CS626 - Speech, Natural Language Processing, and the Web

Assignment-1b
POS Tagging using CRF

Group Id-

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Problem Statement

- **Objective:** Given a sequence of words, produce the POS tag sequence using Conditional Random Field (CRF)
- **Input:** The quick brown fox jumps over the lazy dog
- **Output:** The_{DET} $\text{quick}_{\text{ADJ}}$ $\text{brown}_{\text{ADJ}}$ fox_{NOUN} $\text{jumps}_{\text{VERB}}$ over_{ADP} the_{DET} lazy_{ADJ} dog_{NOUN}
- **Dataset:** Brown corpus
- Use Universal Tag Set (12 in number)
  - <list of tags>
- k-fold cross validation (k=5)

Data Processing Info (Pre-processing)

- <for example, lower casing, tokenization, etc.>

Overall performance

- Precision (round off to 3 decimal places):
- Recall (round off to 3 decimal places) :
- F-score (3 values - round off to 3 decimal places)
  - F_1-score
  - $F_{0.5}$-score
  - F_2-score

Per POS performance

- Tag1: P, R, F1
- Tag2: P, R, F1
- ...
- ...
- Tag-12: P, R, F1

NOTE: All these values should be rounded to 3 decimal places

Confusion Matrix (12 X 12) (can give heat map)

Interpretation of confusion (error analysis)

- <list maximal confusions; which tag is confused with which tag most>
  - Demonstrate examples from the corpus
    - <try giving reasons>

Comparison with HMM

- <Compare the performance of CRF against HMM>
  (Accuracy, P, R, F-score, confusion matrix, per POS accuracy)
  - <Demonstrate with examples (in tabular format), where (a) HMM is better, (b) CRF is better, (c) both equal>
    - <try giving reasons>

Challenges faced

- <Describe any challenges faced in understanding concept or during implementation in 2-3 bullet points>

References

1. https://www.cs.columbia.edu/~jebara/6772/papers/crf.pdf
2. https://aclanthology.org/N03-1028
3. Any Reference of CRF platform used during implementation

Marking Scheme (50)

1. Demo working- 10/10 (if not working or no GUI - 0)
2. Implemented CRF and Clarity on CRF- 5/5
3. Forward and Backward vector clearly described- 5/5
4. Confusion matrix drawn and error analysed- 5/5
5. **Overall F_1-score**
   a. **> 90** - 10/10
   b. **>80 & <=90** - 8/10
   c. **>70 & <=80** - 7/10
   d. **so on**.
6. Unknown word handling- done (5/5; else 0)
7. Comparison with HMM (10)

Note: Must have GUI, otherwise no mark will be given for demo.