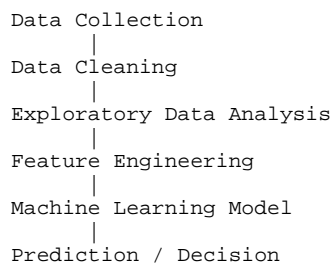


Machine Learning & Statistics for Data Science and Analytics

Full Theory + Exam Diagrams + Solved Numericals

1. Machine Learning – Theory

Machine Learning is a subset of Artificial Intelligence that allows systems to learn patterns from data and make predictions without explicit programming. In Data Science, ML is used for prediction, classification, clustering, and decision-making.



Types of Machine Learning

- 1) Supervised Learning
Input + Output → Model → Prediction
- 2) Unsupervised Learning
Input Data → Pattern / Clusters
- 3) Reinforcement Learning
Agent → Action → Environment → Reward → Agent

2. Statistics – Theory

Statistics is the foundation of data science. It involves collecting, analyzing, interpreting, and presenting data. Statistics helps understand data behavior before applying machine learning.

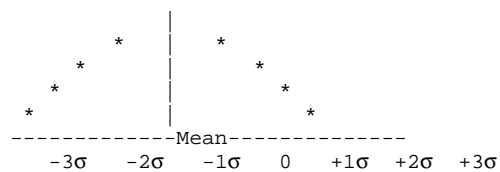
```
Raw Data
|
Descriptive Statistics
|
Exploratory Data Analysis
|
Probability & Distribution
|
Hypothesis Testing
```

Descriptive Statistics

```
Mean   = Sum of values / Total values
Median = Middle value
Mode   = Most frequent value
```

Standard Deviation shows spread of data around mean.

Normal Distribution (Exam Diagram)



3. Solved Numericals (ML + Statistics)

Numerical 1: Mean & Standard Deviation

Given data: 10, 12, 14, 16, 18

Mean = $(10+12+14+16+18)/5 = 14$

Standard Deviation measures how far values are from the mean.

Numerical 2: Probability

A die is rolled. What is the probability of getting an even number?

Even numbers = 2, 4, 6 (3 outcomes)

Total outcomes = 6

Probability = $3/6 = 0.5$

Numerical 3: Machine Learning – Accuracy

A model predicts 90 correct outputs out of 100 samples.

Accuracy = $(\text{Correct Predictions} / \text{Total Samples}) \times 100$

Accuracy = $(90/100) \times 100 = 90\%$

Numerical 4: Hypothesis Testing

If p-value = 0.03 and significance level $\alpha = 0.05$

Since p-value < α , we reject the Null Hypothesis.

4. Conclusion

Statistics explains data behavior, while Machine Learning uses that understanding to make predictions. Both together form the backbone of Data Science and Analytics.