

27/11/19

# Artificial Intelligence

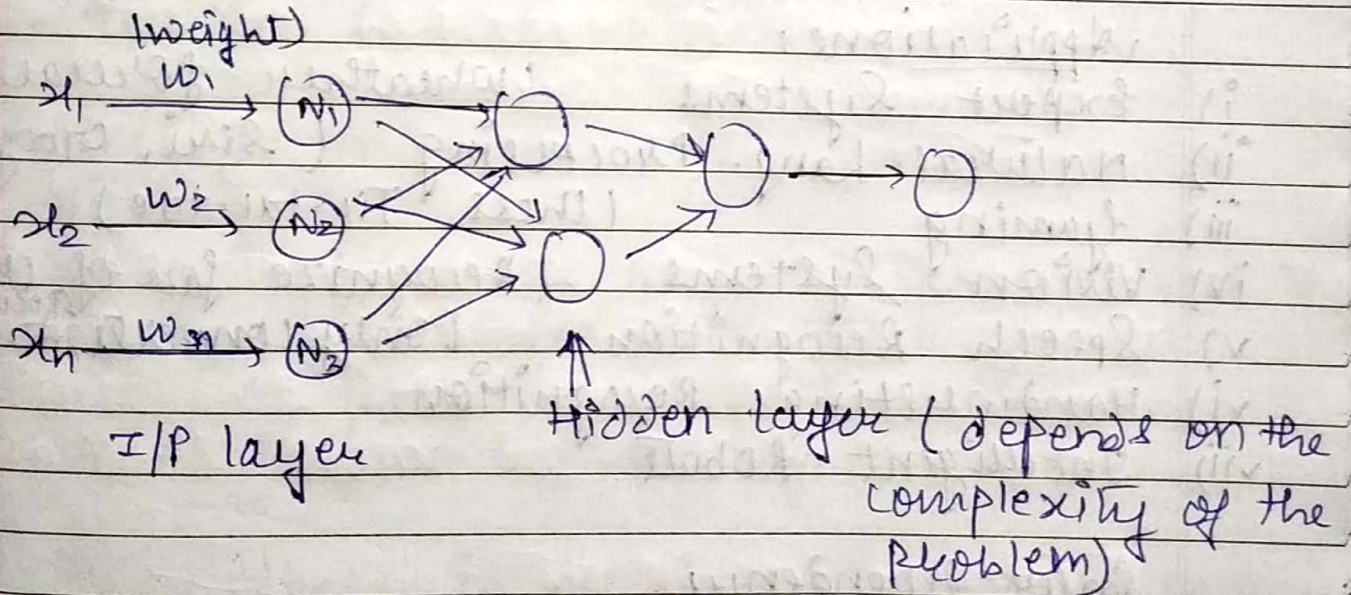
[ Exp - 1, 15 ]

Accomplished by studying:

- how human brain thinks, learn, decide and work
- Using the outcomes of this study to develop systems/machines which mimic human responses.

Neural networks attempt to bring computers closer to brain's capabilities by imitating certain aspects of information processing in the brain.

Basic computational element (model neuron) is called a node or a unit.

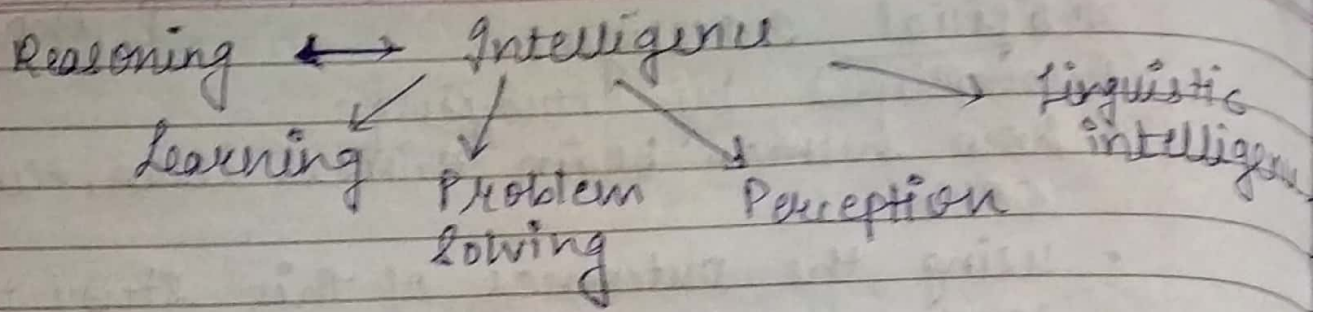


$$y_i = f(\sum w_i y_i)$$

Activation func. :  
 (On every node)

- Linear func.
- Threshold func.
- Sigmoidal func.





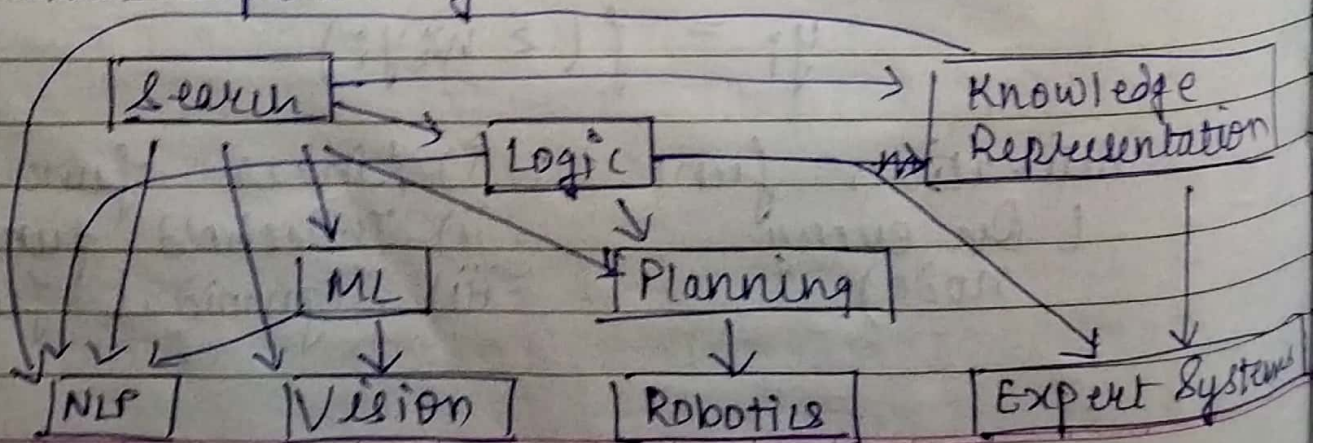
### Goals of AI:

- To create expert systems which exhibits intelligent behavior, learn, demonstrate, explain and advise its users.
- To implement human intelligence in machines creating systems that understand, think, learn and behave like humans.

### Applications:

- Expert Systems (weather forecast)
- Natural Lang. Processing (Siri, Google assistant)
- Gaming (Chess, Tic-tac-toe)
- Vision Systems (Recognize face of criminal)
- Speech Recognition (only converts <sup>speech</sup> into <sup>digital</sup> form)
- Handwriting Recognition
- Intelligent Robots

### Inter-dependency.





## Natural Lang. Processing

- Processing of info contained in natural lang text.

### Why Study NLP?

- A hallmark of human intelligence
- Text is the largest repository of human knowledge

### Challenges

- Lang = words + Rules + Exceptions
- Ambiguity at all levels
- Lang. is a cultural entity.
- Keeps changing (new words, new rules, new exceptions)
- Multiple sources  $\Rightarrow$  noisy data

### Measure intelligence of machine

- Turing Test
- Eliza - Pretends to be a psychiatrist & converses with user on his problems. (chatbot)  
uses keyword matching.

$\Rightarrow$  Effectiveness is related to the relevancy of the data.

### Measures for IR evaluation:

- True +ve : Info. is relevant & retrieved
- False +ve : not relevant & retrieved
- False -ve : not relevant & not retrieved
- True -ve : relevant & not retrieved



Confusion matrix:

irrelevant	False +ve	False -ve
relevant	True +ve	True -ve
	Retrieved	Not Retrieved

$$\text{Precision} = \frac{\text{No. of relevant doc. retrieved}}{\text{Total no. of doc. retrieved}}$$

$$\text{Recall} = \frac{\text{No. of relevant doc. retrieved}}{\text{Total no. of relevant doc.}}$$

Text Categorization / Classification

Classification - It is supervised learning and the model is taught on given knowledge based on which the model is expected to answer/perform. Ex- Learning from a teacher.

Clustering - It is unsupervised learning. No knowledge is provided and data is put into the cluster with which it is most similar to.

Accuracy depends on:

- Naturalness of classes
- Quality of features extracted and amount of training data available.

Ranges from 65% to 91%.

100% - looses naturalness (Ex- any animal having two horns is a cow)



## Information Extraction

- Find and understand relevant parts of text
- Produce a structured representation
- Relate to a specific domain

## NLP libraries

### Open source

- Natural Lang. toolkit
- Apache OpenNLP
- Stanford NLP suite
- GATE NLP suite

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## Components of NLP

### i) Understanding

- Mapping the given input into useful representation.
- 6 levels of analysis

### ii) Generation

- Producing output from some internal representation

## Understanding

### Ambiguity at different levels:

- Lexical - different meanings of words.
- Syntactic
- Interpreting
- Conceptual

## Phases / Levels of NLP

- i) Level 1 - Speech sound (Phonetics & Phonology)
- ii) Level 2 - Words & forms (Morphology, lexicon)
- iii) Level 3 - Structure of sentences
- iv) Level 4 - Meaning of sentences



- Scanned by CamScanner



iii) ~~to~~ Error recovery.

Parsing (Level 3)

Goal: Determine the correctness of a sentence based on a grammar.

Structural ambiguity

Slope ambiguity

Ex- Old men & women

↳ (old men) & women

↳ (old (men & women))

Attachment ambiguity

Ex- Man saw the girl with the telescope.

↳ girl was carrying telescope

↳ man saw her through his telescope

Level 4 (Semantic)

Occurs when the words to (meaning) can be misinterpreted

Ex- Shreya loves her mom. Seema does too.

↳ Seema loves Shreya's mom or hers?

Level 5 (Pragmatic)

Reading or interpreting text in between the lines. If contextual loopholes exist, it becomes very difficult to interpret. (Ex- waiter <sup>does not</sup> fetch shoes when asked to look for them)

Level 6 (Discourse)

Anaphoric references can be difficult to



resolve word in a text refer back to other ideas in the text

Ex - Horse climbed up the hill. It was very steep. It got tired.

(Horse)

(Hill)