**Week 1 Assessment**

**1. What is Machine Learning (ML)?**

Machine Learning (ML) is a branch of Artificial Intelligence (AI) that gives computer systems the ability to automatically learn and improve from experience without being explicitly programmed. Instead of writing code with strict rules for every scenario, ML enables systems to learn from data and make decisions or predictions.  
  
At its core, machine learning involves feeding large volumes of data to an algorithm, which then analyzes the data, identifies patterns, and makes informed decisions based on that information. The more data the system processes, the better it becomes at identifying patterns and making accurate predictions.  
  
Machine learning powers many real-world applications such as:  
- Personalized recommendations on Netflix and YouTube  
- Credit card fraud detection  
- Self-driving cars  
- Voice assistants like Siri and Alexa  
- Image and speech recognition  
  
Three major types of Machine Learning:  
1. Supervised Learning – Learning with labeled data  
2. Unsupervised Learning – Finding patterns in unlabeled data  
3. Reinforcement Learning – Learning through reward and punishment in an environment

**2. What is a Supervised Machine Learning Algorithm?**

Supervised learning is the most common type of machine learning. In supervised learning, the algorithm is trained using a dataset that contains both the input features (independent variables) and the correct output (label or dependent variable). The algorithm learns to map inputs to the correct output using these examples.  
  
The term 'supervised' refers to the process of training the model under the supervision of a dataset that contains the correct answers. The aim is for the algorithm to generalize from the training data so that it can predict outputs for new, unseen inputs accurately.  
  
How it works:  
1. A labeled dataset is provided (e.g., images of cats and dogs labeled with their species).  
2. The algorithm learns from this dataset by minimizing the error between predicted and actual labels.  
3. Once trained, the model can be tested with new data to evaluate its performance.  
  
Applications:  
- Email spam detection  
- Sentiment analysis  
- Credit scoring and risk assessment  
- Diagnosis of diseases using patient data  
  
Common Algorithms:  
- Linear Regression  
- Logistic Regression  
- Support Vector Machines (SVM)  
- Decision Trees  
- Random Forest  
- k-Nearest Neighbors (k-NN)

**3. What is Regression and Classification?**

**A. Regression**

Regression is used when the target or output variable is a continuous numerical value. It helps predict quantitative data. The main goal is to estimate relationships among variables.  
  
Example Use Cases:  
- Predicting the price of a house based on its features  
- Estimating future sales based on market trends  
- Forecasting temperature or rainfall  
  
Common Regression Algorithms:  
- Linear Regression  
- Ridge and Lasso Regression  
- Decision Tree Regression  
- Support Vector Regression (SVR)  
  
Output: Real numbers (e.g., 15.5, 32000, 5.78)

**B. Classification**

Classification is used when the target variable is categorical (i.e., it belongs to a set of categories or classes). The model predicts a label or category for a given input.  
  
Example Use Cases:  
- Classifying emails as spam or not spam  
- Predicting if a loan will be approved or rejected  
- Recognizing whether a tumor is benign or malignant  
  
Types of Classification:  
- Binary Classification: Two classes (e.g., Yes/No, 0/1)  
- Multiclass Classification: More than two classes (e.g., predicting types of fruits: Apple, Banana, Orange)  
  
Common Classification Algorithms:  
- Logistic Regression  
- Decision Trees  
- k-Nearest Neighbors  
- Naive Bayes  
- Support Vector Machines (SVM)  
  
Output: Categories (e.g., 'Approved'/'Rejected', 'Dog'/'Cat')