Problem Statement:

The primary issue is that extreme weather events brought on by climate change continue to occur more frequently and at a rate that is unusual. These events have the potential to cause a wide range of harm to people's homes and environments, and one of the most common is heatwaves. Heatwaves are prolonged periods of extremely hot weather that can last three or more days and may be accompanied by high humidity.

Model Architecture:

XGBoost: decision-tree-based that uses a gradient boosting framework and is a gradient boosting decision trees that solve errors until reaching min. error. The data was split into 80% train (1/1/2001 – 30/12/2004)

And 20% test (1/1/2005 – 30/12/2005).

Related work:

# **Prediction of heat waves over Pakistan using support vector machine algorithm in the context of climate change**

In this paper, researchers found many efficient forecasting models have been discovered to fail or perform poorly because of changes in the predictor-predictand connection when global climate changes. A climate change robust heatwave prediction model has been attempted utilizing machine learning (ML) methods known as Support Vector Machines (SVM), Random Forest (RF), and Artificial Neural Network (ANN). The skilled predictors were chosen using an SVM-based recursive feature elimination strategy. The findings revealed changes in the association of Heatwave Days (HWDs) with all of the ocean-atmospheric variables evaluated as potential predictors in this work, indicating the importance of the forward-rolling strategy presented in this study for the construction of climate change resilient forecasting models.

There was a significant shift in the connection of ocean-atmospheric factors with Pakistani HWDs over time. Changes in the lower atmosphere (925 hPa) were more powerful, particularly in recent decades. These are the results of climate change caused by global warming. As a result, the overall pattern of correlation of those factors with HWDs altered or declined. These patterns are critical to the forecasting model's accuracy. As most of the variables show a temporal and a spatial change over the period, by adding these improvements into the forecasting model, the model's failure or low skill can be prevented. As a result, the forecasting models used in this work were calibrated using a forward-thinking approach to climate change adaptation in terms of all statistical criteria evaluated, the forecasting model established in this study demonstrated predicting solid capabilities of HWDs over Pakistan. The SVM-based forward rolling model performed better in forecasting heatwaves. The SVM model may be used to predict heatwaves in Pakistan in the context of climate change. Moreover, uncertainty in prediction may be analyzed for improved decision-making on the probability of heatwaves.

# **Urban Climate**

In this paper the researchers made a review about the inter-correlation of climate change, air pollution and urban sustainability using novel machine learning algorithms and spatial information science. This study addresses this gap by systematically reviewing pertinent literature on climate change and air pollution studies.it also uses the data analysis and data science to detect the cities vulnerable to air pollution hazards. and according to this study, climatic factors and seasonal variations are critical predictors of air quality in urban areas. A strong correlation exists between climate change and air quality, and air quality in urbanized regions is projected to deteriorate with climate change in the future. This review study was carried out using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) framework in four steps: identifying problems and conducting a literature search, screening and selection, quality assessment, and data extraction from the literature. They used several models in this paper review such as [Random Forest, Gradient Boosting Algorithms, Artificial Neural Network, Support Vector Machine, Decision Trees, Deep Learning and Other Algorithms], But Random Forest and Artificial Neural Network (ANN) were the highest percentage of using in the paper review. ANN is the earliest machine learning algorithms used for air pollution prediction, The relatively higher utilization of ANN may be due to its long existence and adoption for environmental studies. Random forest’s large-scale adoption is likely due to its high capability for air pollution modelling, coupled with higher predictive performance than other algorithms.

# **Risk assessment and resilience of critical infrastructure towards climate change**

The occurring extreme weather events such as flood, heatwaves, precipitation extremes and droughts are increasing the call for a reliable C.I (Critical Infrastructure). Therefore, it is a must that we have to enhance the resilience of our C.I to work as our line of defense against these extreme events in the present and the future. In this paper, a review of current and projected impacts of climate change is carried out on possible applications of C.Is. In this paper, two case studies of precipitation extreme and drought events in India are taken into subject. Results are that north-western, north-eastern westernmost regions and western Ghats are highly prone to floods and northern, central-eastern, western, and central regions are more bound to co-occurrence of flood and drought events. Also, while conducting a case study on Kharif paddy yield forecasting using variant machine learning models, random forest was found to be the most suitable model for yield prediction. Finally, a robust framework for risk assessment and C.I resilience improvement was put forward by the authors based upon the principles of flexibility, diversity and industrial ecology putting in consideration both short-term and long-term impacts of climate risk.

Evaluation results:

First, we calculate the mean absolute error (MAE) for the Model then Make the new predicted temperature in new Data from then Make a condition if there is 3 consecutive that exceed the maximum heat range and print the heat-wave days.