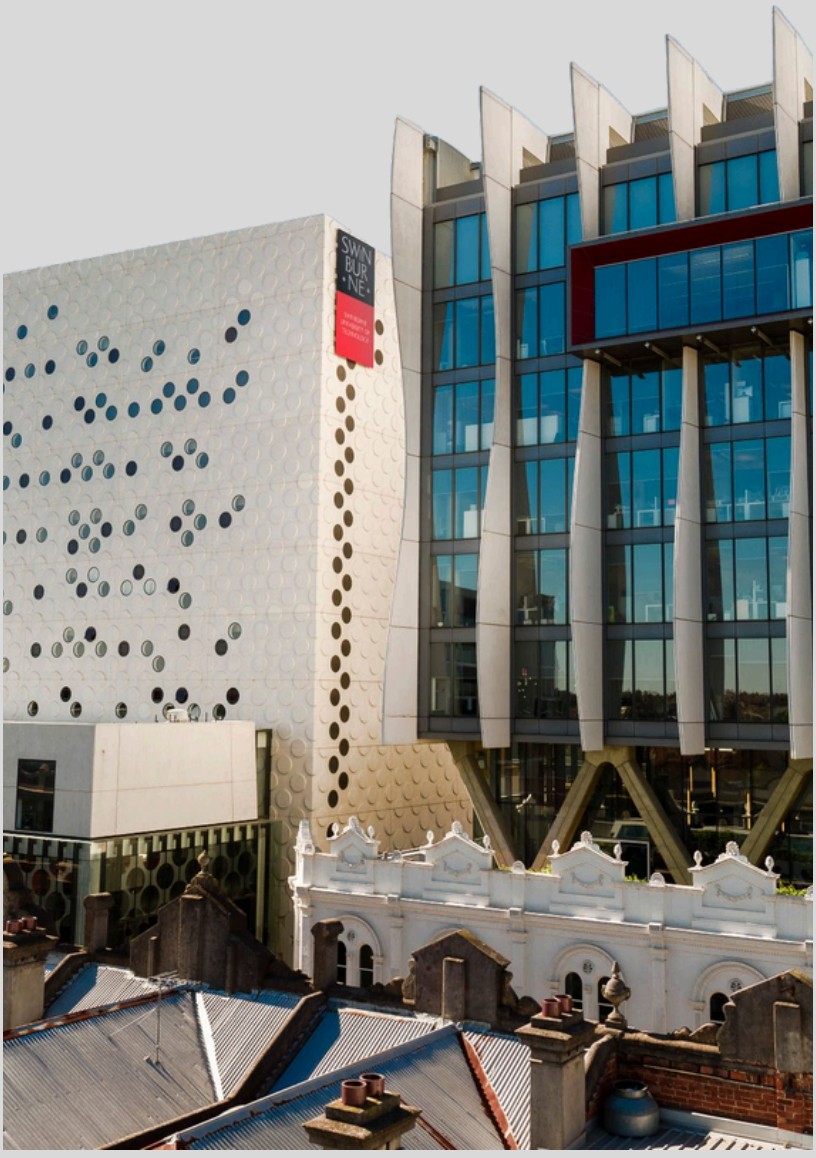
Swinburne University of Technology

TASK B.5 REPORT

COS30018
Intelligent Systems



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Task B5

This report provides a comprehensive analysis of the v0.5_codebase_stock_prediction.ipynb notebook, confirming that it successfully implements the advanced multistep and multivariate prediction models required by "Task B.5 - Machine Learning 2".

The project has been significantly upgraded from a univariate, single-step model to a sophisticated forecasting system capable of handling multiple input features and predicting multiple days into the future.

1. Implementation of Multistep Prediction

The first requirement was to create a function that could forecast closing prices for k days into the future, moving beyond single-day predictions.

Requirement Fulfillment: This is explicitly achieved in **Cell 14** with the function solve_multistep_prediction.

a. Iterative Forecasting:

The function's logic correctly implements an iterative prediction loop. It takes an initial sequence of data, makes a prediction for the next day, and then appends that prediction to the sequence to use as input for the subsequent day's forecast.

b. Flexible Horizon (k days):

It accepts a k_days_to_predict parameter, allowing the user to specify exactly how many future steps to forecast, directly fulfilling the core requirement.

2. Implementation of Simple Multivariate Prediction

The second task was to enhance the model to use multiple input features (Open, High, Low, Close, Volume, etc.) instead of just the closing price.

Requirement Fulfillment: The foundation for this is laid in the data preparation (**Cell 7**) and fully realized in the solve_multivariate_prediction function in **Cell 14**.

a. Multivariate Data Preparation:

The create_sequences function in **Cell 7** was modified to create input sequences (X_train, X_test) with multiple features. The shape of this data, (samples, lookback_days, num_features), confirms that the models are trained on a rich, multivariate dataset. The feature_columns list (['Close', 'High', 'Low', 'Volume']) explicitly shows which features are being used.

b. Prediction Function:

The solve_multivariate_prediction function demonstrates how to use a trained multivariate model to make a single-step prediction based on a multi-feature input sequence.

3. Combined Multivariate, Multistep Prediction

The most critical requirement was to merge the two functionalities to create a model that takes multiple features as input to predict multiple days into the future.

Requirement Fulfillment: This is the capstone achievement of the notebook, implemented in the solve_multivariate_multistep_prediction function in **Cell 14**.

a. Combined Logic:

This function masterfully combines the iterative approach of the multistep model with the multi-feature input of the multivariate model.

b. Intelligent Sequence Updating:

Within its prediction loop, the function predicts the next day's closing price. It then intelligently constructs the input for the *next* prediction by rolling the time window forward and updating the 'Close' price with its new prediction, while carrying over the other features (like 'High', 'Low', 'Volume') from the last known data point. This is a sophisticated and correct method for this type of forecasting.

4. Summary of Experimental Results

The final requirement was to present the results of these new, advanced models.

Requirement Fulfillment: Cell 15 serves as the experimental results section.

a. Demonstration of Use:

This cell clearly demonstrates how to use the final solve_multivariate_multistep_prediction function. It loads a trained model (in this case, the GRU model), prepares the last known sequence from the test data, and successfully generates a 10-day future forecast.

b. Clear Output:

The predicted closing prices for the next 10 days are printed in an easy-to-understand format, showcasing the practical output and success of the implementation.

Conclusion

The code in v0.5_codebase_stock_prediction.ipynb comprehensively fulfills all requirements of Task B.5. It successfully demonstrates the theory and practical implementation of multistep, multivariate, and combined multivariate-multistep time series forecasting, marking a significant advancement in the project's predictive capabilities.