

CS 6320
Natural Language Processing

Assignment 2 - Report

Prof. Dan Moldovan

Akash Biswal (axb200166)

Comparison of results:

For the HMM-based model:

Test 1:

the planet jupiter and its moons are in effect a mini solar system .

- [('the', 'DETERMINER'), ('planet', 'NOUN'), ('jupiter', 'PUNCT'), ('and', 'CONJUNCTION'), ('its', 'PRONOUN'), ('moons', 'NOUN'), ('are', 'VERB'), ('in', 'PREPOSITION'), ('effect', 'NOUN'), ('a', 'DETERMINER'), ('mini', 'NOUN'), ('solar', 'PUNCT'), ('system', 'NOUN'), ('.', 'PUNCT')]
- The 3 incorrect predictions were:
 - 'Jupiter' as Punctuation
 - 'Mini' as a Noun
 - 'Solar' as Punctuation
- Therefore the accuracy is 11/14 which is 78%

Test 2:

computers process programs accurately .

- [('computers', 'NOUN'), ('process', 'NOUN'), ('programs', 'NOUN'), ('accurately', 'ADVERB'), ('.', 'PUNCT')]
- The incorrect prediction:
 - 'process' as Noun instead of Verb
- Therefore the accuracy is 4/5 which is 80%.

For the RNN-based model:

Test 1:

the secretariat is expected to race tomorrow .

- [('the', 'DETERMINER'), ('secretariat', 'NOUN'), ('is', 'VERB'), ('expected', 'VERB'), ('to', 'PREPOSITION'), ('race', 'VERB'), ('tomorrow', 'NOUN'), ('.', 'PUNCT')]
- All tags are predicted correctly
- Accuracy: 100%

Test 2:

The predicted tags for: people continue to enquire the reason for the race for outer space .

- [('people', 'NOUN'), ('continue', 'VERB'), ('to', 'PREPOSITION'), ('enquire', 'VERB'), ('the', 'DETERMINER'), ('reason', 'NOUN'), ('for', 'PREPOSITION'), ('the', 'DETERMINER'), ('race', 'NOUN'), ('for', 'PREPOSITION'), ('outer', 'ADJECTIVE'), ('space', 'NOUN'), ('.', 'PUNCT')]
- All tags are predicted correctly
- Accuracy: 100%

Test 3:

the planet jupiter and its moons are in effect a mini solar system .

- [('the', 'DETERMINER'), ('planet', 'NOUN'), ('jupiter', 'NOUN'), ('and', 'CONJUNCTION'), ('its', 'PRONOUN'), ('moons', 'NOUN'), ('are', 'VERB'), ('in', 'PREPOSITION'), ('effect', 'NOUN'), ('a', 'DETERMINER'), ('mini', 'NOUN'), ('solar', 'ADJECTIVE'), ('system', 'NOUN'), (',', 'PUNCT')]
- The incorrect prediction:
 - 'mini' as Noun instead of adjective
- Accuracy: $13/14 = 92.85\%$

Test 4:

computers process programs accurately .

- [('computers', 'NOUN'), ('process', 'NOUN'), ('programs', 'NOUN'), ('accurately', 'ADVERB'), (',', 'PUNCT')]
- All correct predictions
- Accuracy: 100%

Takeaways:

It is clear that RNNs are more accurate in POS tagging compared to HMM. It's even more clear when we compare the two common sentences.

RNNs seem to perform better because they have the ability to learn from the context, whereas in HMMs the reliance is more on probabilities. This makes RNNs more effective as context is very important in POS Tagging.

RNNs have a memory of previous inputs in their hidden state, this helps them capture the context, HMMs assume the probability of a given output depends on the current input, so therefore there is no dependency observed by the model over many words.

RNNs also require larger amounts of training data than HMMs and are also more computationally expensive as they are a deep-learning model.

In conclusion, this experiment suggests that RNNs are better suited for the task of POS Tagging.

dependencies, making them more accurate in situations where context is important. However, they require more training data and are more computationally expensive than HMMs, which may be a consideration when choosing between the two approaches.
