DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

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Course: Deep Learning

Course Code: ISE741

Semester: VII **Sec:** B

TRAINING AN LSTM MODEL WITH 5 DENSE LAYERS ON TIME SERIES DATASET

Submitted by:

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INDEX

OBJECTIVE

The objective is to train an LSTM (Long Short-Term Memory) model with 5 dense layers on a time series dataset to accurately predict future values, leveraging the network's ability to capture temporal dependencies and patterns in sequential data.

DATASET DESCRIPTION

Date:

Description: Represents the date when the sensor data was recorded.

Use: Temporal information allowing for analysis over time.

Time:

Description: Indicates the time of day when the sensor data was recorded.

Use: Enables the analysis of patterns and variations in the data across different times.

P1 to P9:

Description: Numerical sensor measurements capturing various environmental parameters.

P1 to P4: Measurements related to air quality (e.g., particulate matter concentrations).

P5 to P7: Numeric values representing environmental conditions or sensor readings.

P8 and P9: Potentially binary indicators with values 0 or 1.

Use: Essential variables for understanding and predicting environmental conditions and pollution levels.

Additional Notes:

Units: The units for each parameter should be clarified for accurate interpretation.

Duplicates: The dataset appears to have duplicated rows; clarification or removal may be necessary.

Zero Values: P8 and P9 have consistent zero values; understanding their significance is crucial.

CONCEPT AND MODEL

Long Short-Term Memory (LSTM):

Description: A type of recurrent neural network (RNN) designed to capture long-term dependencies in sequential data.

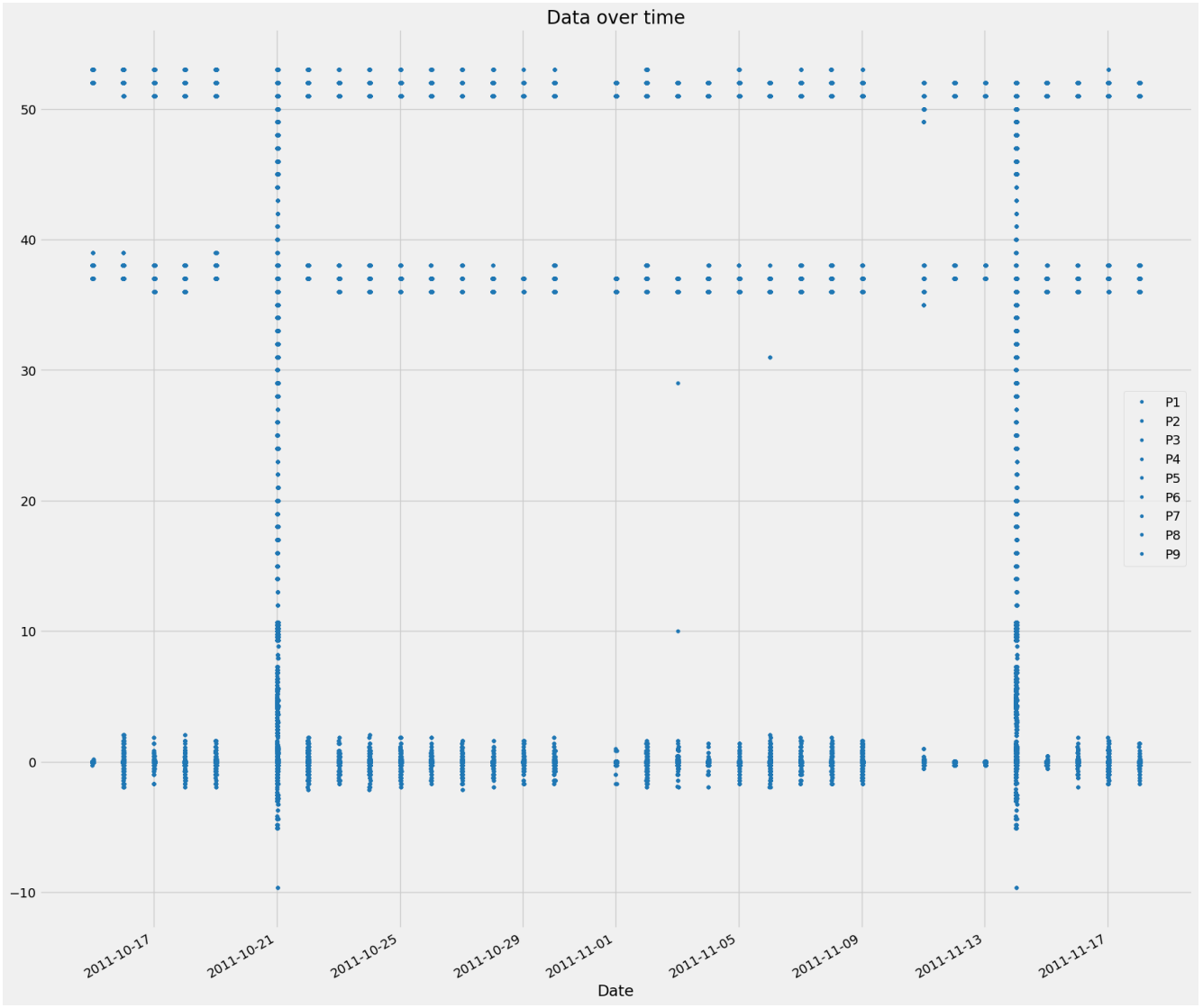
Application: Essential for learning patterns and relationships in time series data with complex temporal structures.

Sequential Data Processing:

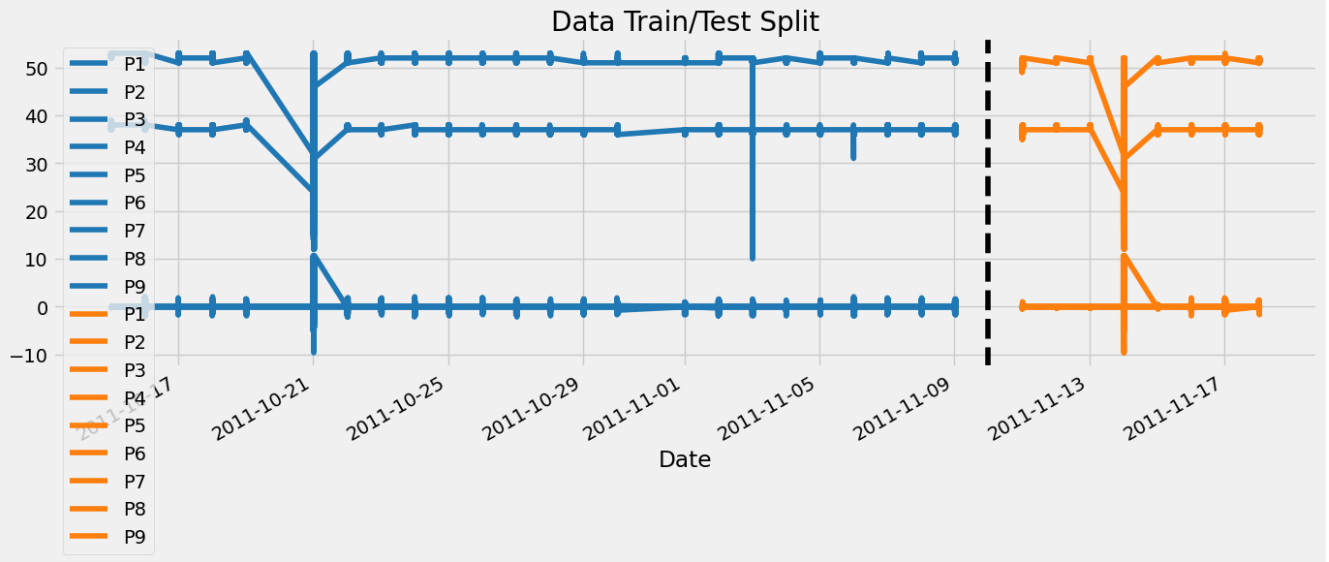
Description: Deep learning models, particularly LSTMs, are designed to handle sequential data where the order of observations matters.

Application: Enables the model to understand and leverage temporal dependencies in sensor data.

DATASET VISUALIZATION



TRAIN TEST SPLIT

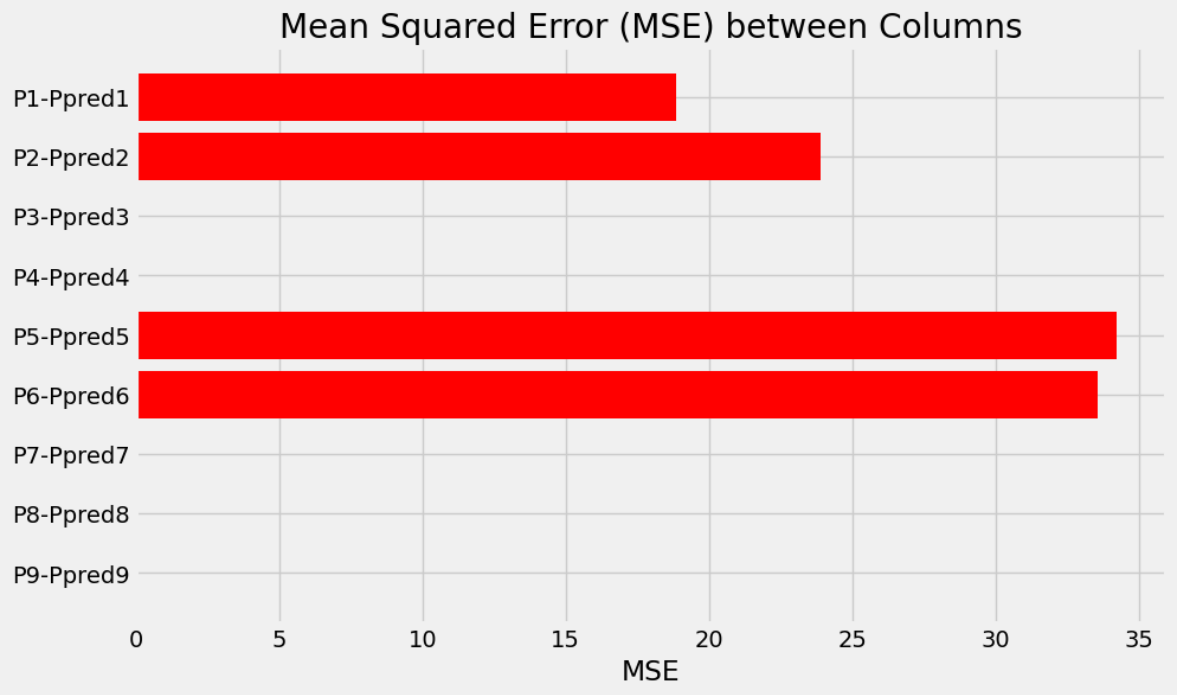


MODEL STRUCTURE

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 100)               44000

 dense (Dense)               (None, 64)                6464

 dense_1 (Dense)             (None, 32)                2080

 dense_2 (Dense)             (None, 16)                528

 dense_3 (Dense)             (None, 8)                 136

 dense_4 (Dense)             (None, 9)                 81

=================================================================
Total params: 53289 (208.16 KB)
Trainable params: 53289 (208.16 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

TRAINING LOSS CURVE

MSE BETWEEN ACTUAL VALUE AND PREDICTION



```
MSE between P1 and Ppred1: 18.8305
MSE between P2 and Ppred2: 23.8992
MSE between P3 and Ppred3: 0.0001
MSE between P4 and Ppred4: 0.0000
MSE between P5 and Ppred5: 34.2335
MSE between P6 and Ppred6: 33.5619
MSE between P7 and Ppred7: 0.0162
MSE between P8 and Ppred8: 0.0168
MSE between P9 and Ppred9: 0.0161
```

PATTERN PREDICTED VS THE ACTUAL PATTERN