ANLP Assignment 1

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1 Perplexity of the Test Case

$$\begin{aligned} PP_M(\vec{w}) &= 2^{H_M(\vec{w})} \\ &= 2^{-\frac{1}{n}\log_2 P_M(\vec{w})} \\ &= 2^{\log_2 P_M(\vec{w})^{-\frac{1}{n}}} \\ &= P_M(\vec{w})^{-\frac{1}{n}} \\ &\approx \prod_{i=1}^{n} P(w_n|w_{n-1}, w_{n-2})^{-\frac{1}{n}} \\ &= (0.2 * 0.7 * 0.6 * 0.25 * 0.5 * 0.1)^{-\frac{1}{6}} \\ &\approx 3.1367 \end{aligned}$$

p.s.: w_{-1} and w_0 refer to the first two '[' characters of each sentence.

2 Line Preprocessing

```
#function turns input into required format
def preprocess_line(line):
    #remove non-necessary characters,
    #and turn string to lowercase
    p = re.compile('[^\w\s,.]')
    line = re.sub(p,'',line.lower())
    #replace \n by ]
    line = re.sub('\n',']',line)
    #turn numbers into 0
```

```
    line = re.sub('[0-9]','0',line)
    #add begining and end [[
    return '[['+line
```

By preprocessing input in this fashion, we essentially assumed that there are no interconnection between lines. All the lines are preprocessed into line units. During language model building, we will not compute $P(]|[[)$ nor $P([|*[)$. This probability will be equal to one, if we treat the whole text as one unit. We consider this as an artifact of ngram model instead of the true underlying language model.
As a consequence, we will sample line by line independently in task 4. Also, we will exclude those probability in computing perplexity.

3 Language Model

3.1 Estimation of Probabilities

3.2 Data Structure

3.3 Excerpt? Please refine

4 Random Output

We generated those sentences line by line. We count the end line line as one character, which is simply newline in the text. We do not count the beginning of sentence '[[' as character.

4.1 English

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4.2 German

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4.3 Spanish

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5 Perplexity & Language Identification

References

Smith, J. M. and Jones, A. B. (2012). *Chemistry*. Publisher, 7th edition.