

## INTISARI

### ANALISIS HISTORIS ALGORITMA PERDAGANGAN CRYPTOCURRENCY DENGAN PENDEKATAN *HIDDEN MARKOV MODEL DAN LONG SHORT-TERM MEMORY*

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Perdagangan cryptocurrency telah menjadi fokus utama dalam lingkup keuangan global, menawarkan peluang investasi yang signifikan namun juga diiringi dengan volatilitas tinggi. Penelitian terdahulu yang melibatkan Hidden Markov Model-Long Short-Term Memory (HMM-LSTM) hanya terfokus pada prediksi harga. Penelitian ini bertujuan mengembangkan model hybrid yang menggabungkan Hidden Markov Model (HMM) dan Long Short-Term Memory (LSTM) untuk meningkatkan ketepatan prediksi pergerakan harga cryptocurrency. Setelah dilakukan prediksi harga dengan HMM-LSTM, akan diterapkan algoritma trading yang diukur menggunakan backtesting untuk melihat Sharpe Ratio, return kumulatif, dan maximum drawdown. Data yang digunakan meliputi Open, High, Low, Close, Volume, serta indikator teknikal, dengan label harga crypto yang diperoleh dari model HMM.

Model ini dirancang untuk memahami pola dan keadaan pasar dengan menggabungkan informasi historis dan fitur teknikal. Pendekatan ini diharapkan dapat meningkatkan kinerja prediktif pergerakan harga crypto melalui kekuatan prediktif LSTM dan kemampuan pemodelan keadaan tersembunyi HMM. Penelitian ini juga melibatkan pengujian kinerja melalui backtesting pada data historis perdagangan cryptocurrency.

Hasil penelitian menunjukkan bahwa model dengan data HMM meningkatkan performa prediksi dengan penurunan Mean Squared Error (MSE) menjadi 609.231,295, turun 18.5% dibandingkan model tanpa HMM. Selain itu, hasil backtesting menunjukkan peningkatan pada Sharpe Ratio, pengembalian kumulatif, dan penurunan maksimum, dengan return kumulatif 58%, Sharpe Ratio 1,93, dan penurunan maksimum -8,3% pada data tes.

**Kata Kunci:** prakiraan, mata uang kripto, long short-term memory, hidden markov model, indikator teknikal, data historis, analisis historis

## ABSTRACT

### ***HISTORICAL ANALYSIS OF CRYPTOCURRENCY TRADING ALGORITHM WITH HIDDEN MARKOV MODEL AND LONG SHORT-TERM MEMORY APPROACH***

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Cryptocurrency trading has become a primary focus in the global financial landscape, offering significant investment opportunities but also accompanied by high volatility. Previous research involving Hidden Markov Model-Long Short-Term Memory (HMM-LSTM) has focused solely on price prediction. This study aims to develop a hybrid model that combines Hidden Markov Model (HMM) and Long Short-Term Memory (LSTM) to improve the accuracy of cryptocurrency price movement predictions. After price prediction with HMM-LSTM, a trading algorithm will be applied and evaluated using backtesting to assess Sharpe Ratio, cumulative return, and maximum drawdown. The data used includes Open, High, Low, Close, Volume, and technical indicators, with cryptocurrency price labels derived from the HMM model.

This model is designed to understand market patterns and states by integrating historical information and technical features. This approach is expected to enhance predictive performance of cryptocurrency price movements by leveraging the predictive power of LSTM and the hidden state modeling capability of HMM. The study also involves performance testing through backtesting on historical cryptocurrency trading data.

The results show that the model incorporating HMM data improves prediction performance, marked by a reduction in Mean Squared Error (MSE) to 609,231.295, a decrease of 18.5% compared to the model without HMM. Additionally, backtesting results indicate better performance on metrics such as Sharpe Ratio, cumulative return, and maximum drawdown, with the HMM-enhanced model achieving a cumulative return of 58%, a Sharpe Ratio of 1.93, and a maximum drawdown of -8.3% on test data.

**Keywords:** forecasting, cryptocurrency, long short-term memory, hidden markov model, technical indicators, historical data, historical analysis.