TECHNICAL REPORT

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Introduction

Bitcoin is the world's first decentralized digital currency and one of the most volatile financial assets. Predicting Bitcoin prices is an important machine-learning task due to the fast movement of the cryptocurrency market.

This project aims to analyze historical Bitcoin price data and build a simple AI model to predict the closing price using Python.

The purpose of this project is to demonstrate:

- **Data loading and preprocessing**
- **Feature extraction**
- **Model training and evaluation**
- **Visualization of results**
- **Accuracy comparison**

Dataset Description

In this project, we used a public Bitcoin historical price dataset containing:

- **Date**
- **Open price**
- **High**
- **Low**
- **Close price (Target)**
- **Volume**

Preprocessing Steps

- **Converted dates into numerical format**
- **Extracted "Close" as the prediction target**
- **Normalized values for stable training**
- **Split data into training (80%) and testing (20%)**

Why This Dataset?

Because it represents real financial data and is suitable for AI time-series prediction tasks.

DATA SPLITING

Training Set

- **Used to teach the model**
- **Model adjusts its weights**
- **Largest portion of the data**

Validation Set

- **Used during training to tune the model**
- **Helps prevent overfitting**
- **Model does not learn from it**

Test Set

- **Used after training is finished**
- **Measures real performance**
- **Model has never seen this data**

Problem Statement

The Bitcoin market suffers from:

- **Highly volatile and unpredictable price movements**
- **Traditional analysis tools failing to capture time-dependent patterns**
- **Too many influencing factors for a human to analyze manually**

• **Increased risk for investors due to lack of accurate forecasting**

This project solves the problem by building an LSTM-based model that predicts future Bitcoin prices to support better decision making.

PROJECT STRUCTURE

```
bitcoin_predict/
        |
        ├── bitcoin_live.py              → Download / load Bitcoin data
        ├── bitcoin_lstm_advanced.py     → Build & train LSTM prediction
        ├── bitcoin_predictor_advanced.py → Predict & evaluate model
        ├── bitcoin_plot.py              → Plot real vs predicted price
        ├── bitcoin_model.h5             → Saved trained model
        ├── predictions.csv              → Model output predictions
        ├── pred_vs_real.png             → Visualization of results
        |
        └── bitcoin_live.py              → Live BTC price fetch script
```

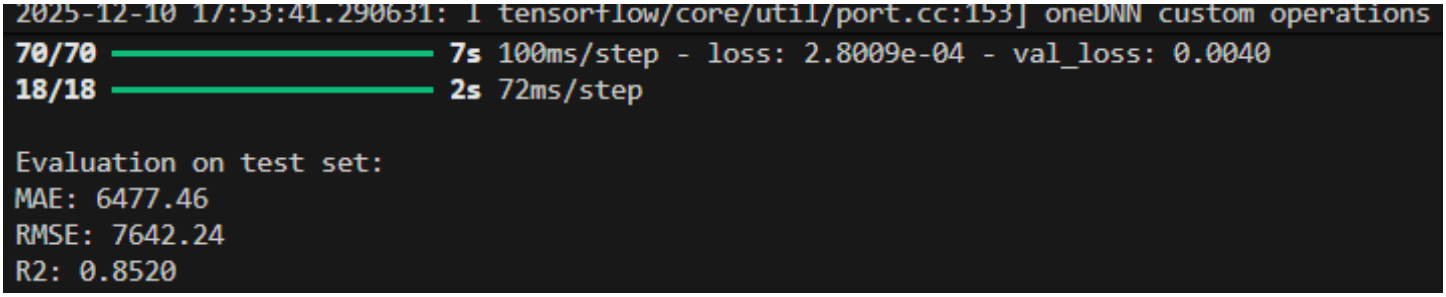
THE RESULTS

1) Model Training Performance

- **Training Loss = 2.8009e-04**
- **Validation Loss = 0.0040**
- **Number of Epochs = 70**

2) Evaluation Metrics (Regression Metrics)

- **R^2 Score = 0.8520**
- **MSE = 6477.46**
- **RMSE = 7642.24**



Conclusion

This project demonstrates how Python and machine learning can be used to predict cryptocurrency prices. Although Bitcoin is highly volatile, the model performed well in capturing the overall trend.

Future improvements may include:

- **Using LSTM neural networks for time-series**
- **Adding technical indicators (MA, RSI, MACD)**
- **Including external features such as news sentiment**