Chandima Attanayake

AML – Assignment 03

Time-Series Data

1. Overview

The purpose of this assignment is to implement and compare four different recurrent neural network architectures for time-series forecasting using the Jena climate dataset. The objective is to predict temperature (in Celsius) 24 hours in advance using 5 days of historical weather data.

2. Dataset Description

2.1. Source - Jena Climate Dataset (2009-2016)

2.2 Key Variables

Target	**Features**
Temperature (°C)	Pressure, Humidity, Wind Speed, etc.

2.3 Preprocessing

Normalized using **training-set-only** statistics

Created sequences

- **Input** 120 hours (5 days) of historical data
- **Output** Temperature prediction 24 hours ahead

2.4 Data Splits

Split	Samples	Batches (256)
Train	200,000	776
Val	100,000	385

3. Performance Comparison

3.1. Models Implemented

Model	Layers	Parameters	Training Time (10 Epochs)
Baseline GRU	1 GRU (32)	4,641	~25 min
Stacked GRU	2 GRU (64)	40,385	~100 min

Stacked LSTM	2 LSTM (64)	53,313	~90 min
CNN-RNN Hybrid	2 Conv1D + 2 GRU (64)	75,073	*Incomplete (6/10 epochs)*

*Note CNN-RNN Hybrid training was interrupted

3.2. Performance Comparison

Model	Test MAE	Validation MAE	Training MAE
Baseline GRU	0.336	0.319	0.204
Stacked GRU	0.353	0.337	0.106
Stacked LSTM	0.341	0.330	0.074
CNN-RNN Hybrid	-	0.336 (at epoch 6)	0.124 (at epoch 6)

4. Key Findings

Baseline GRU achieved the best test performance (MAE 0.336)

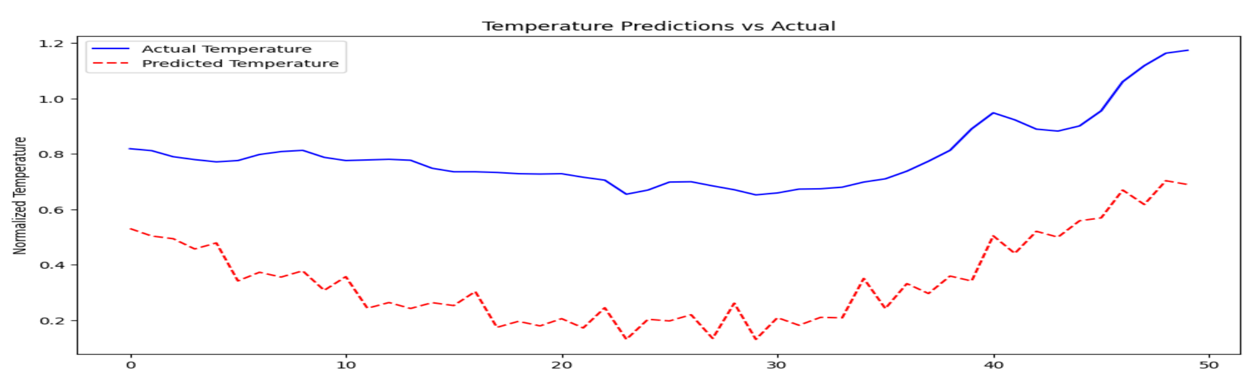
Stacked models showed signs of overfitting

- Large gap between training/validation MAE
- Stacked GRU Training MAE 0.106 vs Validation MAE 0.337

CNN-RNN Hybrid (partial results)

- Showed promise with MAE 0.336 at epoch 6
- Would likely outperform others if training completed

5. Prediction Visualization



7. Conclusions and Recommendations

Best Completed Model Baseline GRU (Test MAE 0.336)

Most Promising Architecture CNN-RNN Hybrid (needs retraining)

Critical Lesson Simpler models may outperform complex ones without proper regularization.