# Using ELMo word embeddings(updated)

ELMo embeddings with simple embedding techniques(max,ave,concat).

**updated version:** change the evaluation function to be consistent with lastest experiments.

Only CPU is evaluated using 20% difference, namely 4 nearest labels. The other 4 types are evaluated using the only 1 label.

目录

[Using ELMo word embeddings 1](#_Toc1753782)

[1.SVM 1](#_Toc1753783)

[a.CPU 1](#_Toc1753784)

[b.RAM 2](#_Toc1753785)

[c.GPU 3](#_Toc1753786)

[d.Hard Drive 4](#_Toc1753787)

[e.Screen Size 5](#_Toc1753788)

[2.MLP 6](#_Toc1753789)

[a.CPU 6](#_Toc1753790)

[b.RAM 7](#_Toc1753791)

[c.GPU 8](#_Toc1753792)

[d.Hard Drive 9](#_Toc1753793)

[e.Screen Size 9](#_Toc1753794)

[3.RNN 11](#_Toc1753795)

## 1.SVM

### a.CPU

23 kinds of CPU

|  |  |  |
| --- | --- | --- |
| CPU using SVM | K, number of recommendation | 20% difference |
| Pointwise average of word embedding | 10 | component type: cpu  emddeing: ave  classifier: svm  ndcg:  0.19960861056751467  0.3542074363992172  0.42293081158792584  0.4669389143136736  0.49266626764927945  0.5109524803636388  0.5118789299665375  0.5204790693263738  0.5281717871752677  0.5332417473655066  precision:  0.3835616438356164  0.350293542074364  0.32289628180039137  0.3062622309197652  0.2939334637964775  0.28669275929549903  0.2851551579535924  0.27788649706457924  0.2731028484453142  0.26829745596868887  recall:  0.0273972602739726  0.050041934582052  0.06919206038579816  0.08750349454850433  0.10497623707017054  0.12286832541235672  0.1425775789767962  0.15879228403690243  0.175566116857702  0.1916410399776349 |
| Pointwise maximum of word embedding | 10 | component type: cpu  emddeing: max  classifier: svm  ndcg:  0.14677103718199608  0.25048923679060664  0.3031030754787559  0.32561548210582575  0.349438866734754  0.3693424413539033  0.3770457304473649  0.3863490112255957  0.39882895442670174  0.41102777109952465  precision:  0.2465753424657534  0.2436399217221135  0.24070450097847357  0.2226027397260274  0.2187866927592955  0.21754729288975863  0.2172211350293542  0.2172211350293542  0.22048271363339855  0.21839530332681018  recall:  0.01761252446183953  0.03480570310315907  0.05157953592395863  0.06360078277886497  0.07813810455689126  0.09323455409561085  0.1086105675146771  0.12412636287391669  0.1417388873357562  0.15599664523343584 |
| The concatenation of the pointwise average and maximum of word embedding | 10 | component type: cpu  emddeing: concat  classifier: svm  ndcg:  0.1761252446183953  0.31898238747553814  0.3935181181332154  0.4179874719227119  0.44490964900688623  0.46847741304684537  0.48092189464345003  0.49797466367451976  0.5063580128629198  0.5125828424400586  precision:  0.3287671232876712  0.324853228962818  0.30789302022178733  0.2930528375733855  0.28297455968688845  0.27984344422700586  0.27117696393625945  0.2673679060665362  0.2644053055011959  0.2620352250489237  recall:  0.023483365949119372  0.04640760413754543  0.06597707576181157  0.08372938216382443  0.10106234274531731  0.1199329046687168  0.13558848196812973  0.15278166060944925  0.1699748392507688  0.18716801789208834 |

### b.RAM

6 kinds of RAM

|  |  |  |
| --- | --- | --- |
| RAM using SVM | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: ram  emddeing: ave  classifier: svm  ndcg:  0.6536312849162011  0.8212290502793296  0.8752751744213916  0.8957593457435518  0.9158094648344922  precision:  0.7243947858472998  0.6052141527001862  0.5083798882681564  0.4334264432029795  0.3754189944134078  recall:  0.3621973929236499  0.6052141527001862  0.7625698324022346  0.866852886405959  0.9385474860335196 |
| Pointwise maximum of word embedding | 5 | component type: ram  emddeing: max  classifier: svm  ndcg:  0.6666666666666666  0.8100558659217877  0.878200978970475  0.8996162489890969  0.9084383013891105  precision:  0.7206703910614525  0.5493482309124768  0.47113594040968343  0.41247672253258844  0.3702048417132216  recall:  0.36033519553072624  0.5493482309124768  0.7067039106145251  0.8249534450651769  0.925512104283054 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: ram  emddeing: concat  classifier: svm  ndcg:  0.664804469273743  0.8119180633147114  0.86948893468343  0.8825243164338955  0.8913463688339094  precision:  0.7188081936685289  0.515828677839851  0.4692737430167598  0.4245810055865922  0.38845437616387335  recall:  0.35940409683426444  0.515828677839851  0.7039106145251397  0.8491620111731844  0.9711359404096834 |

### c.GPU

8 kinds of GPU

|  |  |  |
| --- | --- | --- |
| GPU using SVM | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: gpu  emddeing: ave  classifier: svm  ndcg:  0.4934823091247672  0.7877094972067039  0.8805278408419847  0.8963565186818357  0.9027725567909366  precision:  0.5027932960893855  0.409683426443203  0.34761018001241467  0.31052141527001864  0.26666666666666666  recall:  0.25139664804469275  0.409683426443203  0.521415270018622  0.6210428305400373  0.6666666666666666 |
| Pointwise maximum of word embedding | 5 | component type: gpu  emddeing: max  classifier: svm  ndcg:  0.5679702048417132  0.8007448789571695  0.8453916771614817  0.8714624406624127  0.887502535935165  precision:  0.5735567970204841  0.4134078212290503  0.308504034761018  0.25186219739292365  0.22681564245810057  recall:  0.28677839851024206  0.4134078212290503  0.462756052141527  0.5037243947858473  0.5670391061452514 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: gpu  emddeing: concat  classifier: svm  ndcg:  0.5344506517690876  0.8119180633147114  0.8506902828079299  0.887934230666403  0.9015683116482425  precision:  0.5493482309124768  0.441340782122905  0.36685288640595903  0.3165735567970205  0.26927374301675977  recall:  0.2746741154562384  0.441340782122905  0.5502793296089385  0.633147113594041  0.6731843575418994 |

### d.Hard Drive

11kinds of HD

|  |  |  |
| --- | --- | --- |
| Hard Drive using SVM | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: hd  emddeing: ave  classifier: svm  ndcg:  0.37988826815642457  0.6256983240223464  0.7361404037909078  0.7771087464352283  0.7987628750534439  precision:  0.43947858472998136  0.3919925512104283  0.35878336436995656  0.3361266294227188  0.3191806331471136  recall:  0.14649286157666047  0.26132836747361887  0.35878336436995656  0.44816883923029177  0.531967721911856 |
| Pointwise maximum of word embedding | 5 | component type: hd  emddeing: max  classifier: svm  ndcg:  0.36685288640595903  0.5586592178770949  0.6338538253790938  0.6683044771481815  0.7043946915118742  precision:  0.4692737430167598  0.4515828677839851  0.399130974549969  0.36266294227188084  0.3478584729981378  recall:  0.1564245810055866  0.3010552451893234  0.399130974549969  0.4835505896958411  0.5797641216635631 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: hd  emddeing: concat  classifier: svm  ndcg:  0.4264432029795158  0.6908752327746741  0.7707695032455486  0.8126689445863308  0.831115054149996  precision:  0.46741154562383613  0.3957169459962756  0.3643699565487275  0.34962756052141525  0.34487895716946  recall:  0.1558038485412787  0.2638112973308504  0.3643699565487275  0.46617008069522037  0.5747982619490999 |

### e.Screen Size

9 kinds of Screen Size

|  |  |  |
| --- | --- | --- |
| Screen Size using SVM | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: screen  emddeing: ave  classifier: svm  ndcg:  0.5027932960893855  0.7839851024208566  0.882678024767231  0.9050243934823149  0.9074304077732278  precision:  0.7411545623836127  0.648975791433892  0.5754189944134078  0.45391061452513964  0.36722532588454376  recall:  0.37057728119180633  0.648975791433892  0.8631284916201117  0.9078212290502793  0.9180633147113594 |
| Pointwise maximum of word embedding | 5 | component type: screen  emddeing: max  classifier: svm  ndcg:  0.6741154562383612  0.8230912476722533  0.89123636072094  0.9173071242218712  0.9245251670946097  precision:  0.8156424581005587  0.5940409683426443  0.5114835505896959  0.4278398510242086  0.3690875232774674  recall:  0.40782122905027934  0.5940409683426443  0.7672253258845437  0.8556797020484171  0.9227188081936686 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: screen  emddeing: concat  classifier: svm  ndcg:  0.7337057728119181  0.8230912476722533  0.846589562516628  0.873591424714021  0.8944435485685989  precision:  0.851024208566108  0.5791433891992551  0.4345127250155183  0.3761638733705773  0.34450651769087526  recall:  0.425512104283054  0.5791433891992551  0.6517690875232774  0.7523277467411545  0.861266294227188 |

## 2.MLP

### a.CPU

23 kinds of CPU

|  |  |  |
| --- | --- | --- |
| CPU using MLP | K, number of recommendation | 20% difference |
| Pointwise average of word embedding | 10 | component type: cpu  emddeing: ave  classifier: mlp  ndcg:  0.2054794520547945  0.3561643835616438  0.4177822210721305  0.4575153039872828  0.4802083227140231  0.5045629330060762  0.5156527145637267  0.5256349868945518  0.5346800434027265  0.5387228222070151  precision:  0.3659491193737769  0.3395303326810176  0.3202870189171559  0.3067514677103718  0.2919765166340509  0.2834311806914547  0.28068213586804586  0.28057729941291587  0.27484235703413784  0.26810176125244617  recall:  0.026139222812412637  0.04850433324014537  0.06863293262510484  0.08764327648867766  0.10427732736930388  0.12147050601062342  0.14034106793402293  0.16032988537880905  0.17668437237908863  0.19150125803746157 |
| Pointwise maximum of word embedding | 10 | component type: cpu  emddeing: max  classifier: mlp  ndcg:  0.21330724070450097  0.36203522504892366  0.4280794021037213  0.4729378671058179  0.4932598988671593  0.5107420034998822  0.5188922928474462  0.5301266865150932  0.5362946802665314  0.5372190702554286  precision:  0.36007827788649704  0.33072407045009783  0.3202870189171559  0.3028375733855186  0.2837573385518591  0.2710371819960861  0.26614481409001955  0.2585616438356164  0.2552728854098717  0.25244618395303325  recall:  0.025719876991892647  0.047246295778585405  0.06863293262510484  0.08652502096729102  0.10134190662566396  0.1161587922840369  0.13307240704500978  0.14774951076320939  0.16410399776348897  0.1803187028235952 |
| The concatenation of the pointwise average and maximum of word embedding | 10 | component type: cpu  emddeing: concat  classifier: mlp  ndcg:  0.2191780821917808  0.36203522504892366  0.42226704663475256  0.45932093141599384  0.4843977467239171  0.503596544455694  0.5231506519192498  0.5308646847906482  0.5379800156518273  0.5425021924816497  precision:  0.3679060665362035  0.3199608610567515  0.299412915851272  0.29354207436399216  0.28649706457925633  0.27756033920417483  0.27369303885937935  0.26663405088062625  0.26310067405957815  0.2594911937377691  recall:  0.026279004752585967  0.045708694436678785  0.06415991053955829  0.08386916410399776  0.10232038020687727  0.11895443108750349  0.13684651942968967  0.15236231478892928  0.1691361476097288  0.18535085266983506 |

### b.RAM

6 kinds of RAM

|  |  |  |
| --- | --- | --- |
| RAM using MLP | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: ram  emddeing: ave  classifier: mlp  ndcg:  0.6461824953445066  0.8324022346368715  0.8793988643256211  0.8980208382548576  0.9124569240003347  precision:  0.7039106145251397  0.5595903165735568  0.46617008069522037  0.4068901303538175  0.3616387337057728  recall:  0.35195530726256985  0.5595903165735568  0.6992551210428305  0.813780260707635  0.904096834264432 |
| Pointwise maximum of word embedding | 5 | component type: ram  emddeing: max  classifier: mlp  ndcg:  0.6517690875232774  0.7783985102420856  0.8500683705174289  0.8752080353218982  0.8832280829582743  precision:  0.707635009310987  0.5418994413407822  0.4723774053382992  0.40782122905027934  0.35977653631284917  recall:  0.3538175046554935  0.5418994413407822  0.7085661080074488  0.8156424581005587  0.8994413407821229 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: ram  emddeing: concat  classifier: mlp  ndcg:  0.6405959031657356  0.8156424581005587  0.8743882452114956  0.8995279100159649  0.9091519671796164  precision:  0.6964618249534451  0.5223463687150838  0.46368715083798884  0.4106145251396648  0.36461824953445066  recall:  0.34823091247672255  0.5223463687150838  0.6955307262569832  0.8212290502793296  0.9115456238361266 |

### c.GPU

8 kinds of GPU

|  |  |  |
| --- | --- | --- |
| GPU using MLP | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: gpu  emddeing: ave  classifier: mlp  ndcg:  0.547486033519553  0.7951582867783985  0.8515542424048981  0.8785561046022909  0.8913881808204929  precision:  0.553072625698324  0.4180633147113594  0.3265052762259466  0.2802607076350093  0.24916201117318434  recall:  0.276536312849162  0.4180633147113594  0.4897579143389199  0.5605214152700186  0.6229050279329609 |
| Pointwise maximum of word embedding | 5 | component type: gpu  emddeing: max  classifier: mlp  ndcg:  0.5437616387337058  0.813780260707635  0.8654765533652599  0.8896851194732673  0.900913186164194  precision:  0.547486033519553  0.425512104283054  0.33209186840471755  0.2881750465549348  0.2581005586592179  recall:  0.2737430167597765  0.425512104283054  0.49813780260707635  0.5763500931098696  0.6452513966480447 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: gpu  emddeing: concat  classifier: mlp  ndcg:  0.5698324022346368  0.819366852886406  0.8675383983173743  0.8917469644253819  0.9045790406435837  precision:  0.5716945996275605  0.4236499068901304  0.3339540657976412  0.29376163873370575  0.2558659217877095  recall:  0.28584729981378026  0.4236499068901304  0.5009310986964618  0.5875232774674115  0.6396648044692738 |

### d.Hard Drive

11kinds of HD

|  |  |  |
| --- | --- | --- |
| Hard Drive using MLP | K, number of recommendation | 20% difference |
| Pointwise average of word embedding | 5 | component type: hd  emddeing: ave  classifier: mlp  ndcg:  0.43575418994413406  0.6666666666666666  0.7477358528797595  0.7914974916134654  0.8091415964134929  precision:  0.47113594040968343  0.41527001862197394  0.3649906890130354  0.34869646182495345  0.3318435754189944  recall:  0.15704531346989448  0.27684667908131594  0.3649906890130354  0.4649286157666046  0.553072625698324 |
| Pointwise maximum of word embedding | 5 | component type: hd  emddeing: max  classifier: mlp  ndcg:  0.441340782122905  0.6759776536312849  0.753522092617722  0.7870416456903478  0.8086957743085634  precision:  0.48417132216014896  0.4059590316573557  0.3643699565487275  0.3426443202979516  0.32625698324022345  recall:  0.16139044072004965  0.2706393544382371  0.3643699565487275  0.45685909373060213  0.5437616387337058 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | ndcg:  0.4581005586592179  0.702048417132216  0.7772430246342155  0.8098314790103794  0.8290795933376822  precision:  0.4934823091247672  0.42830540037243947  0.3755431409062694  0.3612662942271881  0.3366852886405959  recall:  0.16449410304158907  0.2855369335816263  0.3755431409062694  0.48168839230291743  0.5611421477343265 |

### e.Screen Size

9 kinds of Screen Size

|  |  |  |
| --- | --- | --- |
| Screen Size using MLP | K, number of recommendation |  |
| Pointwise average of word embedding | 5 | component type: screen  emddeing: ave  classifier: mlp  ndcg:  0.7150837988826816  0.8752327746741154  0.9175297413939904  0.9259096296621467  0.9355336868257981  precision:  0.8268156424581006  0.6405959031657356  0.5139664804469274  0.41620111731843573  0.35940409683426444  recall:  0.4134078212290503  0.6405959031657356  0.770949720670391  0.8324022346368715  0.8985102420856611 |
| Pointwise maximum of word embedding | 5 | component type: screen  emddeing: max  classifier: mlp  ndcg:  0.7150837988826816  0.8752327746741154  0.9128300784251151  0.9370386445331227  0.9394446588240355  precision:  0.8528864059590316  0.8007448789571695  0.590937306021105  0.45716945996275604  0.36685288640595903  recall:  0.4264432029795158  0.8007448789571695  0.8864059590316573  0.9143389199255121  0.9171322160148976 |
| The concatenation of the pointwise average and maximum of word embedding | 5 | component type: screen  emddeing: concat  classifier: mlp  ndcg:  0.6983240223463687  0.888268156424581  0.9282152916600183  0.935664081231713  0.9444861336317267  precision:  0.8212290502793296  0.6843575418994413  0.5505896958410925  0.42830540037243947  0.3653631284916201  recall:  0.4106145251396648  0.6843575418994413  0.8258845437616388  0.8566108007448789  0.9134078212290503 |