåĹĘçŻÿåŁäïijŇ
- æŕŘæİąæăůæIJňçŽĎæ■§åď'śäÿžèť'§åŕźæŢřæ■§åď'śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åď'śavg_costæŸŕåŘĎæİąæăůæIJňçŽĎæ■§åď'śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮécĎæţŃçŽĎaucæŇĞæăĞãĂĆ

46.7 æŢĹæđIJåď'■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď'§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | batch_size |
epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | |
xDeepFM | 0.79 | 512 | 1 | çžę2.5åřŘæŮűź |

1. çąőèőď'æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/xdeepfm
2. è£ŻåĚěpaddlerec/datasets/criteoçŻőå¡ŢäÿŃïijŇæĽ'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■å

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽ'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

46.8 è£ŻéŸűä¡£çŤĺ

46.9 FAQ

CHAPTER

FORTYSEVEN

BERT4RECÆĹĄÅĐŃ (SEQUENTIAL RECOMMENDATION WITH BIDIRECTIONAL ENCODER REPRESENTATIONS FROM TRANSFORMER)

äżčçăĄèŕůåŘĆèĂČïijŽbert4recåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

47.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

47.2 æĺąåđŃçőĂäżŃ

BERT4RecåřĘNLPäÿ■çŽĎmask languageäżżåŁąè£ĄçğżåĹřåžŘåĹŮæŐĺè■ŘéŮőéćŸæİěïijŇ**çżŹäžĹäžĘ**
åĚůä¡Şæİěèŕť'ïijŇåŕźäžŐäÿĂæİąçL'ľåŞĄåžŘåĹŮïijŇ**äżěäÿĂåőŽçŽĎæęĆçŐĞpéŽŘæIJžmaskæŐL'åžŘåĹ**
itemè£ŻèąŇéćĎæţŃãĂĆ éĂŽè£ĞæŢřæ■őåćđåijžïijŇåőŇå¡ćąąńçl'žäżżåŁąçŽĎæŰźåijŘä¡£å¿Ůèő■çżČæŽť'åŁ

BERT4Rec: Sequential Recommendation with Bidirectional Encoder Representations from Transformer æIJňæĺąåđŃæİěèĞłéčđæąĺèőžæŰĞåď'■çŐřæŇŚæĹŸèţŻïijĹçňňåŻŽæIJ§ïijL'çŽĎBERT4Re

47.3 æŢřæ■őåĞĘåď'Ğ

æIJňæĺąåđŃä¡£çŤĺèőžæŰĞäÿ■çŽĎæŢřæ■őéŻĘBeauty DatasetïijŇåIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃ

47.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 3.7

47.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäžěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/bert4rec # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

47.6 æĺąåđŃçżĎç¡Ś

åIJÍBERT4RecäźŃåL'■ïijŇSASRecåůšçżŘåřĘself-attentionåžŢçŤĺåIJĺäžĘåžŘåĹŮæŐĺè■Řäżżå Łąäÿ■ãĂĆ

èĂŇäÿŐäźŃåŕźåžŢçŽĎïijŇBERT4RecçŽĎä¡IJèĂĚèőd'äÿžåČŘSASRecéĆčçğ■left-to-rightçŽĎåżżæĺąæŰźåijŘéŹŘåĹűäžĘæĺąåđŃçŽĎèąĺè¿¿èČ¡åŁŻãĂĆ èŹ¡çĎűçŤĺæĹůçŽĎèąŇäÿžåžŘåĹŮéŢ£æIJ§æĺěçIJŃå■ŸåIJĺéąžåžŘçŽĎä¿ÌèţŰåĚşçşżïijŇä¡ĘåIJĺç§■æIJ§çŽĎ

äÿžäžĘèğčåĘşäÿŁè£řéŮőéćŸïijŇBERT4RecåřĘNLPäÿ■çŽĎMask Language äżżåŁąè£AçğżåĹřåžŘåĹŮæŐĺè■ŘéŮőéćŸæĺěïijŇçżŹäžĹäžĘåžŘåĹŮæŐĺè■ŘäÿĂçğ■äÿ■åŘŇäžŐitem2 åĚůä¡Şæĺěèŕť'ïijŇåŕźäžŐäÿĂæĺąçL'l'åŞĄåžŘåĹŮïijŇäżěäÿĂåőŽçŽĎæęĆçŐĞpéŽŘæIJžmaskæŐL'åžŘåĹŮäÿ itemè£ŻèąŇéćĎæţŃ(net.py)ãĂĆ èő■çżČçŽĎè£ĞçĺŃäÿ■ïijŇåĹŹæŸŕåŘŰåĞžEncoderåŕźåžŤmaskä¡■ç¡őçŽĎr

åŘŕäżěæşĺæĎŘåĹřïijŇéĂŽè£ĞéŽŘæIJžmaskïijŇæĹŚäżňåŘŕäżěæĹŘåĂ■çŽĎçŢ§æĹŘæŰřæůæIJňãĂĆï 1ïijŽåŐ§æIJňæůæIJň)ïijL' åŻäæ■d'BERT4RecæŢĹæđIJçŽĎæŘŘå■ĞïijŇäź§äżŐæŢřæ■őåćđåijžçŽĎèğŠåžęa

åIJĺæĺąåđŃäÿŁéĺćïijŇBERT4Recæ■čåęĆåĚűåŘ■ïijŇåřśæŸŕèů§BERTäÿĂæăůïijŇä¡£çŤĺTransformerçŽĎ

åIJĺæţŃèŕŢçŽĎæŮűåĂŹïijŇæĹŚäżňåŘłéIJĂèęĄmaskæŐL'åžŘåĹŮæIJĂåŘŐçŽĎçL'l'åŞĄïijŇåźűåŘŰåĆ item PredictionäżżåŁąäÿŁãĂĆ

47.7 æŢĹæđIJåd'■çŐř

æIJňæŰĞæŔŘä¿ŻäžĘbeautyæŢřæ■őéŻĘåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇåŘŁåĚűåd'■çŐřãĂĆåIJĺBERT4R

```
# è£ŻåĚěæÍąåđŃçŻőå¡Ţ
# cd models/rank/bert4rec # åIJÍäżżæĎŕçŻőå¡ŢåÎĞåŕŕè£ŘèąŇ
# æŢřæ■őåćđåijžäÿŐåĂŹéĂL'éŻEçŤ§æĹŘ
python -u data_augment_candi_gen.py
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml
# åŁÍæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config_bigdata.yaml
```

47.8 è£ŻéŸűä¡£çŤÍ

47.9 FAQ

CHAPTER

FORTYEIGHT

FAT_DEEPFFM (FAT-DEEPFFM: FIELD ATTENTIVE DEEP FIELD-AWARE FACTORIZATION MACHINE)

äżčçăĄèŕůåŘĆèĂČïijŽFAT_DeepFFMåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstar

48.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

48.2 æĺąåđŃçőĂäżŃ

CTR(Click Through Rate)ïijŇå■ŞçĆźåĞżçŐĞïijŇæŸŕâĂIJæŐĺè■Řçşżçż§/èőąçőŮåź£åŚŁâĂİç■ FAT_DeepFFM æĺąåđŃïijŽ

```
@article{FAT-DeepFFM2019,
  title={FAT-DeepFFM: Field Attentive Deep Field-aware␣
↪Factorization Machine},
  author={Junlin Zhang, Tongwen Huang, Zhiqi Zhang},
  journal={arXiv preprint arXiv:1905.06336},
  year={2019}ïijŇ
  url={https://arxiv.org/pdf/1905.06336},
}
```

48.3 æŢřæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂĽçŤÍDisplay Advertising ChallengeæĽĂçŤÍçŽĎCriteoæŢřæ■őéŻĘãĂĆèŕěæŢřæ■őéŻĘåŇĚæŃňäÿďéČÍåĹĘïijŽèő■çżČéŻĘåŠŇæţŃèŕŢéŻĘæŕŘäÿĂèąŇæŢřæ■őæäijåijŘåęĆäÿŃæĽĂçďžïijŽ

```
<label> <integer feature 1> ... <integer feature 13> <categorical␣
↪feature 1> ... <categorical feature 26>
```

åĚűäÿ■<label>èąÍçď žåź£åŚŁæŸŕåŘęèćńçĆźåĞżïijŇçĆźåĞżçŤÍ1èąÍçď žïijŇæIJłçĆźåĞżçŤÍ0èąÍçď žã
feature>äżčèąÍæŢřåĂijçĽźå¿ĄïijĹè£đçż■çĽźå¿ĄïijĽïijŇåĚśæIJĽ13äÿłè£đçż■çĽźå¿ĄãĂĆ<categori
feature>äżčèąÍåĹĘçśżçĽźå¿ĄïijĹçężæŢčçĽźå¿ĄïijĽïijŇåĚśæIJĽ26äÿłçężæŢčçĽźå¿ĄãĂĆçŻÿéĆżäÿďäÿ

48.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

48.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŽőå¡Ţ
# cd models/rank/fat_deepffm # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

48.6 æĺąåđŃçżĎç¡Ś

FAT_DeepFFM æĺąåđŃçŽĎçżĎç¡ŚïijŇäżčçăĄåŘĆèĂČ net.pyãĂĆæĺąåđŃäÿżèęĄçżĎæĹŘæŸŕ Embedding åśĆïijŇCENet åśĆïijŇDeepFFMçĽźå¿Ąäžď åŘĽåśĆïijŇDNNåśĆäżěåŘŁçŽÿåžŤçŽĎåĹĘçśżäżżåŁąçŽĎlossèőąçőŮåŠŇauc

48.6.1 CENet åśĆ

FAT_DeepFFM æĺąåđŃçŽĎçĽźå¿Ąè¿ŞåĚěïijŇäÿżèęĄåŇĚæŃň sparse çśżåĹńçĽźå¿ĄãĂĆïijĹåIJĺåď ĎçŘĘ dense æŢřåĂijåđŃçĽźå¿ĄæŮűïijŇè£ŻèąŇå■Ğçżť äÿŐsparse

çśżåĹńçL'źå¿ĄæŃijæŐěïijL' sparse features çżŘçŤś embedding åśĆæ§ěæL'¿å¿ŮåĹřçŻÿåžŤçŽĎ embedding åŘŚéĞŘãĂĆä¡£çŤĺCENetæŸ¿çd'žåIJřåžžæĺąçL'źå¿ĄäźŃéŮt'çŽĺ

æăźæ■őç¡ŚçżIJçżŞæđĎåŻ¿ïijŇéĂŽè£ĞCENetçŽĎæşĺæĎŘåŁŻæIJžåĹűæIJL'éĂL'æŃl'æĂğåIJřçłĄåĞžä

48.6.2 DeepFFMåśĆ

DeepFFMç¡ŚçżIJçżŞæđĎåęĆäÿŃåŻ¿æL'Ăçd'žïijŽ

ä¡£çŤĺFFMåŕźçL'źå¿ĄçŽĎäÿ■åŘŇfieldçŽĎåĚşçşżè£ŻèąŇåžžæĺąïijŇèőąçőŮåĚňåijŘåęĆäÿŃæL'Ăçd'žïij

48.6.3 Loss åŘŁ Auc èőąçőŮ

- äÿžäžĘå¿ŮåĹřæŕŘæĺąæăůæIJňåĹĘåśđäžŐæ■čèt'§æăůæIJňçŽĎæęĆçŐĞïijŇæĹŚäżňåřĘécĎæţŃçżŞæđ 1-predict åŘĹåźűèţůæĺěå¿ŮåĹř predict_2dïijŇäżěä¿£æŐěäÿŃæĺěèőąçőŮ aucãĂĆ
- æŕŘæĺąæăůæIJňçŽĎæ■§åd'śäÿžèt'§åŕźæŢřæ■§åd'śåĂijïijŇlabelçŽĎæŢřæ■őçśżåđŃåřĘè¡ňåŇŰäÿžfloa
- èŕěbatchçŽĎæ■§åd'ś avg_cost æŸŕåŘĎæĺąæăůæIJňçŽĎæ■§åd'śäźŃåŠŇ
- æĹŚäżňåŘŇæŮűè£ŸäijŽèőąçőŮécĎæţŃçŽĎaucæŇĞæăĞãĂĆ

48.7 æŢĹæđIJåd'■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åd'§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä README äÿ■çŽĎæŢĹæđIJ,èŕůæŇL'åęĆäÿŃæ■ěéłd'ä¿ĺæňąæŞ■ä¡IJå■şåŘŕãĂĆ åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőd'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡Ţäÿž PaddleRec/models/rank/fat_deepffm
2. è£ŻåĚě PaddleRec/datasets/criteo çŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæ

```
cd ../../../datasets/criteo
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżd'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

48.8 è£ŻéŸűä¡£çŤÍ

48.9 FAQ

CHAPTER

FORTYNINE

DEEPREC (TRAINING DEEP AUTOENCODERS FOR COLLABORATIVE FILTERING)

äżčçăĄèŕůåŘĆèĂČïijŽDeepRecåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

49.1 åĘĚåőź

- *DeepRec*
  - *åĘĚåőź*
  - *æĹąåđŃçőĂäżŃ*
  - *æŢřæ■őåĞĘåď'Ğ*
  - *è£ŘèąŇçŐŕåćČ*
  - *å£ńéĂ§åijĂåğŃ*
  - *æĹąåđŃçżĎç¡Ś*
  - *æŢĹæđIJåď'■çŐř*
  - *è£ŻźŸűä¡£çŤĺ*
  - *FAQ*

49.2 æĹąåđŃçőĂäżŃ

DeepRecä¡£çŤĺå§žäžŐèĞłçijŰçăĄåŹĺçŽĎå■ŘåŘŇè£Ğæżď'ïijŇåŁäåĚěäžĘäÿĂäžŻtricksïijŇè¿¿åĹřäžĘæ åŁäåď'ğDropoutçŽĎæŕŤä¿Ń(0.8); 2. ä¡£çŤĺåÿęèť'§åĂijçŽĎæ£Ăæť'żåĞ¡æŢřselu; 3. æŘŘåĞž-Dense re-feeding, æŁŁéćĎæţŃçżŞæđIJéĞ■æŰřæŤ¿åŻđèĞłçijŰçăĄåŹĺäÿ■ä¡IJäÿžæŰřçŽĎæăůæIJňåĘ■æňąéć äżěè¿¿åĹřæŢřæ■őåćđåijžåÿőåŁl'éŸšæ■ćæĹąåđŃè£ĞæŃ§åŘĹ

49.3 æŢřæ■őåĞĘåďĞ

æĹŚäžňåIJÍä¡IJèĂĚåď ĎçŘĘè£ĞçŽĎåijĂæžŘæŢřæ■őéŻĘNetflixäÿŁéłŇèŕĄæÍąåđŃæŢĹæđIJïijŇåIJÍæÍa
æŢřæ■őçŽĎæăijåijŘåęĆäÿŃïijŽ çŤ§æĹŘçŽĎæăijåijŘäžě\täÿžåĹĘåL'šçĆź

```
u_id        i_id        rating
116        341        3.7
```

49.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 3.5/3.6/3.7/3.8

os : windows/linux/macos

49.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäžěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæÍąåđŃçŻőå¡Ţ
# cd models/rank/deeprec # åIJÍäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u trainer.py -m config.yaml # åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_
↪bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u infer.py -m config.yaml
```

49.6 æÍąåđŃçżĎç¡Ś

DeepRecæŸŕäÿĂäÿłèĞłçijŰçăĄåŹÍ, çŤśencoderåŠŇdecoderçżĎæĹŘ, åIJÍencoderåŠŇdecoderäźŃéŮť åŁăåĚěäžĘäÿĂäÿłdropæęĆçŐĞå¿Ĺåď ğçŽĎdropoutåśĆ, ä¡£çŤÍseluä¡IJäÿžæ£Ăæť žåĞ¡æŢřăĂĆæÍąåđŃçŽĎäÿżèęĄçżĎç¡ŚçżŞæđĎåęĆäÿŃïijŽ

49.6.1 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď §å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäžňåIJÍæŕŘäÿłæÍąåđŃä
åIJÍåĚÍéĞŘæŢřæ■őäÿŃæÍąåđŃçŽĎæŃĞæăĞåęĆäÿŃïijŽ

1. çąőèőď æĆÍå¡ŞåL'■æL'ĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/rank/deeprec
2. è£ŻåĚěpaddlerec/datasets/NetflixçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■
PriceæŢřæ■őéŻĘïijŇåźűèğčåŐŃåĹřæŃĞåőŽæŰĞäżűåď źãĂĆ

```
cd data
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u infer.py -m config_bigdata.yaml # åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_
↪bigdata.yaml
```

49.7 è£ŻéŸűä¡£çŤÍ

49.8 FAQ

CHAPTER

FIFTY

AUTOFIS (AUTOMATIC FEATURE INTERACTION SELECTION IN FACTORIZATION MODELS)

äžčçăĄèŕůåŘĆèĂČïijŽAutoFISåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

50.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

50.2 æĺąåđŃçőĂäżŃ

Automatic Feature Interaction Selection in Factorization Model-
sïijĹçĆźåĞżçŐĞéćĎæţŃéŮőéćŸäÿŃåŻäå■ŘåĹĘèğčæIJžæĺąåđŃçŽĎèĞłåŁĺçL'źå¿Ąäžď'äžŠéĂL'æŃl'æĺąïijL'

50.3 æŢřæ■őåĞĘåď'Ğ

æŢřæ■őäÿžCriteoïijŇéĂL'æŃl'äžEçňň6-12åď'l'çŽĎæŢřæ■őä¡IJäÿžèő■çżČéŻĘïijŇä¡Ő13åď'l'çŽĎæŢřæ■
åIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆĺåĞĘåď'ĞäžĘå£ńéĂ§è£ŘèąŇçŽĎçď'žä¿ŃæŢřæ■őïijŇèŃěéIJĂè

50.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

50.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/deepfm # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿éćĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

50.6 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | auc | log_loss|batch_size
| epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ|
:âĂŤâĂŤ | | AutodeepFM | 0.8009 |0.5403 | 2000 | 1 | çžę3åřŘæŮűˇ |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/autofis
2. è£ŻåĚěpaddlerec/datasets/criteo_autofis
3. æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd ../../../datasets/criteo_autofis
sh run.sh
```

```
cd - # åĹĞåżđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python trainer.py -m config_bigdata.yaml #␣
↪stage0ïijŽèĞłåŁĺæŘIJçt'ćæIJĂä¡ŞçL'źå¿ĄçżĎåŘĹ
python trainer.py -m config_bigdata.yaml -o stage=1 #␣
↪stage1ïijŽèő■çżČæIJĂçżĹæĺąåđŃ
python -u ../../../tools/infer.py -m config_bigdata.yaml -o stage=1
↪# åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

50.7 è£ŻéŸűä¡£çŤĺ

50.8 FAQ

CHAPTER

FIFTYONE

SIGN (DETECTING BENEFICIAL FEATURE INTERACTIONS FOR RECOMMENDER SYSTEMS)

äžčçăĄèŕůåŘĆèĂČïijŽSIGNåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL’çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

51.1 åĘĚåőź

- *Detecting Beneficial Feature Interactions for Recommender Systems*
  - *åĘĚåőź*
  - *æĺąåđŃçőĂäžŃ*
  - *æŢřæ■őåĞĘåď’Ğ*
  - *è£ŘèąŇçŐŕåćČ*
  - *å£ńéĂ§åijĂåğŃ*
  - *æĺąåđŃçżĎç¡Ś*
  - *æŢĹæđIJåď’■çŐř*
  - *è£ŻéŸűä¡£çŤĺ*
  - *FAQ*

51.2 æĺąåđŃçőĂäžŃ

çL’źå¿Ąäžď’åŘL’éĂŽè£ĞåřĘäÿď’äÿłæĹŰåď’ŽäÿłçL’źå¿ĄçŻÿäźŸïijŇæİěåőđçŐřæăůæIJňçl’žéŮť’çŽĎéİđç Beneficial Feature Interactions for Recommender SystemsãĂŃäÿ■æŘŘåĞžäžĘäÿĂçğ■åĹl’çŤĺåŻ¿çěđçżŘç¡ŚçżIJèĞłåŁĺåŘŚçŐřæIJL’æĎŘäźL’çL’źå¿Ąäžď’åŘL’çŽĎæĺą SIGNãĂĆ

ä¡IJèĂĚä¡£çŤĺåŻ¿çěđçżŘç¡ŚçżIJåżžæĺąæŕŘäÿłæăůæIJňçŽĎçL’źå¿ĄïijŇåřĘçL’źå¿Ąäžď’åŘL’äÿŐåŻ¿äÿ■

æIJňæĺąåđŃåőđçŐřäžĘäÿŃè£řèőžæŰĞäÿ■çŽĎ SIGN æĺąåđŃïijŽ

```
@inproceedings{su2021detecting,
  title={Detecting Beneficial Feature Interactions for Recommender␣
↪Systems},
  author={Su, Yixin and Zhang, Rui and Erfani, Sarah and Xu,␣
↪Zhenghua},
  booktitle={Proceedings of the 34th AAAI Conference on Artificial␣
↪Intelligence (AAAI)},
  year={2021}
}
```

51.3 æŢřæ■őåĞĘåďĞ

èőžæŰĞä¡£çŤÍäžĘ4äÿłåijĂæžŘæŢřæ■őéŻĘïijŇDBLP_v1ãĂĄfrappeãĂĄml-tagãĂĄtwitterïijŇ
èŕĕæŢřæ■őéŻĘäÿŞæşÍäžŐçŤţå¡śæăĞç■¿æŐÍè■ŘïijŇæŕŘäÿłæŢřæ■őåőđä¿ŃéČ¡äžčèąÍäÿĂäÿłåŻ¿ïijŇæŢřæ■őa

```
# çŤţå¡śæăĞç■¿ çŤÍæĹůID çŤţå¡śID çŤţå¡śID
0.0 24 25 26
1.0 62 63 64
```

51.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

pgl>=2.2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

51.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäžĕä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ

```
# åĞĘåď ĞçŐŕåćČ: åőL'èčĚpgl
pip install pgl

# è£ŻåĚĕæÍąåđŃçŻőå¡Ţ
cd PaddleRec/models/rank/sign # åIJÍäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml    #␣
↪sampleæŢřæ■őè£ŘèąŇ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇ
# åŁÍæĂĄåŻ¿écĎæţŃ
```

(continues on next page)

(continued from previous page)

```
python -u ../../../tools/infer.py -m config.yaml    #␣
↪sampleæŢřæ■őécĎætŃ
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŔæŢřæ■őécĎætŃ
```

51.6 æÍąåđŃçżĎç¡Ś

L0-SIGNæÍąåđŃæIJL'äÿd'äÿłæÍąåİŮïijŇäÿĂäÿłæŸŕL0è¿źécĎäijřæÍąåİŮïijŇéĂŽè£Ğç§l'éŸţåĹĘèğčåŻ¿
net.py äÿ■çŽĎäžčçăĄäÿĂäÿĂåŕźåžŤ ïijŽ

51.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŔäÿłæÍąåđŃä
åIJÍåĚÍéĞŔæŢřæ■őäÿŃæÍąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď'æĆÍå¡ŞåL'■æL'ĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/rank/sign
2. è£ŻåĚěPaddleRec/datasets/signçŻőå¡ŢäÿŃïijŇæL'ğèąŇrun.shèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■åŁąåŹÍäÿŁäÿŃè¡¡signåĚÍéĞŔæŢřæ■őéŻĘïijŇåźűèğčåŐŃ

```
cd ../../../datasets/sign
bash run.sh
```

1. åőL'èčĚä¿ÍèţŰ

```
# åőL'èčĚpgl
pip install pgl
```

1. åĹĞåŻđæÍąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżd'è£ŘèąŇåĚÍéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæÍąåđŃçŻőå¡Ţ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŔæŢřæ■őè£ŘèąŇ
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŔæŢřæ■őécĎætŃ
```

51.8 è£ŻéŸűä¡£çŤÍ

æIJňæÍąåđŃæŤŕæŇĄéčđæąÍèő■æŐÍäÿĂä¡Şèőď'èŕĄ (Training and Inference Pipeline Certification(TIPC)) ä£ąæĄŕåŠŇæţŃèŕŢåůěåĚůïijŇæŰźä¿£çŤÍæĹůæ§ěéŸĚæŕŘçğ■æÍąåđŃçŽĎèő■çżČæŐÍçŘĘé

ä¡£çŤÍæIJňåůěåĚůïijŇåŔŕäžěæţŃèŕŢäÿ■åŘŇåŁ§èČ¡çŽĎæŤŕæŇĄæČĚåĘţïijŇäžěåŔŁéćĎætŃçżŞæđIJæ

1. è£ŘèąŇprepare.shåĞĘåď ĞæţŃèŕŢæĽ ĂéIJĂæŢřæ■őåŠŇæĹąåđŃïijŻ
2. è£ŘèąŇæţŃèŕŢèĎŽæIJňtest_train_inference_python.shïijŇäžğåĞžlogïijŇçŤślogåŘŕäżěçIJŃåĹřäÿ■åŘŇéĚ■ç¡őæŸŕåŘęè£ŘèąŇæĹŘåŁ§ïijŻ

æţŃèŕŢå■Ţéąźå Ł§èČ¡äżĚéIJĂäÿď èąŇåŚ¡äżď ïijŇåŚ¡äżď æăijåijŘåęĆäÿŃïijŽ

```
# åŁ§èČ¡ïijŽåĞĘåď ĞæŢřæ■ő
# æăijåijŘïijŽbash + è£ŘèąŇèĎŽæIJň + åŘĆæŢř1: éĚ■ç¡őæŰĞäżűéĂĽ'æŃl' +
↪åŘĆæŢř2: æĹąåijŘéĂĽ'æŃl'
# æĹąåijŘéĂĽ'æŃl' [Mode] = 'lite_train_lite_infer' | 'whole_train_
↪whole_infer' | 'whole_infer' | 'lite_train_whole_infer'
bash test_tipc/prepare.sh configs/[model_name]/[params_file_name]
↪[Mode]

# åŁ§èČ¡ïijŽè£ŘèąŇæţŃèŕŢ
# æăijåijŘïijŽbash + è£ŘèąŇèĎŽæIJň + åŘĆæŢř1: éĚ■ç¡őæŰĞäżűéĂĽ'æŃl' +
↪åŘĆæŢř2: æĹąåijŘéĂĽ'æŃl'
bash test_tipc/test_train_inference_python.sh configs/[model_name]/
↪[params_file_name]  [Mode]
```

ä¿ŃåęĆïijŇæţŃèŕŢå§žæIJňèő■çżČéćĎæţŃåŁ§èČ¡çŽĎlite_train_lite_inferæĹąåijŘïijŇè£ŘèąŇæţŃèŕŢ

```
# çąőä£İå¡ŞåĽ'■çŻőå¡ŢåIJÍ PaddleRec
# cd PaddleRec
# åĞĘåď ĞæŢřæ■ő
bash test_tipc/prepare.sh ./test_tipc/configs/sign/train_infer_
↪python.txt 'lite_train_lite_infer'
# è£ŘèąŇæţŃèŕŢ
bash test_tipc/test_train_inference_python.sh ./test_tipc/configs/
↪sign/train_infer_python.txt 'lite_train_lite_infer'
```

51.9 FAQ

CHAPTER

FIFTYTWO

DSIN (DEEP SESSION INTEREST NETWORK FOR CLICK-THROUGH RATE PREDICTION)

äžčçăĄèŕůåŘĆèĂČïijŽDSINåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç Ćźäÿłstarå ŢŁ~

52.1 åĘĚåőź

- *DSINæĺąåđŃ*
- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

52.2 æĺąåđŃçőĂäżŃ

æĺąåđŃäÿżèęĄèĄŽçĎęäžŐçŤĺæĹůçŽĎåŐĘåŘšäijŽèŕİèąŇäÿžïijŇéĂŽè£ĞSelf-AttentionåŠŇBiLSTMåŕźåŐĘåŘšäijŽèŕİèąŇäÿžè£ŻèąŇå■ęäźăïijŇæIJĂåŘŐéĂŽè£ĞActivation Unitå¿ŮåĹřæIJĂçżĹçŽĎsessionèąĺå¿ĄåŘŚéĞŘïijŇåĘ■çżŞåŘĹåĚűäżŰçL'źå¿ĄéĂĄåĚěMLPèőąçőŮæIJĂåŘĞ scoreãĂĆDeep Session Interest Network for Click-Through Rate PredictionæŰĞçńăéĂŽè£Ğ Transformer åŠŇ BiLSTM æİěå■ęäźăçŤĺæĹůçŽĎ Session Interest Interacting ïijŇæŘŘå■ĞæĺąåđŃçŽĎèąĺè¿¿èČ¡åŁŻãĂĆç§ěäźŐèğčæđŘçIJŃè£ŹéĞŇ

52.3 æŢřæ■őåĞĘåďĞ

æIJňæÍąåđŃä¡£çŤÍèőžæŰĞäÿ■çŽĎæŢřæ■őéŻĘAlimama DatasetïijŇåŘĆèĂČåŐ§æŰĞä¡IJèĂĚçŽĎæŢřæ

52.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle == 2.2.2

python 3.7.4

os : windows/linux/macos

52.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåĬĞåŘŕæ

```
# è£ŻåĚěæÍąåđŃçŻőå¡Ţ
# cd models/rank/dsin # åIJÍäżżæĎŘçŻőå¡ŢåĬĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éĬŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éĬŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

52.6 æÍąåđŃçżĎç¡Ś

èőžæŰĞDeep Session Interest Network for Click-Through Rate Prediction äÿ■çŽĎç¡ŚçżIJçżŞæđĎåęĆåŻ¿æL'Ăçď'ž:

52.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď'§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæÍąåđŃä

1. çąőèőď'æĆÍå¡ŞåL'■æL'ĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/rank/dsin
2. è£ŻåĚěpaddlerec/datasets/Ali_Display_Ad_Click_DSINçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäż

```
cd ../../../datasets/Ali_Display_Ad_Click_DSIN
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

æŢĹæđIJåď■çŐřè£ĞçĺŃåŔŕåŔĆèĂČAI Studioéąźç ŻőãĂĆ

Note:è£ŘèąŇçŐŕåćČäÿžèĞşåřŁGPUãĂĆ

52.8 è£ŻéŸűä¡£çŤĺ

52.9 FAQ

CHAPTER

FIFTYTHREE

IPREC (PACKAGE RECOMMENDATION WITH INTRA- AND INTER-PACKAGE ATTENTION NETWORKS)

äżčçăĄèŕůåŘĆèĂČïijŽIPRecåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJĽçŤĺïijŇè£Ÿèŕůç Ćźäÿłstaråţŧ~

53.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æţŤŕæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æţŤĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

53.2 æĺąåđŃçőĂäżŃ

Package Recommendation with Intra- and Inter-Package Attention Networks
ãĂŁåĹľçŤĺâĂIJåŇĚåĘĚâĂİåŠŇâĂIJåŇĚéŮť'âĂİæşĺæĎŔåŁŻç¡ŚçżIJçŽĎåŇĚæŐĺè■ŘãĂŃãĂĆéŽŔçİĂçğżåł
RecommendationãĂĆåIJĺè£Źçğ■åIJżæŹŕäÿ■ïijŇçŤĺæĹůäÿ■åĘ■èćńæŐĺè■Řå■ţäÿłéąźçŻőæĹŰéąźçŻőåĹŮèąĺ

53.3 æţŤŕæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕţæţŤŕæ■őéŻĘéĂĽèĞłæŮűéŮť'çłŮåŘčäÿž3åď'ľçŽĎå¿őä£ąåĚňäijŮåŘůçŽĎçŤĺæĹůæŮ
åIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿżæĆĺåĞĘåď'ĞäžĘå£ńéĂ§è£ŘèąŇçŽĎçď'žä¿ŃæŢŕæ■őïijŇèŃěéIJĂè

53.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

53.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/rank/iprec # åIJĺäżżæĎŔçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿éćĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

53.6 æĺąåđŃçżĎç¡Ś

æĺąåđŃæŢť'ä¡ŞçżŞæđĎåęĆäÿŃïijŽ

53.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŔäÿłæĺąåđŃä

1. çąőèőď'æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/rank/iprec
2. è£ŻåĚěPaddlerec/datasets/iprec

```
cd ../../../datasets/iprec
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
python -u ../../../tools/trainer.py -m config_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml
```

53.8 è£ŻéŸűä¡£çŤÍ

53.9 FAQ

CHAPTER

FIFTYFOUR

ESMM (ENTIRE SPACE MULTI-TASK MODEL: AN EFFECTIVE APPROACH FOR ESTIMATING POST-CLICK CONVERSION RATE)

äżčçăĄèŕůåŘĆèĂČïijŽESMMåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJĽçŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

54.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

54.2 æĺąåđŃçőĂäżŃ

äÿ■åŘŇäžŐCTRéćĎäijřéŮőéćŸïijŇCVRéćĎäijřéİćäÿť'äÿď'äÿłåĚşéŤőéŮőéćŸïijŽ

1. **Sample Selection Bias (SSB)** è¡ňåŇŰæŸŕåIJĺçĆźåĞżäźŃåŘŐæĽ'■âĂIJæIJĽ'åŘŕèČ¡âĂİåŘŚçŤ§çŽĎåŁ
2. **Data Sparsity (DS)** ä¡IJäÿžCVRèő■çżČæŢřæ■őçŽĎçĆźåĞżæăůæIJňè£IJåřŘäžŐCTRéćĎäijřèő■çżČä¡

ESMMæŸŕåŘŚèąĺåIJĺ SIGIRâĂŹ2018 çŽĎèőžæŰĞãĂŁEntire Space Multi-Task Model: An EïňĂective Approach for Estimating Post-Click Conversion RateãĂŃæŰĞçńåå§žäžŐ Multi-Task Learning çŽĎæĂİèůŕïijŇæŘŘåĞžäÿĂçğ■æŰřçŽĎCVRéćĎäijřæĺąåđŃâĂŤâĂŤESMMïijŇæIJĽæŢĹèğčåĘşäžĘçIJ§åőđåIJżæŹŕäÿ■CVRéćĎäijřéİćäÿť'çŽĎæŢřæ■őçĺĂçŰŘäżěåŘŁæăůæIJňéĂĽæ

54.3 æŢřæ■őåĞĘåďĞ

æĹŚäžňåIJÍåijĂæžŘæŢřæ■őéŻĘAli-CCPïijŽAlibaba Click and Conversion PredictionäÿŁéłŇèŕĄæÍąåđŃæŢĹæđIJãĂĆåIJÍæÍąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆÍåĞĘåď ĞäžĘå£ńéĂ§è£ŘèąŇçŐŕåćČæŢřæ■őæăijåijŔåŘĆèğĄdemoæŢřæ■őïijŽdata/train

54.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

54.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæÍąåđŃçŻőå¡Ţ
# cd models/multitask/esmm # åIJÍäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

54.6 æÍąåđŃçżĎç¡Ś

ESMMæŸŕåŘŚèąĺåIJÍ SIGIRâĂŹ2018 çŽĎèőžæŰĞãĂŁEntire Space Multi-Task Model: An EïňĂective Approach for Estimating Post-Click Conversion RateãĂŃæŰĞçńåå§žäžŐ Multi-Task Learning çŽĎæĂÌèůŕïijŇæŘŘåĞžäÿĂçğ■æŰřçŽĎCVRéćĎäijřæÍąåđŃâĂŤâĂŤESMMïijŇæIJL'æŢĹèğčåĘşäžĘçIJ§åőđåIJžæŹŕäÿ■CVRéćĎäijřéİćäÿt'çŽĎæŢřæ■őçÍĂçŰŘäżěåŘŁæăůæIJňéĂL'æESMM:

54.6.1 æŢĹæđlJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎèő■çżČæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc_ctr |
batch_size | epoch_num | Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ|
:âĂŤâĂŤ | | ESMM | 0.82 | 1024 | 10 | çžę3åĹĘéŠ§ |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/multitask/esmm
2. è£ŻåĚěpaddlerec/datasets/ali-ccpçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■
ccpåĚĺéĞŘæŢřæ■őéŻĘïijŇåźűèğčåŐŃåĹřæŇĞåőŽæŰĞäżűåď źãĂĆ

```
cd ../../../datasets/ali-ccp
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

54.7 è£ŻéŸűä¡£çŤĺ

54.8 FAQ

CHAPTER

FIFTYFIVE

MAML (MODEL-AGNOSTIC META-LEARNING FOR FAST ADAPTATION OF DEEP NETWORKS)

äžčçăĄèŕůåŘĆèĂČïijŽMAMLåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

55.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

55.2 æĺąåđŃçőĂäżŃ

Model-Agnostic Meta-Learning for Fast Adaptation of Deep Networksçő̊ŮæşŢæŸŕäÿĂçğ■æĺąåđŃæŮăåĚşçŽĎåĚČå■ęäźăçőŮæşŢïijŇåĚűæĺąåđŃæŮăåĚşä¡ŞçŐŕåIJĺïijŇèČ¡åđ
hrdws åď'ğçěđèť'ąçŇőçŽĎMAMLåĚČå■ęäźăçőŮæşŢïijŇåřŘæăůæIJňå■ęäźăïijŇåď'ŽäżżåŁąå■ęäźăãĂĆ

55.3 æŢřæ■őåĞĘåď'Ğ

èő■çżČåŘŁæţŃèŕŢæŢřæ■őéŻĘéĂL'çŤĺomniglotæŢřæ■őéŻĘãĂĆOmniglot
æŢřæ■őéŻĘåŇĚåŘń50äÿłäÿ■åŘŇçŽĎå■Ůæŕ■èąĺïijŇæŕŘäÿłå■Ůæŕ■èąĺäÿ■çŽĎå■Ůæŕ■åŘĎåŇĚåŘń20äÿłæL
Mechanical Turk åIJĺçž£çżŸåĹűçŽĎãĂĆOmniglotæŢřæ■őéŻĘçŽĎåď'ŽæăůæĂğåijžäžŐMNISTæŢřæ■őéŻĘï

55.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

55.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäžěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/multitask/maml # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

55.6 æĺąåđŃçżĎç¡Ś

èĂČèŹŚäÿĂäÿłåĚşäžŐäżżåŁąTçŽĎåĹĘåÿČp(T)ïijŇæĹŚäżňåÿŇæIJŻæĺąåđŃèČ¡åď§åŕźèŕĕäżżåŁąåĹĘåÿ
shotïijĹå■şKäÿłå■ęäźäæăůæIJňïijL'çŽĎå■ęäźääżżåŁąäÿŃïijŇäżŐp(T)åĹĘåÿČäÿ■éŽŘæIJžéĞĞæăůäÿĂäÿłæĹ

55.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/multitask/maml
2. è£ŻåĚěpaddlerec/datasets/omniglotçŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕĕèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæL

```
cd ../../../datasets/omniglot
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
export FLAGS_cudnn_deterministic=True # åŻžåőŽçąőåőŽæĂğçőŮæşŢ
# åŁĺæĂĄåŻ¿èő■çżČ
```

(continues on next page)

(continued from previous page)

```
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

55.8 è£ŻéŸűä¡£çŤÍ

55.9 FAQ

CHAPTER

FIFTYSIX

MMOE (MODELING TASK RELATIONSHIPS IN MULTI-TASK LEARNING WITH MULTI-GATE MIXTURE-OF-EXPERTS)

äżčçăĄèŕůåŘĆèĂČïijŽMMOEåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

56.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

56.2 æĺąåđŃçőĂäżŃ

åď'Žäżżå Łąæĺąåđ Ńé ĂŽè£Ğå■ęäźääÿ■åŘŇäżżå ŁąçŽĎè ĄŤçşżåŠŇåůőåijĆïijŇåŕŕæŘŘéńŸæŕŘäÿłäżżå Łą bottomçŽĎçżŞæđĎïijŇäÿ■åŘŇäżżå ŁąéŮť'åĚśçŤĺåžŢéČĺçŽĎéŽŘåśĆãĂĆè£Źçğ■çżŞæđĎæIJňèť'ĺäÿŁåŕŕäżěå èőžæŰĞãĂŁModeling Task Relationships in Multi-task Learning with Multi-gate Mixture-of-ExpertsãĂŃäÿ■æŘŘåĞžäžĘäÿĂäÿłMulti-gate Mixture-of-Experts(MMOE)çŽĎåď'Žäżżå Łąå■ęäźäçżŞæđĎãĂĆ

56.3 æŢřæ■őåĞĘåďĞ

æĹŚäžňåIJÍåijĂæžŘæŢřæ■őéŻĘCensus-income DataäÿŁéłŇèŕĄæĺąåđŃæŢĹæđIJ,åIJÍæĺąåđŃçŻőå¡ŢçŽĎ
æŢřæ■őçŽĎæăijåijŔåęĆäÿŃïijŽ çŤ§æĹŘçŽĎæăijåijŔäžěéĂŮåŘůäÿžåĹĘåL'šçĆź

```
0,0,73,0,0,0,0,1700.09,0,0
```

56.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

56.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäžěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŽåĚěæĺąåđŃçŽőå¡Ţ
# cd models/multitask/mmoe # åIJÍäżżæĎŔçŽőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

56.6 æĺąåđŃçżĎç¡Ś

MMOEæĺąåđŃåĹżçŤżäžĘäżżåŁąçŻÿåĚşæĂğïijŇå§žäžŐåĚśäžńèąĺçď'žæİěå■ęäźäçL'źäőŽäżżåŁąçŽĎåĞ
MMoE:

56.6.1 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæĺąåđŃïijŇæĹŚäžňåIJÍæŕŔäÿłæĺąåđŃä
åIJÍåĚĺéĞŔæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc_marital | batch_size

| epoch_num | Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | MMOE | 0.99 | 32 | 100 | çžę1åĹĘéŠ§ |

1. çąőèőď æĆÍå¡ŞåĽ■æĽĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/multitask/mmoe
2. è£ŻåĚěpaddlerec/datasets/censusçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■

```
cd ../../../datasets/census
sh run.sh
```

1. åĹĞåŻđæÍąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚÍéĞŕæŢřæ■ő

```
cd - # åĹĞåŻđæÍąåđŃçŻőå¡Ţ
# åŁÍæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚÍéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

56.7 è£ŻéŸűä¡£çŤÍ

56.8 FAQ

CHAPTER

FIFTYSEVEN

PLE (PROGRESSIVE LAYERED EXTRACTION : A NOVEL MULTI-TASK LEARNING (MTL) MODEL FOR PERSONALIZED RECOMMENDATIONS)

äžčçăĄèŕůåŘĆèĂČïijŽPLEåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

57.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

57.2 æĺąåđŃçőĂäżŃ

åď'Žäżżå Łąæĺąåđ ŃéĂŽè£Ğå■ęäźääÿ■åŘŇäżżå ŁąçŽĎèĄŤçşżåŠŇåůőåijĆïijŇåŕŕæŕŘéńŸæŕŕäÿłäżżå Łą
èőžæŰĞãĂŁProgressive Layered Extraction (PLE): A Novel Multi-Task Learning (MTL) Model for Personalized RecommendationsãĂŃ ïijŇèőžæŰĞæŕŘåĞžäžĘProgressive Layered Extraction (çőĂçğřPLE)ïijŇæİěèğčåEşåď'Žäżżå Łąå■ęäźäçŽĎèůůèůůæİ£çŐřèśąãĂĆ

æĹŚäżňåIJÍPaddlepaddleåőŽäźL'PLEçŽĎç¡ŚçżIJçżŞæđĎïijŇåIJÍåijĂæžŘæŢřæ■őéŻĘCensus-income DataäÿŁéłŇèŕĄæĺąåđŃæŢĹæđIJãĂĆ

æŢřæ■őçŽĎæäijåijŕåęĆäÿŃïijŽ çŤ§æĹŘçŽĎæäijåijŕäżěéĂŮåŕůäÿžåĹĘåL'šçĆź

```
0,0,73,0,0,0,0,1700.09,0,0
```

57.3 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

57.4 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæĺąåđŃçŽőå¡Ţ
# cd models/multitask/ple # åIJĺäżżæĎŘçŽőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

57.5 æĺąåđŃçżĎç¡Ś

57.5.1 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc_marital | batch_size |
epoch_num | Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | PLE
| 0.99 | 32 | 100 | çžę1åĹĘéŠ§ |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/multitask/ple
2. è£ŽåĚěpaddlerec/datasets/censusçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■

```
cd ../../../datasets/census
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŽőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

57.6 è£ŻéŸűä¡£çŤĺ

57.7 FAQ

CHAPTER

FIFTYEIGHT

SHARE_BOTTOM (MULTITASK LEARNING)

äžčçăĄèŕůåŘĆèĂČïijŽShareBottomåęĆæđIJæĹŚäžňçŽĎäžčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢ

58.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

58.2 æĺąåđŃçőĂäżŃ

share_bottomæŸŕåď'Žäżżå Łąå■ęäźăçŽĎå§žæIJňæąĘæđűïijŇåĚűçL'źçĆźæŸŕåŕźäžŐäÿ■åŘŇçŽĎäżżå Łąi basedçŽĎåď'Žäżżå ŁąæĺąåđŃéČ¡æŸŕå§žäžŐshare_bottomåŘŚåśŢèĂŇæİěçŽĎïijŇåęĆMMOEç■L'æĺąåđŃåŘ

æĹŚäžňåIJÍPaddlepaddleåőđçŐřshare_bottomç¡ŚçżIJçżŞæđĎïijŇåźűåIJÍåijĂæžŘæŢřæ■őéŻĘCensus-income Dataäÿ Łéł Ňèŕ ĄæĺąåđŃæŢĹæđIJãĂĆ

58.3 æŢřæ■őåĞĘåď'Ğ

æĹŚäžňåIJÍåijĂæžŘæŢřæ■őéŻĘCensus-income Dataäÿ Łéł Ňèŕ ĄæĺąåđŃæŢĹæđIJ,åIJÍæĺąåđŃçŻőå¡ŢçŽĎ æŢřæ■őçŽĎæăijåijŘåęĆäÿŃïijŽ çŤ§æĹŘçŽĎæăijåijŘäżěéĂŮåŘůäÿžåĹĘåL'šçĆź

```
0,0,73,0,0,0,0,1700.09,0,0
```

58.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

58.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäžěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/multitask/share_bottom # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

58.6 æĺąåđŃçżĎç¡Ś

58.6.1 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc_marital | batch_size
| epoch_num | Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | |
Share_bottom | 0.99 | 32 | 100 | çže1åĹĘéŠ§ |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/multitask/share_bottom
2. è£ŻåĚěpaddlerec/datasets/censusçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■

```
cd ../../../datasets/census
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŕæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

58.7 è£ŻéŸűä¡£çŤĺ

58.8 FAQ

CHAPTER

FIFTYNINE

DSELECT-K(DSELECT-K: DIFFERENTIABLE SELECTION IN THE MIXTURE OF EXPERTS WITH APPLICATIONS TO MULTI-TASK LEARNING)

äżčçăĄèřůåŘĆèĂČïijŽDSelect_KåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèřůçĆźäÿłstaråŢŁ

59.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐřåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

59.2 æĺąåđŃçőĂäżŃ

`MoE(Mixture of Experts)` æđűæđĎåIJĺæŤźåŰĎåď'Žäżżå Łąå■ęäźă MTL(Multi-Task Learning) äÿ■çŽĎåŘĆæŢřåĚśäžńåŠŇæL'l'åśŢåď'ğåőźéĞŘçěđçżŘç¡ŚçżIJæŰźéĺćæŸ¿çď'žåĞżèL'řåě¡çŽĎ çŽĎ MoE çśżæĺąåđŃä¡£çŤĺäÿĂäÿłåŘřèő■çżČçŽĎçĺĂçŰŘéŮĺæŐğæĺěäÿžæřŘäÿłè¿ŞåĚěåőđä¿ŃéĂL'æŃl'äÿĂ Top-K, åźűäÿ■åźşæżŚïijĹæĎŘåŚşçĺĂäÿ■åŘřåřijïijL'ãĂĆåIJĺä¡£çŤĺå§žäžŐæćřåžęçŽĎæŰźæşŢè£ŻèąŇèő■çżČ æIJňæŰĞå§žäžŐäžŇè£ŻåĹűçijŰçăĄæŰźæşŢæŘŘåĞžäžĘ `DSelect-k: a continuously differentiable and sparse gate for MoE`ïijŇ èğčåĘşäžĘçŐřæIJL'çĺĂçŰŘéŮĺæŐğäÿ■åŘřåřijçŽĎåijŁçńřïijŇåŘřäžěæäźæ■őæćřåžęäÿŃéŹ■çśżæŰźæşŢè£Żè

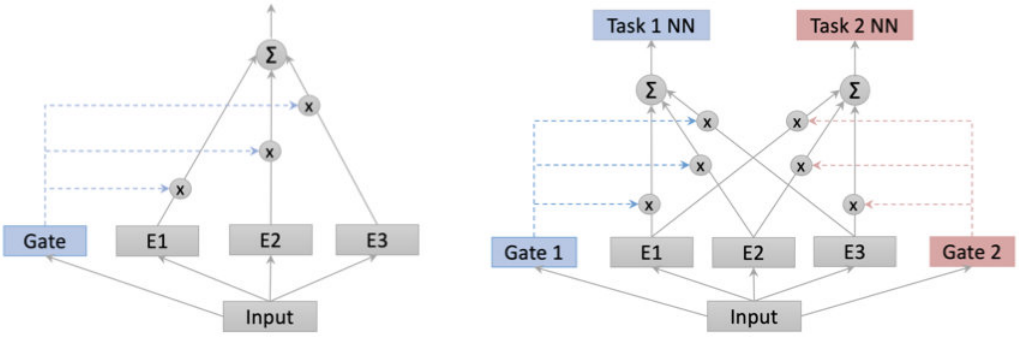


Figure 1: **(Left)**: An example of a MoE that can be used as a standalone learner or layer in a neural network. Here "Ei" denotes the i-th expert. **(Right):** A multi-gate MoE for learning two tasks simultaneously. "Task i NN" is a neural network that generates the output of Task i.

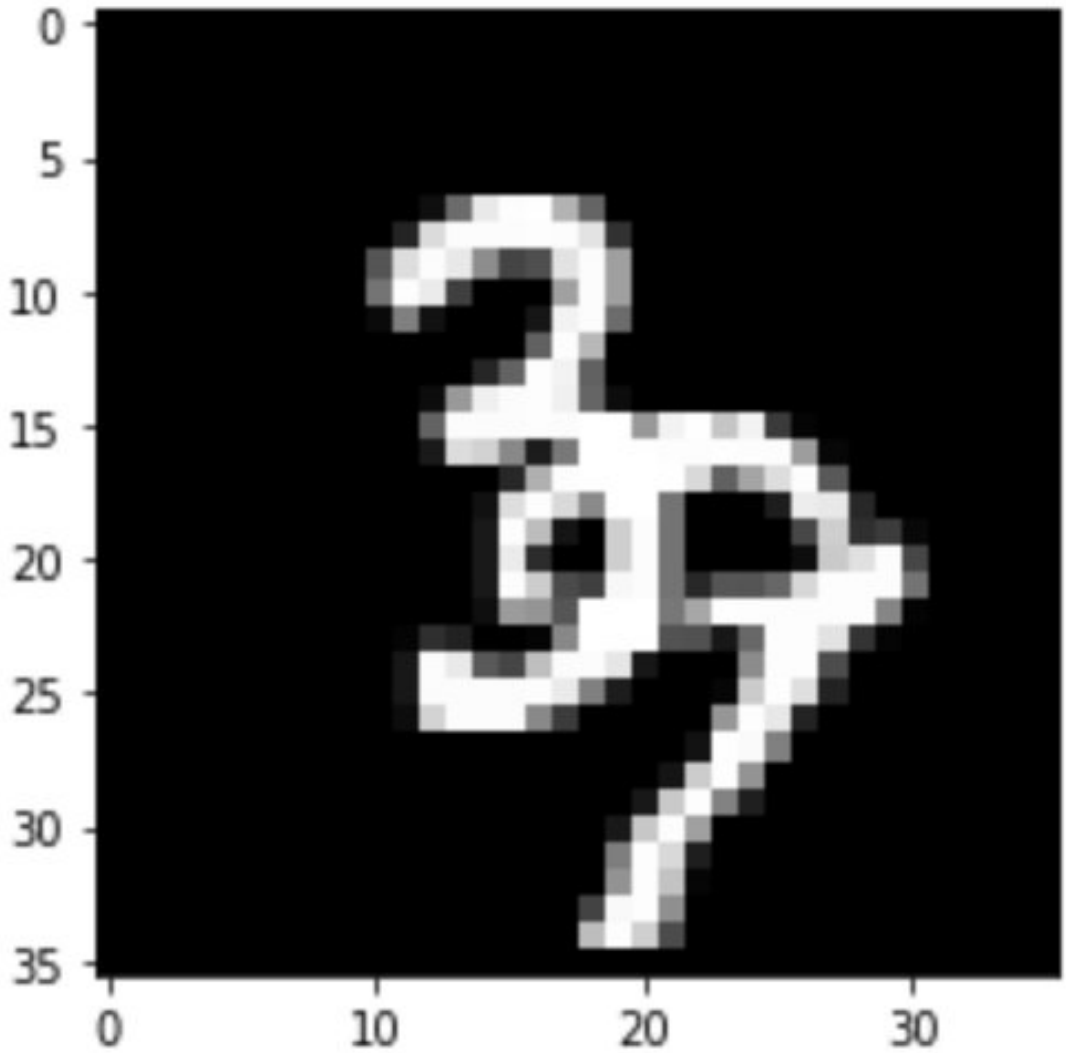
äÿŁåŻ¿æŸŕ MoE åŠŇ MMoE çŽĎçżŞæđĎåŻ¿ïijŇ æIJňæŰĞæĽĂæŘŘåĞžçŽĎ DSelect-k æĺąåđŃçŤĺäžŐäżŐ N äÿłäÿŞåőűäÿ■éĂĽæŃľ Top-K äÿłè£ŻèąŇåŘŐçż■äżżåŁąéćĎæţŃãĂĆåĚűäÿżèęĄæIJĽäÿďçğ■æĺąåijŘïijŇ1ïijĽStatic; 2) Per-example; åĽ■èĂĚäÿ■æĎ§ç§ěè¿ŞåĚěïijŇæĽĂæIJĽåőđä¿ŃäijŽéĂĽæŃľåŘŇæăůçŽĎäÿŞåőűå■ŘéŻĘïijŇåŘŐ

```
@article{hazimeh2021dselectk,
      title={DSelect-k: Differentiable Selection in the Mixture of␣
↪Experts with Applications to Multi-Task Learning},
      author={Hussein Hazimeh and Zhe Zhao and Aakanksha Chowdhery␣
↪and Maheswaran Sathiamoorthy and Yihua Chen and Rahul Mazumder␣
↪and Lichan Hong and Ed H. Chi},
      year={2021},
      eprint={2106.03760},
      archivePrefix={arXiv},
      primaryClass={cs.LG}
}
```

59.3 æŢŕæ■őåĞĘåďĞ

èő■çżČåŘŁæţŃèŕŢæŢŕæ■őéŻĘéĂĽçŤĺçŽĎæŸŕ Multi-MNIST æŢŕæ■őéŻĘïijŇèŕěæŢŕæ■őéŻĘæŸŕåIJĺ Dynamic Routing Between Capsules éęŰæňąäżŃçż■æŘŘåĞžïijŇåŘŐçż■äÿĂäžŻ MTL èőžæŰĞåďğåďŽæš£çŤĺèŕěæŢŕæ■őéŻĘãĂĆ

> The MultiMNIST dataset is generated from MNIST. The training and tests are generated by overlaying a digit on top of another digit from the same set (training or test) but different class. Each digit is shifted up to 4 pixels in each direction resulting in a 36ĂŮ36 image.



äÿŁåŻ¿æŸŕåĚűäÿ■äÿĂåijååŻ¿çĽĞïijŇäÿŐçżŘåĚÿæŢřæ■ŏéŻĘ MNIST äÿ■åŘŇïijŇèŕĕåŻ¿çĽĞäÿŁåŇĚåŘńäÿď ä¡■æŢřå■ŮïijŇåůęäÿŁåŠŇåŘşäÿŃïijŇåŕźåžŤäÿď äÿłåď ŽåĹĘçśżäżżå 100000ãĂĄ20000ãĂĄ20000ãĂĆ

åIJÍ PaperswithCode ç¡ŚçńŹäÿŁæčĂçť ćåĹř ãĂŘNeurlPS 2019ãĂŚPareto Multi-Task Learning åĚňåÿČäžĘèŕĕæŢřæ■ŏéŻĘïijŇ äÿŃè¡¡éŞ¿æŐĕïijŽ https://drive.google.com/drive/folders/1VnmCmBAVh8f_BKJg1KYx-E137gBLXbGGãĂĆ

59.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.1

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

59.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ
dselect_k æĺąåđŃçŻőå¡ŢçŽĎå£ńéĂ§æL'ğèąŇåŚ¡äżď'åęĆäÿŃïijŽ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/multitask/dselect_k # åIJĺäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁĺæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŻ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŻ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

59.6 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď'§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŘäÿłæĺąåđŃä
readme äÿ■çŽĎæŢĹæđIJ,èŕůæŇL'åęĆäÿŃæ■ěéłď'ä¿İæňąæŞ■ä¡IJå■şåŘŕãĂĆ
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/multitask/dselect_k
2. è£ŻåĚě paddlerec/datasets/Multi_MNIST_DselectK çŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ

```
cd ../../../datasets/Multi_MNIST_DselectK
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
# åĹĞåŻđæĺąåđŃçŻőå¡Ţ PaddleRec/models/multitask/dselect_k
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

59.7 è£ŻéŸűä¡£çŤĺ

59.8 FAQ

CHAPTER

SIXTY

METAHEAC (LEARNING TO EXPAND AUDIENCE VIA META HYBRID EXPERTS AND CRITICS FOR RECOMMENDATION AND ADVERTISING)

äżčçăĄèŕůåŘĆèĂČïijŽMetaHeacåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

60.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *inferèŕť'æŸŐ*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

60.2 æĺąåđŃçőĂäżŃ

åIJĺæŐĺè■Řçşżçż§åŠŇåź£åŚŁåźşåŘřäÿŁïijŇèŘěéŤĂäžžåŚŸæĂżæŸŕåÿŇæIJŻéĂŽè£ĞèğĘéćŚæĹŰèĂĚ
alikeåżžæĺąïijL'æŸŕäÿĂçğ■å¿ĹæIJL'æŢĹçŽĎèğčåĘşæŰźæąĹïijŇä¡Ęlook-
alikeåżžæĺąéĂŽåÿÿéİćäÿť'äÿď'äÿłæŇŚæĹŸïijŽïijĹ1ïijL'äÿĂåőűåĚňåŘÿæŕŘåď'l'åŘŕäżěåijĂåśŢæŢřçŹ¿åIJżèŘ
to Expand Audience via Meta Hybrid Experts and Critics for Recommendation and Adver-
tisingãĂŃæŘŘåĞžäžĘäÿĂçğ■æŰřçŽĎäÿď'éŸűæőţæąĘæđűMeta Hybrid Experts and Critics
(MetaHeac)ïijŇéĞĞçŤĺåĚČå■ęäźăçŽĎæŰźæşŢèő■çżČäÿĂäÿłæşŻåŇŰåĹİåğŃåŇŰæĺąåđŃïijŇäżŐèĂŇèČ¡å

60.3 æŢřæ■őåĞĘåďĞ

ä¡£çŤÍTencent Look-alike Dataset,èŕĕæŢřæ■őéŻĘåŇĚåŘńåĞăçŹ¿äÿłçğ■å■Řäžžç¿ďãĂĄæţůéĞŔåĂŹéĂ
data,mataheac/data/çŻőå¡ŢäÿŃå■ŸæŤ¿äžĘäżŐåĚÍéĞŔæŢřæ■őéŻĘèŐůåŔŰçŽĎåřŚéĞŔæŢřæ■őéŻĘïijŇçŤÍä

60.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

60.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæÍąåđŃçŻőå¡Ţ
# cd PaddleRec/models/multitask/metaheac/ #␣
↪åIJÍäżżæĎŔçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŔæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u ./infer_meta.py -m config.yaml
```

60.6 æÍąåđŃçżĎç¡Ś

MetaHeacæŸŕåŔŚèąĺåIJÍ KDD 2021 çŽĎèőžæŰĞãĂŁLearning to Expand Audience via Meta Hybrid Experts and Critics for Recommendation and AdvertisingãĂŃæŰĞçńăæŔŘåĞžäÿĂçğ■æŰŕçŽĎäÿďéŸűæőţæąĘæđűMeta Hybrid Experts and Critics (MetaHeac),æIJL'æŢĹèğčåĘşäžĘçIJ§åőđåIJžæŹŕäÿ■éŽ¿äżěæđĎåżžæşŽåŇŰæÍąåđŃ,åŘŇæŮűåIJÍæL'ĂæI
MetaHeac:

60.7 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæÍąåđŃïijŇæĹŚäżňåIJÍæŕŘäÿłæÍąåđŃä
åIJÍåĚÍéĞŔæŢřæ■őäÿŃæÍąåđŃçŽĎæŇĞæăĞåęĆäÿŃ(train.pyæŰĞäżűåĘĚ paddle.seed = 2021äÿŃæŢĹæđIJ)ïijŽ

1. çąőèőď'æĆÍå¡ŞåL'■æL'ĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/multitask/metaheac

2. è£ŻåĚěpaddlerec/datasets/çŻőå¡ŢäÿŃïijŇæL'ğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■åŁąåŹĺ

```
cd ../../../datasets/Lookalike
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æL'ğèąŇåŚ¡äżd'è£ŘèąŇåĚíéĞŕæŢŕæ■ő

```
cd ../../models/multitask/metaheac/ # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
# step1ïijŽ train
python -u ../../../tools/trainer.py -m config_big.yaml
# åŁĺæĂĄåŻ¿éćĎæţŃ
# step2ïijŽ infer æ■d'æŮűtestæŢŕæ■őéŻĘäÿžhot
python -u ./infer_meta.py -m config_big.yaml
# step3ïijŽä£őæŤźconfig_big.yamlæŰĞäżűäÿ■test_data_
↪dirçŽĎèůŕå¿Ďäÿžcold
# python -u ./infer_meta.py -m config.yaml
```

60.8 inferèŕťæŸŐ

60.8.1 æŢŕæ■őéŻĘèŕťæŸŐ

äÿžäžĘæţŃèŕŢæĺąåđŃåIJĺäÿ■åŘŇèğĎæĺąçŽĎåĘĚåőźåőŽåŘŚæŐĺåź£äżżåŁąäÿŁçŽĎèąĺçŐŕïijŇåŕĘæŢŕæ alikeæŢŕæ■őéŻĘäÿ■çŽĎTèő¿ç¡őäÿž4000ïijŇåĚűäÿ■hotæŢŕæ■őéŻĘäÿ■åĂŹéĂL'éŻĘåď'ğäžŐT,coldæŢŕæ■ő

60.8.2 infer_meta.pyèŕťæŸŐ

infer_meta.pyæŸŕçŤĺäžŐåĚČå■ęäźžäæĺąåđŃinferçŽĎtool,åIJĺä¡£çŤĺäÿ■äÿżèęĄæIJL'äżěäÿŃåĞäçĆźéIJĂ

1. åIJĺåŕźæĺąåđŃè£ŻèąŇinferæŮűäź§åŘŕä¡£çŤĺè£ŹæäůçŽĎæŞ■ä¡IJ),åŘŕäżěåŕĘrunner.infer_bat
2. çŤśäžŐåĚČå■ęäźžäåIJĺinferæŮűéIJĂèęĄåĚĹåŕźçL'źäőŽäżżåŁąçŽĎåŕŚéĞŘæŢŕæ■ő éŻĘè£ŻèąŇèő■çżČ,
3. åőđéŹĚçżĎbatchåIJĺinfer.pyäÿ■è£ŻèąŇ,åIJĺèŐůåŘŰåĹŕå■ŢäÿŁå■ŘäżżåŁąçŽĎæŢŕæ■őåŘŐ,èŐůåŘŰco
4. åŠŇæŹőéĂŽinferäÿ■åŘŇ,çŤśäžŐéIJĂèęĄåŕźå■ŢäÿŁå■ŘäżżåŁąè£ŻèąŇåŕŚéĞŘæŢŕæ■őçŽĎtrainåŠŇte
5. åIJĺåŕźå■ŢäÿŁå■ŘäżżåŁąinferæŮűåĹŻåżżäžĘåśĂéČĺçŽĎpaddle.metric.Auc(âĂİROCâĂİ),åŘŕäżěæ§ěç

60.9 è£ŻéŸűä¡£çŤĺ

60.10 FAQ

CHAPTER

SIXTYONE

ESCM2 (ESCM2: ENTIRE SPACE COUNTERFACTUAL MULTI-TASK MODEL FOR POST-CLICK CONVERSION RATE ESTIMATION)

äżčçăĄèŕůåŘĆèĂČïijŽESCM2åęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£ŸèŕůçĆźäÿłstaråŢŁ~

61.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æĺąåđŃçżĎç¡Ś*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

61.2 æĺąåđŃçőĂäżŃ

èŕěæĺąåđŃäÿżèęĄèğčåĘşESMMå■ŸåIJĺçŽĎäÿď'äÿłéŮőécŸïijŽ

1. **Inherent Estimation Bias (IEB)** ä¡IJèĂĚèőď'äÿžESMMçŽĎCVRäijřèőąæŸŕéńŸäžŐçIJ§åőđæČĚåĘţçŽ
2. **Potential Independence Priority (PIP)** ESMMå£¡çŢĕäžĘè¡ňåŇŰä¿ĺèţŰçĆźåĞżè£ŹäÿĂåŻăæđIJæĂğå

ESCM2æŸŕéŸ£éĞŇåŘŚèąĺåIJÍ SIGIRâĂŹ2022 çŽĎèőžæŰĞãĂŁESCM2: Entire Space Counterfactual Multi-Task Model for Post-Click Conversion Rate EstimationãĂŃæŰĞçńăå§žäžŐåŻăæđIJæŐĺæŰ■çŽĎæĂĺèůŕæĺěèğčåĘşESMMäÿ■çŽĎIEBåŠŇPIPéŮőécŸãĂĆ

61.3 æŢřæ■őåĞĘåďĞ

æĹŚäžňåIJÍåijĂæžŘæŢřæ■őéŻĘAli-CCPïijŽAlibaba Click and Conversion PredictionäÿŁéłŇèŕĄæÍąåđŃæŢĹæđIJãĂĆåIJÍæÍąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆÍåĞĘåď ĞäžĘå£ńéĂ§è£ŘèąŇçŐŕåćČ
æŢřæ■őæăijåijŔåŘĆèğĄdemoæŢřæ■őïijŽdata/train

61.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

61.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŘŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŘŕäżěä¿ŻæĆÍå£ńéĂ§ä¡ŞéłŇïijŇåIJÍäżżæĎŘçŻőå¡ŢäÿŃåİĞåŘŕæ

```
# è£ŽåĚěæÍąåđŃçŻőå¡Ţ
# cd models/multitask/escm2 # åIJÍäżżæĎŘçŻőå¡ŢåİĞåŘŕè£ŘèąŇ
# åŁÍæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# åŁÍæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml

# éİŹæĂĄåŽ¿èő■çżČ
python -u ../../../tools/static_trainer.py -m config.yaml #␣
↪åĚÍéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
# éİŹæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/static_infer.py -m config.yaml
```

61.6 æÍąåđŃçżĎç¡Ś

ESCM2ä¡£çŤÍäžĘåŻăæđIJæŐÍè■Řäÿ■çŽĎIPWåŠŇDRæŰźæşŢæİěè£ŻèąŇçžăåĄŘãĂĆæÍąåđŃçŽĎäÿżè

åĚűäÿ■IPWéČÍåĹĘäijŸåŇŰåĞ¡æŢřäÿžïijŽ

DRéČÍåĹĘäijŸåŇŰåĞ¡æŢřäÿžïijŽ

61.7 æŢĹæđlJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤÍèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŘäÿĂäÿłæĺąåđŃïijŇæĹŚäžňåIJÍæŕŘäÿłæĺąåđŃä
åIJĺåĚĺéĞŘæŢřæ■őäÿŃæĺąåđŃçŽĎèő■çżČæŇĞæăĞåęĆäÿŃïijŽ | æĺąåđŃ | auc_ctr | batch_size | epoch_num | Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | ESCM2 | 0.82 | 1024 | 10 | çžę3åĹĘéŠ§ |

1. çąőèőď æĆĺå¡ŞåĽ■æĽĂåIJÍçŻőå¡ŢäÿžPaddleRec/models/multitask/escm2
2. è£ŻåĚěpaddlerec/datasets/ali-ccpçŻőå¡ŢäÿŃïijŇæĽğèąŇèŕěèĎŽæIJňïijŇäijŽäżŐåŻ¡åĘĚæžŘçŽĎæIJ■
ccpåĚĺéĞŘæŢřæ■őéŻĘïijŇåźűèğčåŐŃåĹřæŇĞåőŽæŰĞäżűåď źãĂĆ

```
cd ../../../datasets/ali-ccp
sh run.sh
```

1. åĹĞåŻđæĺąåđŃçŻőå¡Ţ,æĽğèąŇåŚ¡äżď è£ŘèąŇåĚĺéĞŘæŢřæ■ő

```
cd - # åĹĞåŻđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŻ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml #␣
↪åĚĺéĞŘæŢřæ■őè£ŘèąŇconfig_bigdata.yaml
```

61.8 è£ŻéŸűä¡£çŤÍ

61.9 FAQ

CHAPTER

SIXTYTWO

AITM (MODELING THE SEQUENTIAL DEPENDENCE AMONG AUDIENCE MULTI-STEP CONVERSIONS WITH MULTI-TASK LEARNING IN TARGETED DISPLAY ADVERTISING)

äżčçăĄèŕůåŘĆèĂČïijŽMMOEåęĆæđIJæĹŚäżňçŽĎäżčçăĄåŕźæĆĺæIJL'çŤĺïijŇè£Ÿèŕůç ĆźäÿłstaråŢŁ~

62.1 åĘĚåőź

- *æĺąåđŃçőĂäżŃ*
- *æŢřæ■őåĞĘåď'Ğ*
- *è£ŘèąŇçŐŕåćČ*
- *å£ńéĂ§åijĂåğŃ*
- *æŢĹæđIJåď'■çŐř*
- *è£ŻéŸűä¡£çŤĺ*
- *FAQ*

62.2 æĺąåđŃçőĂäżŃ

åIJĺæŐĺè■ŘåIJžæŹŕéĞŇïijŇçŤĺæĹůçŽĎè¡ňåŇŰéŞ¿èůŕå¿Ăå¿ĂæIJL'åď'Žäÿłäÿ■éŮť'æ■ěéłď'ïijĹæŻĺåĚL'->çĆźåĞż->è¡ňåŇŰïijL'ïijŇèĂŇæIJL'äžŻèąŇäÿŽè¡ňåŇŰéŞ¿èůŕå¿ĹéŢ£ïijŇåęĆéĞŚèđ■-ä£çŤĺå■ąäÿŽåŁąïijŇåőČåŇĚæŃňæŻĺåĚL'->çĆźåĞż->èąĺå■ŢïijĹapplicationïijL'->ä£çŤĺæäÿåĞĘïijĹapprovalïijL'->ä£çŤĺå■ąæ£Ăæť'żïijĹactivationïijL'ãĂĆåď'ĎäžŐéŞ¿èůŕåŘŐçńŕçŽĎèŁĆçĆźĆ

ä¡IJèĂĚèő¿èőąäžĘäÿĂçğ■åď'ŽäżżåŁąæĺąåđŃæąĘæđűïijŇåĚĚåĹĘåĹl'çŤĺäžĘéŞ¿èůŕäÿŁåŘĎäÿłèŁĆçĆźĆ

62.3 æŢřæ■őåĞĘåď'Ğ

æŢřæ■őäÿžAli-CCP click åIJĺæĺąåđŃçŻőå¡ŢçŽĎdataçŻőå¡ŢäÿŃäÿžæĆĺåĞĘåď'ĞäžĘå£ńéĂ§è£ŘèąŇçŽĎ

62.4 è£ŘèąŇçŐŕåćČ

PaddlePaddle>=2.0

python 2.7/3.5/3.6/3.7

os : windows/linux/macos

62.5 å£ńéĂ§åijĂåğŃ

æIJňæŰĞæŔŘä¿ŻäžĘæăůä¿ŃæŢřæ■őåŔŕäżěä¿ŻæĆĺå£ńéĂ§ä¡ŞéłŇïijŇåIJĺäżżæĎŔçŻőå¡ŢäÿŃåİĞåŔŕæ

```
# è£ŻåĚěæĺąåđŃçŻőå¡Ţ
# cd models/multitask/aitm # åIJĺäżżæĎŔçŻőå¡ŢåİĞåŔŕè£ŘèąŇ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config.yaml

# åŁĺæĂĄåŽ¿écĎæţŃ
python -u ../../../tools/infer.py -m config.yaml
```

62.6 æŢĹæđIJåď■çŐř

äÿžäžĘæŰźä¿£ä¡£çŤĺèĂĚèČ¡åď§å£ńéĂ§çŽĎèůŚéĂŽæŕŔäÿĂäÿłæĺąåđŃïijŇæĹŚäżňåIJĺæŕŔäÿłæĺąåđŃä
åIJĺåĚĺéĞŔæŢřæ■őäÿŃæĺąåđŃçŽĎæŇĞæăĞåęĆäÿŃïijŽ| æĺąåđŃ | click auc | purchase auc |batch_size | epoch_num| Time of each epoch | | :âĂŤâĂŤ| :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ | :âĂŤâĂŤ| :âĂŤâĂŤ | | aitm | 0.6130 |0.6166 | 2000 | 6| çžę3åřŔæŮű |

1. çąőèőď'æĆĺå¡ŞåL'■æL'ĂåIJĺçŻőå¡ŢäÿžPaddleRec/models/multitask/aitm
2. è£ŻåĚěPaddlerec/datasets/ali-cpp_aitm
3. æL'ğèąŇåŚ¡äżď'è£ŘèąŇåĚĺéĞŔæŢřæ■ő

```
cd ../../../datasets/ali-cpp_aitm
sh run.sh
```

```
cd - # åĹĞåŽđæĺąåđŃçŻőå¡Ţ
# åŁĺæĂĄåŽ¿èő■çżČ
python -u ../../../tools/trainer.py -m config_bigdata.yaml
python -u ../../../tools/infer.py -m config_bigdata.yaml
```

62.7 è£ŻéŸűä¡£çŤĺ

62.8 FAQ

CHAPTER

SIXTYTHREE

ÅŸŸÈĞĄÉŮŐÉĆŸFAQ

å■ăä¡■

PaddleRecä¡£çŤÍApache License 2.0åijĂæžŘå■Ŕèőő