Temperature Forecasting Using Machine Learning and LSTM

Predicting Temperature 10 Minutes Ahead

Nitchamon Busayaphongchai 6430125321
Date 6 April 2025

Project Overview

- Objective : Predict temperature 10 minutes ahead
- Data : Minutely temperature readings
- Methods :
  - Linear Regression (LR)
  - Support Vector Regression (SVR)
  - LSTM Neural Network

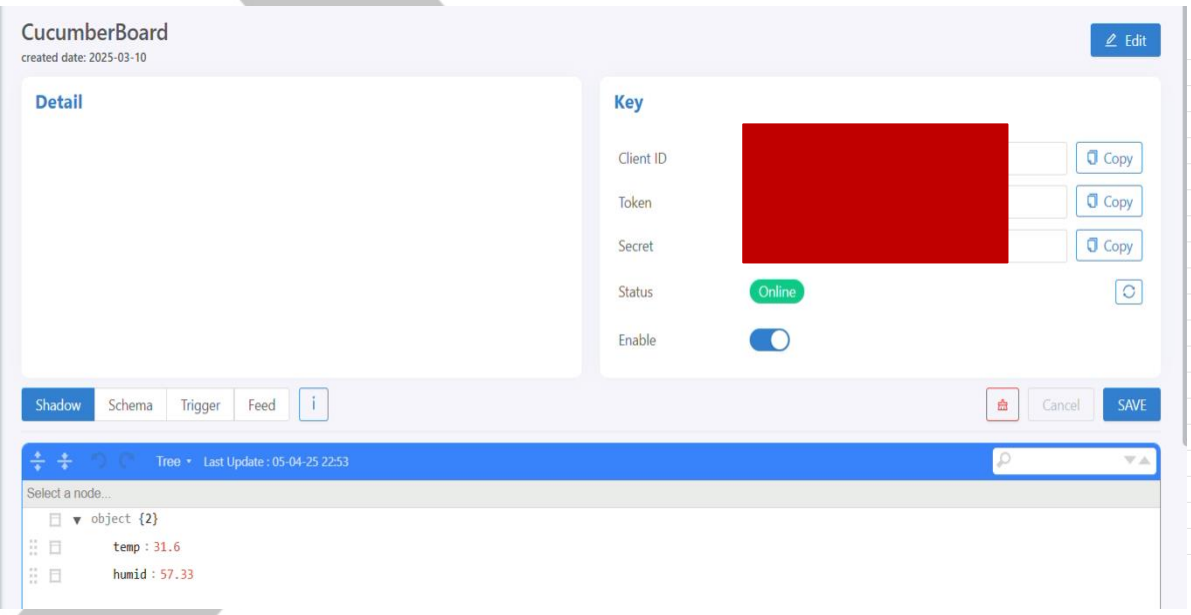
Data Sending via NETPIE and Google sheet

Output Serial Monitor ×

Message (Enter to send message to 'ESP32S2 Dev Module' on 'COM5')

New Line 115200 baud

```
Sensor data added to queue.
Published data to NETPIE.
Google Sheets Response: <HTML>
<HEAD>
<TITLE>Moved Temporarily</TITLE>
</HEAD>
<BODY BGCOLOR="#FFFFFF" TEXT="#000000">
<!-- GSE Default Error -->
<H1>Moved Temporarily</H1>
The document has moved <
</BODY>
</HTML>
```



2025-04-05 16:28:06	33.05	46.91
2025-04-05 16:29:06	33.01	46.86
2025-04-05 16:30:06	31.15	46.67
2025-04-05 16:31:06	32.27	46.67
2025-04-05 16:32:06	32.62	46.63
2025-04-05 16:33:06	32.43	46.47
2025-04-05 16:34:06	32.82	46.41
2025-04-05 16:35:06	30.99	46.21
2025-04-05 16:36:06	32.31	46.41
2025-04-05 16:37:06	32.57	46.29
2025-04-05 16:38:06	32.82	46.39
2025-04-05 16:39:06	32.68	46.21
2025-04-05 16:40:06	31.11	45.77
2025-04-05 16:41:06	32.53	45.79
2025-04-05 16:43:06	32.29	45.83
2025-04-05 16:42:06	32.49	45.81
2025-04-05 16:44:06	32.97	45.98
2025-04-05 16:45:06	31.56	45.62
2025-04-05 16:46:06	31.48	45.81
2025-04-05 16:47:06	33.19	46.16
2025-04-05 16:48:06	32.43	45.92

Traditional Models

- Input Types:
  - Last 5 minutes
  - Last 50 minutes
- Model Used:
  - LR-5, LR-50
  - SVR-5, SVR-50
- Evaluation Metrics: MAE and RMSE

Results – Traditional Models

- Performance Table

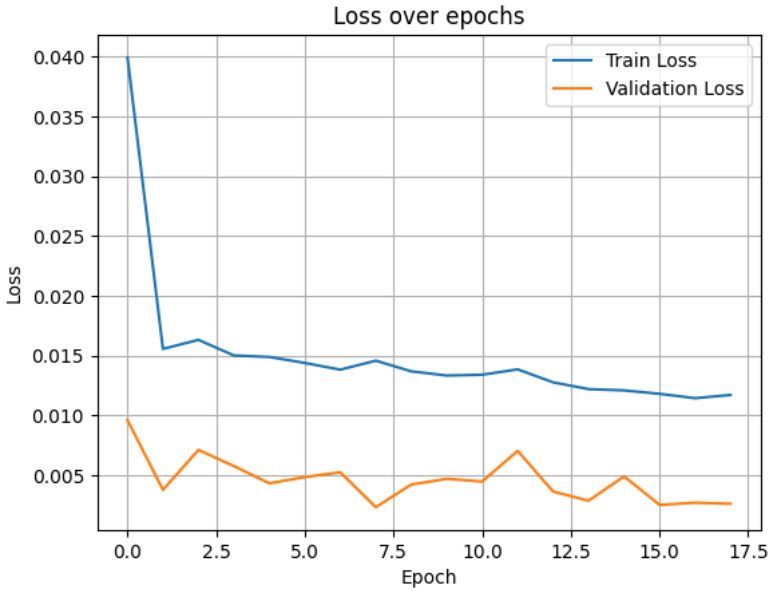
	MAE	RMSE
LR_5	0.991041	1.646082
LR_50	0.875689	1.434040
SVR_5	0.753011	1.399603
SVR_50	0.618184	1.142305

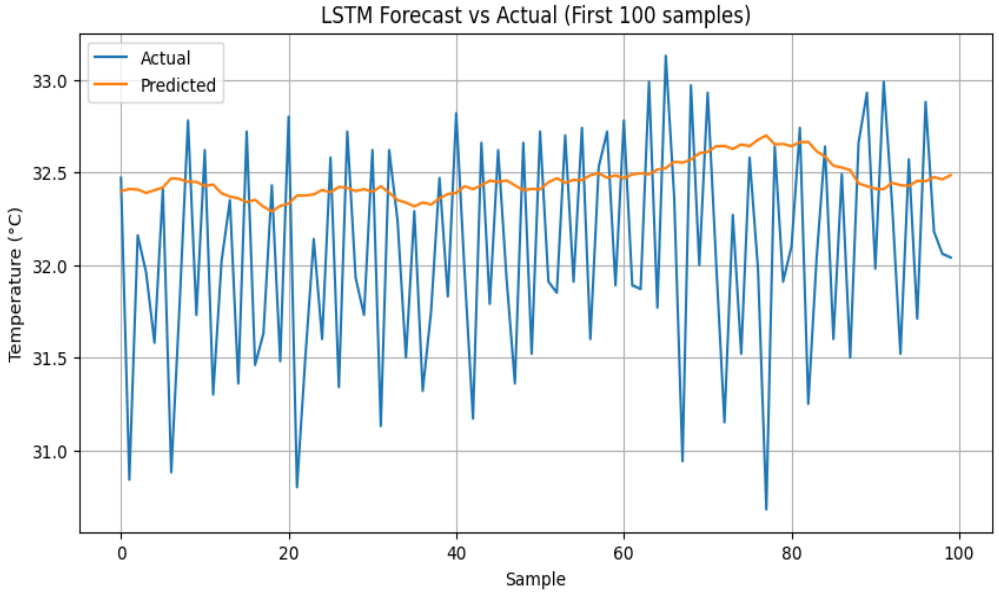
LSTM Model Architecture

- Input : Last 60 minutes of temperature
- Output : Temperature 10 minutes in future
- Layers:
  - LSTM (64 units)
  - Dropout (20%)
  - LSTM (32 units)
  - Dropout (20%)
  - Dense (1 output)

LSTM Training & Results

- Evaluation
  - MAE = 0.5542, RMSE = 0.6747





Discussion

- Why LSTM performed better
  - Capture time dependencies
  - Learns nonlinear patterns
  - Handles longer input sequences

- Conclusion : LSTM > LR/SVR for this task