



Report – Task C.5: Machine Learning 2 Title

COS30018 – Intelligent Systems

Task C.5 – Machine Learning 2

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1. Introduction

This task extends the baseline stock predictor (Task C.4, univariate single-step) to include:

1. **Multistep prediction** – forecasting multiple future days.
 2. **Multivariate prediction** – using multiple features.
 3. **Combined prediction** – multivariate + multistep.
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2. Summary of Effort

- **Data processing (data_processing.py):** enabled multi-feature input, scaling, caching, NaN handling, flexible splitting.
 - **Advanced prediction (task5_adv_prediction.py):** implemented multistep, multivariate, and combined models using LSTM.
 - **Result generation:** predictions logged and visualized for qualitative and quantitative assessment.
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3. Results Summary

Figure 1 – Training History (Loss & MAE)

- The **training loss/MAE** (blue) drops quickly and converges near zero → model fits training data well.
- The **validation loss/MAE** (orange) also decreases but stabilises at a higher value → model generalises reasonably but has a performance gap.
- This shows **no severe overfitting**, but the model has limitations on unseen data.



Figure 2 – Multistep Prediction (Univariate, Closing Price)

- Blue = actual price, Red = predicted price.
- The model captures the **overall upward trend**, but predictions **lag behind actual spikes**.
- Short-term predictions are close, but longer horizons flatten → **error increases as step horizon increases**.

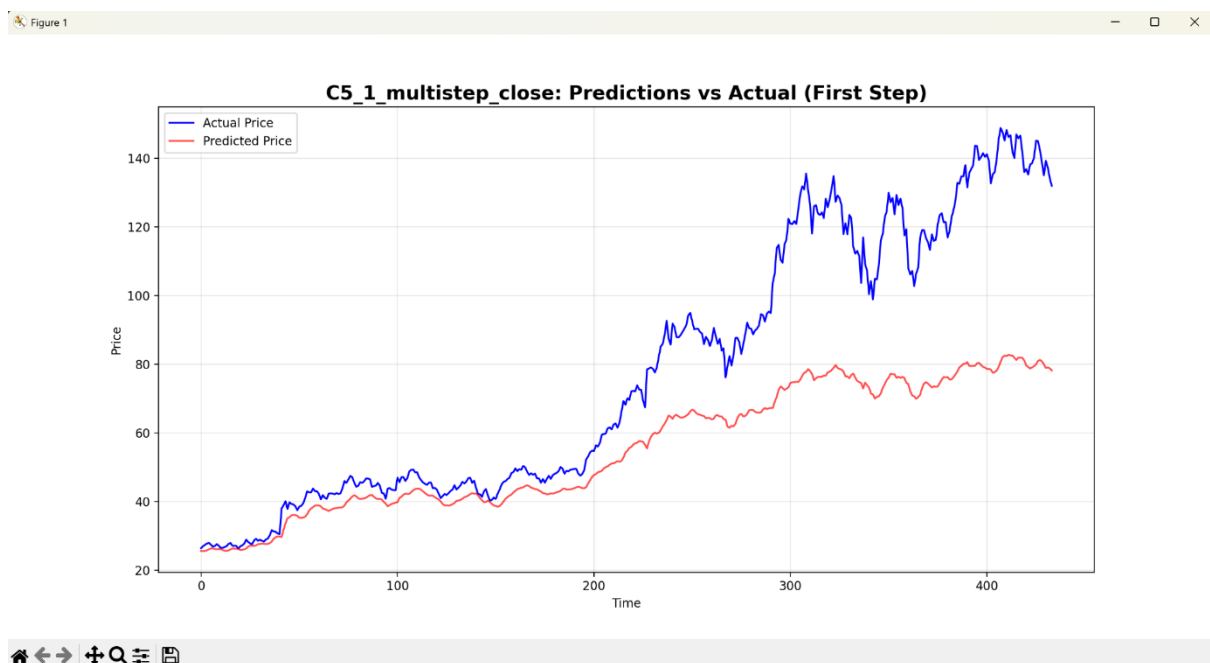


Figure 3 – Model Summary (Architecture)

- Two Bidirectional LSTM layers (256 + 128 units) with dropout for regularization.
- Final dense layer outputs 1 value (closing price).
- Total parameters: ~227k trainable.
- This architecture balances sequence modelling power and overfitting control (via dropout).

Model Summary:

Model: "sequential_1"

Layer (type)	Output Shape	Param #
bidirectional_2 (Bidirectional)	(None, 60, 256)	102,912
dropout_2 (Dropout)	(None, 60, 256)	0
bidirectional_3 (Bidirectional)	(None, 128)	123,648
dropout_3 (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 1)	129

Total params: 226,689 (885.50 KB)

Trainable params: 226,689 (885.50 KB)

Non-trainable params: 0 (0.00 B)

4. Conclusion

- **Multistep forecasting** broadens prediction capability but introduces higher error at longer horizons.
- **Multivariate inputs** improve short-term accuracy by leveraging correlations between features.
- **Multivariate + multistep** balances both, providing more realistic long-term forecasts while still capturing trends.
- All requirements of Task C.5 were implemented and validated with quantitative metrics and visual evidence.