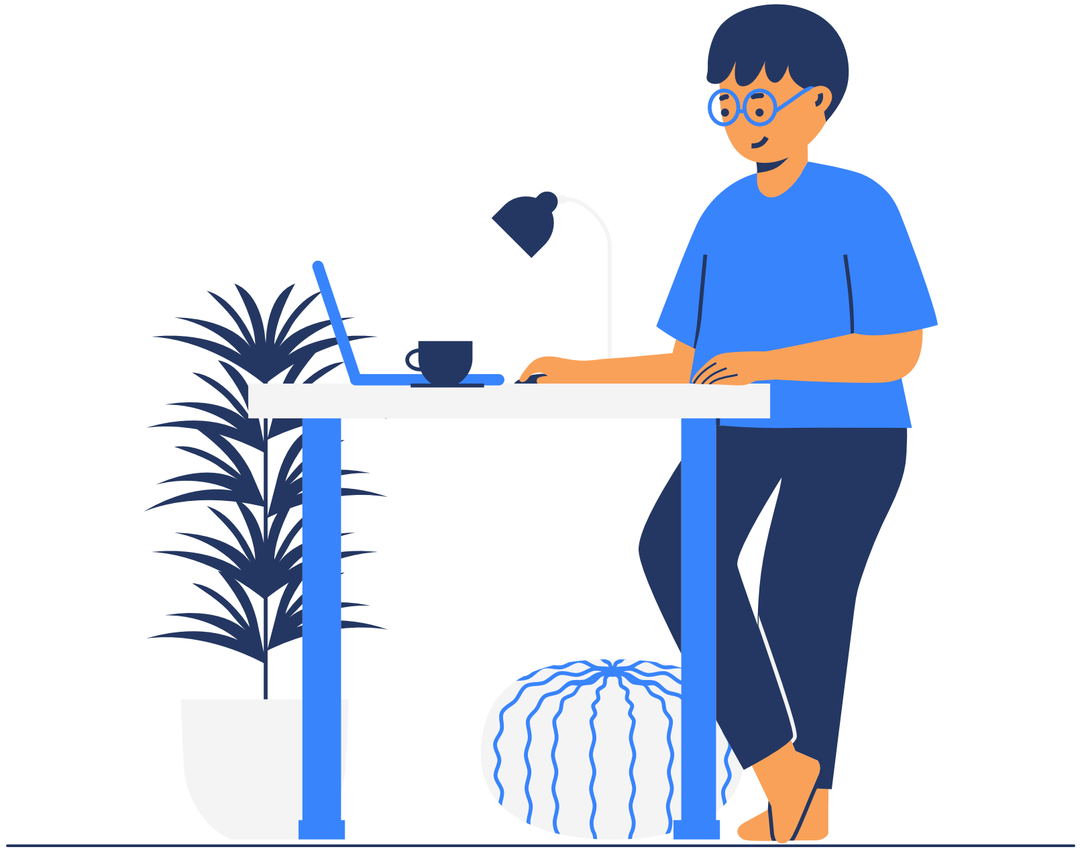
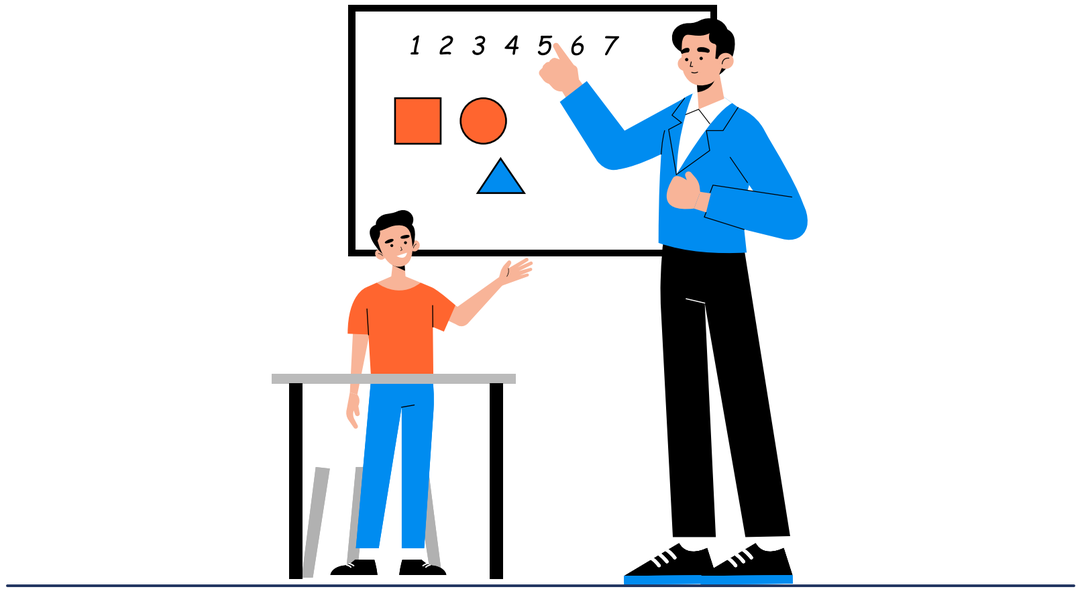
Artificial Intelligence

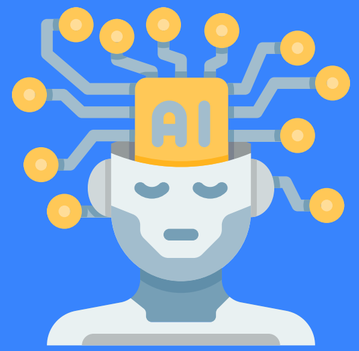
Unit 5



Topics to be covered...

AI Applications
Information retrieval
Information extraction
Natural language processing
Applications of NLP
Role of NLP and Phases in AI
Machine Translation Approaches
Process of Machine Translation
Speech recognition Algorithms
Speech recognition Applications
Robot vs Robotics
Robot locomotion and Types
Motion of Mobile Robot
Happy Ending!





AI Applications

AI Applications

- **AI in Healthcare:** Faster diagnosis than humans.
- **AI in Gaming**
- **AI in Finance**
- **AI in Data Security**
- **AI in Social Media**
- **AI in Travel & Transport**
- **AI in Robotics**
- **AI in Entertainment**
- **AI in Speech recognition**
- **AI in Natural Language Processing**

Information retrieval

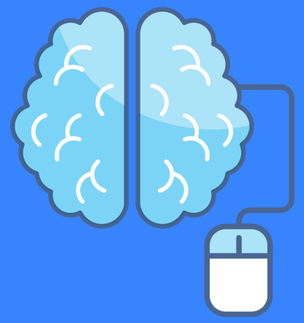
Information retrieval

- Information Retrieval (IR) can be defined as a software program that deals with the organization, storage, retrieval, and evaluation of information from document repositories, particularly textual information.
- The main goal of IR research is to develop a model for retrieving information from the repositories of documents.
- In ad-hoc retrieval, the user must enter a query in natural language that describes the required information. Then the IR system will return the required documents related to the desired information.
- IR is widely used in popular search engine like google, yahoo, bing etc.
- **Characteristics:**
  - A huge data/document collection
  - A format of query with standard query language
  - The generated result model
  - Displaying results model

Information extraction

Information extraction

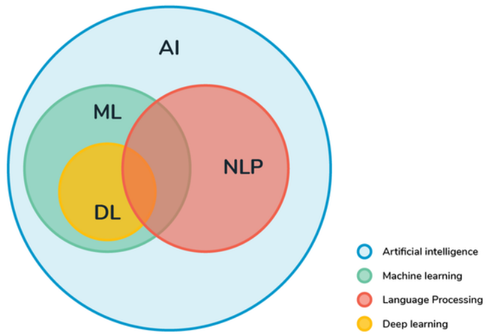
- Information extraction is the task of automatically extracting structured information from unstructured and/or semi-structured machine-readable documents and other electronically represented sources.
- In most of the cases this activity concerns processing human language texts by means of natural language processing.
- One of the most trivial examples is when your email extracts only the data from the message for you to add in your Calendar.
- The instance of weather report with temperature, wind, speed, humidity are extracted.



Natural language processing

Natural language processing

- NLP stands for Natural Language Processing, which is a part of Computer Science, Human language, and Artificial Intelligence.
- It is the technology that is used by machines to understand, analyse, manipulate, and interpret human's languages.
- It helps developers to organize knowledge for performing tasks such as translation, automatic summarization, Named Entity Recognition (NER), speech recognition, and topic segmentation.



Advantages of NLP

- NLP helps users to ask questions about any subject and get a direct response within seconds.
- NLP offers exact answers to the question means it does not offer unnecessary and unwanted information.
- NLP helps computers to communicate with humans in their languages.
- It is very time efficient.

Disdvantages of NLP

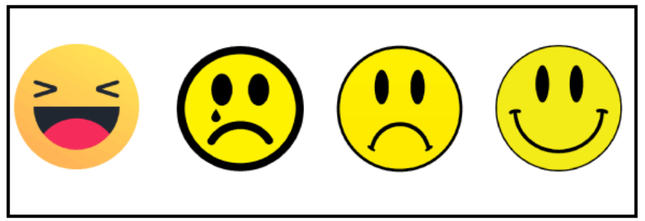
- NLP may not show context.
- NLP is unpredictable
- NLP may require more keystrokes.
- NLP is unable to adapt to the new domain, and it has a limited function that's why NLP is built for a single and specific task only.

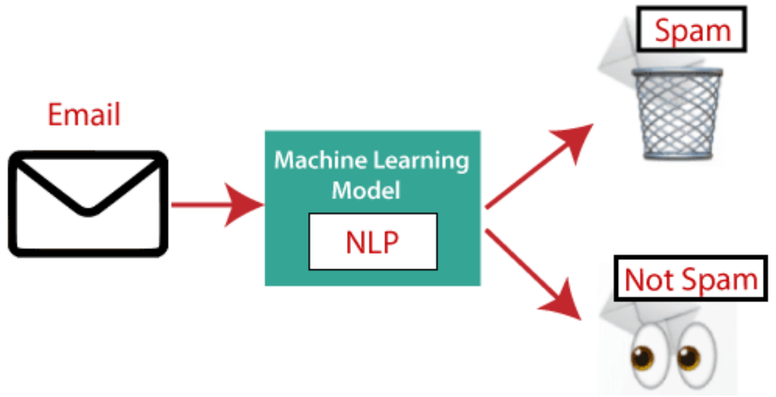
NLU vs NLG

NLU	NLG
NLU is the process of reading and interpreting language.	NLG is the process of writing or generating language.
It produces non-linguistic outputs from natural language inputs.	It produces constructing natural language outputs from non-linguistic inputs.

Applications of NLP

- Machine Translation
- Sentiment analysis
- Spelling correction
- Spam Detection
- Speech Recognition
- Chatbot





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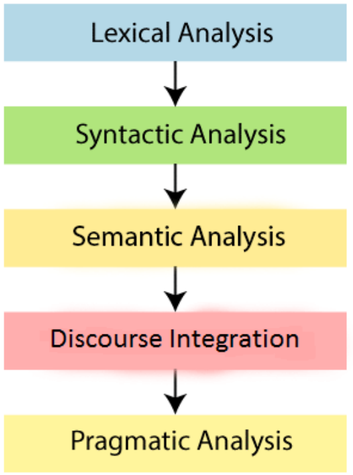
Role of NLP in AI

Role of NLP and Phases

- NLP help to communicate with intelligent system.
- Helps to control computer with voice commands.
- Helps human to communicate with machines.

- **Phases:**
  - Lexical Analysis
  - Syntactic Analysis
  - Semantic Analysis
  - Discourse Integration
  - Pragmatic Analysis



Phases

1. Lexical Analysis:

- This is the first phase of NLP. This phase scans the source code as a stream of characters and converts it into meaningful lexemes. It divides the whole text into paragraphs, sentences, and words.

2. Syntactic Analysis:

- It is used to check grammar, word arrangements, and shows the relationship among the words.
- **Example:** Mumbai goes to the Delhi.
- In the real world, Agra goes to the Poonam, does not make any sense, so this sentence is rejected by the Syntactic analyzer.

Phases

3. Semantic Analysis:

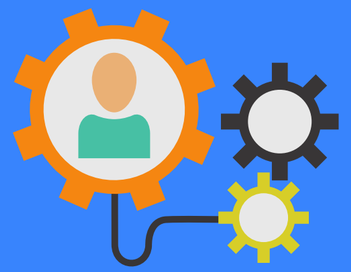
- Concerned with the meaning representation. It mainly focuses on the literal meaning of words, phrases, and sentences.

4. Discourse Integration:

- It depends upon the sentences that proceeds it and also invokes the meaning of the sentences that follow it.

5. Pragmatic Analysis:

- Pragmatic is the fifth and last phase of NLP. It helps you to discover the intended effect by applying a set of rules that characterize cooperative dialogues.
- **For Example:** "Open the door" is interpreted as a request instead of an order.



Machine translation

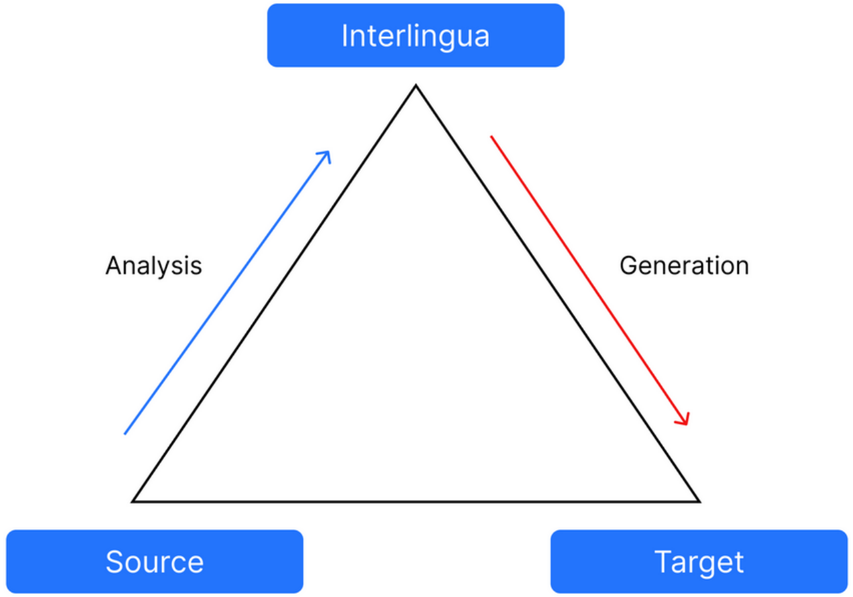
Machine translation

- Machine translation is the process of using artificial intelligence to automatically translate text from one language to another without human involvement.
- Modern machine translation goes beyond simple word-to-word translation to communicate the full meaning of the original language text in the target language.

- **Types of MT Systems:**
  - Bilingual MT System
  - Multilingual MT System

Approaches Machine translation

- Direct MT Approach
- Interlingua Approach
- Transfer Approach
- Empirical MT Approach



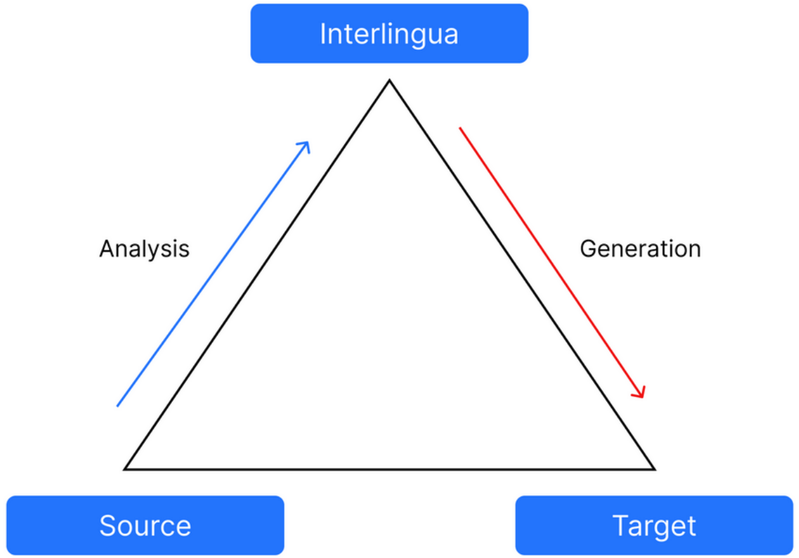
Approaches Machine translation

Direct MT Approach:

- It is less popular but the oldest approach of MT.
- SL to TL(directly).

Interlingua Approach:

- SL to IL called Interlingua
- Then translate IL to TL.



Approaches Machine translation

Transfer Approach:

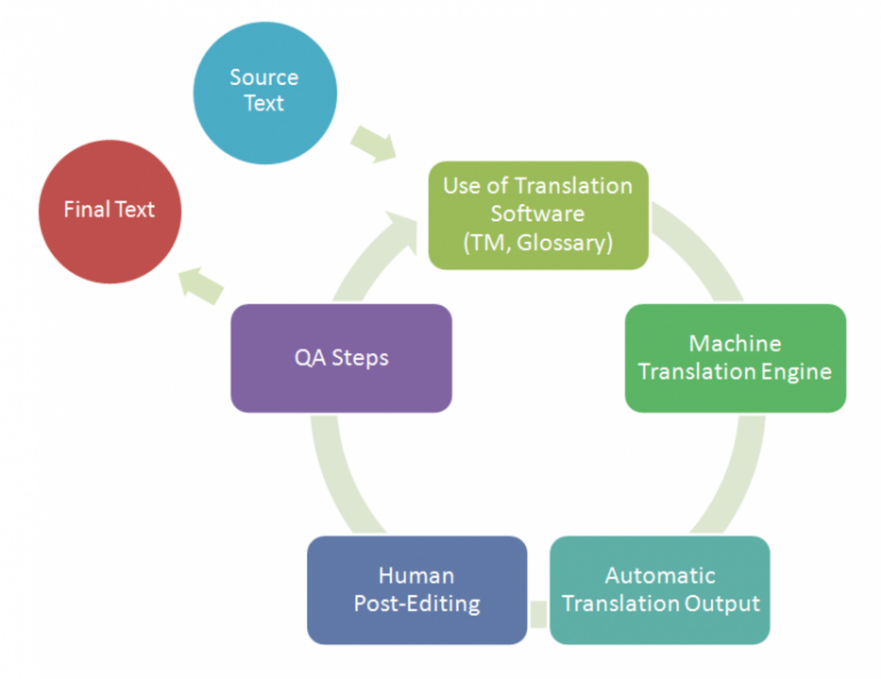
- 1st----> SL texts to abstract SL-oriented representations.
- 2nd---> SL-oriented representations to equivalent TL-oriented representations.
- 3rd----> Final text is generated.

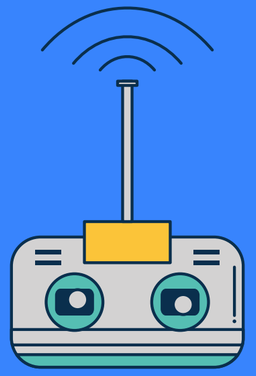
Empirical MT Approach:

- This is an emerging approach for MT.
- It uses large amount of data.
- Raw data consists of the text and their translations.
- Analogy-based, example-based, memory machine translation techniques use empirical MT approach.

EIOV

Process of Machine translation





Speech recognition

Speech recognition

- Speech recognition speech recognition is the process that enables a computer to recognize and responds to its spoken words and then convert them in a format that the machine understands.
- Speech recognition is widely used in digital assistants, smart speaker, smart homes and automation for a variety of services, products and solutions.

Algorithms for Speech recognition

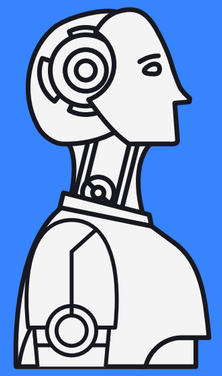
- **Natural language processing(NLP)**

- **Hidden Markov models**
  - Markov chain model is useful for observable events such as text inputs.
  - Hidden Markov models allow us to incorporate hidden events, such as part of speech tags into a probabilistic model.

- **Neural networks**
  - A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.
  - In this sense, neural networks refer to systems of neurons, either organic or artificial in nature.

Applications of Speech recognition

- Automotive
- Technology
- Healthcare
- Sale
- Security



Robot

Robot

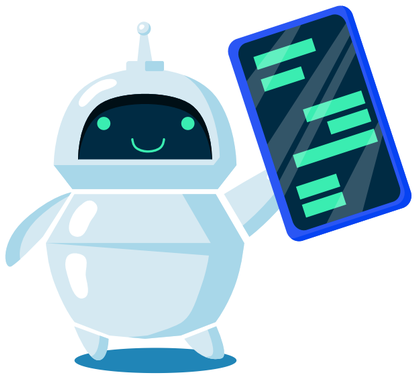
- Robot are the artificial agents acting in real world environment.
- Robots are aimed at manipulating the objects by perceiving moving and doing repetitive functions without getting bored, distracted.

Robotics

- Robotics is a branch of AI which is composed of electrical engineering, mechanical engineering and computer science for designing, construction and application of robots.

Components of Robot

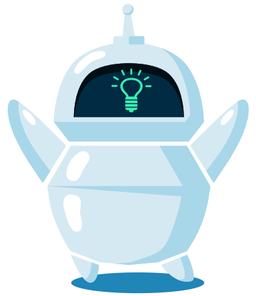
- Power supply
- Actuators
- Electric motors (AC/DC)
- Pneumatic air muscles
- Muscle wires
- Piezo Motors and ultrasonic motors
- Sensors.



Robot Locomotion and Types

- Locomotion is the mechanism that makes a robot capable of moving in its environment.

- **There are various types of locomotion:**
  - 1. Legged the locomotion
  - 2. Wheeled the locomotion
  - 3. Slip locomotion



Motion of Mobile Robot

Motion of Mobile Robot

- **Terrestrial:**
  - Terrestrial robots move on the ground.
  - Wheeled robots are most common type of robots in this category.

- **Airborne**
  - Robotic helicopters, robotically controlled parachutes have been deployed.

- **Aquatic**
  - This type of robots operates in water, either at the surface or underwater.

- **Space**
  - Robots are designed to operate in the microgravity of outer space, typically for space station maintenance.

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