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14259
Sessional Assignment
Course: Natural Language Processing
Instructor: Mam Aasma Khan
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Note: Attempt all Questions.

Question No. 1: **(15)**

a. Explain Part of Speech Tagging (POS) and explain POS tag ambiguity with two examples.

ANSWER#1A

(03)

POS Tagging:

It is a process of converting a sentence to forms – list of words, list of tuples (where each tuple is having a form *(word, tag)*). The tag in case of is a part-of-speech tag, and signifies whether the word is a noun, adjective, verb, and so on.

Types of POS Tagger: Most of POS-tagging algorithms fall under

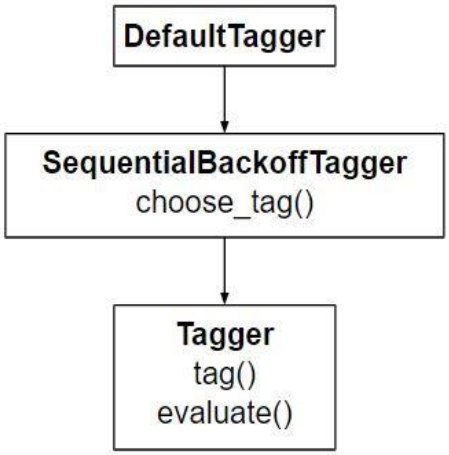
Rule-Based POS Taggers

Stochastic POS Taggers

Transformation based POS Taggers

Hidden Markov Model POS Taggers

Default tagging: is a basic step for the part-of-speech tagging. It is performed using the Default Tagger class. The Default Tagger class takes 'tag' as a single argument. **NN** is the tag for a singular noun. Default Tagger is most useful when it gets to work with most common part-of-speech tag. That's why a noun tag is recommended.



POS tag ambiguity:

Common parts of speech in English are noun, verb, adjective, adverb, etc.
The POS tagging problem **is to determine the POS tag for a particular instance of a word**. The main problem with POS tagging is **ambiguity**. In English, many common words have multiple meanings and therefore multiple POS. The job of a POS tagger is to resolve this ambiguity accurately based on the context of use.

For Example

POS Tag Ambiguity

In English : I $bank_1$ on the $bank_2$ on the river $bank_3$ for my transactions.

$Bank_1$ is verb, the other two banks are noun

- Words often have more than one POS: *back*
  - The *back* door = JJ
  - On my *back* = NN
  - Win the voters *back* = RB
  - Promised to *back* the bill = VB

b. State difference between open vs. closed classes. (02)

ANSWER#1B

- **Open class (CONTENT/LEXICAL)**
  - Lexical words deal with content and vocabulary.
  - They have concrete meaning that goes beyond their function in a sentence.
  - These words refer to things, people, actions, descriptions, or other ideas that have more than just a grammatical usage.

- **Closed class (Grammatical/Function)**
  - Grammatical words deal with the formation of sentences.
  - They have ambiguous meaning and serve to express grammatical relationships with other words within a sentence.
  - They signal the structural relationships that words have to one another and are the glue that holds sentences together.
  - Thus, they serve as important elements to the structure of sentences.

c. Apply Viterbi Algorithm on the below given bigram and lexical probabilities; (10)

Initial Probabilities	
Noun	1\3
Verb	0
Other	1\3

Bigram Probabilities			
	Noun	Verb	Other
Noun	1\4	1\4	0
Verb	1\4	0	1\4
Other	1\3	0	1\3

Lexical Probabilities					
	O1=time	O2=flies	O3=like	O4=an	O5=arrow
Noun	1\5	1\5	0	0	1\5
Verb	1\5	2\5	1\5	0	0
Other	0	0	1\5	2\5	0

ANSWER#1C

hi	P1(h1)	P2(h2)	P3(h3)	P4(h4)	P5(h5)
noun	1/3x1/5=1/15	1/5x1/4x1/15=1/300	0x1/150=0	0	1/5x1/4x1/16875
verb	0	2/5x1/4x1/15=1/150	1/5x1/4x1/150=1/3000	0	0
other	0	0	1/5x1/3x1/150=1/2250	1/3x2/5x1/2250=1/16875	0
	time=noun	flies=verb	like=other	an=other	arrow=noun

Question No. 2: **(05)**

Apply Bayesian theorem over the below given string:

^John got many NLP books. ^He found them all very interesting.

Where for lexical probabilities assume John=0.5, got=0.3, many=0.2, NLP=0.1 and books=0.

ANSWER#2

POS Tags:

^N V A N N. ^ N V N A R A.

Recording Numbers:

	^	N	V	A	R	.
^	0	2	0	0	0	0
N	0	1	2	1	0	1
V	0	1	0	1	0	0
A	0	1	0	0	1	1
R	0	0	0	1	0	0
.	1	0	0	0	0	0

Bigram Probability:

Bigram Probability= P(x|y)=P(a.b)/P(a)

	^	N	V	A	R	.
^	0	1	0	0	0	0
N	0	1/5	2/5	1/5	0	1/5
V	0	1/2	0	1/2	0	0
A	0	1/3	0	0	1/3	1/3
R	0	0	0	1	0	0
.	1	0	0	0	0	0

Now putting all the values in **Bayes theorem** i.e.
P(T)=P(W/T)=TTP(Ti-/Ti-1)x P(Wi/Ti)
Where **lexical probability** is given i.e.
John=0.5, got=0.3, many=0.2, NLP=0.1 and books=0.

Good Luck ☺