K.G.C.E.
Karjat - Raigad

AI Assignment 1) Part B)

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Name – Rohan. K. Mudaliyar.

Roll no. – 38

Class – B.E. (I.T.

Batch – I-2.

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AI Assignment 1) Part B)

Q.1) Explain PEAS descriptons for wumpus World.

→ a) Perfonmance measune.

(i) +100 fon gnabing the gold and coming back to the stanting position.

(ii) -200 if the playen (agent) is killed.

(iii) -1 pen action.

(iv) -10 fon using the annow.

b) Envinonment.

(i) Empty Rooms.

(ii) Rooms with wumpus.

(iii) Rooms neighbouning to wumpus which one smelly.

(iv) Rooms with bottomless pits.

(v) Rooms neighbouning to bottomless pitts which one bneezy.

(vi) Room with gold which is glitteny.

(vii) Annow to shoot the wumpus.

c) Senson (assuming a nobotic agent).

(i) Camena to get the view.

(ii) Odoun senson to smell the stench.

(iii) Audio senson to listen to the scneam & bump.

d) Effectons (assuming a nobotic agent).

(i) Motan to move left, night.

(ii) Robot anm to gnab the gold.

(iii) Robot mechanism to shoot the annow.

The wumpus wonld agent has following chanactenistics:

- Fully obsenvable.
- Single agent.
- Detenministic.
- Episodic
- Static.
- Dis cnete.

(Q.2) Explain various elements of congnitive system.

→a) A way of interpreting input.

A Cognitive System needs to answer a question or provide a result based on an input. The ~~in~~ input might be a search term, text phrase, a query asked in natural language, or it may be a response to an action of some sort. The first thing a system needs to do is understand the context of signal.

Eg: Location, speed of motion.

Such context info will enable the system to narrow down the potential responses to those that are more appropriate.

b) A body of content / Information that supports the decesion.

The purpose of cognitive system is to help humans make choices and solve problems. But the system is ~~t~~ does not make up the answer. Even synthesis of new knowledge is based on foundation knowledge. IBM watson for example ingests many structured repositories of information, dictionaries, news articles, databases, taxonomics & ontologies.

c) A way of processing the signal against the content / info corpus.

This is where machine learning for eg comes in play. ML has been applied to categorization & classification approcaches and advanced text analytics. The processing might be in form of query / matching algorithm or may involve other mechanisms to interpret the query, transform it, reduce ambiguity,

derive syntax, define word sense deduce logical relationships or otherwise parse/process the signal against the corpus.

(Q.3) Write note on Language model.

→a) The goal of language model is to ~~compare~~ compute in many different Natural Language processing applications

b) Lm actually is a grammar of a Languages.

c) For Eg - they have been used in Twitter Bots for 'robots' accounts to form their own sentence.

Language model Definition:

a) In case of Probablistic language modeling the Probability of a sentence as sequence of words is calculated: $P(w) = P(w_1, w_2, w_3, \ldots, w_n)$.

b) It can also be used ~~in~~ to find the probility of the next word in the sentence: $P(w_5 | w_1, w_2, w_3, w_4)$.

c) A model that computes either of these is called a Language model.

d) There are various Language models in ~~availble~~ available in practise. Following are few of them.

ci) Methods using the Markov assumption.

- The Probability of the next word can be estimated given only the previous 'K' number of words.

Eg: if K=1:

P(transparent | its water is so) ≈ P(transparent | so)

or if K=2:

P(transparent | its water is so) ≈ P(transparent | is so)

- Following is the general equation for the Markov Assumption, K=i: $P(w_i | w_1, w_2 \ldots w_{i-1}) = P(w_i | w_{i-K} \ldots w_{i-1})$.

(ii) N-gram Models.

From the Markov Assumption, we can formally define N-gram models where $K = n-1$ as follows:

$$P[(w_i) w_1 w_2 \ldots \ldots w_{i-1}] \approx P[w_i \mid w_{i-(n-1)} \ldots \ldots w_{i-1}]$$

The simplest version of this are defined as Unigram model ($K=1$) & the Bigram model ($K=2$).

(iii) Unigram Model ($K=1$): $P(w_1 w_2 \ldots \ldots w_n) \approx \pi p(w_i)$.

(iv) Bigram Model ($K=2$): $P[(w_i) w_1 w_2 \ldots \ldots w_{i-1}] \approx P[w_i \mid w_{i-1}]$

Following is max Likelihood Estimate model to Estimating Bigram Probabilities:

$$(w_i) w_{i-1}) = \frac{\text{Count } (w_{i-1} \ldots \ldots w_i)}{\text{Count } (w_{i-1})}$$

Eg: A corpus with following 3 sentence, lets find out probability that "I" stant the sentence. Here "<s" & "/s>" denote the start and end of sentence respectively.

<s I am Sam /s>

<s Sam I am /s>

<s I do not like green eggs & ham /s>

Therefore, wehave: $P(I \mid <s) = \frac{\text{Count } (<s, I)}{\text{Count } (<s)} = \frac{2}{3}$

"I" appeared as the First word in two Sentence.

(v) Language modelling is one of most imp. parts of modern Natural Language. Processing. There are many sort of apps for Language modelling like: Spell connection, Speech recoghition, Machine Translation, Question Answering, Symmanization, Sentiment analysis etc, requires use of LM.

(vii) Moreover, language modelling must also consider the co-related ordening of tokens.

Q4) Write note on Machine Translation.

a) → Machine translation is the classic test of language understanding. It consists of both language analysis & language generations. Many machine translation systems have huge commercial use like:

(i) Google Translate goes through 100 billion words perday.

(ii) eBay uses machine Translation Techniques to enable cross-borden trade & connect buyers and sellen around the world.

(iii) Facebook uses machine translation to translate text in posts and comments automatically in onden to break language barriers.

b) In a traditional Machine Translation System parallel corpus a collection of Texts is used each of which, is translated into one or more language.

c) It is obvious that, this approach requires a lot of a lot of human feature engineering consists of many different & Independent ML problems.

– Neural Machine Translation (NMT).

Std NMT is an end-to-end neural network where the Source Sentence is encoded by a Recurrent Neural Network (RNN) called encoden, & the target words are predicted using another RNN known as decoden.

Features of NMT are:

(i) End-to-End training – All parametens in NMT are simultaneously optimized to minimize a loss function in o/p.

(ii) Distributed representation – NMT has a better explanation of word & phrase similarities. Hences, its robust translaton.

(iii) Better exploration of content – NMT can use a much bigger context for both Source and partial ~~target~~ target text.

(iv) More fluent text generation :- Deep Learning text generation is of much higher quality than the parallel corpus way.

- Long Short Term Memory (LSTM).

LSTM works as a solution to vanishing gradient problem by introducing gates and an explicitly defined memory cell. Each neuron has memory cell and three gates : Input, Output & Forget. The function of these gates is to safeguard info by stopping or allowing the flow of it.

(i) The I/p gate determines how much of the info. from the previous layer get stored in cell.

(ii) The output layer takes the job on the other end & determines how much of next layer get to know about the state of this cell.

(iii) The forget gate seems like an odd inclusion at first but sometime its good to forget. If its Learning a book and a new chpa chapter begins, it may be necessary for the network to forget some characters from the previous chapter.

- Gated Recurrent Units (GRU).

They are slight variation on LSTMs and are extensions of Neural Machine Translation. They have one less gate & are wired slightly differently. GRU has an update gate instead of an I/p, O/p or a forget gate. This update gate determines how much info. to be kept from the last state & how much info. to forget from the previous Layer.

Q.5) Explain following terms.

a) Phonology.

→ It is the study of the speech sounds of a particular language. The origin of the word can be traced to Greek language where 'phone' means sound or voice. Phonetics, a subdivision of phonology is the study of speech sounds of human language from the perspective on their physical properties. IPA (International Phonetic Alphabet) is a tool that represents human sounds in a regular way while studying phonology.

b) Morphology.

It is a branch of linguistics that focuses on the way in which words are formed from morphemes - ~~namely~~ There are two types of morphemes namely lexical morpheme & grammatical morpheme - steming is the simplest form of morphological processing.

c) Lexical analysis.

Lexical is the words and phrases in language. Lexical analysis deals with the recognition and ~~identifical~~ identification of structure of the sentences. It divides the panagraphs in sentences, phrases and words.

d) Syntatic analysis.

In Syntactic analysis the sentence are parsed as noun, verbs, ~~adje~~ adjectives and other parts of sentences. In this phase the grammar of sentence is analyzed in

order to get the relationships among different words in the sentence.

Eg: "mango eats me" will be rejected by Syntactic analyzer.

e) Word sence Disambiguation.

Word sense disambiguation in natural language processing may be defined as the ability to determine which meaning of word is activated by the user use of word in particular context. a process which appears to be ~~largely~~ largely unconscious in people.