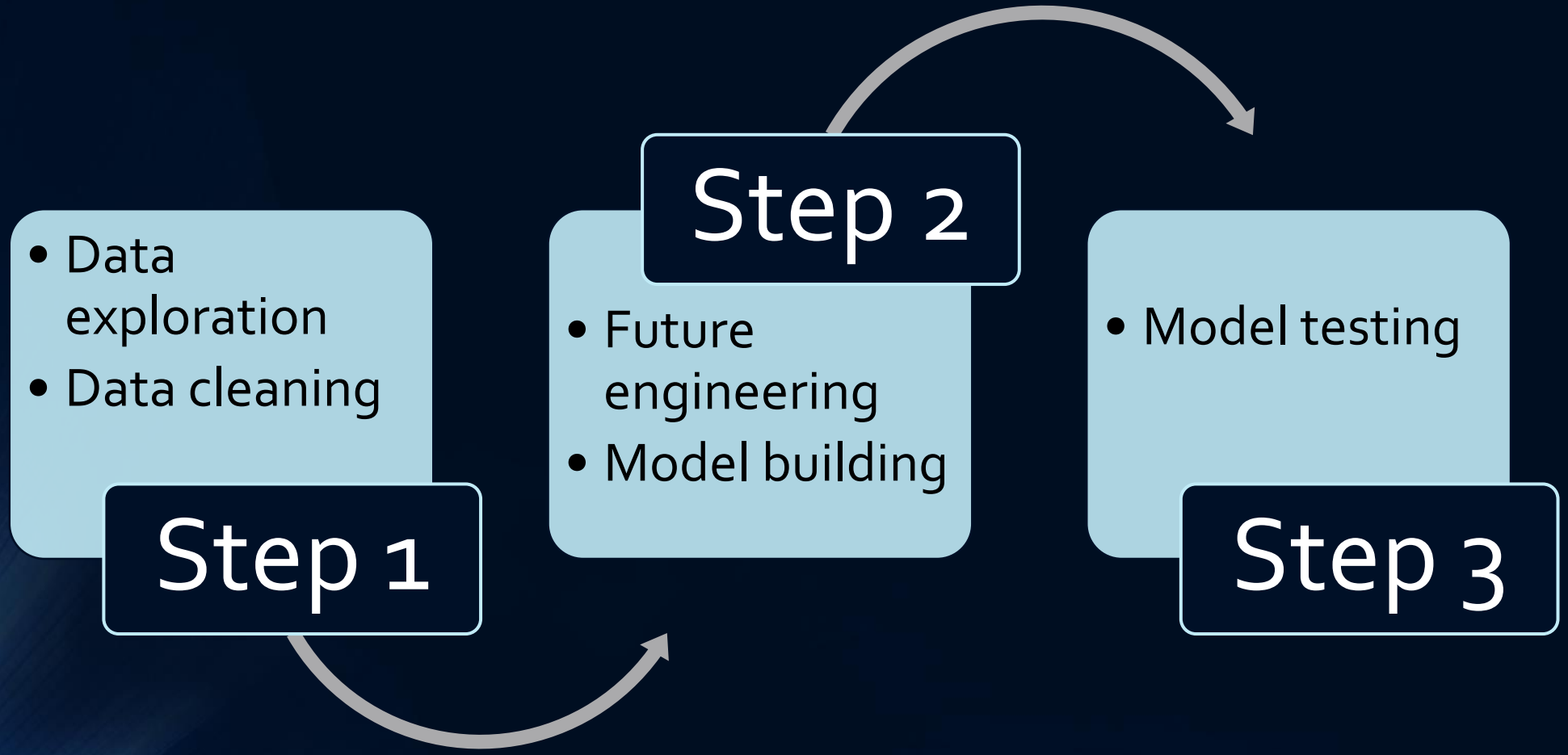
PRODUCT DEMAND PREDICTION WITH MACHINE LEARNING

- STEPS FOR OUR PROBLEM
- METHODOLOGY
- FORECASTING TECHNIQUES
- CONCLUSION


Step 1
• Data exploration
• Data cleaning
Step 2
• Future engineering
• Model building
Step 3
• Model testing

STEPS TO SOLVE THE PROBLEM

- ***Problem Definition and Data Collection***
- ***Data Preprocessing***
- ***Data Splitting***
- ***Model Selection***
- ***Model Training***
- ***Model Evaluation***
- ***Model Testing***
- ***Deployment***
- ***Monitoring and Maintenance***
- ***interpretability and Explainability***
- ***Scalability and Optimization***
- ***Feedback Loop***
- ***Documentation***
- ***Compliance and Security***
- ***Continuous Improvement***

PROBLEM DEFINITION AND DATA COLLECTION:

Define the problem you want to solve. In this case, it's predicting product demand. Gather historical data related to product sales, such as date, product attributes (type, price, etc.), and external factors (seasonality, promotions, economic indicators, etc.).

DATA PROCESSING:

Clean and preprocess the collected data. This includes handling missing values, outliers, and data transformation if necessary. Feature engineering: Create relevant features like lag features, rolling statistics, or one-hot encoding for categorical variables.

DATA SPILITTING:

Split your data into training, validation, and test sets. Common splits include 70-80% for training, 10-15% for validation, and 10-15% for testing.

MODEL SELECTION:

CHOOSE APPROPRIATE MACHINE LEARNING MODELS FOR DEMAND PREDICTION. COMMON CHOICES INCLUDE:

- Time series models (e.g., ARIMA, SARIMA, Prophet)
- Regression models (e.g., Linear Regression, Random Forest, XGBoost)
- Neural networks (e.g., LSTM, GRU)

MODEL TRAINING:

- Train the selected models using the training dataset.
- Optimize hyperparameters using techniques like grid search or Bayesian optimization.
- Evaluate models on the validation set using appropriate metrics (e.g., Mean Absolute Error, Root Mean Square Error).

MODEL TESTING:

- Assess the selected model's performance on the test set to estimate how it will perform in real-world scenarios.

METHODOLOGY

- *Time Series Analysis*
- *Regression Analysis*
- *Machine Learning Algorithms*
- *Deep Learning*
- *Seasonal Decomposition*
- *Prophet*
- *Bayesian Models*
- *Ensemble Methods*
- *Feature Engineering*
- *Anomaly Detection*

REGRESSION METHODOLOGY

A SET OF STATISTICAL PROCESS FOR ESTIMATING THE RELATIONSHIP BETWEEN A DEPENDENT VARIABLE AND ONE OR MORE INDEPENDENT VARIABLES

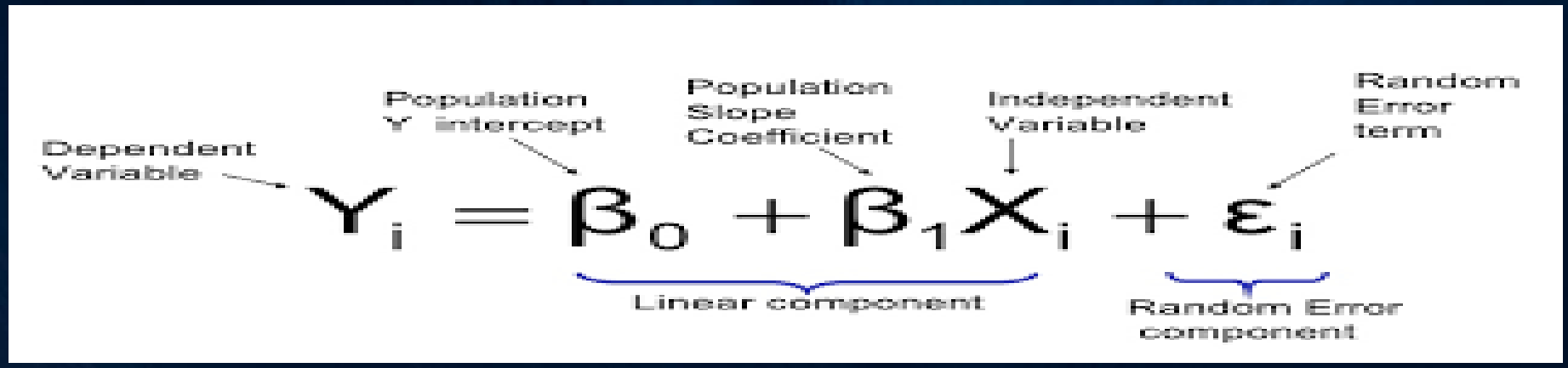


Fig : Regression Formula

MACHINE LEARNING METHODOLOGY

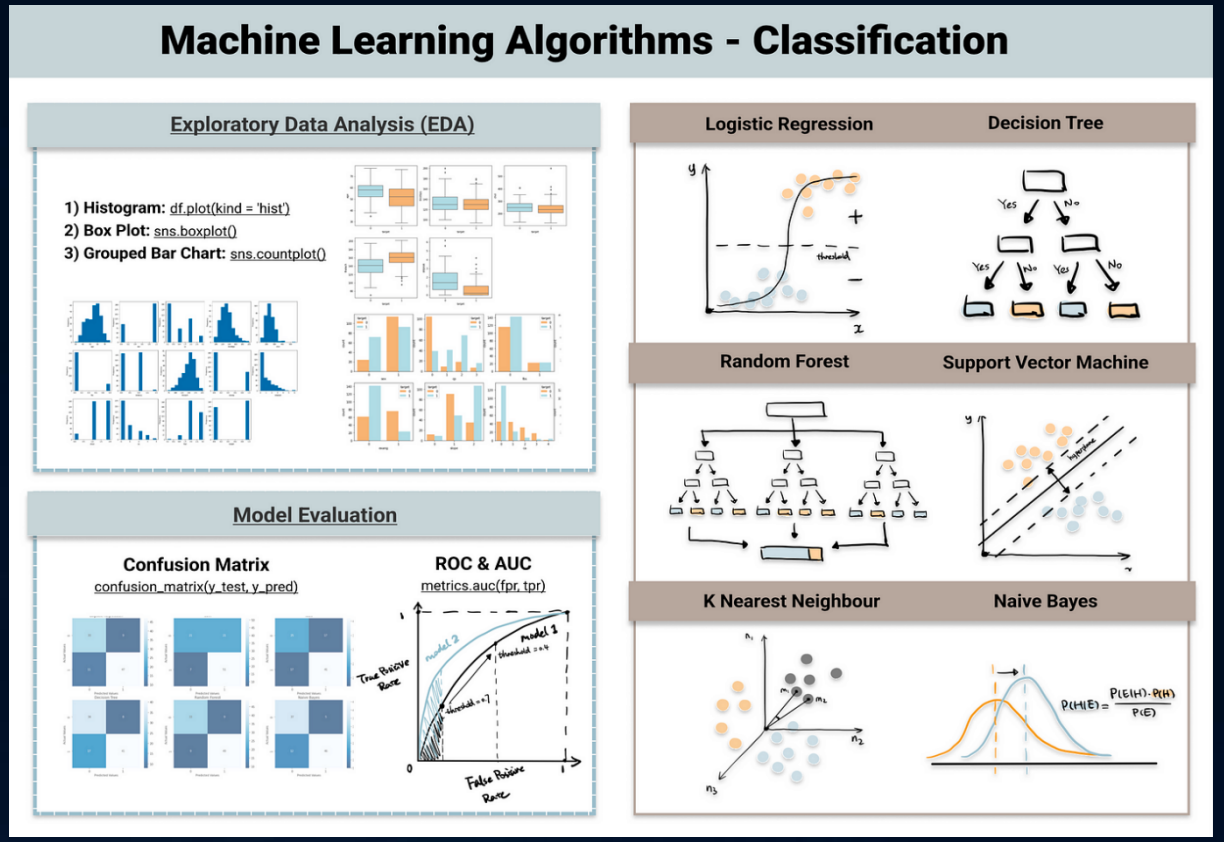


Fig : Machine Learning Algorithm-Classification

FORECASTING TECHNIQUES

- ***Data Collection and Preprocessing***
- ***Exploratory Data Analysis (EDA)***
- ***Train-Test Split***
- ***Model Selection***
- ***Hyperparameter Tuning (Optional)***
- ***ARIMA Modeling***
- ***Model Evaluation***
- ***Prophet Modeling***
- ***Forecasting (Optional)***
- ***Decision-Making and Inventory Management***

***DATA COLLECTION AND PREPROCESSING*:**

- Gather historical demand data for the product(s) you want to predict.
- Ensure the data is clean and contains a time series component (date or timestamp).
- Handle missing values and outliers appropriately.

EXLORATORY DATA ANALYSIS(EDA):

- Visualize the data to understand trends, seasonality, and any other patterns.
- Check for stationarity, which is a requirement for ARIMA modeling. You may need to perform differencing to achieve stationarity.

***TRAIN-TEST SPLIT*:**

- Split your data into a training set for model development and a testing set for evaluation.
- Typically, you would use older data for training and more recent data for testing.

***ARIMA MODELING*:**

- Choose the appropriate order (p, d, q) for your ARIMA model through ACF (Auto Correlation Function) and PACF (Partial Auto Correlation Function) plots or by using methods like grid search.
- Fit the ARIMA model to your training data.

MODEL EVALUATION:

- Use the ARIMA model to make predictions on your test set.
- Evaluate the model's performance using metrics like Mean Absolute Error (MAE), Mean Squared Error (MSE), or Root Mean Squared Error (RMSE).
- Consider visualizing the predictions alongside the actual demand to assess the model's accuracy.

PROPHET MODELING OPTION:

- Prophet is a forecasting tool developed by Facebook that can capture daily and yearly seasonality, holidays, and trend changes.
- Train a Prophet model on your demand data and evaluate its performance.

CONCLUSION

- Proper demand forecasting enables better planning and utilization of resources for business to be competitive
- Forecasting is an integral part of demand management since it provides an estimate of the future demand and the basis for planning and making sound business decisions.