Artificial Intelligence (AI), Machine Learning (ML) And Deep Learning

Module 1

Data Science: Definition

Data science is an interdisciplinary field that employs various techniques, algorithms, processes, and systems to extract insights and knowledge from structured and unstructured data. It encompasses a range of skills and methods, including statistics, machine learning, data mining, and data visualization. Data scientists leverage these tools to uncover patterns, make predictions, and inform decision-making.

Use Cases

Predictive Analytics

What will happen?

Recommendation Systems

To predict the likes and dislikes of users

Prescriptive Analytics

What should happen to achieve the best course of action

Estimation

To predict with accuracy about what can be

ML & AI

To provide better Artificial intelligence and human behaviour replication

Artificial Intelligence (AI)

Artificial Intelligence refers to the development of computer systems that can perform tasks typically requiring human intelligence. These tasks include reasoning, learning, problem-solving, perception, understanding natural language, and interacting with the environment. AI systems aim to mimic human cognitive abilities and adapt their behavior based on new information or experiences.

01

Machine Learning

A subset of AI, machine learning involves the use of algorithms that enable computers to learn patterns from data and improve their performance over time without being explicitly programmed.

Use Cases of Machine Learning

Image Classification

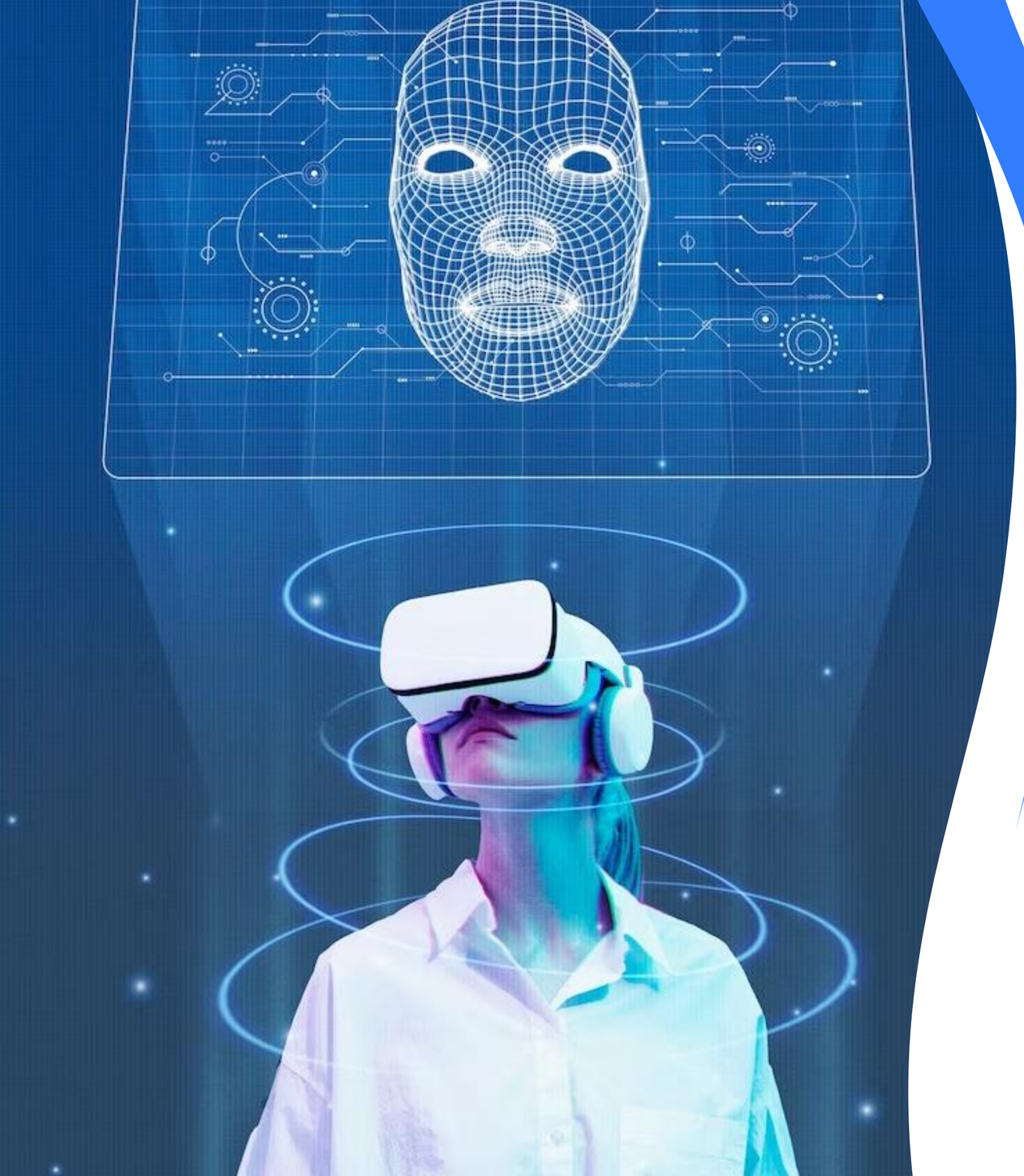
Lorem ipsum dolor sit amet, feugiat delicata liberavisse id cum. No quo maiorum intelleget. Mea cu case ludus integre.

Fraud Detection

Lorem ipsum dolor sit amet, feugiat delicata liberavisse id cum. No quo maiorum intelleget. Mea cu case ludus integre.

Recommendation Systems

Lorem ipsum dolor sit amet, feugiat delicata liberavisse id cum. No quo maiorum intelleget. Mea cu case ludus integre.

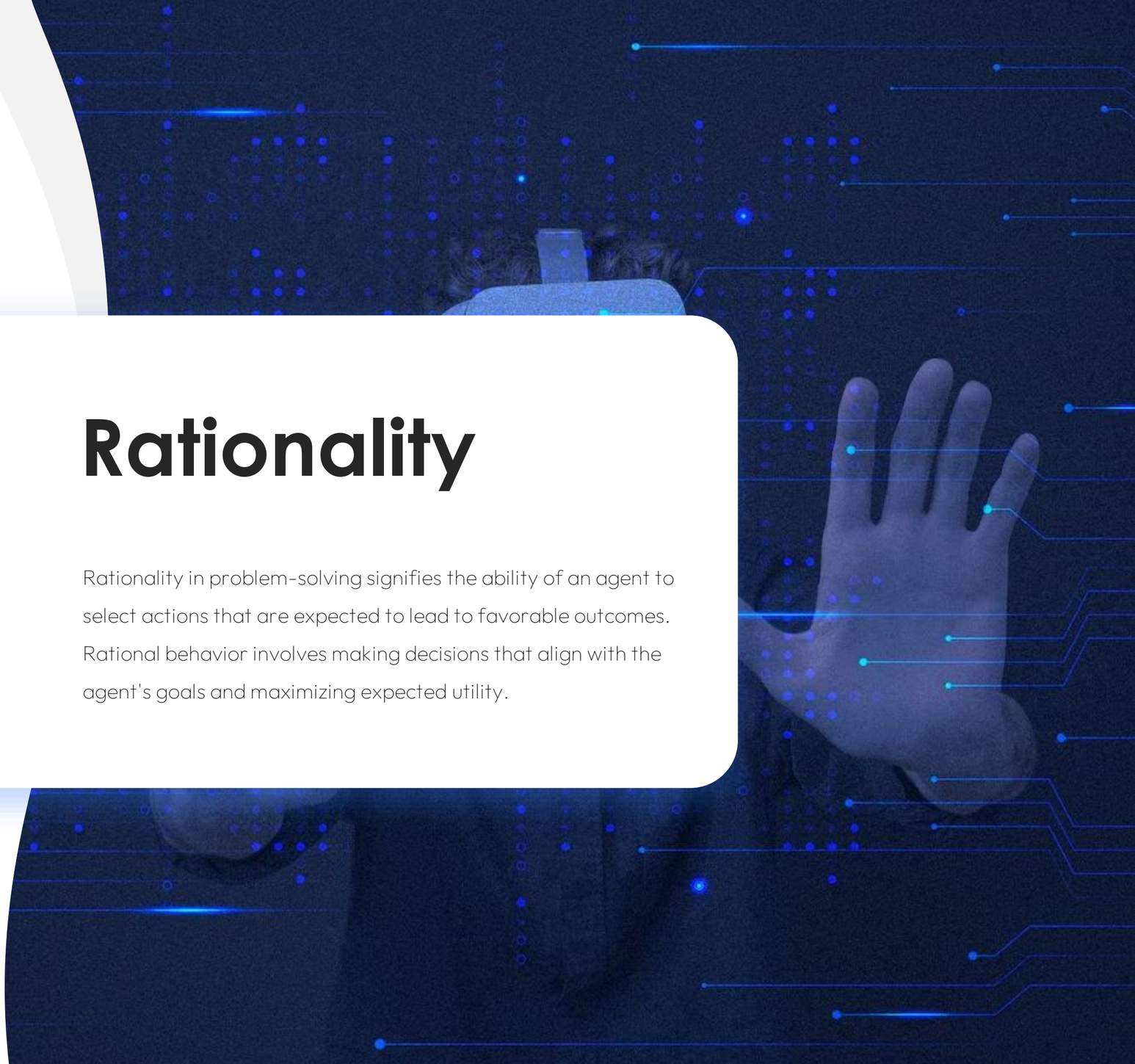


Problem Spaces

Problem spaces refer to the set of possible states or configurations that a problem-solving agent can navigate through to reach a solution. These spaces encompass the initial state, intermediate states, and the goal state of a problem.

Search Knowledge

Search knowledge pertains to the information an agent possesses about the problem space and the strategies it can use to traverse it. This knowledge includes heuristics, rules, and algorithms that guide the agent's search for a solution.hul



02

Rationality

Rationality in problem-solving signifies the ability of an agent to select actions that are expected to lead to favorable outcomes. Rational behavior involves making decisions that align with the agent's goals and maximizing expected utility.

Machine Learning V/S Artificial Intelligence

Criteria	Artificial Intelligence	Machine Learning
Definition	Focuses on creating machines capable of intelligent behavior.	A subset of AI that focuses on enabling machines to learn from data and improve performance.
Scope	Encompasses broader cognitive abilities like reasoning, understanding natural language, problem-solving, etc.	Primarily concerned with learning patterns and making predictions based on data.
Goal	Aims to replicate human-like intelligence and adaptability.	Aims to enable machines to learn from experience and improve without explicit programming.
Example	Speech recognition, language translation, game playing AI.	Image recognition, spam email filtering, recommendation systems.
Human Intervention	May require pre-defined rules and significant human guidance.	Learns from data and improves over time without constant human intervention.

Machine Learning V/S Artificial Intelligence

Criteria	Artificial Intelligence	Machine Learning
Definition	Generally involves complex algorithms and architectures.	Utilizes algorithms that adapt and generalize based on data.
Scope	Relies on structured and unstructured data for decision-making.	Depends heavily on large datasets for training and validation.
Goal	Can involve shallow or deep levels of understanding.	Aims to enable machines to learn from experience and improve without explicit programming.
Example	Can make decisions based on explicit rules and logic.	Makes decisions based on patterns learned from data.
Human Intervention	May not always lead to a specific goal; more exploratory.	Focused on achieving a specific task or outcome.
Examples	IBM's Watson, Siri, chatbots.	Netflix recommendation, fraud detection, autonomous vehicles.

Machine Learning - Types, Process and Applications

01

Supervised Learning

02

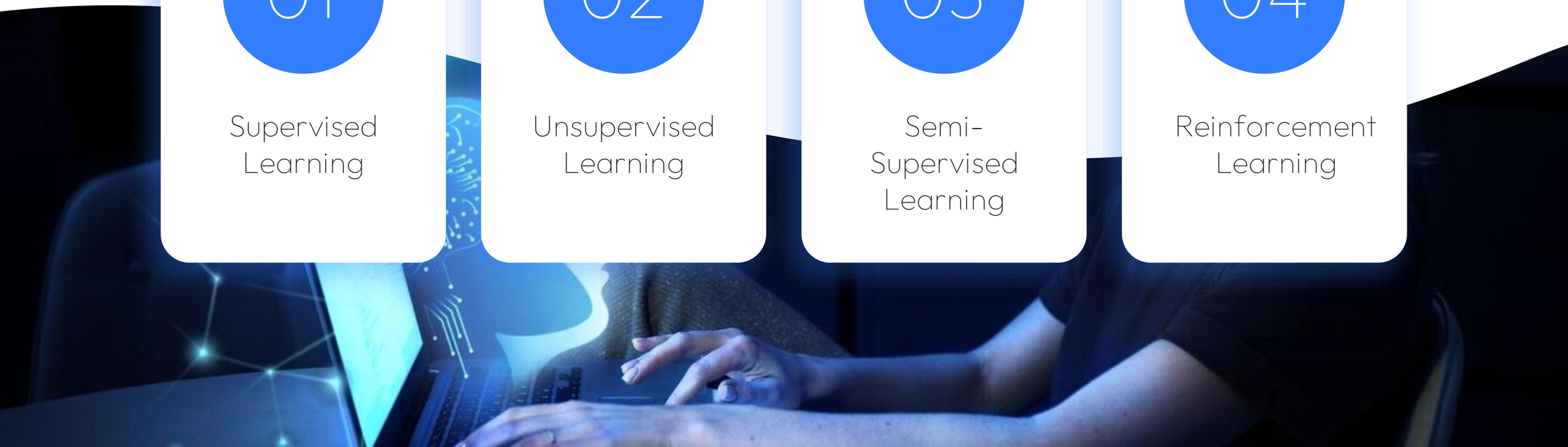
Unsupervised Learning

03

Semi-Supervised Learning

04

Reinforcement Learning



Reinforcement Learning

Involves an agent learning to take actions in an environment to maximize cumulative rewards.

Supervised Learning

Involves training a model on labeled data, where inputs are mapped to desired outputs.

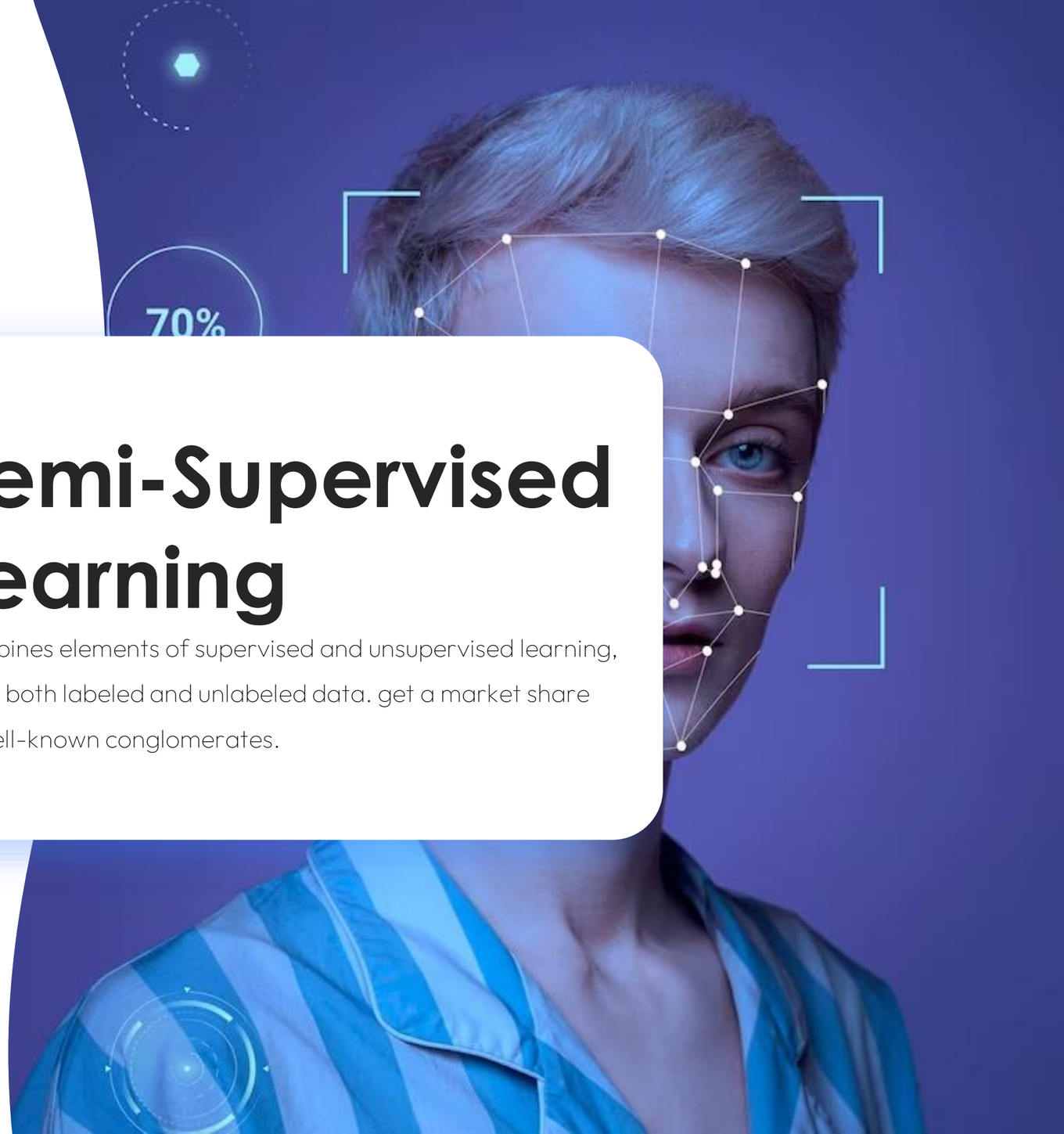
Unsupervised Learning

Focuses on finding patterns and structures in unlabeled data without predefined outputs.

03

Semi-Supervised Learning

Combines elements of supervised and unsupervised learning, using both labeled and unlabeled data. get a market share of well-known conglomerates.



Deep Learning

Deep Learning and Neural Networks have significantly advanced the capabilities of machine learning, enabling computers to tackle complex tasks that were once thought to be beyond their reach.

Deep Learning

Definition

Deep Learning is a subset of machine learning that involves neural networks with multiple layers, allowing for the automated learning of intricate patterns and hierarchies from data.

Significance

Deep Learning has revolutionized various fields by enabling computers to learn and perform tasks that were previously considered challenging for traditional algorithms.

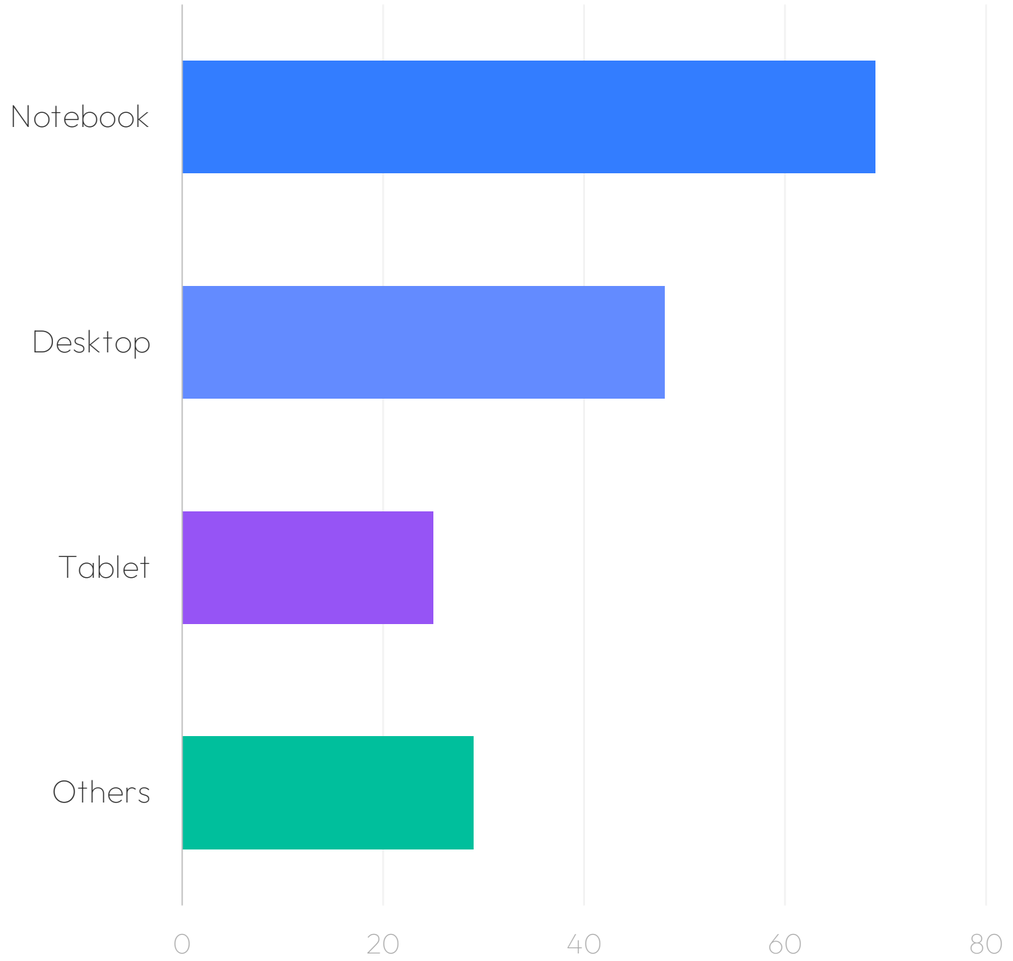
Neural Networks

Neural networks are a set of interconnected nodes, or neurons, that process and transmit information. They are inspired by the structure and function of the human brain.

Neural networks consist of layers: an input layer, one or more hidden layers, and an output layer. The hidden layers enable the network to learn complex relationships in the data.

Activation Function

Neurons use activation functions to introduce non-linearity and decision-making into the network.



Weights and Bias

Each connection between neurons has associated weights and bias, which are adjusted during training to optimize the network's performance.

Types of Neural Networks

Feedforward Neural Networks

Convolutional Neural Networks (CNNs

Recurrent Neural Networks (RNNs)

Types of Neural Network

FNN

- Data flows through the network from input to output in a forward direction.
- Each neuron's output serves as input for neurons in subsequent layers.
- Used for tasks like classification and regression.

CNN

- Specialized for processing grid-like data, such as images and videos.
- Employs convolutional layers to automatically learn hierarchical features from data.
- Widely used in image recognition and computer vision.

RNN

- Designed to handle sequential data, like time series and natural language.
- Contains recurrent connections that allow information to be passed from one step to the next.
- Effective for tasks involving temporal dependencies, such as language translation and speech recognition.

Deep Learning Techniques

Loss Function:
Measures the difference between predicted and actual outputs.

Forward Propagation:
Input data is fed through the network to generate predictions.

Optimization:
Algorithms like Gradient Descent update weights to minimize the loss function.

Backpropagation:
Gradients of the loss function are calculated and used to adjust weights and biases in reverse order through the layers.

Natural Language Processing

Natural Language Processing (NLP) is a subfield of artificial intelligence (AI) that focuses on enabling computers to understand, interpret, and generate human language in a way that is both meaningful and contextually relevant.

Tokenization

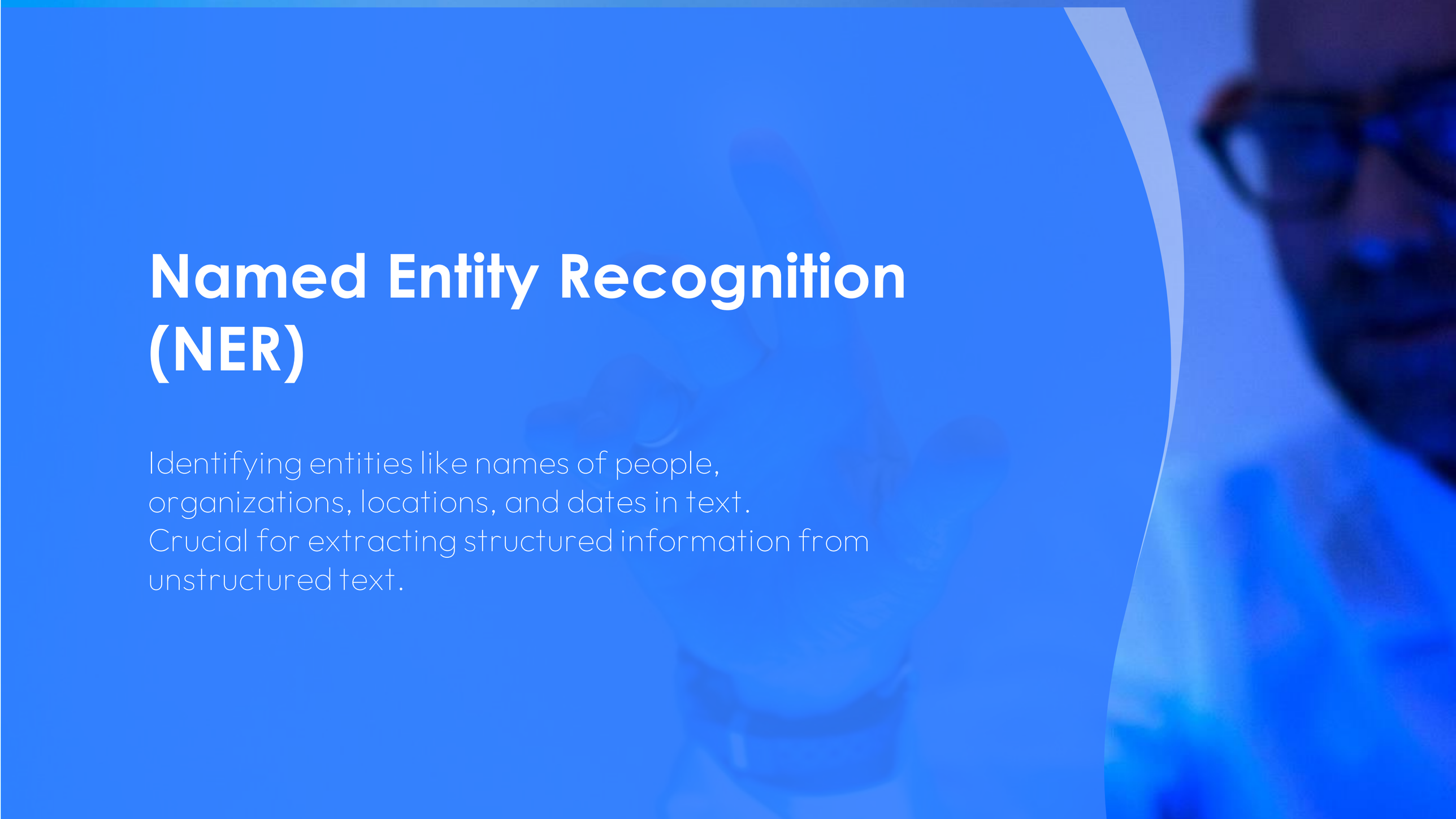
Tokenization is a fundamental preprocessing step in Natural Language Processing (NLP) that involves breaking down a text into smaller units, called tokens. Tokens are the basic building blocks of language, and they can be words, subwords, characters, or even phrases, depending on the level of granularity chosen for analysis.

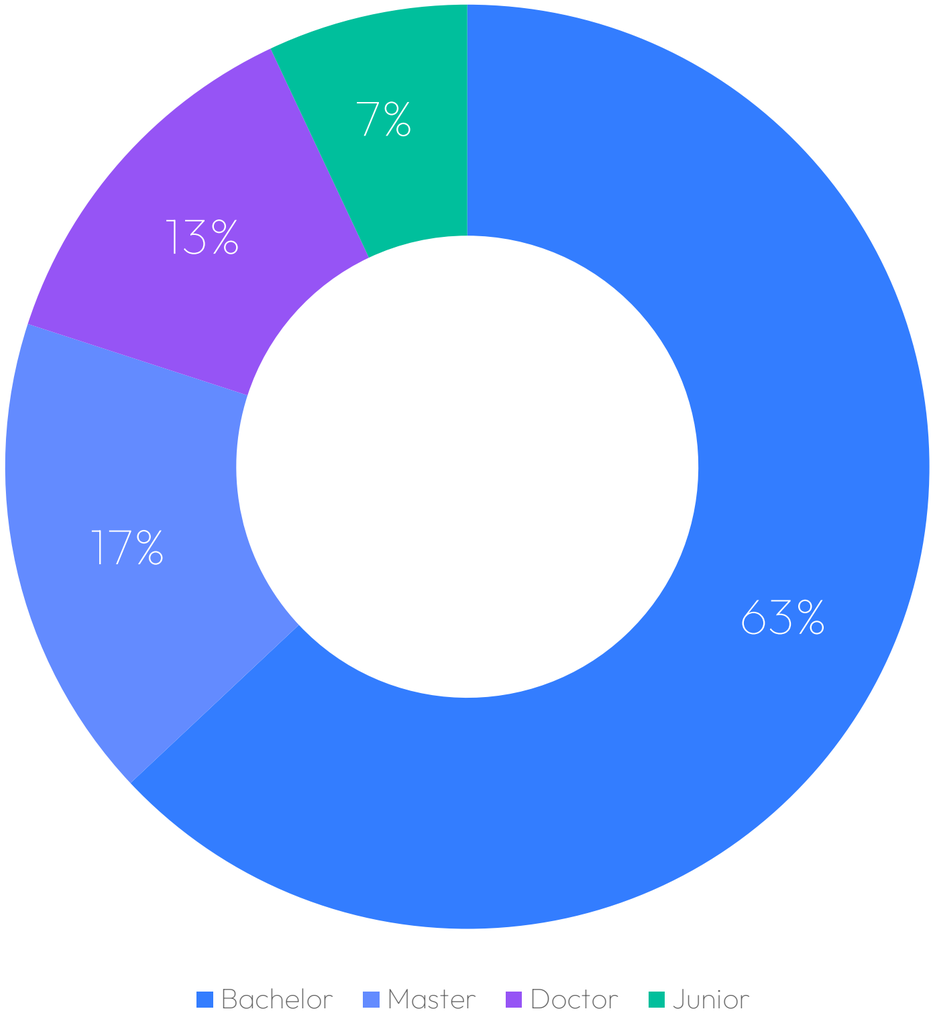
- Word tokenization: Involves splitting a text into individual words.
- Sentence Tokenization : Involves splitting a text into sentences.
- Subword Tokenization : Divides words into smaller linguistic units, such as subword pieces or characters.
- Character Tokenization : Breaks down the text into individual characters

Tokenization is a crucial step in NLP because it simplifies the complexity of language by converting continuous text into discrete units that can be easily processed and analyzed. Once a text is tokenized, it becomes easier to perform various NLP tasks such as part-of-speech tagging, named entity recognition, sentiment analysis, and machine translation. Additionally, tokenization is a key step in preparing text data for input into machine learning models.

Named Entity Recognition (NER)

Identifying entities like names of people, organizations, locations, and dates in text. Crucial for extracting structured information from unstructured text.

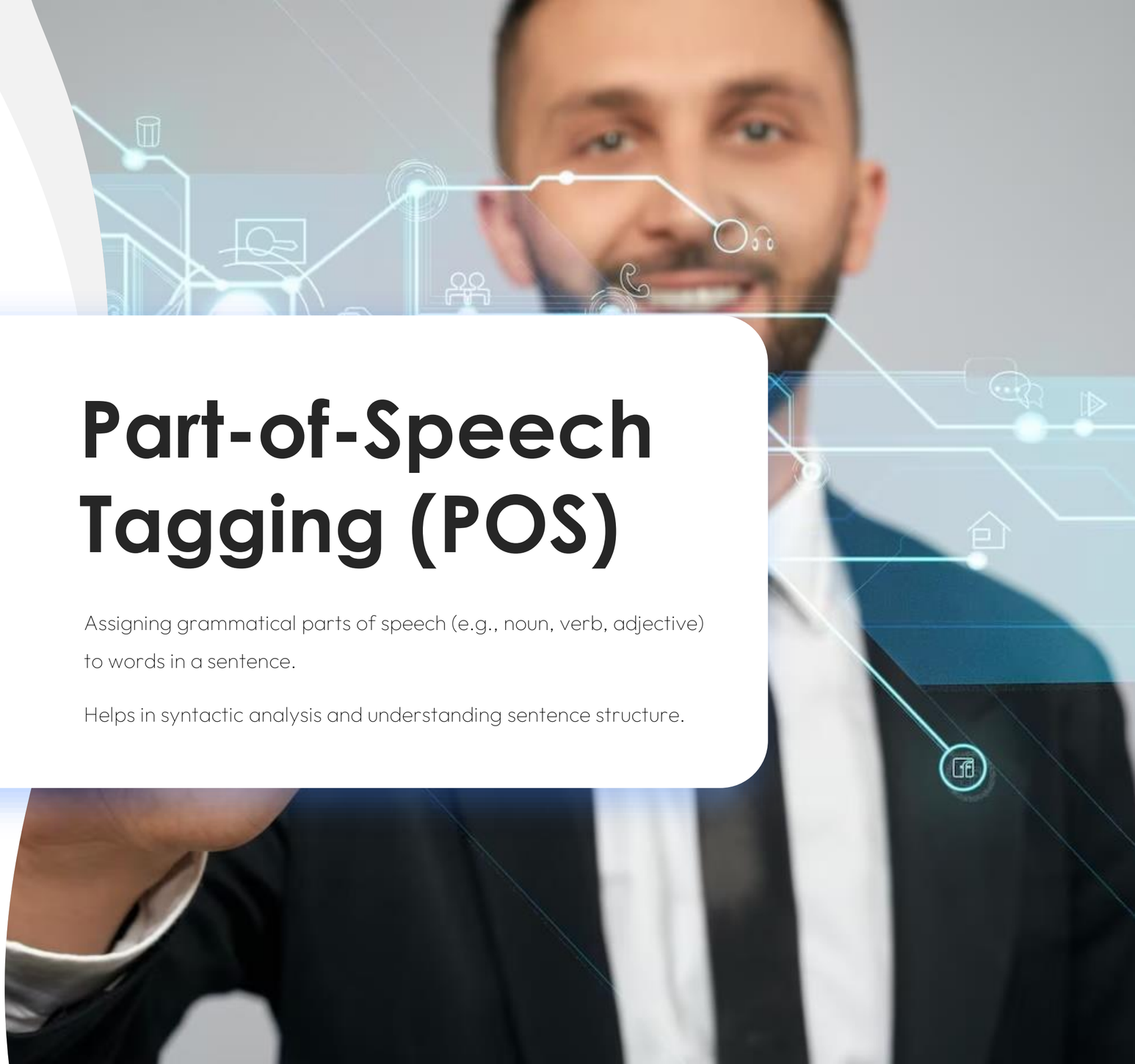




Text Classification

Assigning predefined categories or labels to text based on its content.

Common in sentiment analysis, spam detection, and topic categorization.



04

Part-of-Speech Tagging (POS)

Assigning grammatical parts of speech (e.g., noun, verb, adjective) to words in a sentence.

Helps in syntactic analysis and understanding sentence structure.

Language Generation

Creating human-like text, such as chatbot responses or content generation.

Involves techniques like rule-based generation and neural language models.

Modeling Concepts

Modeling refers to the process of creating algorithms or systems that can learn from data, make predictions, and perform tasks without explicit programming.

Models in machine learning and AI are built to understand patterns, relationships, and trends in data, enabling them to generalize and make informed decisions on new, unseen data.

Thanks!

Any questions?