Module 1

Current and Future Applications of Machine Learning

▼ What have modern ML techniques mostly evolved from?

statistical regression methods

▼ What type of method is classification?

supervised learning

▼ What does classification rely on?

being trained on pre-classified data in order to learn *features* of that data that correlate to a particular class

▼ What is binary classification?

it categorizes input into a boolean true/false statement, where the input either *is or is not*
 classified as a certain thing

▼ What is multiclass classification?

it classifies inputs based on confidence scores (usually displayed as percentages) and assigns a class to each input

▼ What does regression output?

real numbers

▼ How do regression models generally work?

they use independent variables and relationships between them to generate target prediction values

▼ What is linear regression?

it derives a prediction target for a dependent variable (the output) based on an independent variable (the input)

▼ What is logistic regression?

a form of linear regression you would use to **discover the optimal decision boundary separating classes** by <u>predicting the probability</u> that an input will <u>belong to a particular class</u>

▼ What is cluster analysis?

- an unsupervised technique
- instead of using predefined class labels, models utilizing cluster analysis group data points into "clusters"
- these data points are unlabeled, but using cluster analysis you can identify patterns in the variables and class inputs into unlabeled classes

▼ Where is cluster analysis often used?

in Expert Systems (ES) and Decision Support Systems (DSS) for its capability of identifying unknown similarities in highly variable datasets

▼ What are the essential steps of a ML task?

1. define the problem
2. identify and collect the data that you will need to perform analysis
3. decide which type of ML modeling technique will best suit your use case

▼ What are the two main use-cases for ML techniques?

intelligent information services and automation technology

▼ How is an expert system different from a decision support system?

an ES program provides a full solution rather than just visualizing relevant data, and determines how to make decisions based on rules in its program

▼ What is supervised learning?

learning wherein a model is trained on a pre-labeled (usually by a human) dataset consisting of input-output pairs

▼ What is unsupervised learning?

learning that does not rely on labeled data, and instead makes predictions based on probability densities that are calculated differently depending on the model

▼ What is semi-supervised learning?

uses small portions of labeled data in order to classify or correlate a larger amount of unlabeled data, making the unlabeled data more useful and the model more efficient

▼ What is self-supervised learning?

- learning that automatically labels unlabeled data
- this is done by using a supervised model to represent the specific task to the unsupervised model

▼ What are Generative Adversarial Networks (GANs)?

- algorithmic architectures that use two neural networks, pitting one against the other (thus the "adversarial") in order to generate new, synthetic instances of data that can pass for real data
- they are used widely in **image generation, video generation and voice generation**
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▼ What is multi-instance learning?

- a type of supervised learning that uses a technique known as "bagging"
- in this type of supervised learning, an entire collection of inputs is labeled together as either containing or not containing examples of a class, while individual members of the collection remain unlabeled

▼ What is reinforcement learning?

- it is difficult to categorize in terms of supervised or unsupervised
- it involves a system of feedback for the model to base its decisions on experience

- shaping the reward function is the key factor in the success of a reinforcement learning model; rewards define goals for the AI

▼ What is deep learning?

- deep learning is an extension of ML, usually utilizing ANNs

- it is a branch of ML that focuses on using layers on top of network layers to increase network size, increase complexity, and mimic biological neural networks more closely