A Study of Weather Conditions for Developing a Local Weather Forecast Web Application

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Introduction

Inage from: Wikipedia

Thailand map

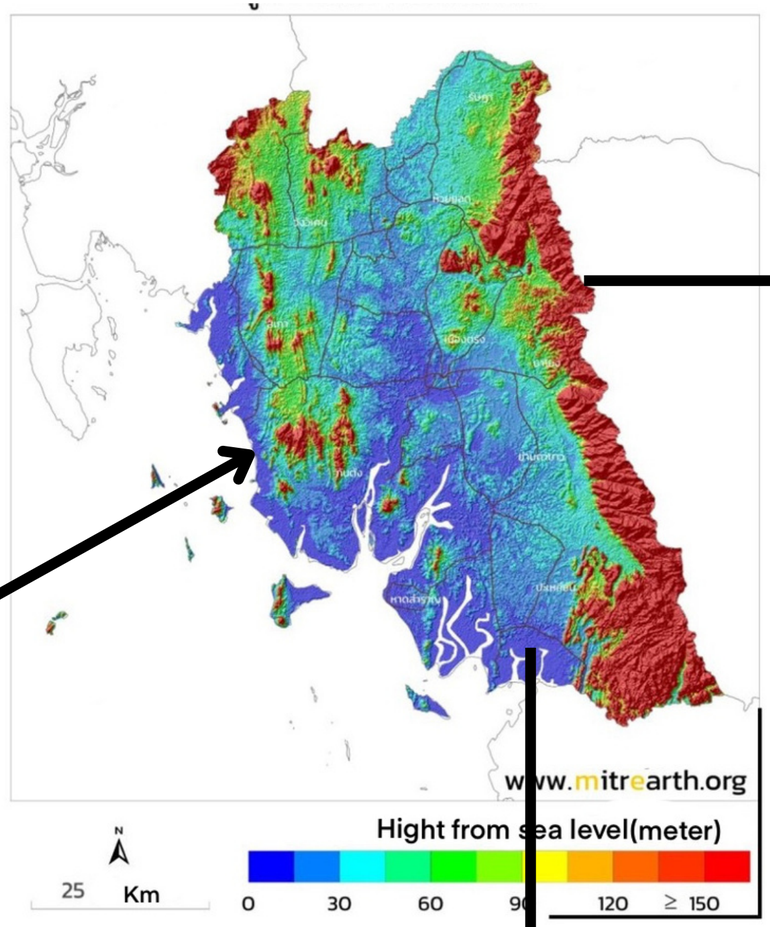


Image from: iStock

Mountain landscape

Different?

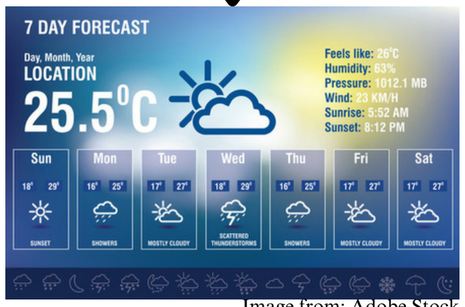
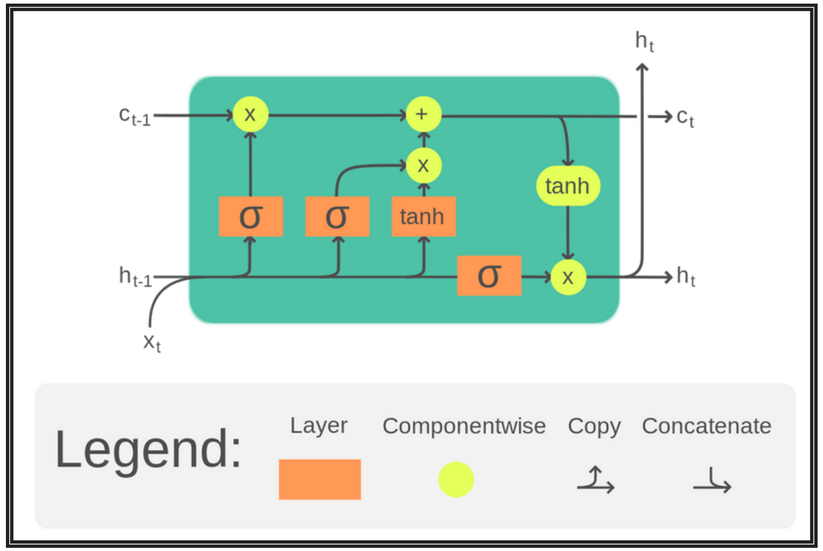


Image from: Adobe Stock

Plain landscape

Introduction

python



LSTM

Line Chatbot

Research Question

1. Are weather condition different in Mueang Trang district and Yan Ta Khao district of Trang province?

2. Could our web application report weather conditions and forecast the weather in Mueang Trang district and Yan Ta Khao district?

Research Hypothesis

1. The weather condition in Mueang Trang district and Yan Ta Khao district of Trang province are different.

2. Our web application can report weather conditions and forecasts the weather in Mueang Trang district and Yan Ta Khao district

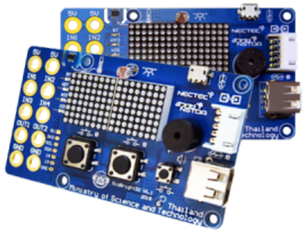
Material

Digital themometer

Digital hygrometer

rain gauge

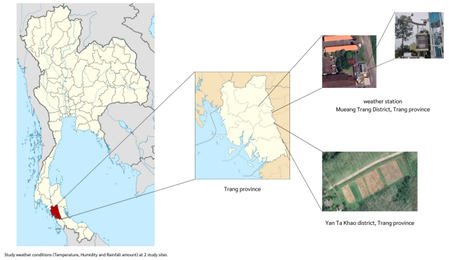
Anemometer



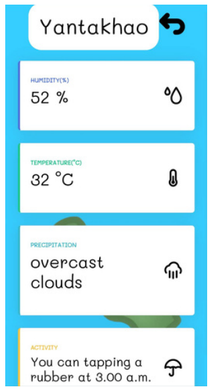
Kid Bright board

Google Colab

Method



Study weather conditions (Temperature, Humidity and Rainfall amount) at 2 study sites



1 Set study site

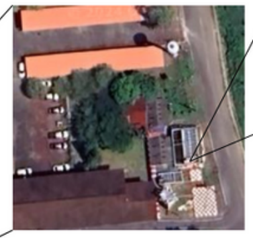
2 Data Collection

3 Creating web application

4 Data Analysis

Study Site

Trang province



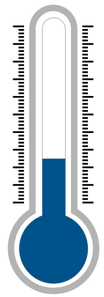
weather station
Mueang Trang District, Trang province

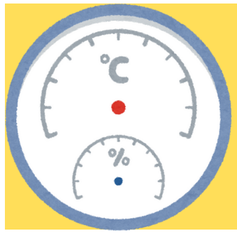
Yan Ta Khao district, Trang province

Study weather conditions (Temperature, Humidity and Rainfall amount) at 2 study sites

Data Collection

1. Measuring air temperature using a digital thermometer by requiring the thermometer to read the temperature every noon.





2. Measuring relative humidity in the air using a digital hygrometer.

3. Measuring the rainfall amount using a rain gauge to collect rainfall data once a day (every 24 hours) at noon (Solar noon).

4. Send data to GLOBE Data Entry.

Creating web application

1. Data preparation to make a model understand input data and arrange data to 20 previous hour weather data and 1 hour future data then separate data 80% for training data and 20% for testing

2. Modify a lstm model by add input layer, hidden layer and output layer of neural network model

3. Evaluate model 1.Check a loss graph to prove that model didn't overfitted
2.Check mean square error of model

Creating web application

1. Training LSTM model

2. Creating web application using JavaScript CSS and HTML and use Vercel for hosting the web application

3. Creating Line Chatbot using Python.

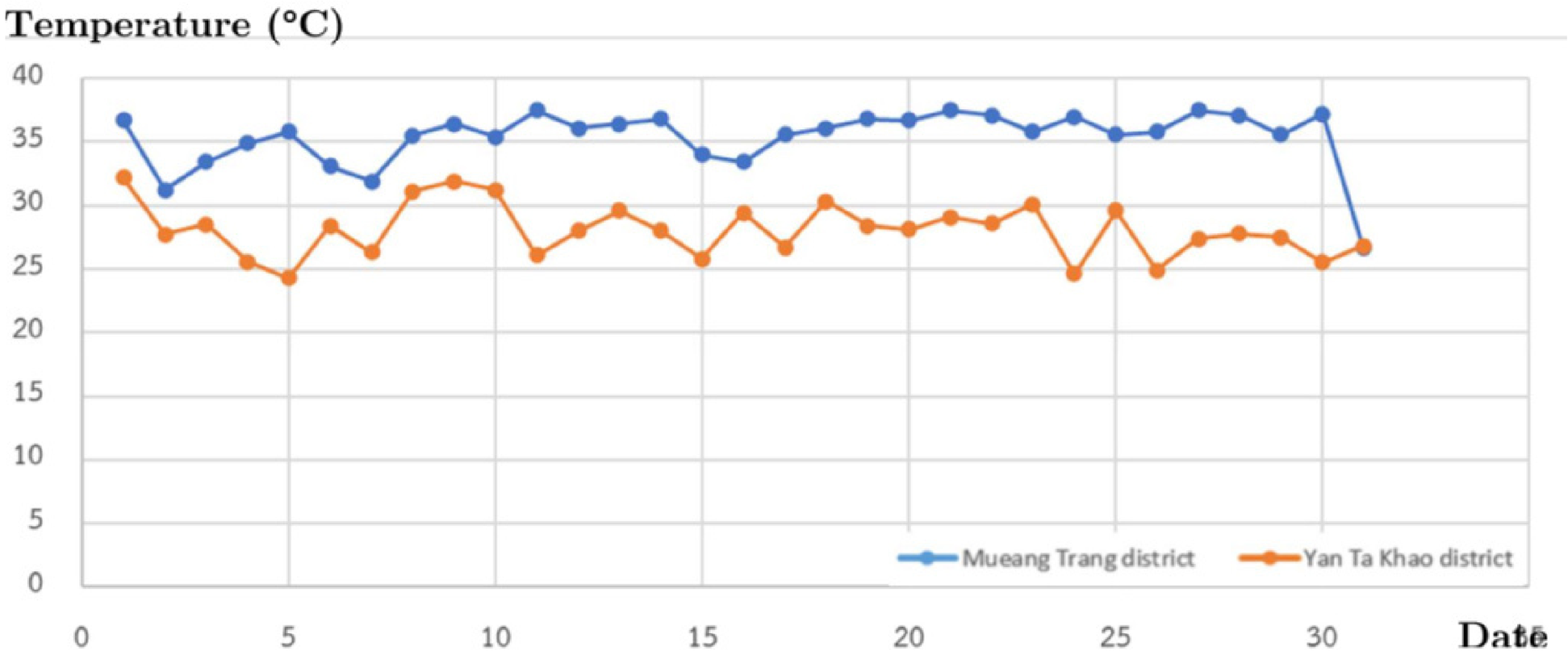
Data Analysis

Analysis the t-ststistic of weather condition and root mean squared error of LSTM model

1. Use t-ststistic to analyze the differences in weather conditions between Mueang Trang district and Yan Ta Khao district at the significance level of .05 using Microsoft Excel.

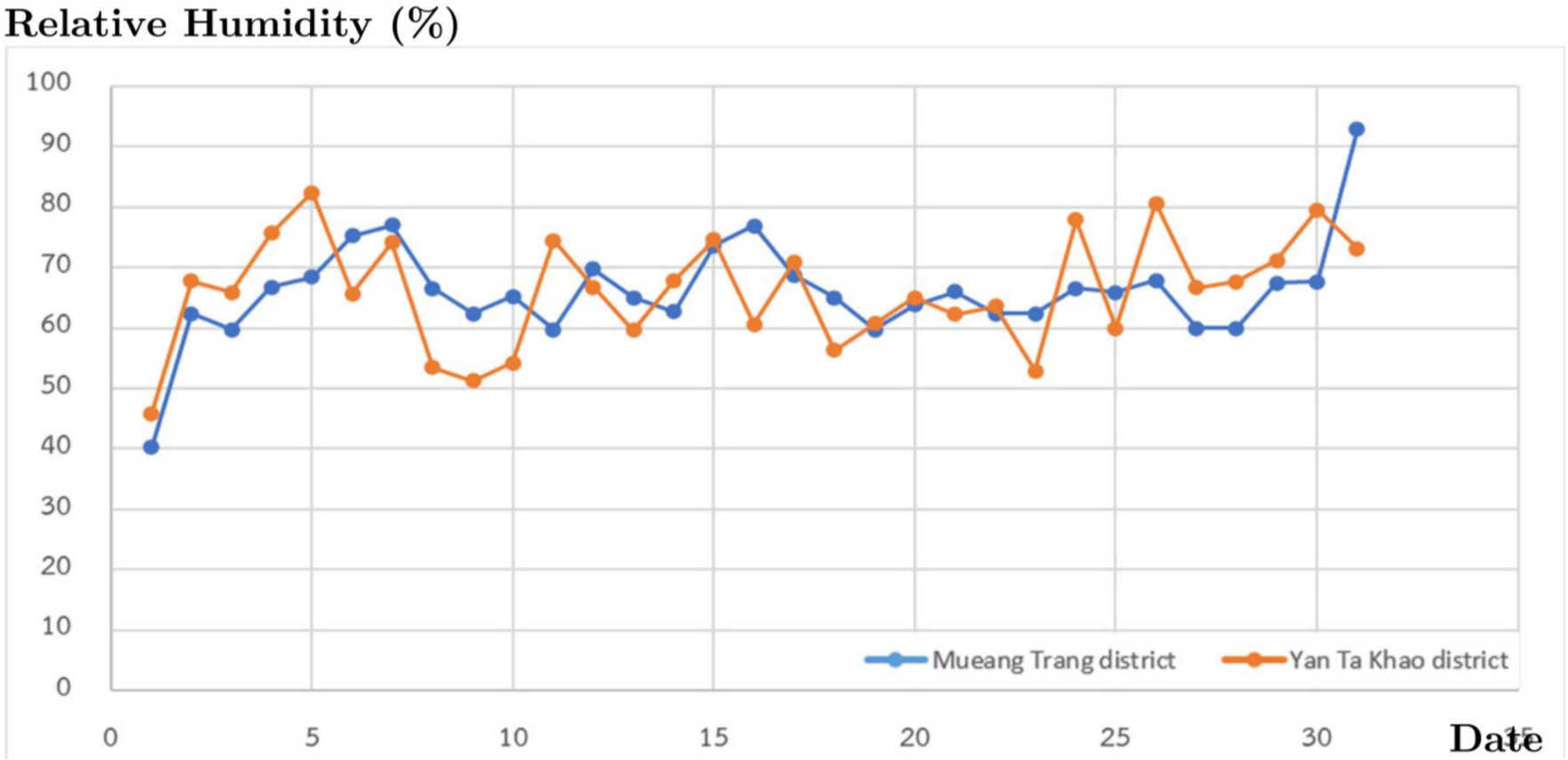
2. Using Root mean squared error in Google Colab

Result



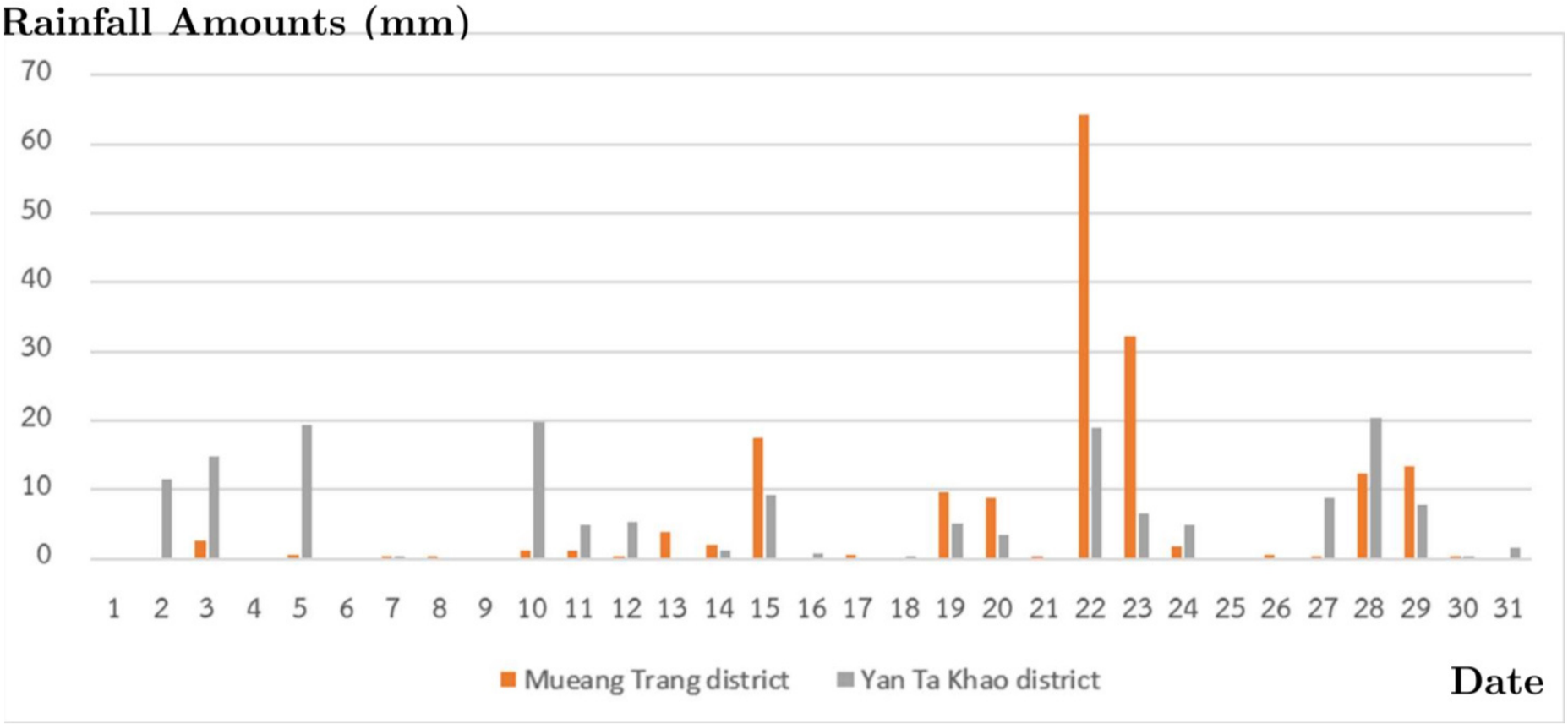
The average temperatures of Muang and Yan Ta Khao districts, Trang province, in October 2023, as shown in Graph 1

Result



The relative humidity of Muang and Yan Ta Khao districts, Trang province, in October 2023, as shown in Graph 2

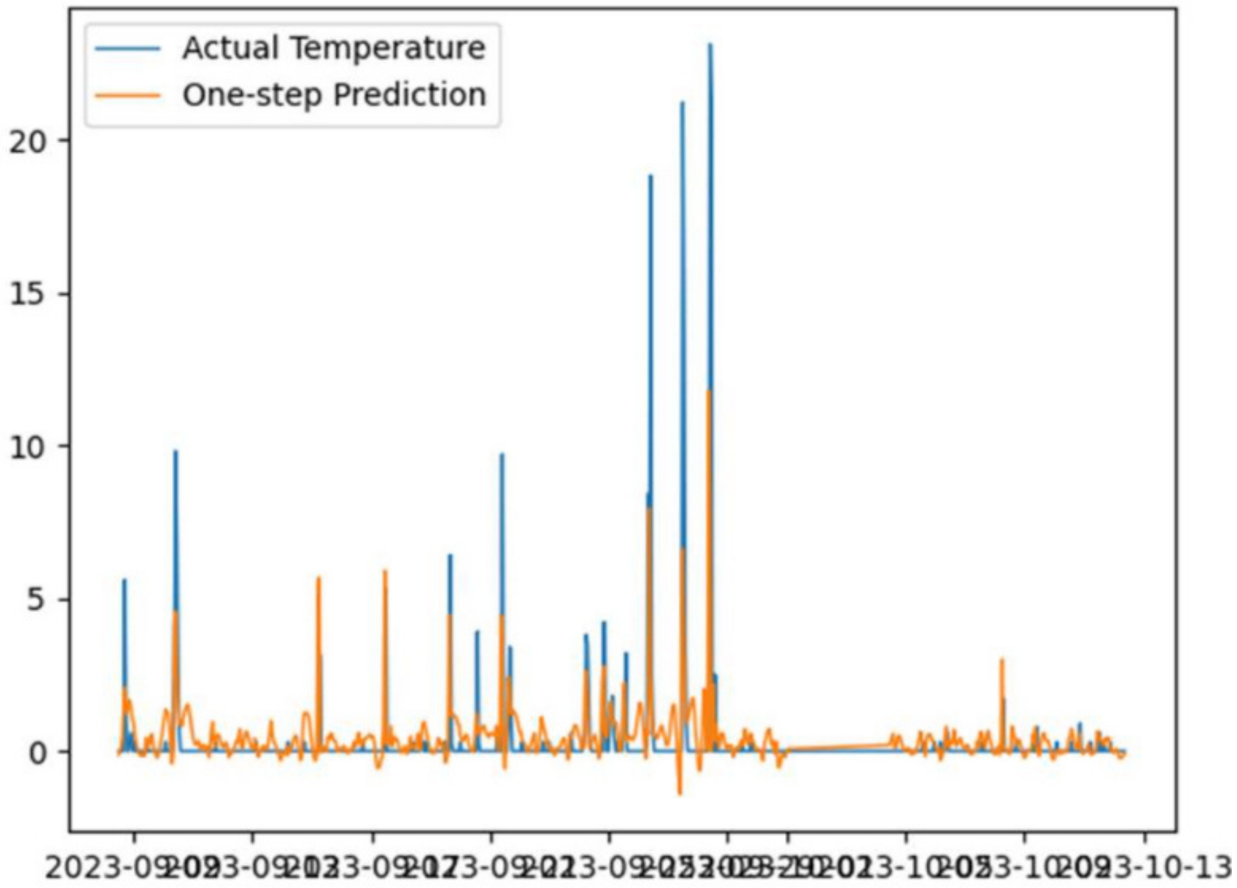
Result



The rainfall amounts of Muang and Yan Ta Khao districts, Trang province, in October 2023, as shown in Graph 3

Result

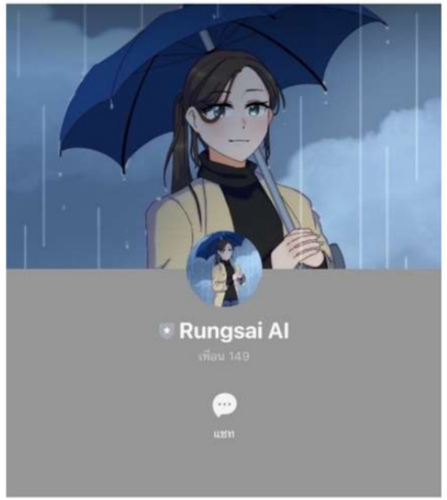
Compare the actual data and forecasting data to check mean square error



The mean squared error of LSTM model

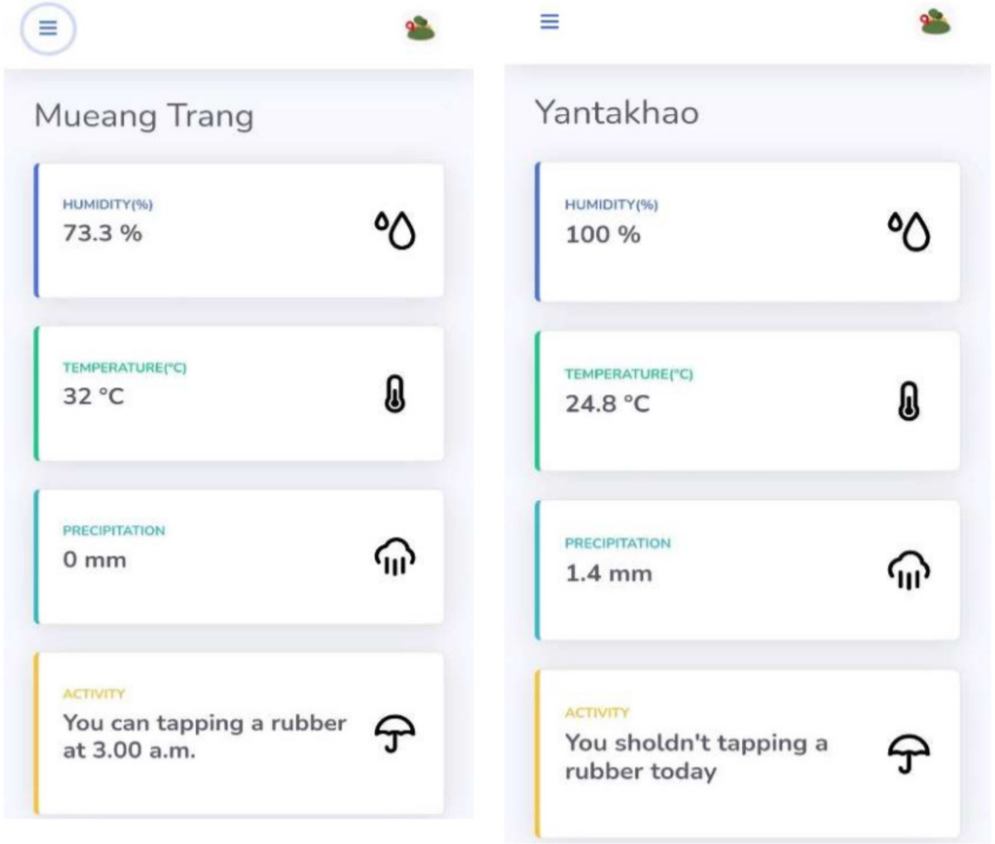
Result

LINE Chatbot



The weather conditions reported by the Chatbot is 100% accurate.

Web Aplication



The weather forecast reported via web application

Conclusion

The temperature and the amount of rainfall during October 2023 are statistically significantly different at the .05 level.

But the relative humidity of the air in both districts is not different.

This aims to increase the accuracy of weather information, allowing people in the district to receive more accurate forecasts. The study found that the chatbot was able to report weather information with 100% accuracy, while web applications built to forecast weather conditions were 85% accurate..

It was concluded that weather condition reports and forecasts from web applications for specific areas can be utilized and are beneficial to the people in those districts who wish to obtain weather information and plan their activities.

Discussion

From studying weather condition data in Mueang Trang district and Yan Ta Khao district, both are different because topography of Yan Ta Khao district is next to the sea and has mountains. For Mueang Trang district, the topography is mostly plain Therefore, if we install a weather station in each district in Trang province. Collected data and analyzed so that we can get more accurate weather information for specific areas which will be beneficial to the people in that district.

References

Al Sadeque, Z., & Bui, F. M. (2020). A deep learning approach to predict weather data using cascaded LSTM network. 2020 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE). https://doi.org/10.1109/ccece47787.2020.9255716

Hewage, P., Behera, A., Trovati, M., & Pereira, E. (2019). Long-short term memory for an effective short-term weather forecasting model using surface weather data. IFIP Advances in Information and Communication Technology, 382-390. https://doi.org/10.1007/978-3-030-19823-7_32

Maqsood, I., Khan, M., & Abraham, A. (2004). An ensemble of neural networks for weather forecasting. Neural Computing and Applications, 13(2). https://doi.org/10.1007/s00521-004-0413-4

Schultz, M. G., Betancourt, C., Gong, B., Kleinert, F., Langguth, M., Leufen, L. H., Mozaffari, A., & Stadtler, S. (2021). Can deep learning beat numerical weather prediction? Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 379(2194), 20200097. https://doi.org/10.1098/rsta.2020.0097

Zenkner, G., & Navarro-Martinez, S. (2023). A flexible and lightweight deep learning weather forecasting model. Applied Intelligence, 53(21), 24991-25002. https://doi.org/10.1007/s10489-023-04824-w