

# Sales Forecasting Capstone Project — Explanation

## Objective

The goal of this capstone project is to build and evaluate machine learning models to **forecast future sales** using historical data. Accurate sales forecasting is crucial for inventory planning, budgeting, and strategic decision-making in any business.

## Dataset

The dataset contains monthly sales records over a multi-year period. It includes a date column and corresponding sales values. We performed data preprocessing, feature engineering, and time-series transformation to prepare the data for modeling.

## Methodology

We approached the forecasting task using two different models:

### 1. XGBoost Regressor

- We extracted **month** and **year** as numerical features from the date.
- Trained the model on the **entire historical dataset**.
- Forecasted **sales for the next three months** by creating future **month** and **year** combinations.
- XGBoost provided fast and interpretable results based on calendar trends.

### 2. LSTM (Long Short-Term Memory) Neural Network

- LSTM is well-suited for **sequence modeling** and time-series forecasting.
- We used a **sliding window approach** with a look-back of 3 months to predict the next month.
- Trained the model on scaled sales values and forecasted the next **3 months** recursively.
- This model captured temporal patterns better, especially in non-linear sales trends.

## Results

- Both models successfully forecasted sales for the next 3 months.
- XGBoost performed well with fewer data requirements and higher speed.
- LSTM required more training and tuning but offered better long-term pattern recognition.

Forecasts were visualized using line plots, showing both historical trends and forward predictions, clearly separated by a red vertical line to denote the start of forecasting.

## Conclusion

This project demonstrates how **machine learning and deep learning** can be used to build effective sales forecasting models. Depending on the business context, a lightweight model like XGBoost may be more practical, while LSTM can be used for richer, complex time-series patterns.