

Midterm Exam Glossary

Term Project

Jeffery Dirden

ITAI 1370

Maryam Esmalifalak

Module 1:

Introduction to A.I.

1. Artificial Intelligence (AI)



Artificial Intelligence

Artificial intelligence (AI) is technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity and autonomy.



Examples of Artificial Intelligence

Google Maps / Apple Maps uses AI enabled mapping that scans road information and uses algorithms to determine the best route to take.

iRobot is a **smart vacuum** that uses AI to scan room size, identify obstacles, and it also remembers the most efficient routes for cleaning.

Grammarly provides AI powered writing assistance.

A lot of use **Facial Recognition** on our personal devices for security reasons which is also a common form of Artificial Intelligence.

Chatbots that interact with customers providing assistance and information to clients.

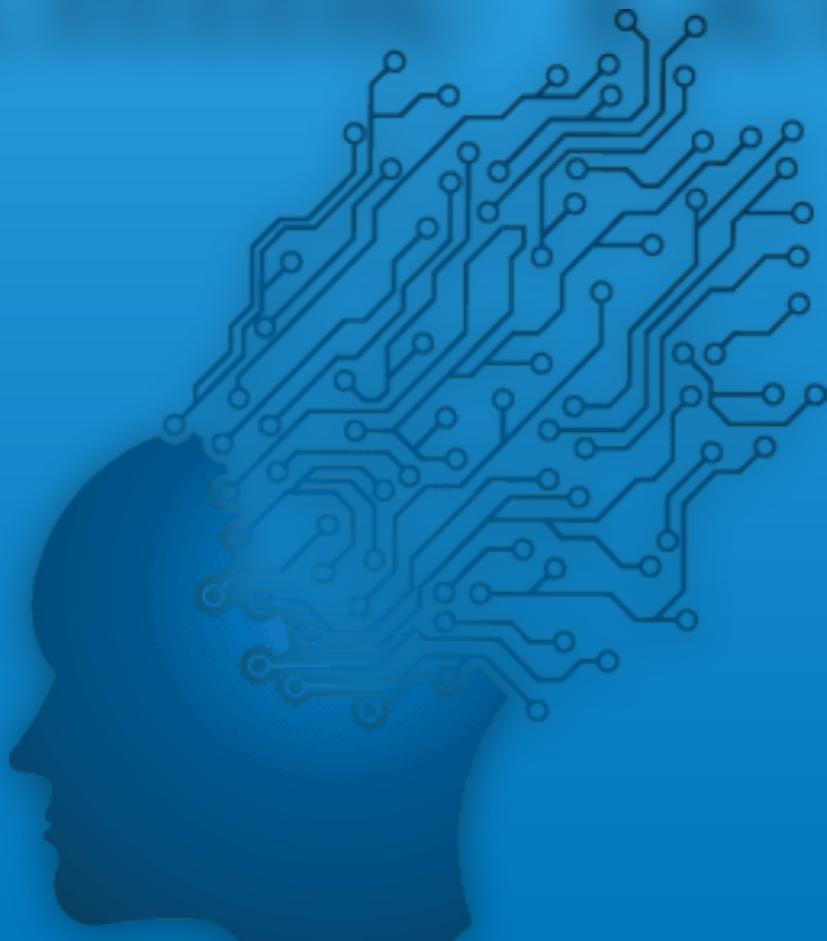
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2. Machine Learning



Machine Learning

Machine learning is a subfield of artificial intelligence that uses algorithms trained on data sets to create models that enable machines to perform tasks that would otherwise only be possible for humans, such as categorizing images, analyzing data, or predicting price fluctuations.

Examples of Machine Learning

Recommendation Systems use machine learning algorithms to recommend music, movies, shows, and etc, based on your previous listening and viewing history. Websites track your behavior and recognize patterns in your browsing history.

Image Recognition can identify an object or person based on the intensity of the pixels.

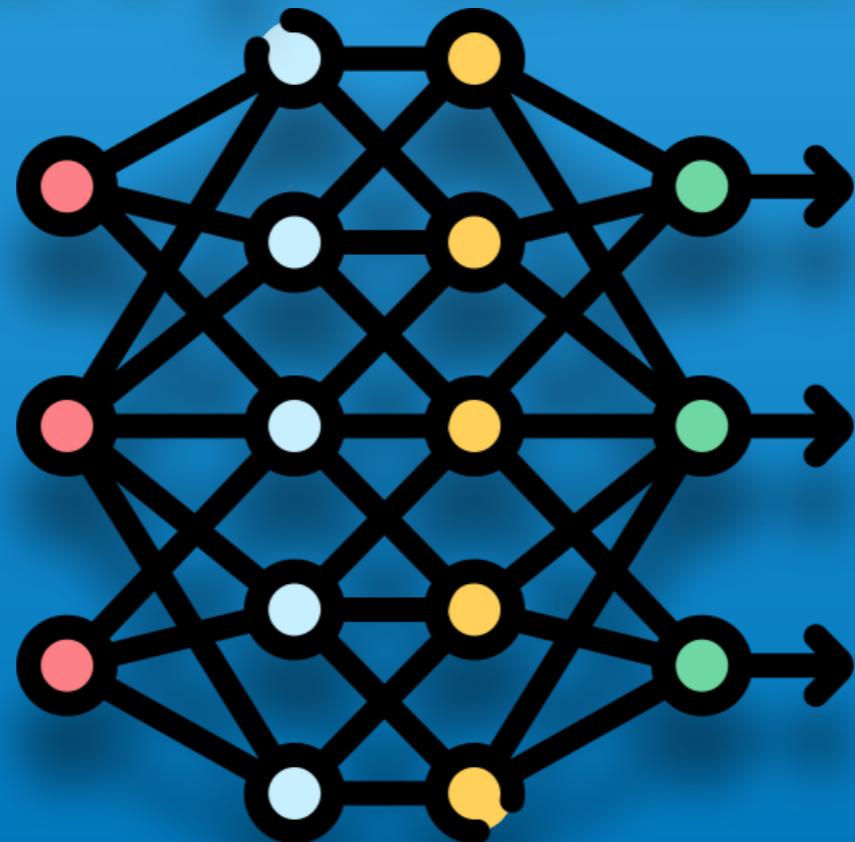
Stock Market Predictions, predictive analytics and algorithmic trading are common in machine learning.

Self-driving car technology uses machine learning sensors to collect data of the cars surroundings, and environments. This helps the respond in different real time situations.

Machine Learning Sources

- Staff, C. (2024, March 27). *What Is Machine Learning? Definition, Types, and Examples*. Coursera. https://www.coursera.org/articles/what-is-machine-learning?utm_source=gg&utm_medium=sem&utm_campaign=B2C_NAMER_google_FTCOF_professional-certificates_pmax-enhanced-NRL-w/in-14d-new-cust-country-US-country-CA&campaignid=20388318227&adgroupid=6472791487&device=c&keyword=&matchtype=&network=x&devicemodel=&adposition=&creativeid=6472791487&hide_mobile_promo&gad_source=1&gclid=CjwKCAjwyfe4BhAWEiwAkIL8sBwpEUweT8fq_wdGRVUvHBrhqX4GITXBZtkFBCe4Cw5ggqVZvV2GxRoC5U0QAvD_BwE
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3. Deep Learning



Deep Learning

Deep learning is a method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain. Deep learning models can recognize complex patterns in pictures, text, sounds, and other data to produce accurate insights and predictions. You can use deep learning methods to automate tasks that typically require human intelligence, such as describing images or transcribing a sound file into text.

Examples of Deep Learning

Deep learning is a subset of machine learning that requires less human intervention. Some examples include:

Neural Networks, Fraud Detection, Financial Services.

Natural language processing is an important part of deep learning applications that rely on interpreting text and speech. Customer service chatbots, language translators, and etc, are all examples of an application benefitting from NLP and deep learning.

Industrial in deep learning applications helps keep workers safe in factories by having machine to detect dangerous situations, such as when objects or people are too close to the machines.

Deep Learning Sources

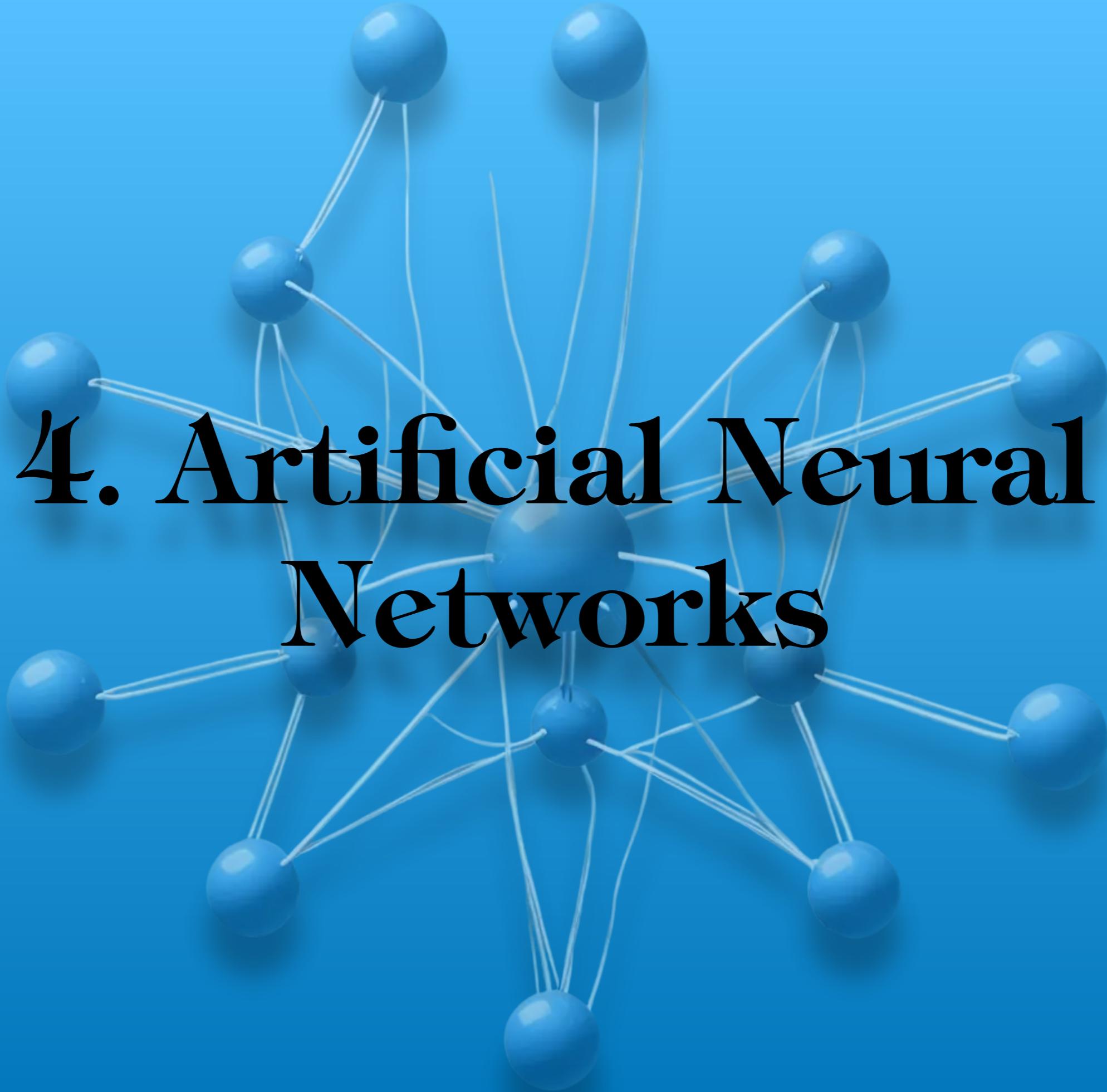
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MODULE 2:

Introduction to A.I. – The Big Issues

4. Artificial Neural Networks



Artificial Neural Networks

A neural network is a machine learning program, or model, that makes decisions in a manner similar to the human brain, by using processes that mimic the way biological neurons work together to identify phenomena, weigh options and arrive at conclusions.

Examples of Artificial Neural Networks

Image Classification using a Convolutional Neural Network (CNN). An example would be using the CIFAR-10 dataset a CNN can distinguish different classes like cat, dog, airplane etc.

Recurrent Neural Network (RNN) for Text Generation. RNNs are designed to handle sequential data by retaining information from previous steps, making them ideal for tasks with temporal dependencies. Text generation, such as generating sentences or entire paragraphs in a certain style or context. For instance, given a few lines of Shakespearean text, an RNN can learn to produce new text in a similar style.

Generative Adversarial Network (GAN) for Image Synthesis GANs consist of two networks: a generator, which creates images, and a discriminator, which tries to distinguish between real and generated images. The two networks train together in a "game" to improve the generator's outputs.

Artificial Neural Networks

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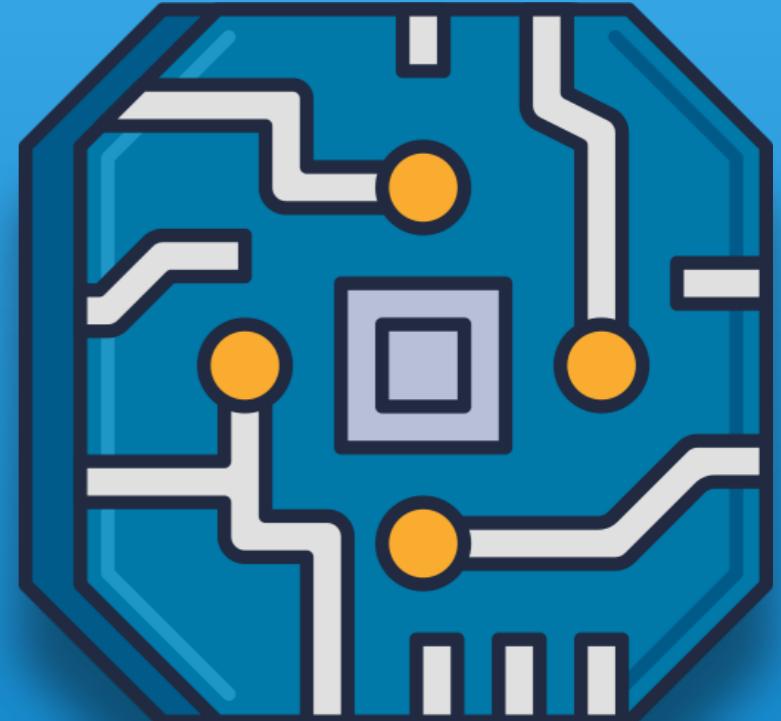
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Chollet, F. (2018). *Deep Learning with Python*. Manning Publications.

5. Cybernetics

Cybernetics

Cybernetics is the scientific study and mathematical modeling of regulation and control in systems, focusing on the flow of information and how it is used by the system to control itself. It has applications in various fields such as artificial intelligence, robotics, and systems science.



Examples of Cybernetics

Home thermostats are operated by cybernetics principles, which use feedback loops to regulate heating or cooling in order to maintain a certain temperature.

Biological Prosthetics: Sensor-equipped prosthetic limbs allow for controlled movement by using input from muscle impulses.

Autonomous Vehicles: Cybernetic feedback systems are used by self-driving automobiles to analyze sensor data, adjust to their surroundings, and make judgments.

Ecological Monitoring Systems: Feedback systems monitor and react to changes in the environment, such as pollution levels.

Organizational Management Systems: To sustain performance, businesses employ cybernetic concepts in decision-making, communication feedback loops, and adaptive tactics.

Cybernetics Sources

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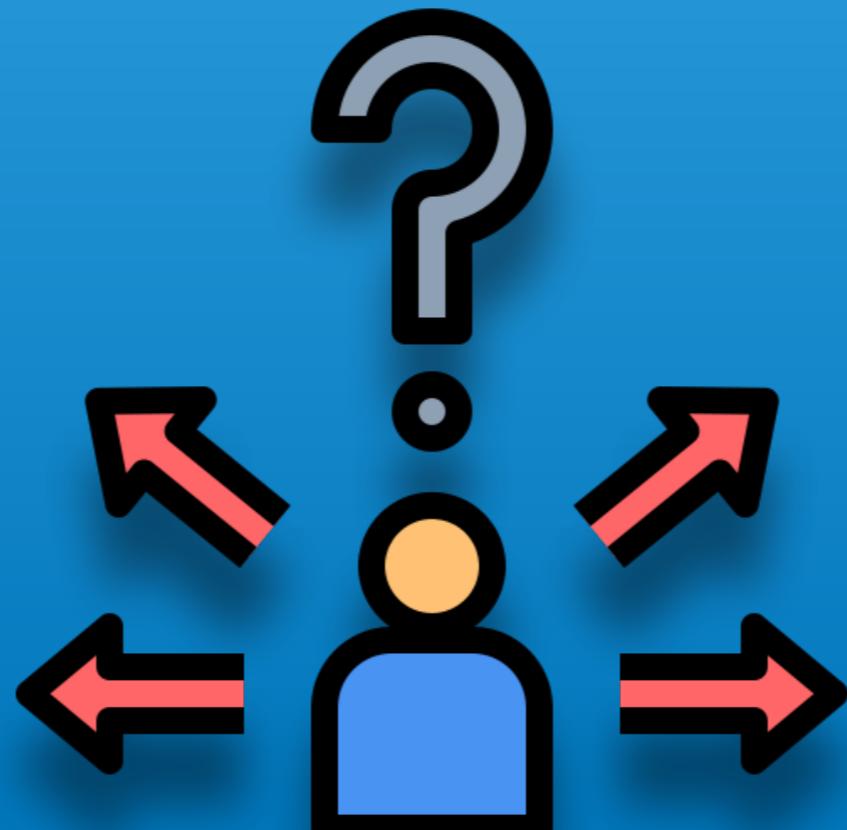
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Module 3:

Games, Prelude to A.I.

6. Decision Theory



Decision Theory

A branch of statistical theory concerned with quantifying the process of making choices between alternatives



Examples of Decision Theory

By evaluating clinical literature and patient data, IBM's Watson for Oncology uses AI to assist doctors in suggesting individualized cancer treatment plans. It evaluates medical data, finds therapy alternatives, and rates them according to the strength of the evidence. It was created in partnership with Memorial Sloan Kettering. Watson's increasing importance in improving treatment by cutting down on clinical trial screening time is shown by its use in hospitals both locally and internationally. Also, this technology helps detect genetic abnormalities that might affect clinical trials and treatment choices.

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MODULE 4:

Games Change Everything

7. Virtual Reality (VR)



Virtual Reality

Virtual reality, or VR, is a simulated three-dimensional (3D) environment that lets users explore and interact with a virtual surrounding in a way that approximates reality, as it's perceived through the users' senses. The environment is created with computer and software, although users might also need to wear devices such as goggles, headsets or bodysuits to interact with the environment.

Examples of Virtual Reality

Gaming of course is very popular in the VR field. VR games immerse player in 3D environments, giving realistic interactions.

In education you can launch virtual VR labs for a more fun learning experience.

VR is used for surgical simulations, and an array of many more things.

In real estate VR has become very popular, you are allowed to engage in virtual 3D tours of properties giving a more exciting and in depth experience versus just looking at photos.



Virtual Reality (VR) Sources

Yasar, K., & Sheldon, R. (2024, August 14). *What is virtual reality? How it's used and how it will evolve*. WhatIs. <https://www.techtarget.com/whatis/definition/virtual-reality>

Journeys, V. (n.d.). *Top 10 Virtual Reality Examples - What is it used for?* Virtual Journeys. <https://virtualjourneys.co.nz/f/top-10-virtual-reality-examples---what-is-it-used-for>

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8. Augmented Reality (AR)

Augmented Reality

Augmented reality (AR) is an interactive experience that combines the real world and computer-generated 3D content.



Examples of Augmented Reality

Pokemon Go attracted a lot of attention for its immersive experience, it was released at a time when augmented reality was starting to gain popularity. The game's interactive elements, which included using an app to hunt virtual Pokemon in the real world, were liked by both adults and kids worldwide.

With **Ikea furniture placements** you can see how the sofa you're thinking about buying will look in your living room with its specific measurements and other items using augmented reality. To see the ideal setup, you may select several places for the plan.

Home Depot's color options lets you experiment with alternative color schemes and paint ideas by changing the color of your walls using AR.

There are a number of **augmented reality applications** that let you try on clothing and footwear, Adidas may have been the first. The business launched an app that let people digitally put on shoes to see how they look.



Augmented Reality Sources

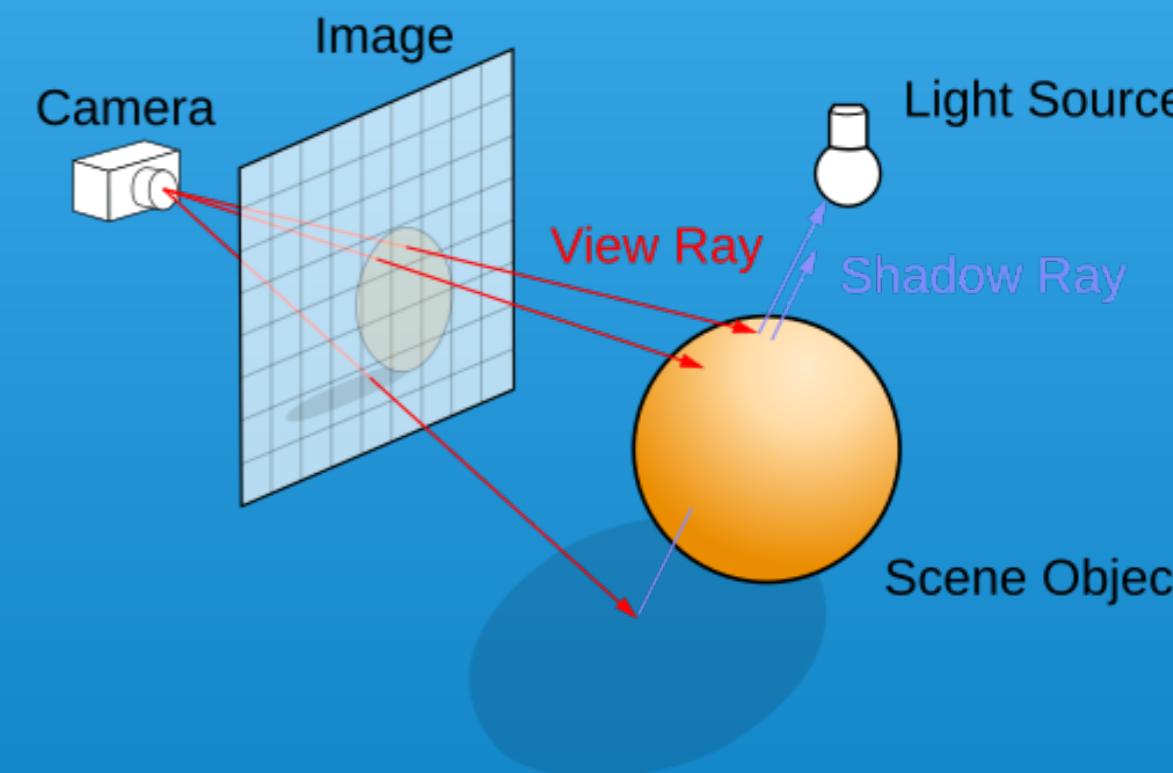
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<https://www.coursera.org/articles/augmented-reality-examples>

9. Raytracing

Raytracing

Ray tracing is a rendering technique that can realistically simulate the lighting of a scene and its objects by rendering physically accurate reflections, refractions, shadows, and indirect lighting. Ray tracing generates computer graphics images by tracing the path of light from the view camera (which determines your view into the scene), through the 2D viewing plane (pixel plane), out into the 3D scene, and back to the light sources.



Examples of Raytracing

Ray tracing is frequently used in computer generated imagery (CGI) for movies to provide lifelike lighting, shadows, and reflections, as seen in animated films such as Frozen and Toy Story.

Video games use ray tracing to create realistic lighting effects in games.

Architects use ray tracing to create photorealistic pictures of structures.

Businesses use lighting and material simulations in virtual product design to preview how their products will look.

Raytracing Sources

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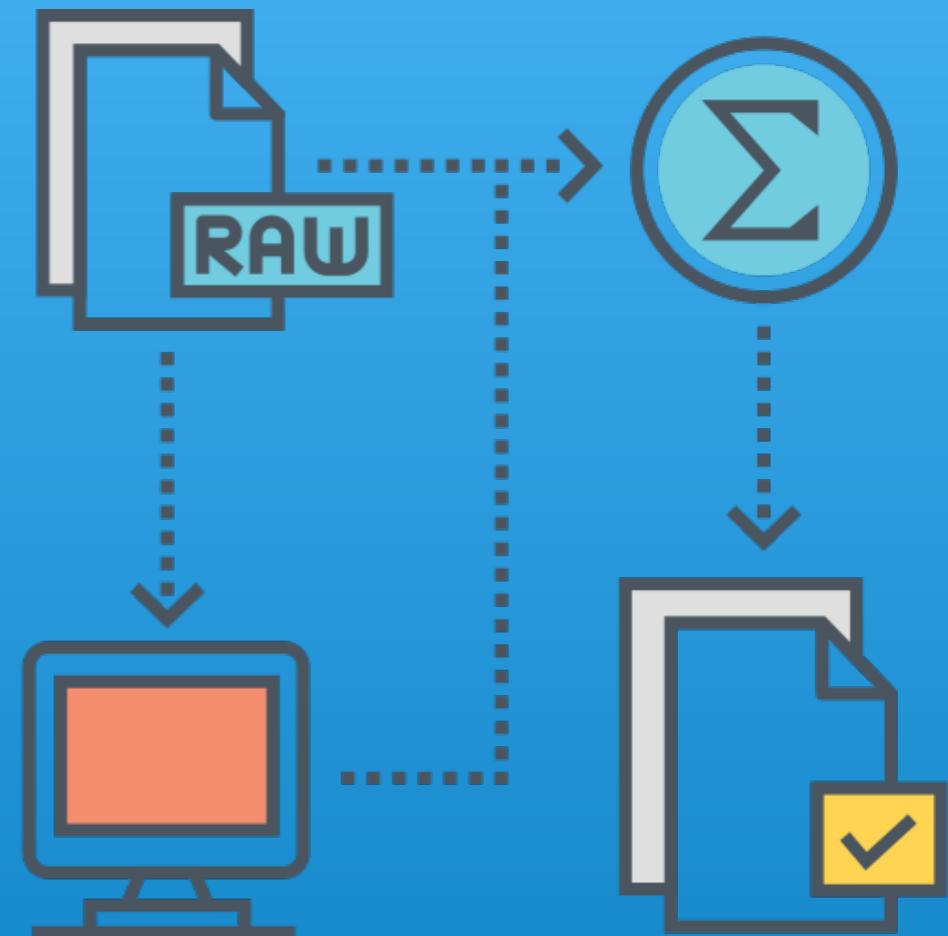
Module 5:

Machine Learning – The Data

10. Supervised Learning

Supervised Learning

Supervised learning is a type of machine learning algorithm that learns from labeled data. Labeled data is data that has been tagged with a correct answer or classification.

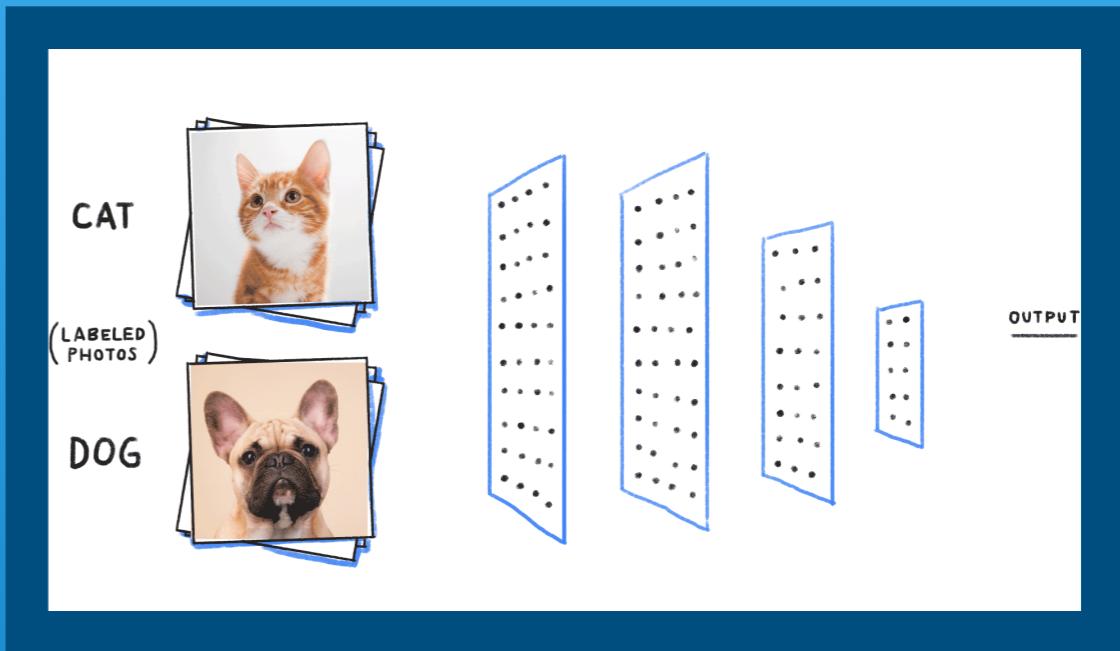


Examples of Supervised Learning

Email Spam Detection labels datasets with attributes like the sender details, subject lines, and email substance are used by machine learning models to determine if an email is spam or not.

Image Classification, computer vision tasks like categorizing pictures (e.g., cats vs. dogs) often use supervised learning.

Supervised learning is used in **credit scoring** to estimate the chance of a borrower failing on a loan, financial institutions employ supervised learning. To create forecasts, models such as logistic regression and decision trees examine past information, such as income, credit history, and loan amounts.



Supervised Learning Sources

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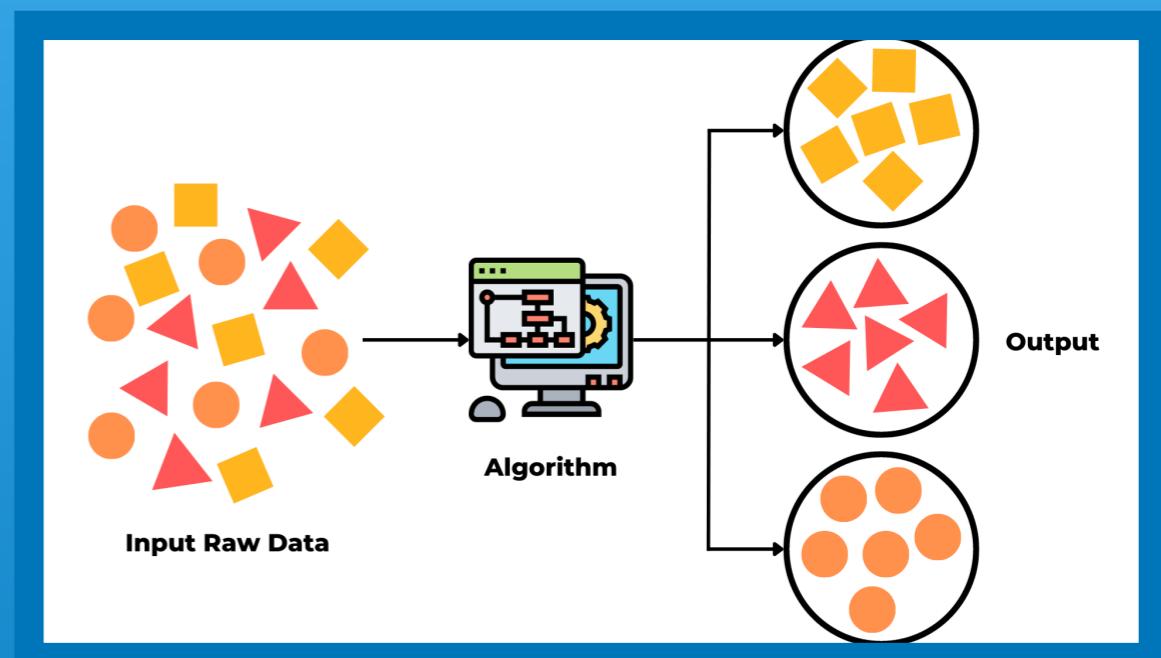
11. Unsupervised Learning

Unsupervised Learning

Unsupervised learning is a type of machine learning that learns from unlabeled data.

This means that the data does not have any pre-existing labels or categories.

The goal of unsupervised learning is to discover patterns and relationships in the data without any explicit guidance.

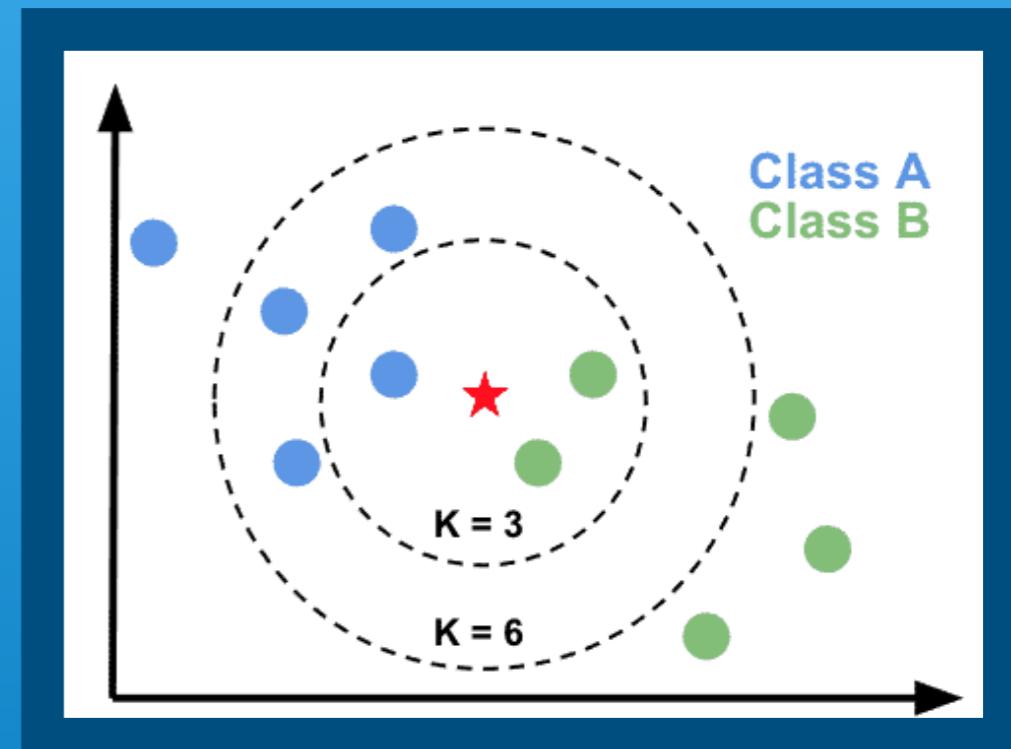


Examples of Unsupervised Learning

Customer segmentation for example, companies categorize clients according to demographics, purchasing patterns, or other attributes using clustering methods such as K-means. This helps in customizing marketing tactics for various client groups.

Unsupervised learning is used in fraud detection to find odd patterns that could point to fraudulent activity. For example, transactions that differ from normal user behavior might be flagged by models.

Large text data sets may be analyzed via unsupervised learning to find themes or topics in texts. In natural language processing jobs, algorithms such as Latent Dirichlet Allocation (LDA) are frequently employed.



Unsupervised Learning Sources

GeeksforGeeks. (2024, September 23). *Supervised and Unsupervised learning*. GeeksforGeeks. <https://www.geeksforgeeks.org/supervised-unsupervised-learning/>

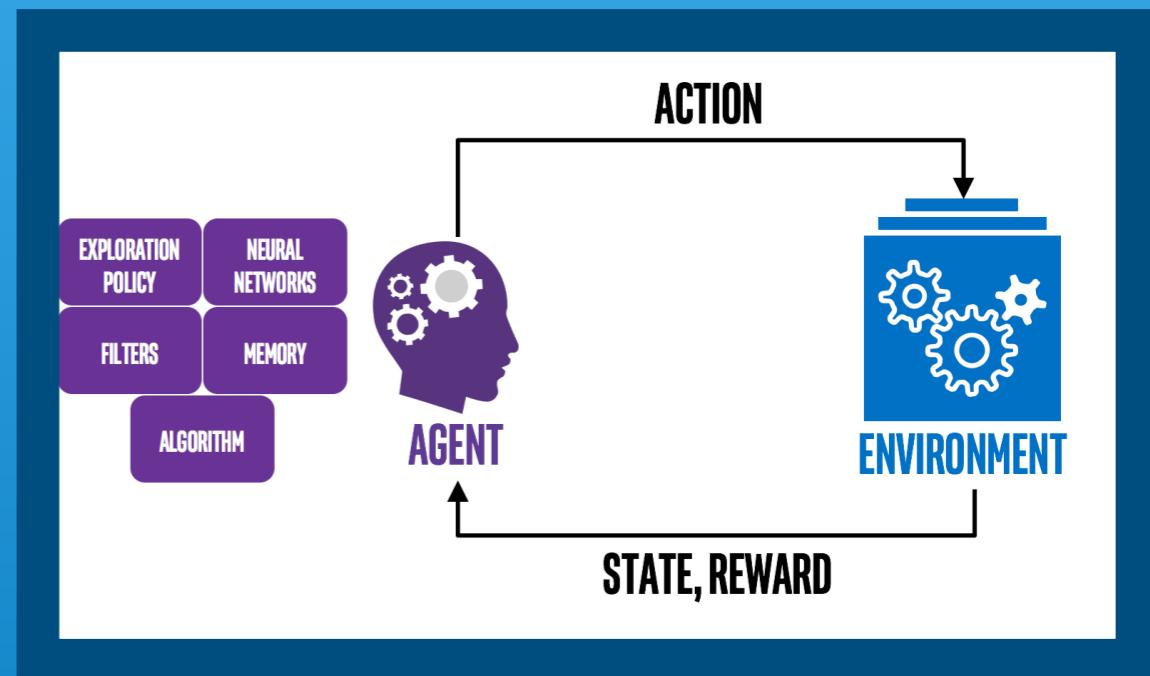
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12. Reinforcement Learning

Reinforcement Learning

Reinforcement learning (RL) is a machine learning technique that trains software to make decisions to achieve the most optimal results. It mimics the trial-and-error learning process that humans use to achieve their goals.



Examples of Reinforcement Learning

In video games AlphaGo developed by DeepMind, uses reinforcement learning to play the board game Go. It learned strategies by playing against itself and achieved a historic victory against the world champion.

In robotics, reinforcement learning is used for tasks like autonomous navigation and manipulating robotic arms. Robots gain their skills through trial and error, modifying their behavior in response to input from their environment.

In medicine, reinforcement learning is used to optimize patient treatment programs. The efficiency of treatment can be increased by using algorithms to recommend the optimal medication doses depending on patient reactions and results.

Reinforcement Learning Sources

What is Reinforcement Learning? - Reinforcement Learning Explained - AWS. (n.d.). Amazon Web Services, Inc. <https://aws.amazon.com/what-is/reinforcement-learning/>

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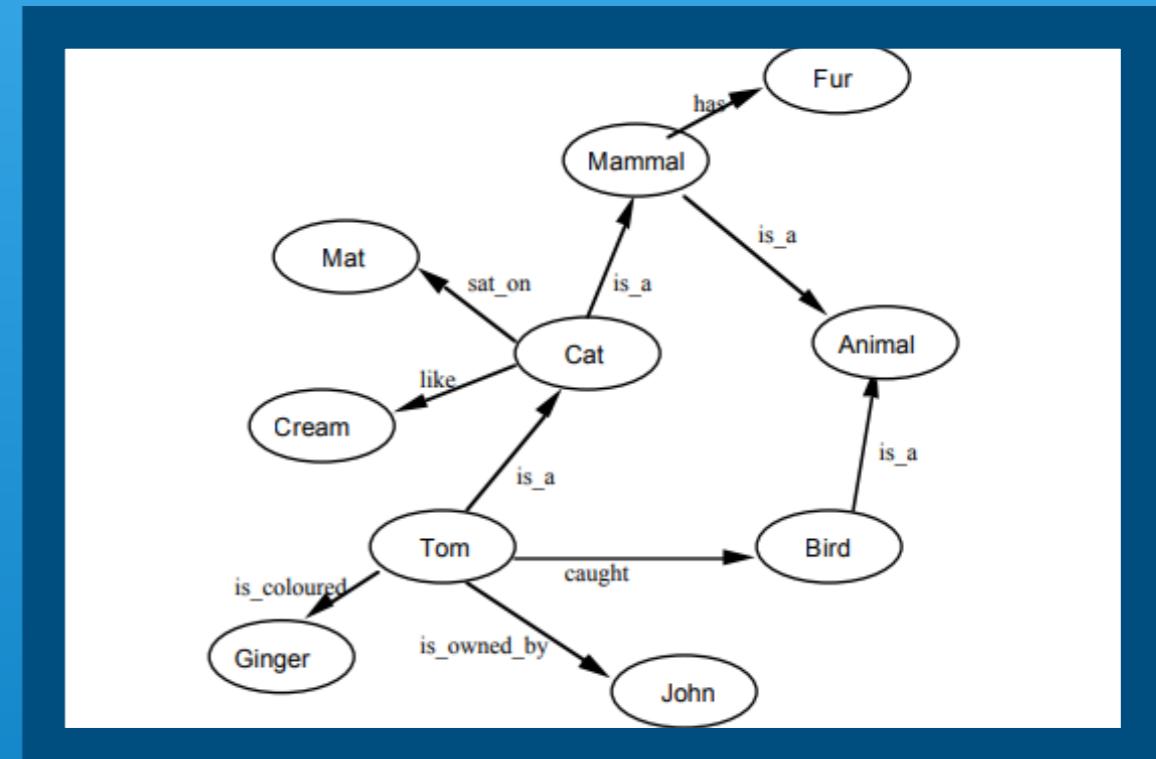
MODULE 6:

Machine Learning – The Pipeline

13. Semantic Network

Semantic Network

A semantic network is a graphic representation used to represent knowledge or support reasoning systems. It is a declarative notation that can be applied in various disciplines, including artificial intelligence, philosophy, psychology, and linguistics.



Examples of Semantic Networks

One of the most well-known semantic networks is WordNet, which groups English words into synsets, or collections of synonyms, and offers linkages and meanings. It is often employed in jobs involving natural language processing.

Semantic networks may also be thought of as social networks, such as Facebook and LinkedIn, where people (entities) are linked by a variety of relationships (friendships, professional connections, etc.).

Graph databases such as Neo4j and other technologies enable the dynamic representation of entities and interactions in semantic networks for a range of applications, from recommendation systems to social network research.

Semantic Network Sources

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