



# CRYPTOCURRENCY MOVEMENT AND VOLATILITY PREDICTION USING DEEP LEARNING MODEL

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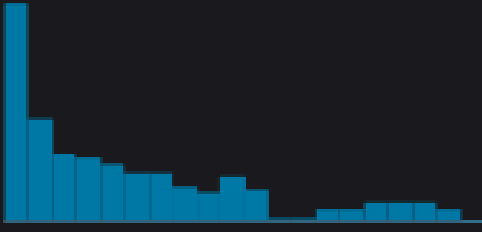
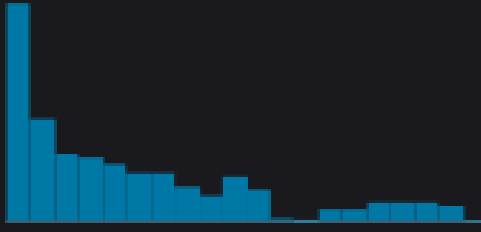
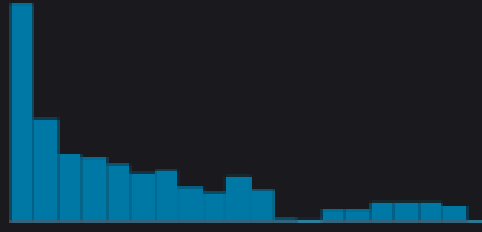
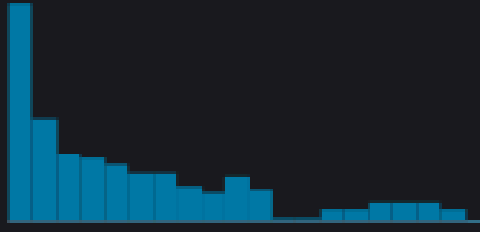
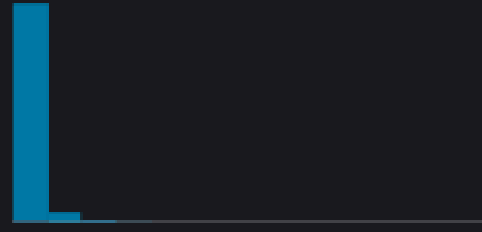
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# PROBLEM

Cryptocurrency has grown tremendously in the past few years as a means of exchange and a store of value for the trading market. However, cryptocurrencies market has proven to be less stable and more volatile than traditional state-issued equity markets. Therefore, accurate forecasting of their price dynamics is crucial.

Most existing research focuses solely on future price prediction or movement prediction. However, a complete understanding of the market requires assessment of both directional movement and market risk/volatility. Therefore, we proposed a dual-task deep learning model capable of simultaneously predict directional movement and market risk/volatility.

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# Open	# High	# Low	# Close	# Volume
 3.17k126k	 3.18k126k	 3.16k125k	 3.17k126k	 0137k
13715.65	13715.65	13400.01	13529.01	443.356199
13528.99	13595.89	13155.38	13203.06	383.697006
13203.0	13418.43	13200.0	13330.18	429.064572
13330.26	13611.27	13290.0	13410.03	420.08703
13434.98	13623.29	13322.15	13601.01	340.807329

# DATASET

Dataset used is sourced from Binance exchange via Kaggle data repository. The dataset contains many key features, but the columns used only include Open, High, Low, Close, Volume (OHLCV).

The dataset is structured in hourly interval covering from January 1, 2018 to December 8, 2025.

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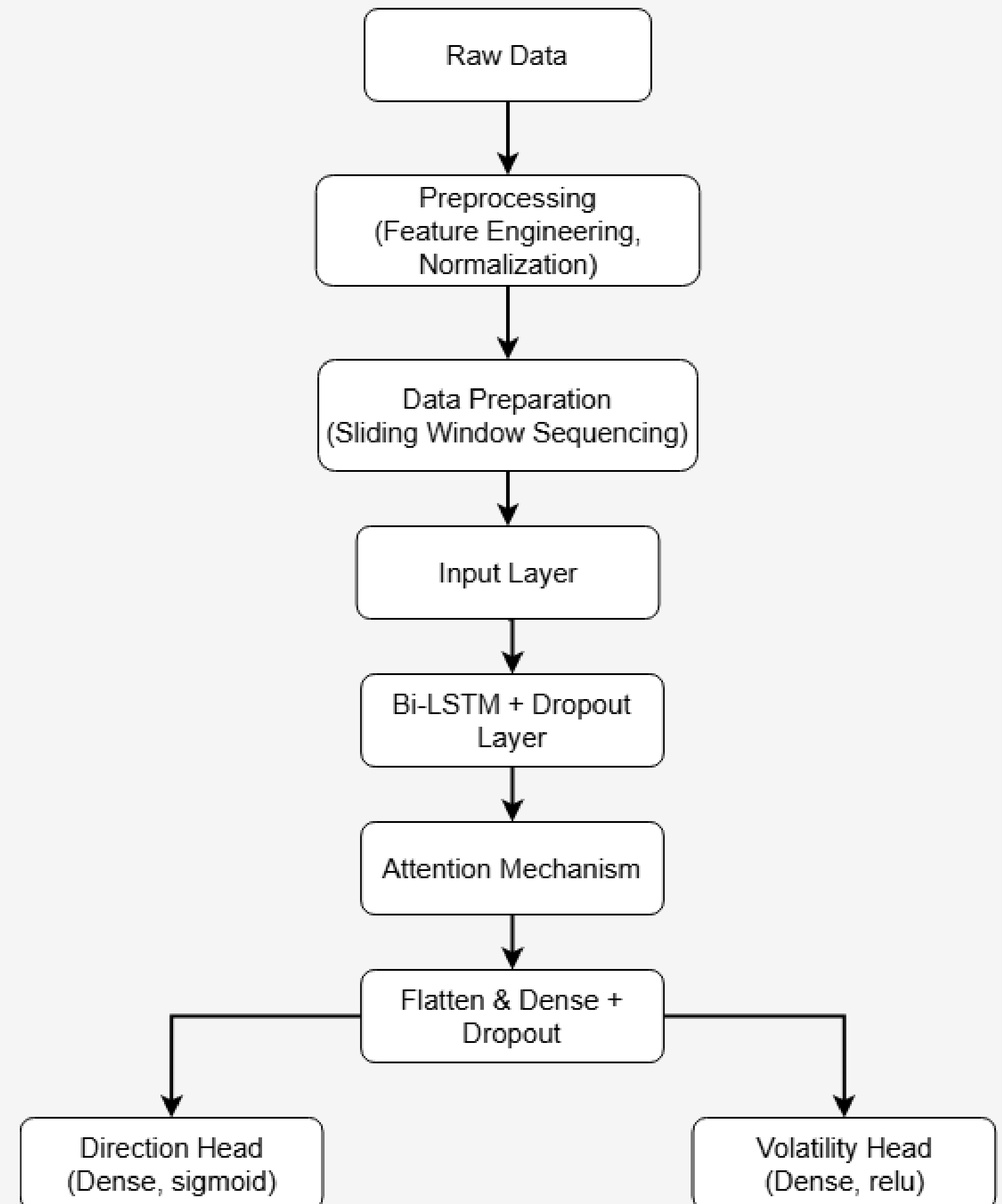
## FEATURE ENGINEERING

To enhance model's ability to detect market patterns, some features are made to achieve stationarity of data. Features engineered include:

- Logarithmic Return and Logarithmic Volume
  - Candlestick shadows including upper shadow and lower shadow
  - Technical indicators including RSI and normalized MACD
  - Target prediction including target direction and target volatility
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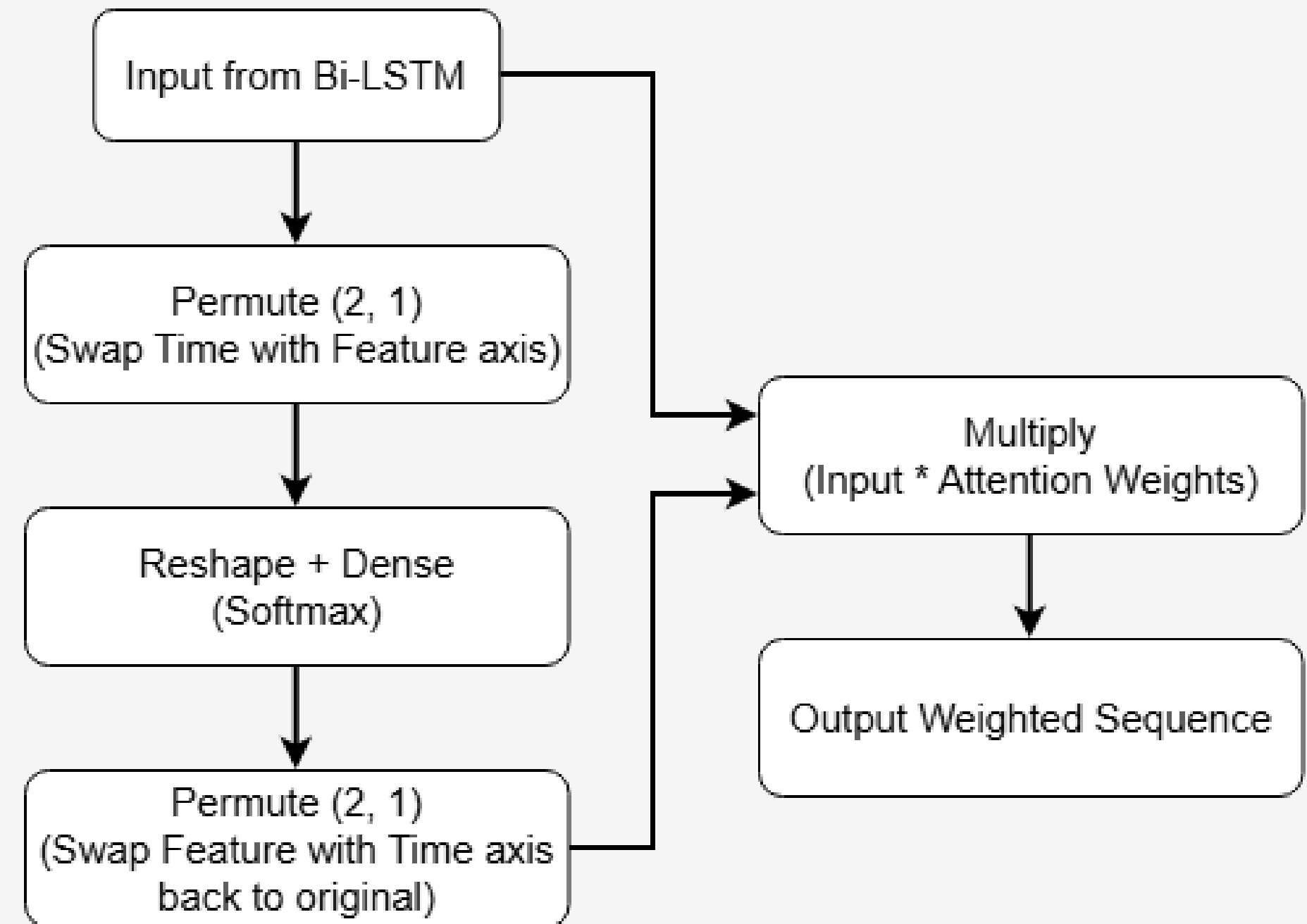
# MODEL ARCHITECTURE

The proposed model is a dual-task deep learning model of Bi-LSTM enhanced with custom Attention Mechanism to ensure the model focuses on important events of the market reducing noise from the data. The dual-task architecture allows the model to simultaneously predict future price movement and market risk/volatility.



# ATTENTION MECHANISM

The custom attention mechanism learns to assign dynamic weights to each timestep, making certain critical timesteps to be more important than other timesteps of noise.



	precision	recall	f1-score	support
Turun (0)	50.10%	24.09%	32.53%	9,780
Naik (1)	51.26%	76.89%	61.51%	10,156
accuracy	50.99%			19,936
macro avg	50.68%	50.49%	47.02%	19,936
weighted avg	50.69%	50.99%	47.30%	19,936

MAE	RMSE	MSE
0.00658	0.00998	0.000100

# EVALUATION

The model evaluation on directionality head achieves 51% accuracy with 47% weighted average f1-score, indicating the model is slightly biased in predicting up.

The regression head achieved a low regression error score, though it's because the model is lazy training and making prediction of only 0 for volatility.



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**THANK YOU**

