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# Assignment 1 (Part B)

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# Assignment 1 (Part B)

Q1. Explain PEAS descriptors for WUMPUS world.

1.) Performance measure.
1. +100 for grabbing the gold and coming back to the starting position,
2 -200 if the player (agent) is killed.
3. -1 per action,
4. -10 for using the arrow.

2.) Environment.
- Empty Rooms
- Room with WUMPUS.
- Rooms neighbouring to WUMPUS which are smelly.
- Rooms with bottomless pits.
- Rooms neighbouring to bottomless pits which are breezy.
- Room with gold which is glittery.
- Arrow to shoot the WUMPUS.

3) Sensors (assuming a robotic agent)
- Camera to get the view.
- odour sensor to smell the stench.
- Audio sensor to listen to the scream and bump.

4) Effectors (assuming a robotic agent)
- Motor to move left, right.
- Robot arm to grab the gold.
- Robot mechanism to shoot the arrow.
- the WUMPUS world agent has following characteristics. 1. Fully observable 2. Deterministic
3. Episodic 4. Static 5. Discrete. 6. Single agent.

Q2. Explain various elements of cognitive system.

1. Cognitive Computing is a new type of computing with the goal of more accurate models of how the human brain / mind senses, reasons and responds to stimulus.

- Following are some of the elements of cognitive systems.

1.) **Interactive**: They may interact easily with users so that those users can define their needs comfortably. They may also interact with other processors, devices, and cloud services, as well as with people.

2.) **Adaptive**: They may be engineered to feed on dynamic data in real time. They may learn as information changes and as goals and requirements evolve. They may resolve ambiguity and tolerate unpredictability.

3.) **Contextual**: They may understand, identify, and extract contextual elements such as meaning, syntax, time, location, appropriate domain, regulations, user's profile, process, task and goal. They may draw on multiple sources of information, including both structured and unstructured digital information, as well as sensory inputs like visual, gestural, auditory or sensor-provided.

4.) **Iterative and stateful**: They mad aid in defining a problem by asking questions or finding additional source of input if a problem statements is ambiguous or incomplete. They may "remember" previous interactions in a process and return information that is suitable for the specific application at that point in time.

Q3. Write note on Language Model

1. The goal of a language model is to compute a probability of a token (eg. a sentence or a sequence of words) and are useful in many different Natural language Processing applications.
2. Language Model (LM) actually a grammer of a language as it gives the probability of word that will follow.
3. For eg, they have been used in Twitter Bots for 'robot' account to form their own sentences.
4. Language Model Definition:

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

$$P(W) = P(w_1, w_2, w_3 \cdots w_n).$$

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

$$P(w_5 \mid w_1, w_2, w_3, w_4)$$

- A model that computes either of these is called a Language Model.

- There are various language models in available in pratice- Following are few of them.

1. **Methods using the Markov assumption:**

→ Markov property: A process which is stochastic in nature, is said to have the markov property if the conditional probability distribution of future states of the process depends only upon the present state, not on the sequence of events that happened in the past.

2. **N-gram Models:**

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

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

- The simplest version of this are defined as the Unigram Model ($k=1$) and the Bigram Model ($k=2$)

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

$$P(w_1 w_2 \cdots w_n) = \prod_i P(w_i)$$

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

$$P(w_i \mid w_1 w_2 \cdots w_{i-1}) = P(w_i \mid w_{i-1})$$

- These equation can be extended to compute trigrams, 4-grams, 5-grams, etc. This is an insufficient model of language because sentences often have long distance dependency. For eg. the subject of a sentence may be at the start whilst our next word to be predicted occur more than 10 words later.

Q4. write note on Machine Translation.

1. Machine translation is the classic Test of language understanding. It consists of both language analysis and language generation. Many machine translation systems have
2 huge commercial use. Following are few of the examples:

2. Google Translate goes through 100 billion words per day.

3. eBay uses Machine translation techniques to enable cross-broder trade and connect buyers and sellers around the world.

4. Facebook uses machine translation to translate text in post and comments automatically, in order to break language barriers and allow people around the world to communicate with each other.

5. Systran became the first software provider to launch a Neutral Machine Translation engine in more than 30 languages back in 2016.

6. Microsoft brings AI-powered translation to end users and developers on Android, ios and Amazon Fire, whether or not they have access to the Internet.

7. In a traditional Machine Translation system, parallel corpus a collection of texts is used each of which is translated into one or more other languages than the original.

8. It is obvious that, this approach skips hundreds of machine details, requires

a lot of human feature engineering.

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.

B. **Long Short-Term Memory (LSTM):**

- LSTM works as a solution to the vanishing gradient problem by introducing gates and an explicitly defined memory cell. Each neuron has a memory cell and three gates: Input, output and forget.

C. **Gated Recurrent Units (GRU):**

They are a slight variation on LSTMs and are extensions of Neutral Machine Translation. They have one less gate and are wired slightly differently. GRU has an update gate instead of a input, output, and a forget gate. This update gate determines how much information to be kept from the last state and how much information to froget from the previous layer.

Q5. Explain following terms:

a. **Phonology**.
Phonology is typically defined as the "the study of speech sounds of a language or languages, and the laws governing them, particularly the laws governing the composition and combination of speech sounds in language.

b. **Morphology**.
Morphology is the study of word structure, the way words are formed and the way their form interacts with other aspects of grammer such as phonology and syntax.

c. **lexical analysis**.
lexical analysis is the very first phase in the compiler designing. A lexer takes the modified source code which is written in the form of sentences. In other words, it helps you to convert a sequence of characters into a sequence of tokens. The lexical analyzer breaks this syntax into a series of tokens.

d. **syntax Analysis**.
syntax Analysis or Parsing is the second phase, i.e after lexical analysis. It checks the syntactical structure of the given input i.e whether the given input is in the correct syntax or not.

e. **Word sence Disambiguation**

word sense dis ambiguation , in natural language processing (NLP), may be defined as the ability to determine which meaning of word is activated by the use of word in a particular context. Lexical ambiguity, syntactic or semantic, is one of the very first problem that any NLP system faces.