1. Supervised learning is a type of machine learning where an algorithm learns from labeled data to make predictions or classify new, unseen data. The algorithm is trained on a dataset with input data and corresponding output labels, allowing it to learn patterns and relationships between the inputs and outputs.

   Example Application:

   Image Classification: Spam vs. Non-Spam Images

   Labeled Dataset: 10,000 images labeled as either "spam" (ads) or "non-spam" (legitimate content)
   Algorithm: Trained convolutional neural network (CNN)
   Goal: Classify new images as spam or non-spam

   The trained model can then be used to classify new images, automatically filtering out unwanted ads.

2. In Supervised Learning:

   Classification: Predicts categorical labels (classes) for new instances based on labeled training data.
    - Goal: Assign data points to predefined categories (e.g., spam/not spam emails).
    - Example: Image recognition (dog/cat).

   Regression: Predicts continuous numerical values for new instances based on labeled training data.
   - Goal: Forecast continuous outcomes (e.g., stock prices, temperatures).
   - Example: Predicting house prices based on features like size and location.

   In Unsupervised Learning:

   Clustering: Groups similar data points into clusters without labeled training data.

    - Goal: Identify patterns or structures within data.

   - Example: Customer segmentation based on buying behavior and demographics.

   Real-world clustering example:

   A retail company clusters customers into three groups based on purchase history and demographics:

- Cluster 1: Young, urban shoppers (frequent online purchases)
- Cluster 2: Suburban families (periodic bulk purchases)
- Cluster 3: Retirees (infrequent, discounted purchases)

This clustering helps the retailer tailor marketing strategies and product offerings to each group.

3. Categorical Data (qualitative):
- - Describes characteristics or categories
- - No inherent numerical value
- - Often represented as text or categories

Example: Color (Red, Blue, Green)

Numerical Data (quantitative):
- - Represents measurable values
- - Can be expressed as numbers
- - Can be used for mathematical operations

Example: Height (170 cm, 180 cm, 175 cm)