# Assignment 1 Part B

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class :- B.E.

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subject :- AI

DEPt :- Information technology

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Q 2 Explain PEAS descriptors for wumpus world

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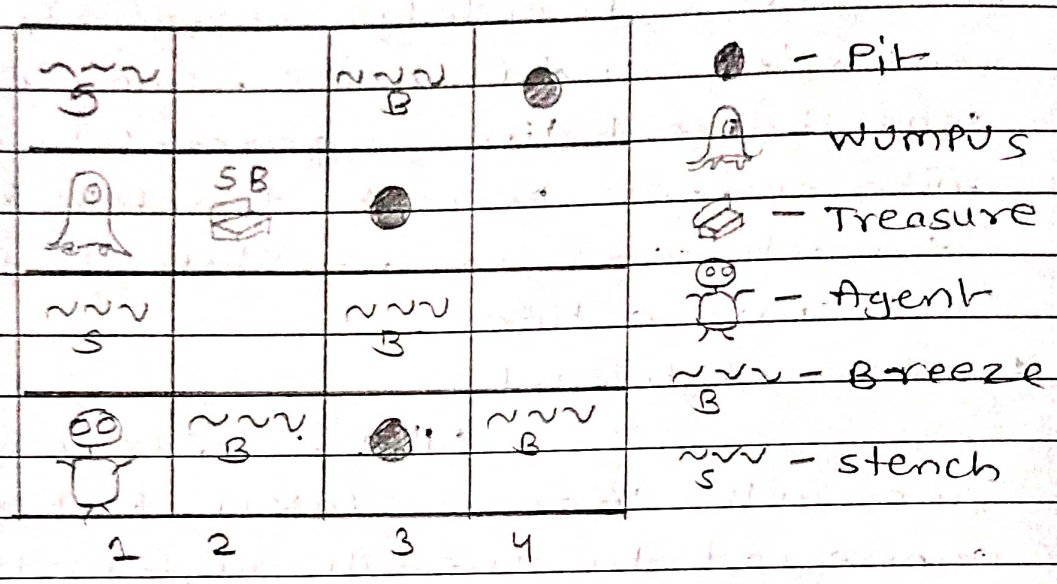
The wumpus world's agent is an example of knowledge based agent that represents knowledge representation, reasoning and planning. Knowledge Based agent links general knowledge with current percepts to infer hidden characters of current state before selecting actions.

Problem statement:-

The wumpus world is a cave with 16 rooms (4x4). Each room connected to other through walkways (No rooms are connected diagonally). The knowledge based agent starts from Room [1,1] The cave has some pits, a treasure and a beast named Wampus. The wumpus can not move but eats the one who enters ~~of~~ its room. If the agent enters the pit, it gets stuck there. The goal of the agent is to take the treasure and come out of the cave. The agent is rewarded when the goal condition are met. The agent is penalized when it falls into a pit or being eaten by the wumpus some elements support the agent to explore the cave, like the wumpus adjacent rooms are stenchy.

The agent is given one arrow which it can use to kill the wumpus when facing it. The adjacent rooms of the room with pits are killed with breeze




The cave

PEAS represent Performance Measure, Environment, Actuators and sensors. The PEAS descripitor helps in grouping the agent.

PEAS descriptor for the wumpus world Problem:

1) performance measure:

- Agent gets the gold and return back safe = +1000 points
- Agent dies = -1000 points
- Each move of the agent = -1 Point
- Agent uses the arrow = -10 point

2) Environment:

- A cave' with 16 (4x4) Rooms
- Rooms adjacent (not diagonally) to the wumpus are stinking.
- Rooms adjacent (not diagonally) to the pit are breezy
- The rooms with the gold glitters.
- Agent initial position - Room [1, 1] and facing right side
- Location of wumpus gold and 3 pits can be anywhere except in Room [1, 1]

3) Actuators:-

Device that allows the agent to perform the following actions in the environment

- move forward
- Left turn
- Right turn
- Grab
- Release
- Shoot

4) sensors:-

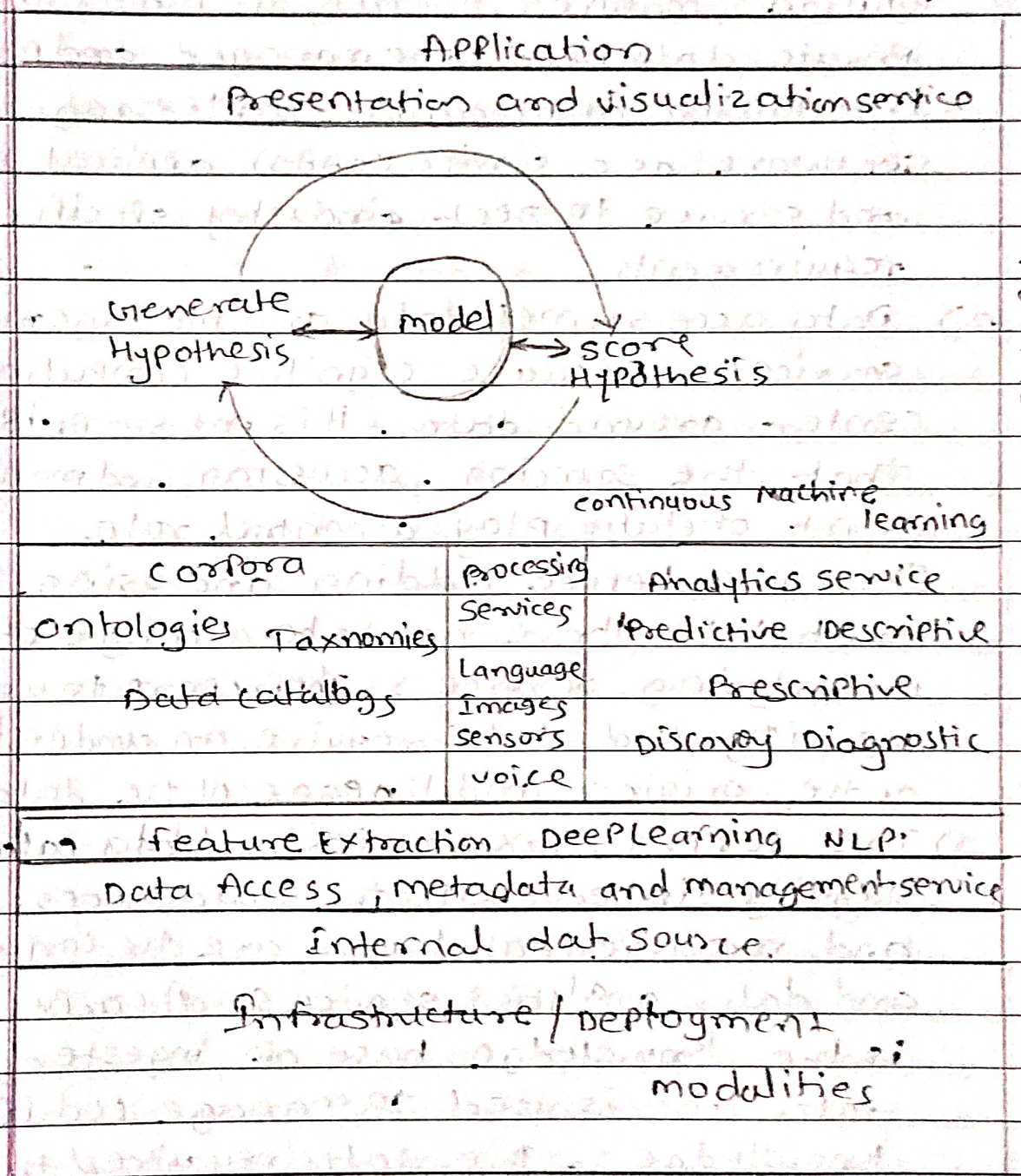
- The agent will perceive the stench if he is in the room adjacent to the wumpus (Not diagonally)
- The agent will perceive breeze if he is in the room directly adjacent to the pit.

- The agent will perceive the glitter in the room where the gold is present.
- The agent will perceive the bump if he walks into a wall.
- When the wumpus is shot, it emits a horrible scream which can perceived anywhere in the cave.
- These percepts can be represented as five element list in which we will have different indicator for each sensor.
- Example if agent perceives stench, breeze, but no glitter, no bump and no scream ~~whi~~ then it can represented as:

  [strench, Breeze, None, None, None].

Q 2 Explain various Elements of cognitive System.

→ A cognitive system consists of many different elements ranging from the hardware and deployment model to machine learning and applications.




Elements of Cognitive System.

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1) Infrastructure and deployment modalities :
In a cognitive system it is critical to have a flexible and agile infrastructure to support application that continue to grow over time. As the market for cognitive solutions matures, a variety of public and private data need to be managed and processed. In addition organization can leverage software as a service (SAAS) application and service to meet industry specific requirements.

2) Data access, metadata and management service :- Because cognitive computing center around data, it is not surprising that the sourcing, accessing and management of data play a central role. Therefore before adding and using that data there has to be a range of underlying services. The prepare to use the ingested data require an understanding of the origins and lineage of the data.

3) The corpus, Taxonomies and data catalogs :- Tightly linked with the data access and management layer are the corpus and data analytics services. A corpus is the knowledge base of ingested data and is used to manage codified knowledge. The data required to establish the domain for the system is included in the corpus.

4) Data analytics service:-

Data analytics service are the technique used to gain an understanding of the data ingested and managed within the corpus. Typically users can take advantage of structured unstructured and semi structured data that has been ingested and begin to use sophisticated algorithm to predict outcomes, discover patterns or determine next best actions.

5) continuous machine learning:-

Machine learning is the technique that provides the capability for the data to learn without being explicitly programmed cognitive systems are not static rather models are continously updated based on new data, analysis and interaction

6) Hypothesis Generation and Evaluation:-

A hypothesis is a testable assertion based on evidence that explains some observed phenomenon. In a cognitive system, you look for evidence to support or refute hypothesis. you need to acquire data from various sources, create models and then test how well the models work. This is done through an interactive process of training the data.

7) The learning Process:

To learn from data you need tools to Process both structured and unstructured data. for unstructured textual data, NLP service can interpret and detect patterns to suport a cognitive system. unstructured data such as image, video, and sound requires deep learning tools. Data from sensors are important in emerging cognitive system. Industries ranging from transportation to healthcare use sensor data to monitor speed, performance, failure rates, and other metrics and then capture and analyze this data in real time.

8) Presentation and visualization service:

complex and often massive amount of data require new visualization interfaces. Data visualization is the visual representation of data as well as the study of data in a visual way. for example a bar chart or pie chart is visual representation of underlying data. Patterns and relationship in data are easier to identify and understand when visualized with structure, color and such.

Q3 Write note on language model

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The goal of a language model is to compute a probability of a token (e.g. a sentence or a sequence of words) and are useful in many different natural language processing application.
Language model actually a grammer of a language as it gives the probability of word that follows.

- In case of probabilistic language modeling the probability of a sentence as sequence of words is calculated:

$$P(W) = P(W_1, W_2, W_3 \ldots W_n)$$

It can also be used to find the probability of the next word in the sentence:

$$P(W_5 | W_1, W_2, W_3, W_4)$$

A model that computes either of these is called language model.

Some common statistical language model types

1) markov assumption:- A process which is stochastic in nature is said to have the markov property if the conditional probability distribution of future states of process depends upon the present state not on the sequence of event that happened in the past.

for example if K = 1 :-

P(transperent | its water is so) = P(transperent | so)

or if K = 2 :

P(transperent | its water is so) = P(transperent | is so)

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following general equation for markov assumption
$k = i$ :-

$$P(w_i | w_1 w_2 \ldots w_{i-1}) = P(w_i | w_{i-k} \ldots w_{i-1})$$

2) N-gram model :-
from the markov assumption we can formally define N-gram model where $k = n-1$ as the following:

$$P(w_i | w_1 w_2 w_3 \ldots w_{i-1}) = P(w_i | w_{i-(n-1)} \ldots w_{i-1})$$

The simplest versions of this are defined as the unigram model ($k=1$) and Bigram model ($k=2$)

3) Unigram Model ($k=1$):

$$P(w_1 w_2 \ldots w_n) = \prod_{i} P(w_i)$$

4) Bigram Model ($k=2$):

$$P(w_i | w_1 w_2 \ldots w_{i-1}) = P(w_i | w_{i-1})$$

These equations can be extended to compute trigrams, 4grams, 5-grams etc. This is an insufficient model of because sentence often have long distance dependencies.
following is the maximum likehood Estimate model to Estimating Bigram Probabilities

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

Q4 write note on Machine Translation

→ Machine translation is the process of using Artificial intelligence (AI) to automatically translate content from one language to another without any human input. Translation was one of the first application computing power starting in the 1950 unfortunately, the complexity of the task was far higher than early computer scientists estimate, requiring enormous data processing power and storage far beyond the capabilities of early machine.

- Google translate goes through 100 billion words per day.
- eBay uses machine translation technique to enable cross broder trade and connect buyers and sellers around the world

A) Neural Machine Translation (NMT):-

standard Neural machine translation is an end-to-end neural network where the source sentence is encoded by a RNN called encoder, and the target words are predicted using another RNN known as decoder.

1) End-to-end training: All parameters in NMT are simultaneously optimized to minimize a loss function on the

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Network output

1) Distributed representation:- NMT has a better exploitation of word and phrase similarities. Hence it forms a robust translator.

3) Better exploration of context:- NMT can use a much bigger context for both source and partial target text in order to translate more accurately

4) More fluent text generation:- Deep learning text generation is of much higher quality than the parallel corpus way.

B) Long short-term memory (LSTM):-

LMST works as a solution to the vanishing gradient problem by introducing gates and an explicitly defined memory cell.

1) The input gate determine how much of information from the ~~previous~~ previous layer gets stored in the cell.

2) The output layer takes the job on the other end and determines how much of the ~~text~~ next layer gets to know about the state of this cell.

3) The forget gate seems like an odd inclusion at first but sometimes it's good to forget: if it's learning a book and a new chapter begins, it may be necessary for the network to forget some character from previous chapter.

c) Gated Recurrent units (GRU):
They are a slight variation on LSTMs and are extension of Neural machine translation. They have one less gate and are wired slightly differently.
The reset gate functions much like the forget gate of an LSTM but it's located slightly differently. They don't have an output gate.

- sequence to sequence learning with neural Network proved the effectiveness of LSTM for neural machine translation. It presents a general end to end approach to sequence learning that makes minimal assumption on the sequence structure.
- Neural machine Translation (NMT) by Jointly Learning to align and translate introduced the attention mechanism in N.L.P.
- convolutional over Recurrent encoder for Neural machine translation augments the standard RNN encoder in NMT with additional convolution layers in order to capture wider context in the encoder output.
- Insted of using Recurrent Neural Network, facebook AI researchers uses convolution neural network for sequence to sequence learning tasks in NMT.

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Q 5 Explain following terms:-

a) Phonology:-
phonology is the study of organizing sound systematically

b) Morphology:-
Morphology is study of construction of words from Primitive meaningful units. morphological method used to describe a technique for identifying indexing, counting and Parametrizing the collection of all Possible device to achieve a specified functional capability.

c) Lexical analysis:-
Lexicon is the words and pharses in language. Lexicon analysis deals with the recognition and identification of structure of the sentences. It divides the Paragraph in sentence, Phrases and words.

D) syntactic Analysis:-
In Syntactic analysis the sentences are Parsed as noun, verbs, adjactives, and other Parts of sentences. In this

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. Phase - the grammer of the sentence is analyzed In order to get the relationships among different words in the sentence. for example "mango eats me" will be rejected by syntactic analyzer.

e) Word sense disambiguation:-

Word sense disambiguation is the Problem of determining which sense (meaning) of word is activated by the use of the word in a Particular context, a Process which appears to be largly unconscious in people. WSD is a natural classification Problem : Given a word and its Possible senses, as defined by a dictionary, classify an occurrence of the word in context into one or more of its sense classes. The feature of the context Provide the evidence for classification.