The Blue Sky Challenge

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Theme & Objective

Sub-Theme: 2

Forecasting Sensor Measurements in Smart Air Quality Monitoring System.

Objective:

To discover new innovative solutions for developing smart air quality monitoring systems by integrating sensor technology with machine learning algorithms.

Literature Review

Sr. No.	Author	Title	Publisher
1.	Chew Cheik Goh, Latifah Munirah Kamarudin, Ammar Zakaria, Hiromitsu Nishizaki, Nuraminah Ramli, Xiaoyang Mao, Syed Muhammad Mamduh Syed Zakaria , Ericson Kanagaraj, Abdul Syafiq Abdull Sukor and Md. Fauzan Elham	Real-Time In-Vehicle Air Quality Monitoring System Using Machine Learning Prediction Algorithm	**MDPI**
2.	Salman Ahmad Siddiqui, Neda Fatima, Anwar Ahmad	Smart Air Pollution Monitoring System with Smog Prediction Model using Machine Learning	International Journal of Advanced Computer Science and Applications.

Literature Review

Sr. No.	Author	Title	Publisher
3.	D.Saravanana, K.P.Hemalathab, B. Jinithac, Dr. K. Santhosh Kumard, and P.Hemalathae	Predict and Measure Air Quality Monitoring System Using Machine Learning	Turkish Journal of Computer and Mathematics Education
4.	Marzena Banach, Rafał Długosz, Tomasz Tala´ska and Witold Pedrycz 3	Air Pollution Monitoring System with Prediction Abilities Based on Smart Autonomous Sensors Equipped with ANNs with Novel Training Scheme	MDPI

Implemented Models

- LSTM with GRU layer.
- LSTM with Dense layer
- LSTM with Conv1D layer.

Model 1: LSTM with GRU layer

- Layers Used: This models consists of one GRU layer with a kernel initializer of “he_normal”, dropout layer and two LSTM layers with one Dense layer as an output layer.
- Optimizer used: Adam.
- Results:
  - Mean absolute percentage error:

1. CO(GT): 0.35
2. T: 0.16

Model 2: LSTM with Dense layer

- Layers Used: This models consists of one dropout layer and a Dense layer as an output layer.
- Optimizer used: Adam.
- Results:
  - Mean absolute percentage error:

1. CO(GT): 0.35
2. T: 0.15

Model 3: LSTM with Conv1D layer

- Layers Used: This models consists of two LSTM layers dropout layer, Conv1D layer and a Dense layer as an output layer.
- Optimizer used: Adam.
- Results:
  - Mean absolute percentage error:
  1. CO(GT): 0.35
  2. T: 0.15

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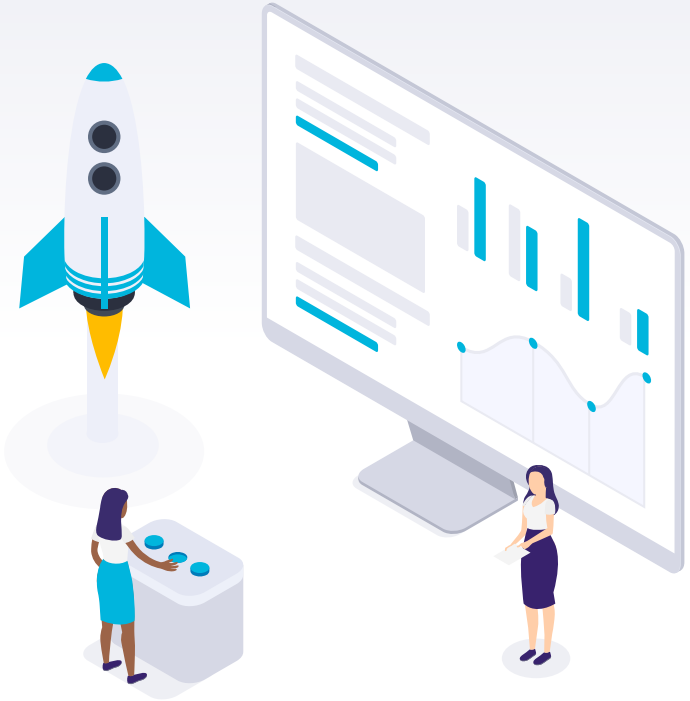
Proposed Methodology



Data Preprocessing

- The CO(GT) and T columns from the given dataset were chosen for the preprocessing.
- Total number of anomaly values to be replaced by null values: -200.
- Method used to fill the Null values: Linear Interpolation
- Then we took the data for first 7 days and then proceeded for training.

Final Model: LSTM with GRU layer

- We finalized LSTM model with GRU in which we have used:
- Layers used-
  1. 2 LSTM layers,
  2. 1 Dropout layer
  3. 1 Dense layer
- Activation function- relu
- Optimizer- adam.

Attributes	MAPE
CO(GT)	**0.34**
Temperature	**0.16**

Results & Discussions

Model	CO(GT) AVG MAPE	Temperature AVG MAPE
LSTM with GRU	**0.35**	**0.20**
LSTM With Dense	**0.35**	**0.15**
LSTM Wih Conv1D	**0.35**	**0.24**

Results & Discussions

Day	CO(GT) MAPE	T MAPE
Day 8	**0.18583**	**0.07434**
Day 9	**0.16049**	**0.27813**
Day 10	**0.47705**	**0.12950**
Day 11	**0.30354**	**0.06220**
Day 12	**0.63927**	**0.09712**
Day 13	**0.36005**	**0.39956**
Day 14	**0.29879**	**0.13799**
Average	**0.34643**	**0.16841**

References

1. "MDPI-The publisher of open access journals" Accessed on: 29th December 2021, Available [Online] At: https://www.mdpi.com

2. "Smart Air Pollution Monitoring System with Smog Prediction Model using Machine Learning" by Salman Ahmad Siddiqui, Neda Fatima, Anwar Ahmad. Accessed on: 29th December 2021, Available [Online] At: https://thesai.org/Downloads/Volume12No8/Paper_46Smart_Air_Pollution_Monitoring_System.pdf

3. "An IoT enabled system for enhanced air quality monitoring and prediction on the edge" by Ahmed Samy Moursi, Nawal El-Fishawy, Soufiene Djahel & Marwa Ahmed Shouman. Accessed on: 30th December 2021, Available [Online] At: https://link.springer.com/article/10.1007/s40747-021-00476-w

THANKS!

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