**E-commerce Data Analytics & Forecasting Project**

**1. Project Overview**

**Objective:**  
Analyze an e-commerce dataset to uncover insights, optimize profits, and forecast future trends.

**Tech Stack:**

* **Languages:** Python
* **Libraries:** Pandas, NumPy, Matplotlib, Seaborn, Prophet
* **Tools:** Jupyter Notebook / VS Code

**Dataset:**  
Contains order-level data with sales, profit, quantity, discounts, product details, customer information, and timestamps.

**2. Step 1 — Data Import & Initial Overview**

* **Import dataset:** Successfully loaded with pandas.read\_csv().
* **View structure & columns:** Used df.head(), df.info(), df.columns.
* **Check data size:** df.shape revealed total rows and columns.
* **Initial summary:** df.describe() provided summary statistics for numeric columns.

**Key insight:** Initial check helps understand dataset completeness and numeric ranges.

**3. Step 2 — Data Cleaning**

* **Missing values:** Identified with df.isnull().sum(). Handled via deletion or imputation.
* **Duplicate entries:** Removed using df.drop\_duplicates().
* **Correct data types:** Converted object columns to category and float as needed.
* **Date columns:** Converted Order\_Date to datetime using pd.to\_datetime().
* **Outliers:** Analyzed via boxplots and removed extreme values where necessary.
* **Cleaned data saved:** df.to\_csv("Cleaned\_Data.csv", index=False).

**Key insight:** Cleaned dataset ensures accurate KPI calculation and reliable forecasts.

**4. Step 3 — Feature Engineering**

* **Date-based features:** Extracted Year, Month, Weekday for trend analysis.
* **Profit Margin column:**

df['Profit\_Margin'] = df['Profit'] / df['Sales']

**Key insight:** Derived features enable deeper analysis and better forecasting.

**5. Step 4 — KPI Calculation**

* **Total Sales:** df['Sales'].sum()
* **Total Profit:** df['Profit'].sum()
* **Average Margin:** df['Profit\_Margin'].mean()
* **Orders & Customers:** df['Order\_ID'].nunique(), df['Customer\_ID'].nunique()
* **Top Customers:** Grouped by customer and sorted by total purchase.
* **Top Products:** Grouped by product and sorted by revenue.

**Key insight:** KPIs summarize business performance at a glance.

**6. Step 5 — Exploratory Data Analysis (EDA)**

* **Category-wise sales & profit:** Identified high-performing categories.
* **Sub-category analysis:** Found products contributing most to profit or loss.
* **Regional performance:** Analyzed sales and profit by country/region.
* **Monthly & yearly trends:** Showed seasonality and peak periods.
* **Discount effect:** High discounts correlate with lower profit margins.

**Key insight:** Visual and numerical analysis highlights growth opportunities and risk areas.

**7. Step 6 — Visualization & Storytelling**

* **Category comparisons:** Bar charts showing sales vs. profit.
* **Time-series trends:** Line plots for monthly sales/profit trends.
* **Correlation heatmap:** Visualized relationships between numeric features.

**Tip for recruiters:** Include **clean, colorful, and annotated plots** with insights in the caption.

**8. Step 7 — Forecasting Next 6 Months**

* **Tool:** Prophet library for time-series forecasting.
* **Sales forecast:** Predict next 6 months’ sales trends.
* **Profit forecast:** Predict future profits and identify months needing attention.

**Visuals:**

* Plot with forecast line + confidence intervals.
* Highlight potential revenue growth and expected dips.

**Key insight:** Forecasting helps in **inventory planning, marketing strategy, and budgeting.**

**9. Step 8 — Recommendations**

1. **Profit Improvement:**
   * Reduce discounting on low-margin products.
   * Focus on upselling high-margin categories.
2. **Customer Strategy:**
   * Loyalty programs for top customers.
   * Targeted promotions for low-profit segments.
3. **Marketing & Logistics:**
   * Seasonal campaigns during peak months.
   * Optimize shipping costs for regions with low profitability.
4. **Forecast Action:**
   * Prepare inventory for months with forecasted high demand.
   * Plan marketing budget based on predicted low-profit months.

**10. Project Highlights**

* Cleaned, feature-engineered, and analyzed **real-world e-commerce data**.
* Delivered **KPIs, trends, and insights** for decision-making.
* Forecasted next 6 months’ sales and profit using **Prophet**.
* Provided actionable **recommendations to improve profit & efficiency**.