**Method and State of Art**

**Sravan Kumar Borra**

**Introduction:**

Now days all the research has been concentrated on Big data and Internet of things (IoT). Big data is a vast concept used for analyzing and studying the data collected from different sources. IoT is concept about connectivity where everything is connected to internet. All these concepts are digitally revolutionized and the research is in nascent stage. One of the most important concepts which were based on IoT is Smart city.

Smart city are typically based on connectivity where everything is connected to internet. Insights for these cities are based on big data. The data is collected from different sources such as traffic, library events, pollution etc. All this data is collected and analyzed to provide better services to the people living in the city. Mainly insurance companies are looking forward to collect the data and analyze it.

**Data:**

A data set with weather observations has been selected for this project. Data set observations are collected from the city of Aarhus in Denmark. This data set has been fetched form City pulse website, which is trying to provide models to build smart city. Data set has different types of fields such as Dew point, humidity, pressure, temperature, wind direction, wind speed. All these parameters are used for predicting weather conditions in different times of the year. We have two sets of data. One is from February-June 2014 and other set is from August-September 2014. These data sets were provided in JSON file format. We use Zeppelin platform to study the data. We initially load the data and study about the different fields in the data.

**Method:**

Our aim in this project is to provide an efficient model which helps to build a Smart city. Smart city mostly runs on connectivity. This connectivity is established by using big data. We are using big data techniques, machine learning techniques, data mining techniques to build a model that will that is used for the prediction of weather which helps in building a smart city. There are various machine learning techniques that are used for predicting the weather. We can use Support vector machines method; Decision trees techniques, neural networks. All these methods are used in machine learning for predicting using the given data set. For this particular paper, we selected weather data of Aarhus city located in Denmark to predict the climatic changes. This prediction model helps in building a Smart city which runs on connectivity.

The techniques mentioned above are used in machine learning. For using those techniques we need big data set. To perform those machine learning techniques we divide the data set into two parts. One part is used for testing data where the machine learning technique is applied to the data set. Using the prediction results obtained from training set we will run a prediction on the remaining data set which is known as test data set. We already know the results for the test data set, so if the predicted results match with the original set of results then we can use our model to predict the weather for upcoming years.

We can predict weather or climatic changes for quarterly, yearly, seasonally, daily time periods for a year. We can compare our results after testing the data set with the original data set. This comparison is done by using a set of topics or metrics such as MAE and MSE. MAE is known as Mean absolute error and MSE is known as Mean square error. Among the machine learning techniques, the predictions done by using SVM (Support Vector Machines) technique turns out to be more accurate and reliable. We are comparing our predicted results with the results obtained from multiple linear regression models. It is a machine learning technique which is used for every type of prediction for comparing the results.

**Idea- Planning to investigate:**

There are several ideas which are useful to predict the weather conditions, climatic changes, forecasting the weather which can be used for daily predictions, half yearly predictions. We can predict the temperatures changes such as maximum temperature of a particular day and minimum temperature of a particular day. We can also predict the weather condition for a particular day. We can predict whether the day is going to be sunny or it is going to rain. We can find out or predict the wind speed for a specific day so that people can take safety measures if there are high speed winds which can even destroy the buildings.

We can predict the climate changes seasonally. We can predict whether the summer season is going to be with high temperatures. We predict winter season whether it is going to have heavy snow fall or low temperatures so that people can be alerted if there is any problem. Natural calamities can be predicted if we can build a model using our machine learning technique methods. Now days it has become very important for detecting the blizzards and storms so that people can take shelters.

For building a smart city, these types of predictions are very useful. To build a smart city we need very good weather conditions where there is seasonal rainfall which helps for farmers and agriculture sector of that city. There should not be a frequent change in weather conditions which can destroy the seasonal crops. Our model is useful to find a place where the weather conditions are suitable for building a smart city. We can use the weather data of particular places to study and predict the weather changes and prepare a report about climatic changes in future for that particular area.

We can also build a model which is useful after building a smart city. We can predict the climatic changes, prediction of blizzards and storms. Due to that prediction one can take safety measures which helps in decreasing the losses which can be caused by a storm or blizzard. Now days due to pollution, the climate is changing without any warning. In those conditions these types of predictive models will help for damage control.

Therefore the main idea behind this project is to predict the temperatures to their maxima and minima for a particular day. We are going to predict wind speed and humidity for a particular day. Predicting climatic changes seasonally based on the data that we already have. We can also predict some of the areas in a city or a place where the solar energy production is suitable. We can also find the places which are helpful for producing wind energy. These predictions are done by using wind speed data. These are natural energies which are helpful for building a smart city as the city is going to be pollution free city. We can also predict the amount of rainfall that is going to come for a particular season which helps the farmers.

Forecasting accurate weather conditions can also help in transportation. For flights and airplanes which are flying mostly in air perfect weather conditions are must and important. If we forecast the weather in advance it helps the aviation department to plan according and it also helps in damage control.

**State of Art:**

There are so many research papers which were already published based on this topic. All those papers are being used for predicting climatic changes and weather conditions. But this paper particularly concentrates on the results and models which will help to build a smart city. All the predictions and predictive models will help to build a smart city which will run based on internet and connectivity. There are so many papers that used techniques for predicting weather conditions especially machine learning techniques such as SVM, linear regression, neural networks etc.

In an article named “An efficient approach for Weather forecasting using Support Vector Machines” used support vector machines technique to predict maximum and minimum temperatures for a particular day. This article has been published in International conference in 2012. In this paper we are taking inspiration from this particular technique to perform the predictive model. This forecasting helps in building the smart city efficiently and helps the people who live in those cities. By taking inspiration form this paper we are also going to use decision tree model and neural network model to predict the temperatures. As mentioned above we are dividing the data into two sets one is for training and other is for testing the data. This approach will help us in predicting accurate maximum and minimum temperatures.

In an IEEE article named “Unsupervised and supervised learning concept for 24-hour loading” used supervised or unsupervised learning techniques to predict the load and temperature for a given season. They used the algorithms which are supervised and help in predicting the temperature based on the 24 hour loadings of the day and these predictions are done seasonally. In this paper we are taking inspiration from this particular technique to perform the predictive model. This forecasting helps in building the smart city efficiently and helps the people who live in those cities. This can help to predict the seasonal changes in hourly timings. If we take USA into consideration Day time saving will affect the behavior of temperatures etc. This type of prediction is very useful for building smart cities.

# In an IEEE paper named “Incremental learning for place recognition in dynamic environments” explains about the learning techniques which are used for a city in different learning techniques. For building a smart city, these types of predictions are very useful. To build a smart city we need very good weather conditions where there is seasonal rainfall which helps for farmers and agriculture sector of that city. There should not be a frequent change in weather conditions which can destroy the seasonal crops.

# In an article named “Modeling and Forecasting the Daily Maximum Temperature Using Abductive Machine Learning” used AML to predict the maximum and minimum temperatures of a city in a particular day. Here AML is a different machine learning technique that has been used for the prediction purpose. We are using Zeppelin as a platform to perform all our predictions and using Spark language. Our ways of technique is very unique and predict more accurately. We are using our test data and training data to predict the temperatures of a particular day. This will help us in finding more accurate results. Accurate results will help us to build most efficient smart city.

# An article named “Complex hybrid models combining deterministic and machine learning components for numerical climate modeling and weather prediction” used most of the complex hybrid models to predict the climatic changes and change in weather conditions. They used deterministic machine learning techniques to build the predictive models and to perform the techniques. They produced phenomenal results of predictions and that model help us to take the inspiration and build a similar model. We can predict most of the data temperatures and climatic changes by replicating and producing the same predictive model. The results of this model are more accurate than the original model. The accuracy of the model helps in building efficient smart city. Building efficient smart city requires perfect statistical models which predict accurate climatic changes and helps in predicting temperature changes.

# Conclusion:

Therefore the main idea behind this project is to predict the temperatures to their maxima and minima for a particular day. We are going to predict wind speed and humidity for a particular day. Predicting climatic changes seasonally based on the data that we already have. We can also predict some of the areas in a city or a place where the solar energy production is suitable. We can also find the places which are helpful for producing wind energy. These predictions are done by using wind speed data. These are natural energies which are helpful for building a smart city as the city is going to be pollution free city. We can also predict the amount of rainfall that is going to come for a particular season which helps the farmers.

# References:

# <http://ieeexplore.ieee.org/abstract/document/6102379/>

# <https://pdfs.semanticscholar.org/9e88/5c0d28d5c19baf0d183af109b99e74575d7d.pdf>

# <http://digital-library.theiet.org/content/journals/10.1049/ip-c.1993.0046>

# <https://arxiv.org/abs/1304.2363>

# <http://ieeexplore.ieee.org/abstract/document/4398986/>

# <http://journals.ametsoc.org/doi/citedby/10.1175/1520-0434%281995%29010%3C0310%3AMAFTDM%3E2.0.CO%3B2>

# <http://www.aaai.org/Papers/JAIR/Vol18/JAIR-1805.pdf>

# <http://www.sciencedirect.com/science/article/pii/S0893608006000050>

# <http://dl.acm.org/citation.cfm?id=219768>

# <http://link.springer.com/article/10.1007/BF00115009>

# <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.489.8776&rep=rep1&type=pdf>

# <http://ieeexplore.ieee.org/abstract/document/396988/>

# <http://ieeexplore.ieee.org/abstract/document/621229/>

# <http://www.sciencedirect.com/science/article/pii/S0022169411007633>

# <http://link.springer.com/article/10.1007/s10723-005-9017-1>

# <http://digital-library.theiet.org/content/journals/10.1049/ip-c.1993.0046>

# <https://arxiv.org/abs/1304.2363>

# <http://ieeexplore.ieee.org/abstract/document/4398986/>

# <http://journals.ametsoc.org/doi/citedby/10.1175/1520-0434%281995%29010%3C0310%3AMAFTDM%3E2.0.CO%3B2>