

# Literature Survey

India has a typical weather condition consisting of various seasons and geographical conditions. Country has extreme high temperatures at Rajasthan desert, cold climate at Himalayas and heavy rainfall at Chirapunji. These extreme variations in temperatures make us to feel difficult in inferring / predictions of weather effectively. It requires higher scientific techniques / methods like machine learning algorithms applications for effective study and predictions of weather conditions. To make better weather prediction, we need to have a big collection of data with sufficient amount of information of the weather. Machine Learning / Deep Learning Applications are one of those techniques which can be used to perform various weather forecast. The use of machine Learning

Farmers in India suffer gruesome fate at the mercy of rain gods since primary source of agriculture in India is rainfall. Agriculture is a major source of living but contributes only about 18% of total gross domestic product, its reason being lack of adequate crop planning by farmers. Although India has surplus fertile land, inefficient agricultural practices due to deficiency of rainfall and crop prediction techniques, in turn, leads to uncountable farmer suicides. Currently, the invasion of Machine Learning (ML) has abetted in finding promising solutions to address the problems of predicting rainfall, soil assessment, crop management, yield prediction, crop quality and disease detection and classification. Despite the technology, hitherto, there is no platform nor system in place to inform farmers of the rainfall predicted and advise what crops to grow.

Rainfall prediction using diverse ML and statistical algorithms is encapsulated, accordingly best suitable crops to grow are recommended keeping soil as a parameter. The raw real-time rainfall data acquired was pertained to three regions of Karnataka North, South and Coastal. Data was cleaned and structured and its features extracted. Statistical tests — ADF, KPSS, ACF, PACF executed on the feature extracted data revealed its trend and seasonality insightful for modelling. Using effective ML and statistical algorithms such as ARIMA, ANN, random forest, TBATS, Holt-Winters, simple, double, triple exponential smoothening et al., rainfall for the next six years was predicted. All three regions were distinctly modelled.

Time series forecasting using ARIMA proved to be the best performer. All models' performances are validated using standard error measures to have authenticity of accuracy.

The generalized accuracy of ARIMA model averaging on all three regions is 92.91%, ANN 88.26%, TBATS 61%, simple exponential smoothing had 71.1%, double exponential smoothing is 68.63%, triple exponential smoothing accuracy is 57.42%, and random forest gave 42%.

In India, a few investigations have been completed to decide the progressions on relationship of temperature with environmental modification. Pramanik and Jagannathan (1954) concentrated those common patterns can be observed on the yearly average greatest & least temperatures throughout our country remained. They inferred that it is observed no broad inclination can be seen increment as well as lessening in these readings. The breaking down of the arrangement of time of average yearly readings done a bunch of 8 weather stations of India by Jagannathan and Parthasarathy (1973).

It was a detailed and expanding pattern in the average yearly weather readings of Allahabad, Bangalore, Mumbai, Kolkata and a diminishing pattern at Chennai. Sarker and Thapliyal (1988) looked into environmental alteration of the past 70 years and demonstrated a minor heating pattern, dry-bulb temperature has an estimation of patterns of temperature; although precipitation displayed no pattern.

Srivastava et al. (1992) investigated the patterns of decadal in environment all across India provided the primary signs of the daytime deviation of weather patterns across India is very not moderately the same as which saw across numerous different pieces around the world. Srivastava et al. (1992) tracked down that greatest reading display a lot bigger expanding patterns as compared to the base temperatures, across a significant piece of the nation. The diminishing pattern in reading of temperature across the vast majority on the northerly pieces of the nation, combined through an expanding pattern across southerly parts, and an in general marginally expanding pattern of the request for  $0.30^{\circ}\text{C}$  remained during the most recent century.

It was shown by Rupa Kumar et al. (1994) that the nationwide average greatest temperature has ascended by  $0.5^{\circ}\text{C}$ , and the average least temperature was

diminished by  $0.2^{\circ}\text{C}$ . Notwithstanding, as per outcome from average least temperature reading isn't genuinely critical, they reasoned that a large portion in expansions in average temperature of air and surface above India are because of the increment in daylight reading. Kumar and Gasp (1998) dissected the information for 1880–1996 and exhibited that a huge heating pattern of  $0.60^{\circ}\text{C}$  was observed each century.

The extent of heating is increasing in the post-monsoon & wintertime. It can be seen temperature in rainy season doesn't demonstrate a critical pattern at all in significant pieces in our nation with the exception of a huge negative pattern across north-western parts of our country. Not one critical pattern stood in the precipitation on any yearly or the occasional premise. The current data on environmental variation as well as on patterns are event of the outrageous occasions across the nation was summed up by Sinha Ray and De (2003). The situation is accounted for that precipitation and external pressing factor found that middle value of over the country all in all show no huge pattern.

An expanding pattern of the request for  $0.35^{\circ}\text{C}$  in the course of the most recent was observed in archives. Outrageous most stimulating and least readings display a diminishing pattern in the northside and expanding in southern parts. Forthcoming heating situations were created for the nation's mainland utilizing universal sequence models. Water assets assume an imperative part of the economic development of the sub-continent. The rural areas were probably going the most noticeably awful influenced by hotter environment.

The significant streams of India originating from the Himalayas, in particular, the Ganga, the Indus, as well as north eastern Brahmaputra, and get the generous measure of water obtained by melting of snow as well as glacial masses. The Himalayan water produce from ice-took care of streams is generally double as compare to the peninsular waterways. A few investigations to appraise the commitment of snow and glacial masses in the yearly progressions of a couple of Himalayan streams were done by Singh et al. (1995, 1998) and Singh and Jain (2001).

A case study has been undertaken to examine the occurrence of climate change in Tamil Nadu, the southernmost state of India and its impact on rainfall pattern which is a primary constraint for agricultural production. Among the five sample

stations examined across the state, the minimum temperature has increased significantly in Coimbatore while the same has decreased significantly in Vellore whereas both minimum and maximum temperatures have increased significantly in Madurai since 1969 with climate change occurring between late 1980s and early 1990s. As a result, the south-west monsoon has been disturbed with August rainfall increasing with more dispersion while September rainfall decreasing with less dispersion. Thus September, the peak rainfall month of south-west monsoon before climate change, has become the monsoon receding month after climate change. Though there has been no change in the trend of the north-east monsoon, the quantity of October and November rainfall has considerably increased with increased dispersion after climate change.

On the whole, south-west monsoon has decreased with decreased dispersion while north-east monsoon has increased with increased dispersion. Consequently, the season window for south-west monsoon crops has shortened while the north-east monsoon crops are left to fend against flood risk during their initial stages. Further, the incoherence in warming, climate change and rainfall impact seen across the state necessitates devising different indigenous and institutional adaptation strategies for different regions to overcome the adverse impacts of climate change on agriculture.