

### AI Mini Glossary

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- **Artificial Neural Networks (ANNs):** Artificial Neural Networks (ANNs) function as computational models that derive their design from the neural system of the human brain. The structure of these networks includes connected nodes (neurons) which perform information processing tasks. Example: ANNs power image recognition systems to identify and categorize objects within photographs.
- **Backpropagation:** Backpropagation functions as a supervised learning technique that trains neural networks through error rate reduction. The network connection weights get updated according to the output error during training. Example: The training of deep learning models commonly involves backpropagation.
- **Convolutional Neural Networks (CNNs):** Convolutional Neural Networks (CNNs) function as neural networks that process structured grid data including images. Convolutional neural networks use convolutional layers to learn spatial feature hierarchies automatically and adaptively. Example: Facial recognition systems employ Convolutional Neural Networks (CNNs).
- **Deep Learning:** Deep Learning represents a machine learning domain that uses neural networks with multiple layers which are known as deep neural networks. Deep learning performs exceptionally well with image and speech recognition tasks. Example: Artificial assistants Siri and Alexa employ deep learning techniques to understand natural language.
- **Expert Systems:** Expert Systems refer to AI applications that duplicate the decision-making expertise of human specialists in particular fields. These systems make decisions by applying rules and storing knowledge bases. Example: Medical diagnosis systems that suggest treatments based on symptoms.
- **Fuzzy Logic:** Fuzzy Logic is a type of logic system which processes reasoning involving uncertain or inexact information. This type of logic models complex systems because traditional binary logic does not provide adequate solutions. Example: Washing machines use fuzzy logic controllers to adjust the washing cycle according to both load size and fabric type.
- **Generative Adversarial Networks (GANs):** Generative Adversarial Networks (GANs) represent machine learning frameworks that use two neural networks named generator and discriminator which compete to produce realistic synthetic data samples. Example: GANs generate realistic images which can create photorealistic portraits of imaginary people.
- **Heuristic Search:** Heuristic Search uses practical methods and shortcuts to solve problems by generating solutions quickly. Artificial Intelligence frequently applies heuristic search to obtain approximate solutions. Example: The A algorithm represents one

pathfinding solution for game development applications.

- **Image Recognition:** Image Recognition works by applying machine learning algorithms to detect and categorize objects, people, or scenes in images. Example: Security systems use image recognition technology to find and recognize people in surveillance video feeds.

- **Joint Probability Distribution:** Joint Probability Distribution measures the likelihood of multiple random variables occurring together. Example: Bayesian networks apply these models to show the probabilistic connections between different variables.

- **Knowledge Representation:** Knowledge Representation refers to how information and relationships about the world are organized and stored so AI systems can use them for reasoning and making decisions. Example: Semantic web technologies make use of ontologies to describe connections between various concepts.

- **Long Short-Term Memory (LSTM):** The Long Short-Term Memory (LSTM) network represents a recurrent neural network architecture specially designed to learn long-term dependencies. Time-series data processing and prediction tasks benefit from this model. Example: Language models utilize LSTMs for text prediction and translation tasks.

- **Machine Learning:** Machine Learning represents AI's subdivision where algorithms teach computers to learn from data for making predictions. Example: Email spam filters use machine learning to detect and block unwanted messages.

- **Natural Language Processing (NLP):** Natural Language Processing (NLP) represents an artificial intelligence domain that gives computers the ability to interpret and produce human language. Example: Virtual assistants and chatbots which are designed to comprehend and reply to questions from users.

- **Optimization Algorithms:** Techniques which help find the best possible solution from among multiple choices while dealing with constraints are known as Optimization Algorithms. Example: Engineers apply genetic algorithms to solve optimization problems in design solutions.

- **Perceptron:** The Perceptron represents the most basic form of artificial neural network which operates for binary classification purposes. This artificial neural network has just one neuron layer. Example: Researchers used an initial version of the perceptron in the 1950s to identify elementary patterns.

- **Q-Learning:** Q-Learning represents a reinforcement learning method that discovers the best action-selection policy for finite Markov decision processes (MDPs). Example: AI agents for games including Atari video games receive their training through the use of Q-Learning.

- **Reinforcement Learning:** Reinforcement Learning refers to machine learning techniques where agents learn optimal actions within an environment by aiming to accumulate the highest total reward. Example: Autonomous robots apply reinforcement learning algorithms to successfully operate and accomplish tasks inside changing environments.

- **Supervised Learning:** During supervised learning the machine learning model uses labeled data to learn input-output mappings from example input-output pairs. Example: Machine learning models for image classification are developed from datasets containing labeled images paired with their correct labels.
- **Transfer Learning:** Transfer Learning applies knowledge from a pre-existing model that was trained on one task to solve another task that has similarities to the original task. Example: A pre-trained image recognition model was first trained on a large dataset before it was fine-tuned to perform medical image analysis.
- **Unsupervised Learning:** Unsupervised Learning refers to the machine learning method where models discover hidden structures in data that lacks predefined labels. Example: K-means clustering algorithms group similar customer profiles together in marketing applications.
- **Variational Autoencoder (VAE):** Variational Autoencoder (VAE) represents a generative model which encodes data into latent space before decoding it to reproduce the original space enabling new data generation. Example: Variational Autoencoders find applications in the synthesis of music and creation of new images.
- **Weak AI:** AI systems that are designed to perform specific tasks are known as weak AI which is also called narrow AI. Example: A system that offers personalized product suggestions for online shopping websites.
- **Explainable AI (XAI):** Explainable AI (XAI) represents the techniques and methods created to make AI model operations and decisions clear to human users. Example: Models which generate explanations for their predictions enable users to understand the reasoning behind specific decisions.
- **YOLO (You Only Look Once):** YOLO (You Only Look Once) processes images and videos to detect and classify objects during a single operational pass. Example: Autonomous vehicles use YOLO to identify pedestrians and other road objects.
- **Zero-shot Learning:** Zero-shot Learning enables models to predict classes they have not been trained on by transferring knowledge from related classes. Example: Classification of unknown animal species is possible through the application of existing knowledge about analogous familiar species.

Terms and definitions from completed course - 6251-ITAI-1371-Intro to Machine Learning and searches through Google, ChatGPT and Copilot.