Backtesting and Risk Assessment for Financial Institutions

MINI PROJECT – COMPUTATIONAL INTELLIGENCE (CS354-N)

Group- 28

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Problem Statement

- Accurate prediction of Bitcoin prices is difficult due to high volatility and noise in market data.
- Traditional models often lack evaluation based on real-world trading performance.
- There is a need for a robust forecasting approach integrated with financial backtesting and risk analysis.
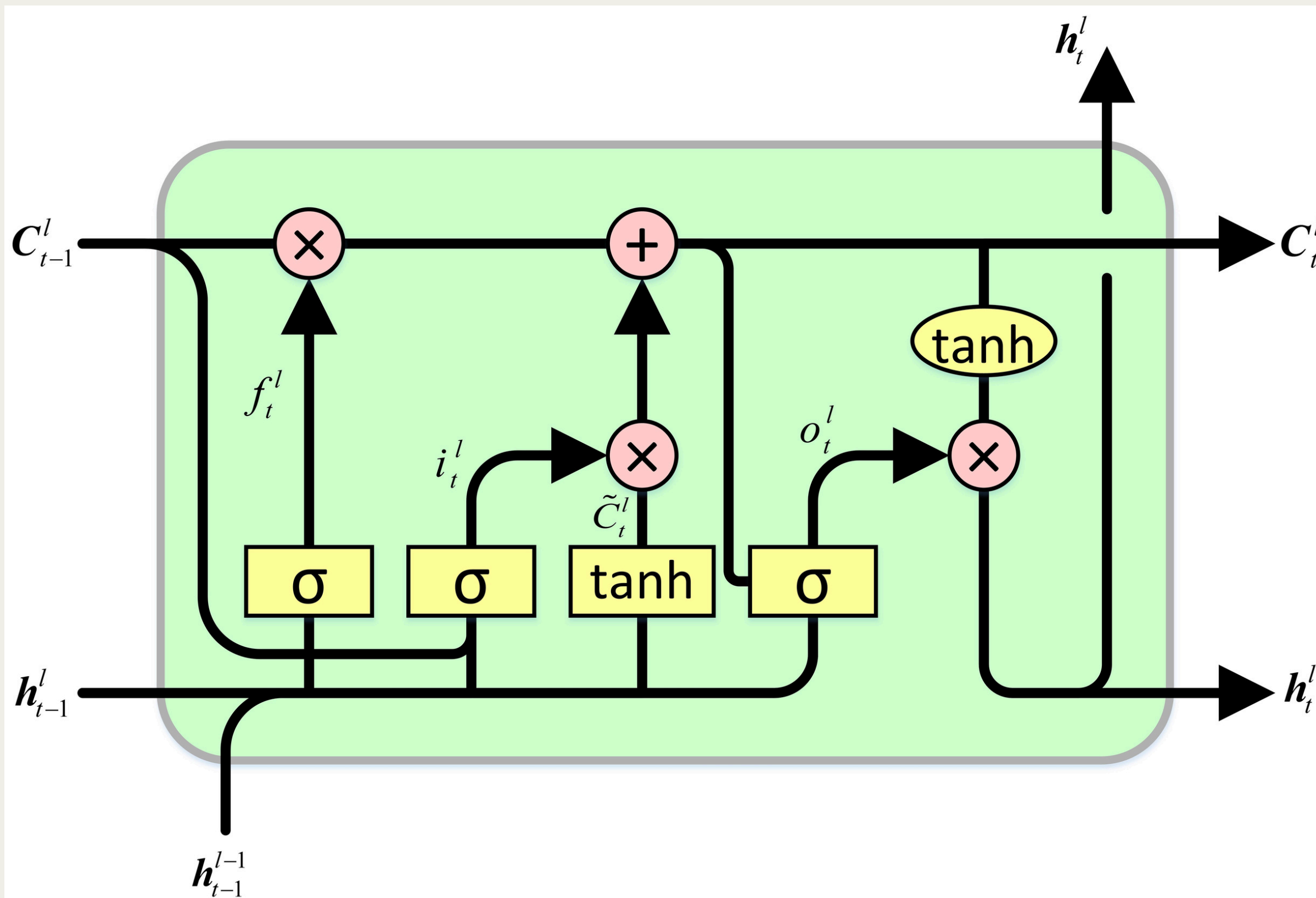
Dataset

- Bitcoin historical price dataset
- Source: Deribit API
- Features: Open, High, Low, Close, Volume
- Preprocessing: Normalization using MinMaxScaler

Model Architecture

- Model Type: Sequential
- Layers:
    1. LSTM
    2. Dropout
    3. Dense
- Loss Function: Mean Squared Error (MSE)
- Optimizer: Adam

Long Short Term Memory

Layers

#	Layer Type	Configuration	Purpose
1	LSTM Layer	64 units, return_sequences=True, input_shape=(50, 5)	Captures time-dependent features
2	Dropout	Rate=0.2	Prevents overfitting
3	LSTM Layer	64 units, return_sequences=False	Processes sequential data
4	Dropout	Rate=0.2	Further regularization
5	Dense Layer	32 units, ReLU activation	Learns complex features
6	Dense Layer	1 unit (Linear)	Predicts Bitcoin Close Price

Model Training and Testing

- Data Split: 80% Training, 20% Testing
- Sequence length: 50mins
- MAE: 307.2999
- RMSE: 329.4235
- R^2 Score: 0.9469
- MAPE: 0.65%

Predicted vs Actual Prices


Actual vs Predicted Close Prices
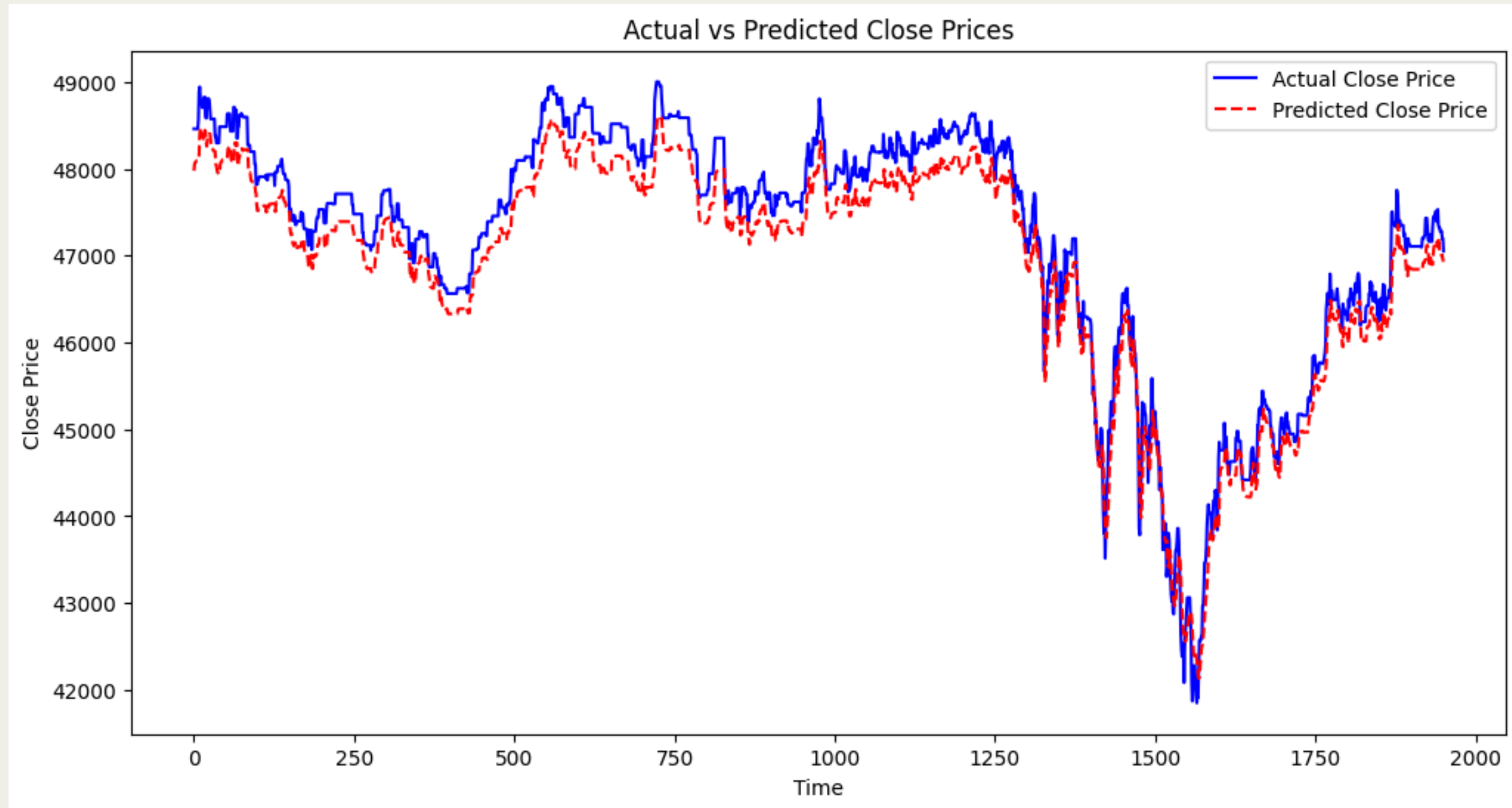
Backtesting Strategy

- Simulated Trading Based on LSTM Predictions.
- Strategy: Moving Average Crossover
- Buy Signal: Predicted price crosses above moving average.
- Sell Signal: Predicted price crosses below moving average.
- Initial Investment: $10,000

Window Size = 2

Backtest - MA Crossover Strategy on LSTM Predictions

Window Size = 3

Backtest - MA Crossover Strategy on LSTM Predictions
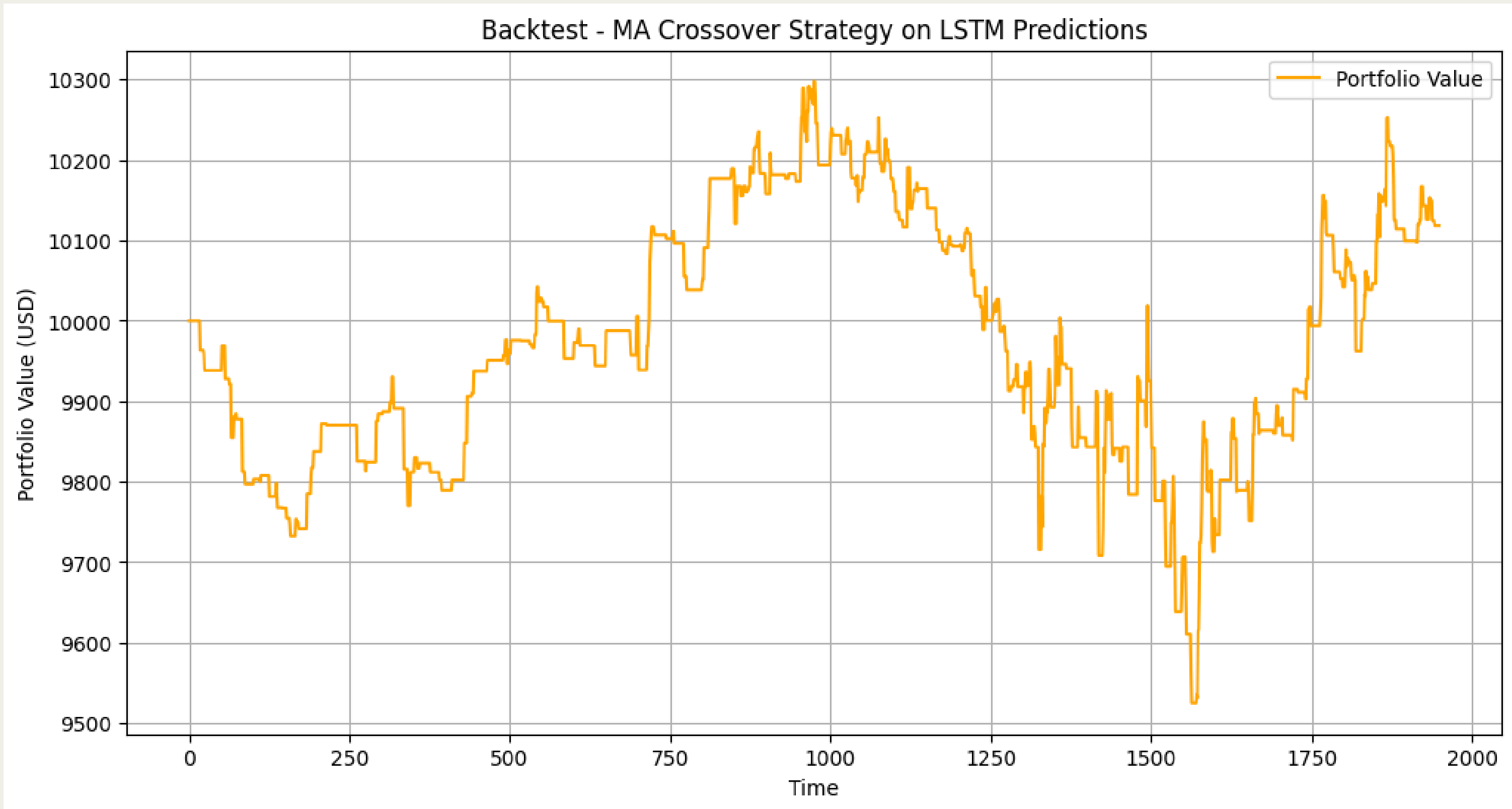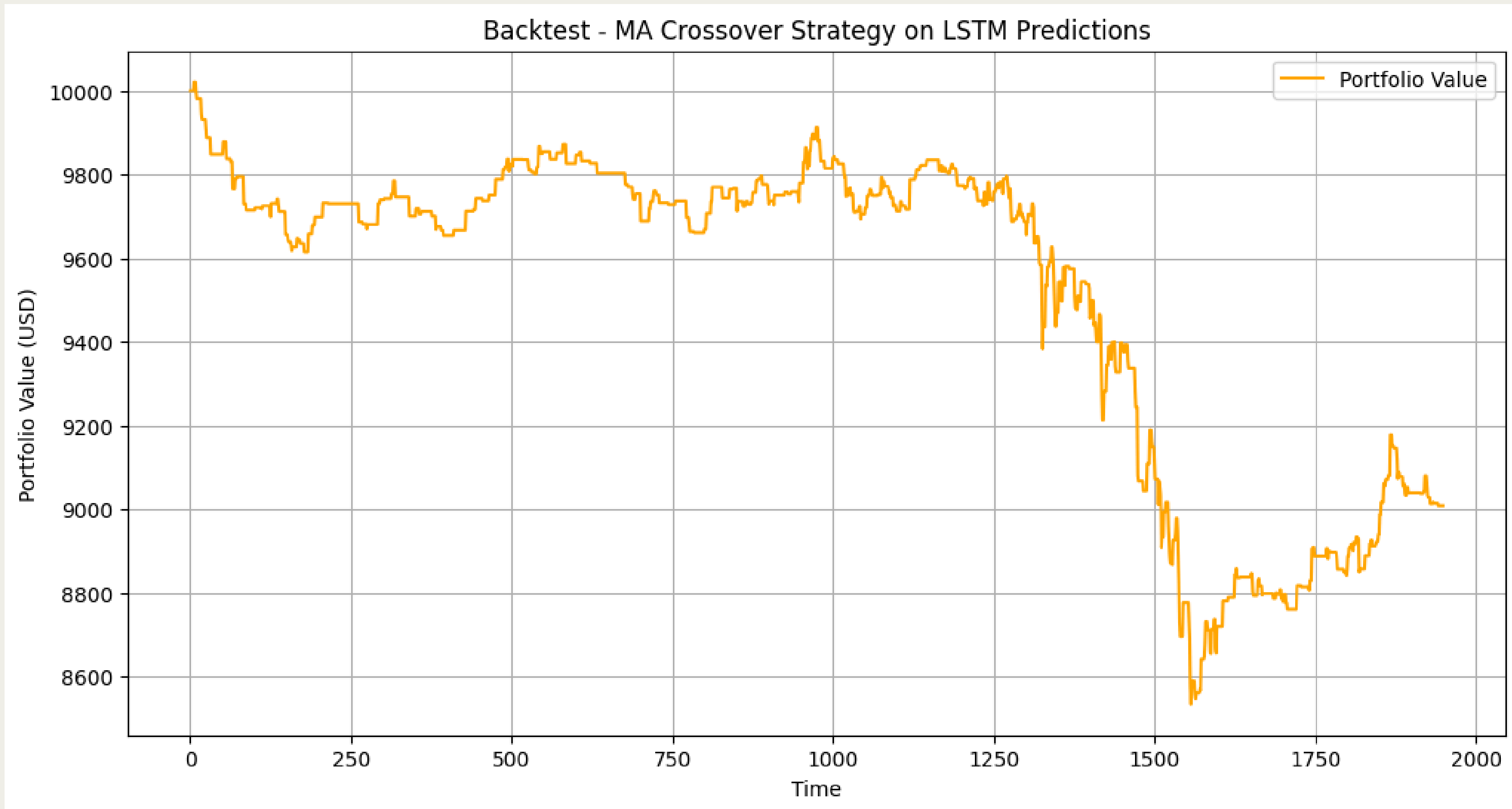
Risk Assessment

- We used key financial metrics to evaluate the stability and reliability of our LSTM-based trading strategy.
- Total Return reflects overall gain/loss.
- Volatility shows price fluctuation.
- Sharpe Ratio measures risk-adjusted return.
- Max Drawdown indicates potential maximum loss.

Window Size = 2

- Final Portfolio Value: $10118.27
- Total Return: 1.18%
- Volatility: 0.0016
- Sharpe Ratio: 0.0046
- Max Drawdown: $772.82

Window Size = 3

- Final Portfolio Value: $9007.96
- Total Return: -9.92%
- Volatility: 0.0017
- Sharpe Ratio: -0.0305
- Max Drawdown: $1487.03

Conclusion

- Built a system that uses machine learning to help with financial decision-making.
- LSTM model predicts Bitcoin prices with high accuracy
- Backtesting shows the trading strategy needs improvement
- Risk metrics confirm the results are reliable, not random

Thank you!

Questions?