

# CS460 Project proposal: Weather forecast by time series forecast method

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September 10, 2021

# Goal

- Our goal is to predict different quantities like average monthly temperature, rainfall of different location
- We will be using time series forecast method.
- We will try to do some changes or/and add something to these time series forecast method to improve the forecast

# Time series

- A time series is a series of data points indexed in time order. Most commonly, a time series is a sequence of observation taken at successive equally spaced points in time.  
e.g Daily Max and Min Temperature record
- Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data.
- Time series forecasting is the use of a model to predict future values based on previously observed values.

- We will be accumulating data from IMD websites and other meteorological websites.
- Our data will be temperature, pressure, wind speed, humidity etc.

- Auto regressive (AR) Model
- Integrated (I) Model
- Moving average(MR) Model
- Combination of these: autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models ARIMAX
- SARIMA
- SARIMAX

# ARIMA model

- AR MODEL AR(p): we forecast the variable of interest using a linear combination of predictors. In an autoregression model, we forecast the variable of interest using a linear combination of past values of the variable.

$$y_t = c + \phi_1 y_{t-1} + \dots + \phi_p y_{t-p} + \epsilon_t \quad (1)$$

$\epsilon_t$  is white noise

- MA model MA(q):-Rather than using past values of the forecast variable in a regression, a moving average model uses past forecast errors.

$$y_t = c + \epsilon_t + \theta_1 \epsilon_{t-1} + \dots + \theta_p \epsilon_{t-p} \quad (2)$$

# ARIMA

An ARIMA model is characterized by 3 terms:  $p$ ,  $d$ ,  $q$ . It is basically a combination of previous mentioned model where,

- $p$  is the order of the AR term.
- $q$  is the order of the MA term.
- $d$  is the number of differencing required to make the time series stationary.

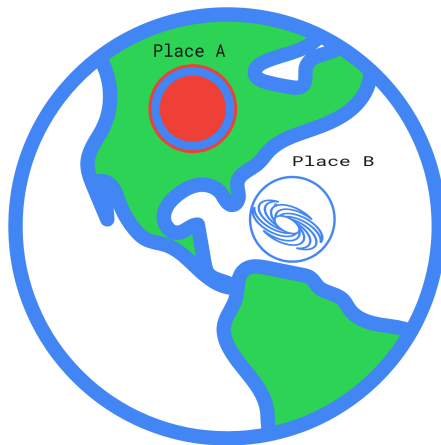
If a time series, has seasonal patterns, then you need to add seasonal terms and it becomes SARIMA, short for 'Seasonal ARIMA'.

# Challenge

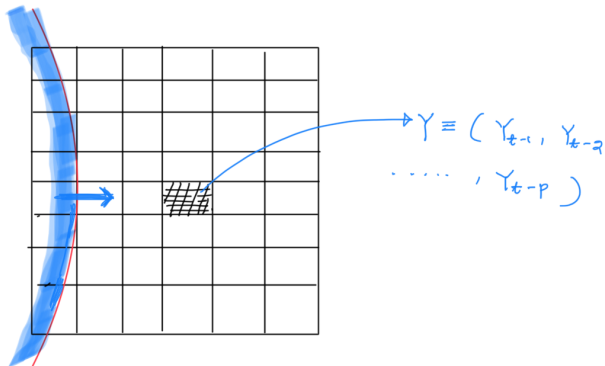
- 1 SARIMAX and ARIMAX uses Exogenous variable( $X$ ) on which our prediction may depend. We are thinking to add some more Exogenous variables to our model.
- 2 In case of weather forecast just a time evolution of a place cannot give us a good result. We are thinking of adding information about surrounding places to it as well. The major problem will be showing the connection between the places. We would like to make a model for a place so that it is coupled to surrounding places.



# Challenge



# Challenge

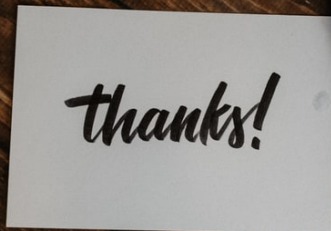


- **Upto Midway**
- We want study these Model in detail and use it (with python libraries) to predict maximum and minimum temperatures of selected local areas where we have the data.
- We would like to make experiments with the Exogenous variables (X) of SARIMAX and ARIMAX model to improve the forecast.
- **Post midsem**
- we will be thinking about some ways to tackle the above mentioned challenge
- and try to do the forecast in short time scale.

- Data Collection - Hara
- Data Refining-Ravi
- Feature engineering -Both
- implementation in python-Ravi
- HTML Site maintenance -Hara
- Thinking about the challenge -Both

# Relevance Paper

- ARIMA based daily weather forecasting tool: A case study for Varanasi, by - NIKITA SHIVHARE, ATUL KUMAR RAHUL, SHYAM BIHARI DWIVEDI and PRABHAT KUMAR SINGH DIKSHIT  
[https://metnet.imd.gov.in/mausamdocs/17019\\_F.pdf](https://metnet.imd.gov.in/mausamdocs/17019_F.pdf)
- Time series analysis of climate variables using seasonal ARIMA approach, by -TRIPTI DIMRI , SHAMSHAD AHMAD and MOHAMMAD SHARIF  
<https://www.ias.ac.in/article/fulltext/jess/129/0149>
- Forecasting daily meteorological time series using ARIMA and regression models, by - Małgorzata Murat, Iwona Malinowska, Magdalena Gos, and Jaromir Krzyszczak  
<http://www.international-agrophysics.org/pdf-104317-35384?filename=Forecasting%20daily.pdf>  
<http://www.international-agrophysics.org/Forecasting-daily-meteorological-time-series-using-ARIMA-104317,0,2.html>



*thanks!*