



# Precipitation Forecasting by Deep Learning based Model using Bhopal Radar Data

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## Introduction

Precipitation nowcasting is essential because it provides critical information that is used to protect people, property, and infrastructure from the impacts of extreme weather events. It is crucial tool for weather forecasting, flood prediction and management, agriculture, transportation, and emergency responses particularly important for people who live or work in areas prone to extreme weather events, as it helps them prepare for potentially dangerous conditions and make informed decisions about their activities hence, it plays a vital role in keeping communities safe and resilient. In this study, we use Bhopal Radar Precipitation Data for 2021 JJAS duration with twenty minutes resolution to develop a Deep Learning-based Conv-LSTM model for precipitation nowcasting.

## Data & Methodology

- We considered the data from IMD radar . The data was provided from duration June to September with time interval of 20 minutes.
- The raw data was provided in the polar coordinates.

Duration	Time resolution	#Samples
JJAS 2021	20 minutes	8459

### Data Pre-processing:

1. Conversion from polar to cartesian coordinate by fixing 2 Km height above the ground.
2. Data Capping is applied to remove outliers and scaling is done using Normalization.
3. Transformation from real space to exponential space to deal with 'NaN' values. ( $e^{kx}$  where  $k = 2$ )
4.  $k = 2$  is used to scale back the values to the original range (see figure 1).

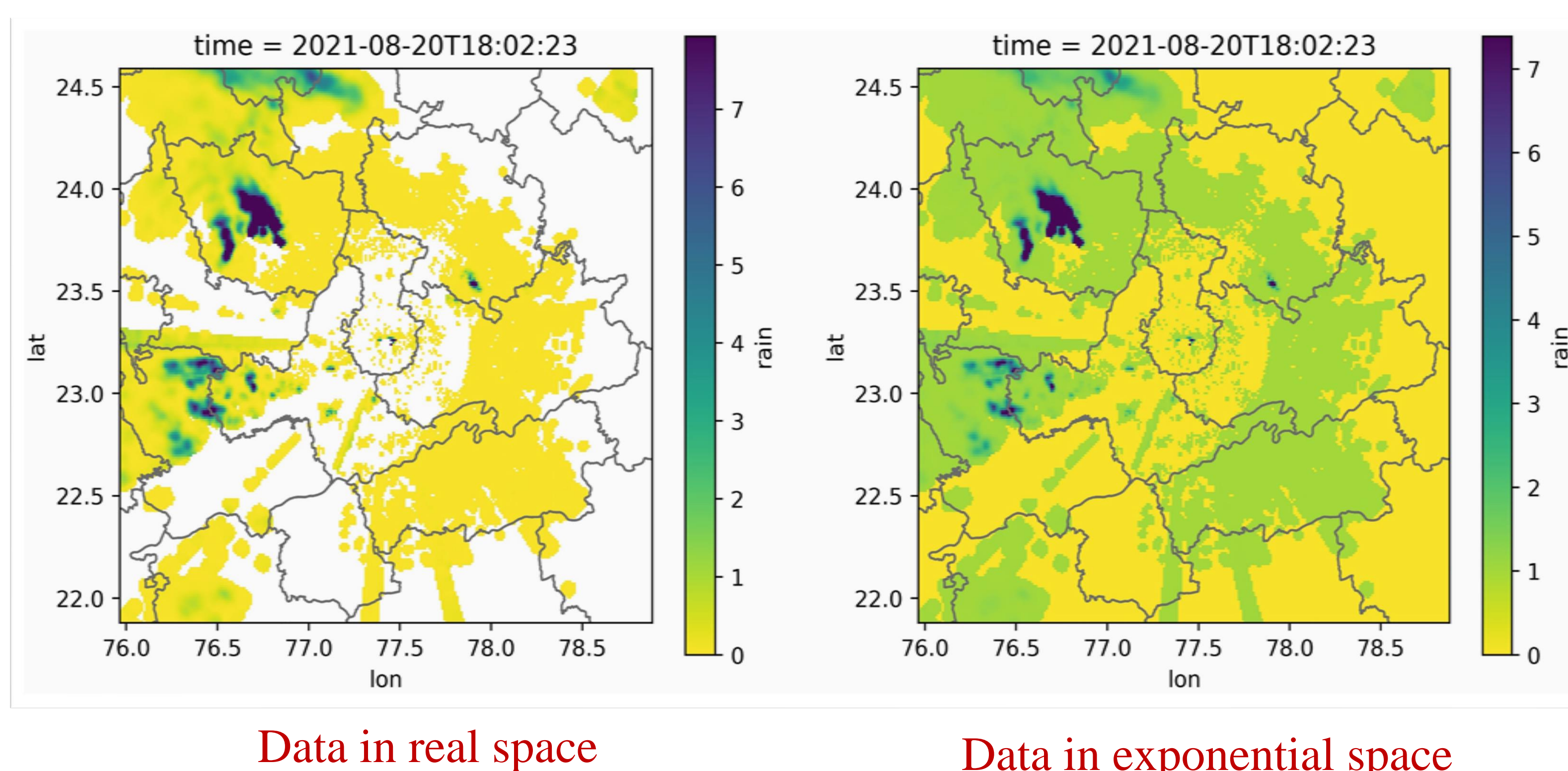


Figure 1: Transformation of Data from Real Space to Exponential Space

## Results

- We used CNN based deep learning model 'ConvLSTM'.

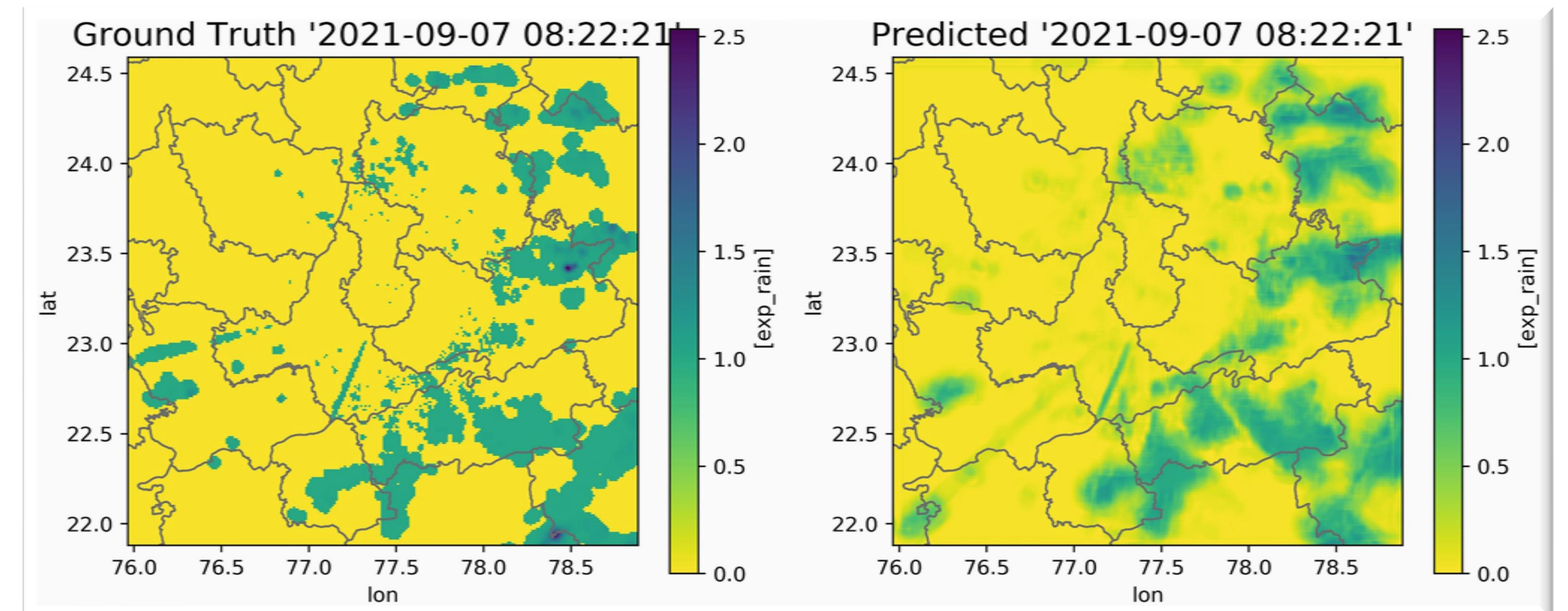


Figure 2: Ground Truth vs Predictions for Lead 1 (Correlation of 0.70)

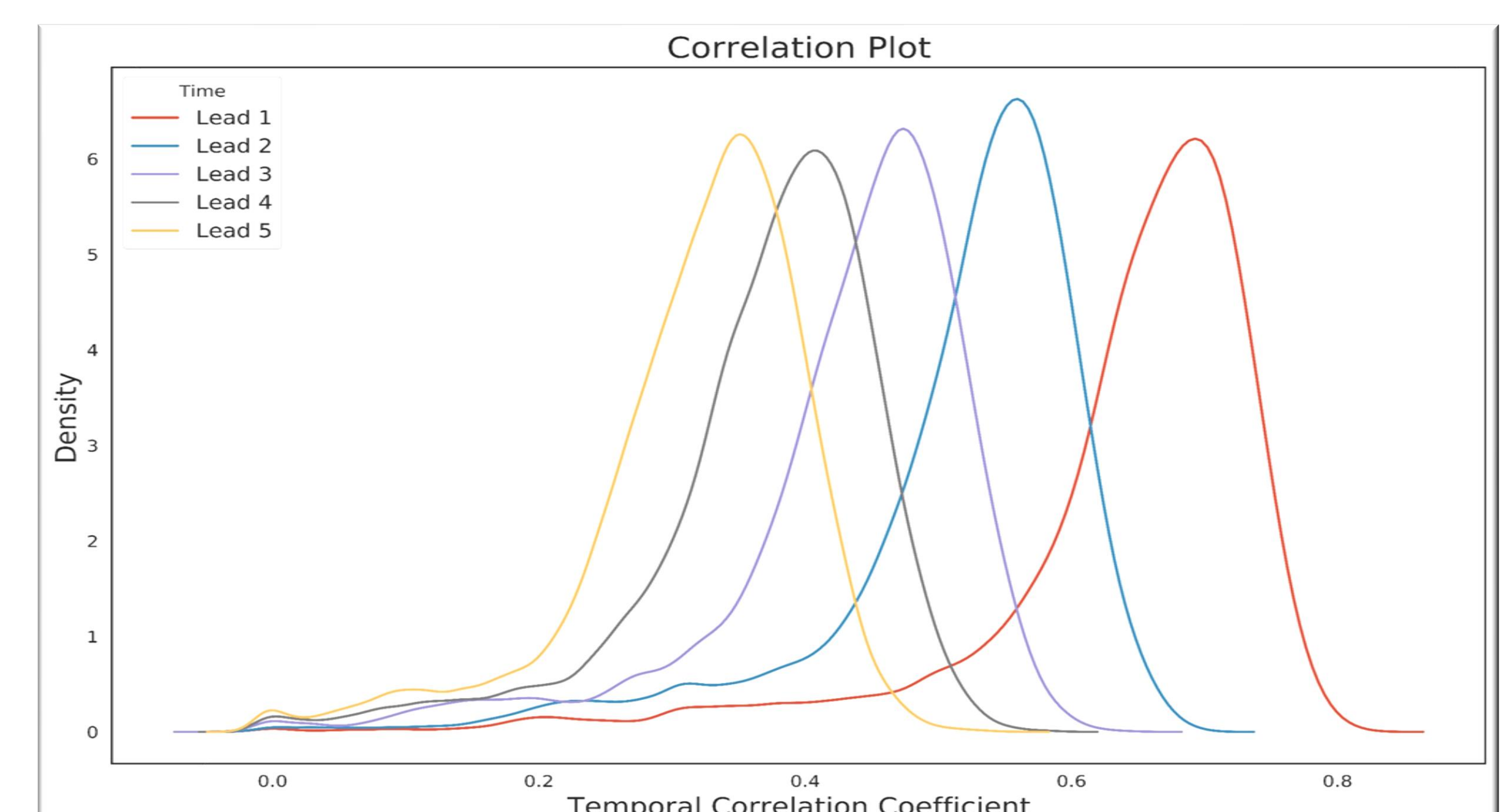


Figure 3: Density plot of correlation distribution up to Lead Time 5.

## Conclusions

- For Lead Time 1 model gives high correlation of 0.75 for most of the values.
- The model accuracy falls for successive lead times this is due to lead time 1 predictions are used to generate following predictions
- The model provided good correlation up to three lead time steps using single variable equivalent to one hour nowcasting.

## Future work

- Current the model takes only one variable as input, i.e. precipitation. The skill can be improved by using multivariable input.
- The data was available only for one year 2021. More data can enhance the model skill.
- The model can also be improved by more hyper parameter tuning.

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