Tesla Stock Price Prediction using Deep Learning (SimpleRNN & LSTM)

# 1.Project Title

**Tesla Stock Price Prediction using Deep Learning (SimpleRNN & LSTM)**

# 2. Skills Applied

- Python Programming  
- Data Preprocessing & Cleaning  
- Data Visualization  
- Time-Series Analysis  
- Deep Learning with Keras (RNN, LSTM)  
- Hyperparameter Tuning using Keras Tuner

# 3. Problem Statement

To build deep learning models (SimpleRNN and LSTM) that can predict the closing price of Tesla stock for the next 1 day, 5 days, and 10 days using historical stock data.   
The goal is to help traders, investors, and financial analysts make informed decisions based on predictions.

# 4. Dataset

- Source: TSLA.csv (Tesla historical stock data)  
- Columns: Date, Open, High, Low, Close, Adj Close, Volume  
- Target Column: Close

# 5. Approach and Methodology

**5.1 Data Preprocessing:**  
- Converted 'Date' column to datetime and set it as index.  
- Selected 'Close' price for forecasting.  
- Scaled data using MinMaxScaler.  
- Created time-series sequences using 60-day window.  
  
**5.2 Model Building:**  
- SimpleRNN and LSTM models using TensorFlow/Keras.  
- Layers: Recurrent (SimpleRNN/LSTM), Dropout, Dense.  
  
**5.3 Hyperparameter Tuning:**  
- Used Keras Tuner (RandomSearch).  
- Tuned units, dropout, learning\_rate.  
  
**5.4 Evaluation Metrics:**  
- Mean Squared Error (MSE)  
- Actual vs Predicted plots

# 6. Results

**Model**  **Forecast Horizon** **MSE**   
  
 SimpleRNN 1 Day 197.6462   
 LSTM 1 Day 316.1385   
 LSTM 5 Days 495.0036   
 LSTM 10 Days 807.6019   
  
**Observation:**

- SimpleRNN performed better for 1-day forecast.  
- LSTM handled multi-day forecasts and showed increasing error as forecast horizon increased, which is expected in time-series prediction.  
- LSTM outperformed in flexibility and multi-step capabilities despite slightly higher short-term error.

# 7. Insights and Conclusion

- LSTM model enabled multi-step forecasting (1, 5, and 10-day) effectively.  
- SimpleRNN provided better short-term prediction for 1-day horizon.  
- Model performance depends on tuning, data volume, and volatility of stock market.  
- Combining both models could lead to better hybrid forecasting solutions.

# 8. Future Scope

- Integrate news sentiment analysis.  
- Use technical indicators (moving average, RSI).  
- Try GRU, Transformer, or Prophet models.  
- Add macroeconomic indicators.

# 9. Business Use Cases

- Automated Trading Systems  
- Investment Advisory Tools  
- Financial Forecasting for Funds and Analysts  
- Competitive Analysis for EV market

# 10. Technical Tags

#DeepLearning #RNN #LSTM #TimeSeries #StockPrediction #Finance #Python #TensorFlow