**Experiment 1: Singular Value Decomposition (SVD)**

**What is SVD?**  
SVD is a technique to break a large matrix into smaller, simpler components for analysis.

**Example:** Compressing a large photo into its essential parts without significant quality loss.

**Where is SVD used?**

* **Image Compression:** Reduces file size while retaining clarity.
* **Netflix Recommendations:** Identifies patterns in user preferences to suggest movies.

**Experiment 2: Probability Density Functions (PDFs)**

**What are Gaussian, Uniform, and Exponential PDFs?**

* **Gaussian:** Bell-shaped curve (e.g., IQ scores, where most are average).
* **Uniform:** Equal chances for all outcomes (e.g., rolling a fair die).
* **Exponential:** Models events where short times are more likely (e.g., light bulb lifespan).

**What are skewness and kurtosis?**

* **Skewness:** Shows if data leans left or right (e.g., tough exams are right-skewed).
* **Kurtosis:** Measures peak sharpness or flatness (e.g., lotteries have high kurtosis).

**Experiment 3: Logistic Regression**

**What is Logistic Regression?**  
It predicts binary outcomes, such as yes/no or 1/0.

**Example:** Predicting if a customer will buy a product based on age and income.

**How is it different from linear regression?**  
Linear regression predicts numbers, while logistic regression predicts categories.

**Is it supervised or unsupervised?**  
Supervised, as it learns from labelled data with known outcomes.

**Experiment 4: Multivariate Linear Regression**

**What is multivariate linear regression?**  
It predicts a result using multiple factors.

**Example:** Predicting house prices based on size, location, and age.

**How do we measure how good the model is?**

* **R-squared:** Explains the percentage of variation (e.g., 80% means R² = 0.8).
* **MSE:** Measures prediction errors; lower is better.

**How to find the best-fit line?**  
By minimizing the prediction errors during training.

**Experiment 5: Exploratory Data Analysis (EDA)**

**What is EDA?**  
EDA involves analysing data to find patterns, relationships, or errors.

**Example:** Checking student scores to identify problem areas in specific subjects.

**How does Seaborn help?**  
Seaborn creates attractive visualizations like scatter plots, bar charts, and heatmaps.

**Example:** Plotting scores in math vs. science to find correlations.

**Experiment 6: ROC Curve and AUC**

**What is an ROC curve?**  
It’s a graph showing a model’s ability to separate groups (e.g., sick vs. healthy).

**Example:** Evaluating how well a blood test detects diseases.

**What is AUC?**  
AUC measures the area under the ROC curve; higher values mean better performance.

**Example:** AUC = 0.9 indicates 90% accuracy in distinguishing classes.

**What is a lift curve?**  
It compares model predictions to random guessing.

**Example:** A marketing model doubles the chance of finding potential customers.

**Experiment 7: Principal Component Analysis (PCA)**

**What is PCA?**  
PCA reduces data dimensions while retaining important information.

**Example:** From 10 survey questions, PCA can extract 2 key themes.

**Where is PCA used?**

* **Face Recognition:** Simplifies image data for faster recognition.
* **Stock Analysis:** Groups stocks with similar behaviour.

**Experiment 8: Algorithmic Trading Model**

**What is technical analysis?**  
It analyses past stock prices to predict future trends.

**Example:** Buying a stock that consistently rises after hitting a certain price.

**How does AI help in trading?**  
AI detects patterns and automates trades.

**Example:** Selling shares when AI predicts a sudden market drop.