# Elmo Single Task experiment

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

Note: CPU relabeled to 10 classes to be consistent with multitask experiment. The others 4 types the same with previous setting.

## Comparison:

Compared with multitask experiment. (analyzing using average embedding):

The arrow -> indicate : ***single task experiments with elmo -> multitask experiments with elmo***

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| --- | --- |
| CPU | (R@1 :  **0.31->0.33** R@5:  **0.76->0.81** ) |
| RAM | (R@1 :  **0.35->0.65**  R@5: **0.90-> 0.99** ) |
| HD | (R@1 : **0.15->0.46** R@5: **0.55->0.94** ) |
| GPU | (R@1 :  **0.27->0.59** R@5:  **0.62->0.99** ) |
| Screen | (R@1 :  **0.41->0.73** R@5:  **0.89->0.99** ) |

## Conclusion:

Compared to single experiment, all of the R@1 and R@5 shows great improvement using multitask models.

So in all (include another task glove + multitask) , we can say that

1. compared to glove embedding, elmo embedding has a small improvement
2. compared to single-task experiment setting, multitask experiment has a big improvement

## Experiment Result:

### a.CPU

23 kinds of CPU

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| --- | --- |
| CPU using MLP |  |
| Pointwise average of word embedding | component type: cpu  emddeing: ave  classifier: mlp  ndcg:  0.31098696461824954  0.4692737430167598  0.5374188560654459  0.5858359882814609  0.625134221699704  precision:  0.31098696461824954  0.2346368715083799  0.19242706393544382  0.1685288640595903  0.15307262569832403  recall:  0.31098696461824954  0.4692737430167598  0.5772811918063314  0.6741154562383612  0.7653631284916201 |
| Pointwise maximum of word embedding | component type: cpu  emddeing: max  classifier: mlp  ndcg:  0.3091247672253259  0.478584729981378  0.551429505998939  0.5905356512503359  0.6234178465594782  precision:  0.3091247672253259  0.239292364990689  0.1980136561142148  0.1680633147113594  0.14972067039106146  recall:  0.3091247672253259  0.478584729981378  0.5940409683426443  0.6722532588454376  0.7486033519553073 |
| The concatenation of the pointwise average and maximum of word embedding | component type: cpu  emddeing: concat  classifier: mlp  ndcg:  0.31098696461824954  0.46368715083798884  0.5447563370510807  0.5922423705706339  0.625124565879776  precision:  0.31098696461824954  0.23184357541899442  0.1973929236499069  0.1717877094972067  0.1527001862197393  recall:  0.31098696461824954  0.46368715083798884  0.5921787709497207  0.6871508379888268  0.7635009310986964 |

### b.RAM

6 kinds of RAM

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| RAM using MLP |  |
| Pointwise average of word embedding | 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 | 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 | 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

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| GPU using MLP |  |
| Pointwise average of word embedding | 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 | 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 | 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

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| Hard Drive using MLP | 20% difference |
| Pointwise average of word embedding | 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 | 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 | 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

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| Screen Size using MLP |  |
| Pointwise average of word embedding | 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 | 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 | 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 |