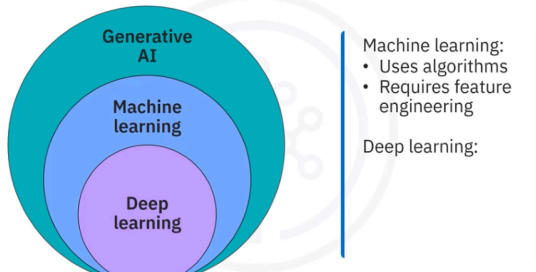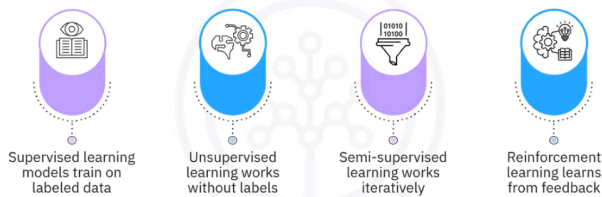# Module 1

Wednesday, July 02, 2025   11:37 PM
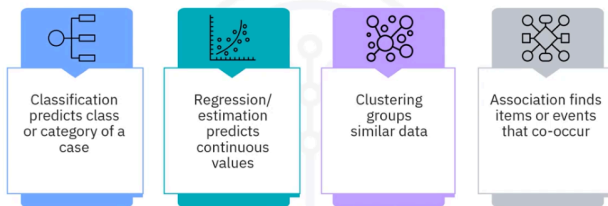
AI, machine learning, and deep learning

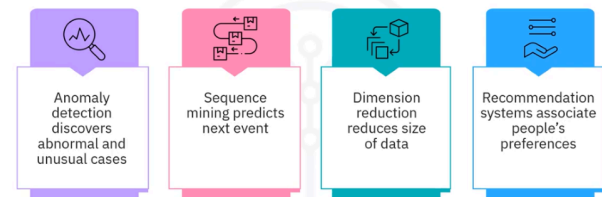Machine learning:
- Uses algorithms
- Requires feature engineering

Deep learning:

Machine learning paradigms

Supervised learning models train on labeled data

Unsupervised learning works without labels

Semi-supervised learning works iteratively

Reinforcement learning learns from feedback

Machine learning techniques

Classification predicts class or category of a case

Regression/estimation predicts continuous values

Clustering groups similar data

Association finds items or events that co-occur

Machine learning techniques

Anomaly detection discovers abnormal and unusual cases

Sequence mining predicts next event

Dimension reduction reduces size of data

Recommendation systems associate people's preferences

Classification and regression

Classification

Regression

Predicts class membership of new observations

Clustering

Cluster 1

Cluster 3

Cluster 2

Unsupervised machine learning technique
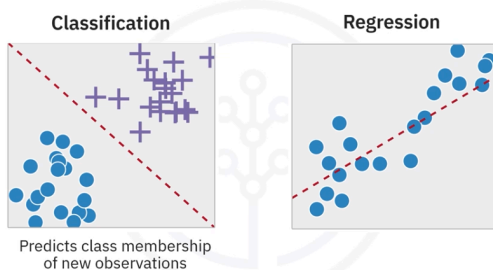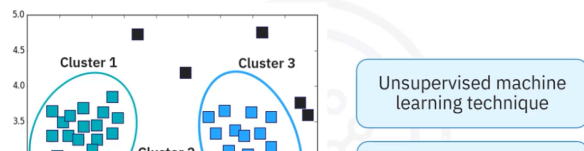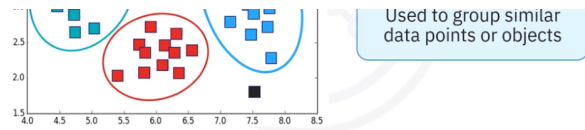
Applications of machine learning

- This human cell has some unique features
- It can be benign or malignant

ID	Clump	UnifSize	UnifShape	MargAdh	SingEpi Size	Bare Nuc	Bland Chrom	Norm Nucl	Mit	Class
1000015	6	1	1	1	7	1	3	1	1	
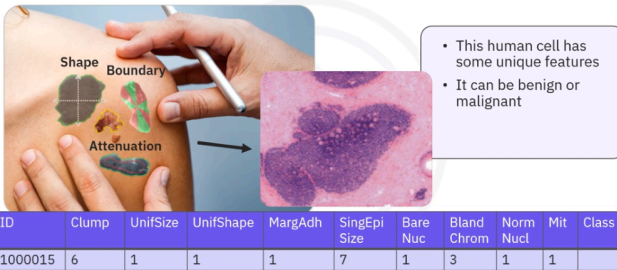
Machine learning programming language

Julia: Parallel and distributed numerical computing support

Scala: Processing big data and building ML pipelines

Java: Supporting scalable ML applications

JavaScript: Running ML models in web browsers
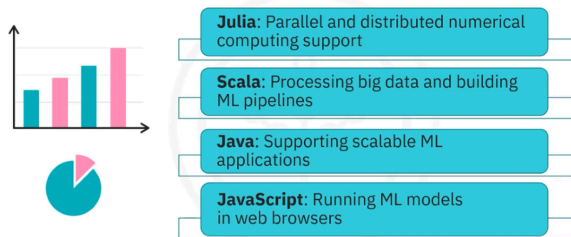
Module 1 Summary and Highlights

Congratulations! You have completed this lesson. At this point in the course, you know that:

- Artificial intelligence (AI) simulates human cognition, while machine learning (ML) uses algorithms and requires feature engineering to learn from data.
- Machine learning includes different types of models: supervised learning, which uses labeled data to make predictions; unsupervised learning, which finds patterns in unlabeled data; and semi-supervised learning, which trains on a small subset of labeled data.
- Key factors for choosing a machine learning technique include the type of problem to be solved, the available data, available resources, and the desired outcome.
- Machine learning techniques include anomaly detection for identifying unusual cases like fraud, classification for categorizing new data, regression for predicting continuous values, and clustering for grouping similar data points without labels.
- Machine learning tools support pipelines with modules for data preprocessing, model building, evaluation, optimization, and deployment.
- R is commonly used in machine learning for statistical analysis and data exploration, while Python offers a vast array of libraries for different machine learning tasks. Other programming languages used in ML include Julia, Scala, Java, and JavaScript, each suited to specific applications like high-performance computing and web-based ML models.
- Data visualization tools such as Matplotlib and Seaborn create customizable plots, ggplot2 enables building graphics in layers, and Tableau provides interactive data dashboards.
- Python libraries commonly used in machine learning include NumPy for numerical computations, Pandas for data analysis and preparation, SciPy for scientific computing, and Scikit-learn for building traditional machine learning models.
- Deep learning frameworks such as TensorFlow, Keras, Theano, and PyTorch support the design, training, and testing of neural networks used in areas like computer vision and natural language processing.
- Computer vision tools enable applications like object detection, image classification, and facial recognition, while natural language processing (NLP) tools like NLTK, TextBlob, and Stanza facilitate text processing, sentiment analysis, and language parsing.
- Generative AI tools use artificial intelligence to create new content, including text, images, music, and other media, based on input data or prompts.
- Scikit-learn provides a range of functions, including classification, regression, clustering, data preprocessing, model evaluation, and exporting models for production use.
- The machine learning ecosystem includes a network of tools, frameworks, libraries, platforms, and processes that collectively support the development and management of machine learning models.