AUTOREGRESSIVE MODELLING FOR FINANCIAL TIME SERIES

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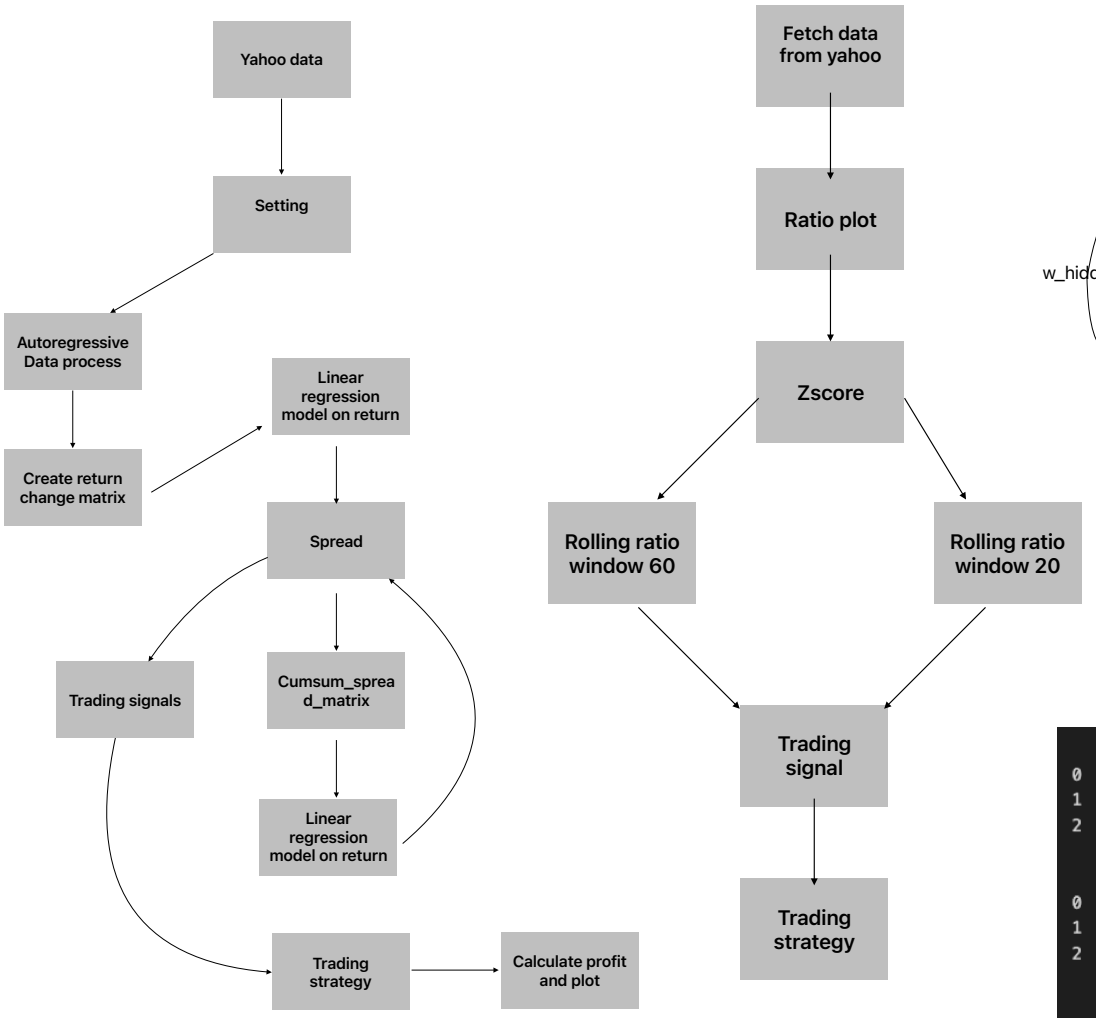
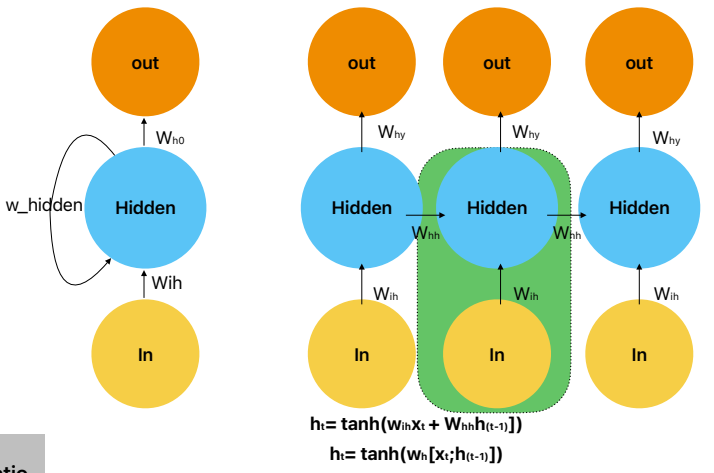
ABSTRACT

This project focuses on the application of machine learning and neural networks in the field of finance, specifically for pairs trading. The objective is to develop a Pairs Trading Application (PTA) that predicts the future prices of two selected companies (Pepsi and Coca-Cola) based on their historical price data.

INTRODUCTION & BACKGROUND

The main aim is to develop a pair trading system that utilises autoregressive modelling for linear regression, time series, and deep learning modelling to analyse and predict historical stock price data, resulting in profit from the relative price movements of two assets.

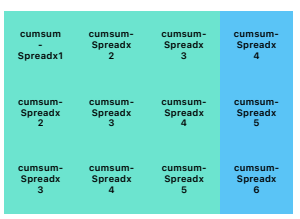


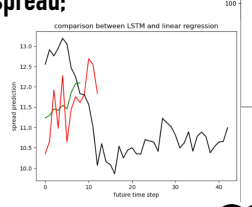


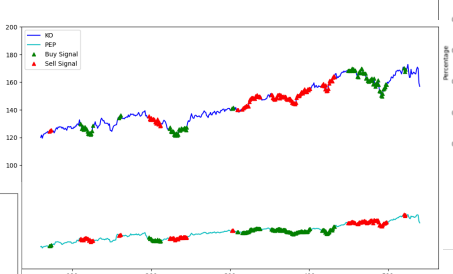
METHODOLOGY:

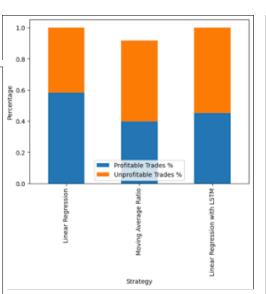
1 Autoregressive modelling for financial time series
Y = a + b (x) -> Coefficients alpha , beta
(Manual)
2 Multiple moving average rolling windows
X/y -> moving average -> 20 days windows, 60 days windows

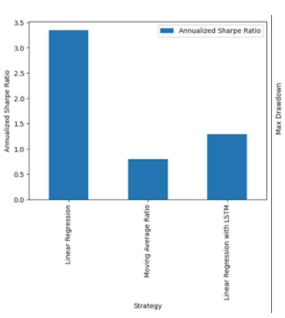
3 OLS linear regression with Bidirectional LSTM validation
OLS linear regression-> deep learning ->RNN -> B LSTM-> gate->long short term memory-> feed spread;

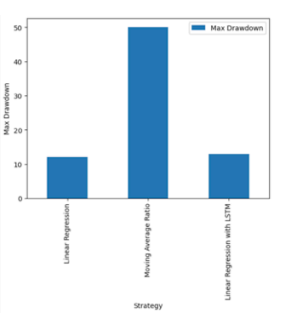












PERFORMANCE EVALUATION

	Strategy	Number of Trades	Profitable Trades
0	Linear Regression	172	100
1	Moving Average Ratio	146	58
2	Linear Regression with LSTM	100	45

	Unprofitable Trades	Profitable Trades %	Unprofitable Trades %
0	72	0.581395	0.418605
1	76	0.397260	0.520548
2	55	0.450000	0.550000

	Cumulative Profit	Annualized Mean Return	Annualized Std Dev
0	75.536399	110.669608	33.064249
1	196.405644	339.001523	423.761452
2	20.627666	51.981718	40.258088

	Annualized Sharpe Ratio	Max Drawdown
0	3.347108	12.070422
1	0.799982	50.085590
2	1.291212	12.932060

CONCLUSIONS & FUTURE WORK

This report provides a comprehensive analysis of pairs trading as an investment strategy to enhance investor returns, utilizing three different methodologies, including Autoregressive modelling, multiple rolling ratio moving Average windows, and OLS Linear Regression with Bidirectional LSTM validation. The results indicate that the Linear Regression strategy demonstrated the highest percentage of profitable trades and the best risk-adjusted performance, while the Moving Average Ratio strategy yielded the highest cumulative profit. The project aims to assist investors in understanding the fundamentals of pairs trading and implementing a tested methodology to maximize their returns while minimizing risk, taking into account their risk tolerance, trading frequency, and other preferences.