MACHINELEARNINGTECHNIQUESOF WEATHERFORECASTING–AREVIEW

Abstract:

Weather is a particular state of the atmosphere that describes the degrees to which itis hot orcold, wet or dry, calm or stormy, clear or cloudy. On earth, most weather phenomena occurs in thelowestlayerof theplanet's atmospherei.ethetroposphere.Weather forecasting tools are used in the field ofscience and technology to forecast atmosphericconditions for a certain place and period. It is a very challenging task for the researchers of this field inthis modern era. In this review paper we have tried to estimate the accuracy level of different machine learning method of weather forecasting.

Introduction:

Now a days weather and climate of this planet is changing very drastically andcontinuously as a result of the climate change. Earth is suffering very badly due to this continuousclimatechange.Itisverycrucialandessentialtasktopredicttheexactcurrentweatherconditions.Presently machine learning techniques are widely use to forecast the weather. These techniquesdepend on complex physical models and uses of the dataset of some previous years having theweather parameters, i.e temperature, dew, humidity, pressure, visibility, wind speed and winddirection also. The terms of forecasting weather in Machine learning methods may be 'No rain', 'Fog','Rain' 'Thunderstorms', 'Fog Rain', 'Tropical Cyclones', "Heat waves', 'Cold snaps','Heavydownpours', 'Floods' etc. In this research process the predicted outcomes are continuous numericvalues temperature.

The different Machine. Learning Methods which is used in this technique are random forest,decision tree, support vector Machine, KNN, Adaboost, Xgboost, Gradient Boosting, Naïve Bays andlogistic regression etc. The Models are evaluated in the basis of their accuracy in prediction andverificationprocess.TheusedtechniquesofMachinelearningmethod forweatherforecasting is analysed in respect of their accuracy level to get an overall idea and its applications.

Methodology and Techniques:

Here we aim to use Machine Learning techniques to predict the weather day by day andhourly. We use the techniques namely Chi square test and Naïve Bayes statistics applied on thedatasetto examinetheusefulinformationfromthatdataset. Firstofallherewecollectthedatabyuser information. The we process the data by transformation and combination and prepare adatabase. By Data Mining Techniques the data is stored. At last by making Decision Tree, here weprocess thedatasetandgivesthedatasetfor weatherprediction.

The techniques that are used in this machine learning processdepicted below in thechartanddescribedbrieflyto understandthe process

Techniques Used

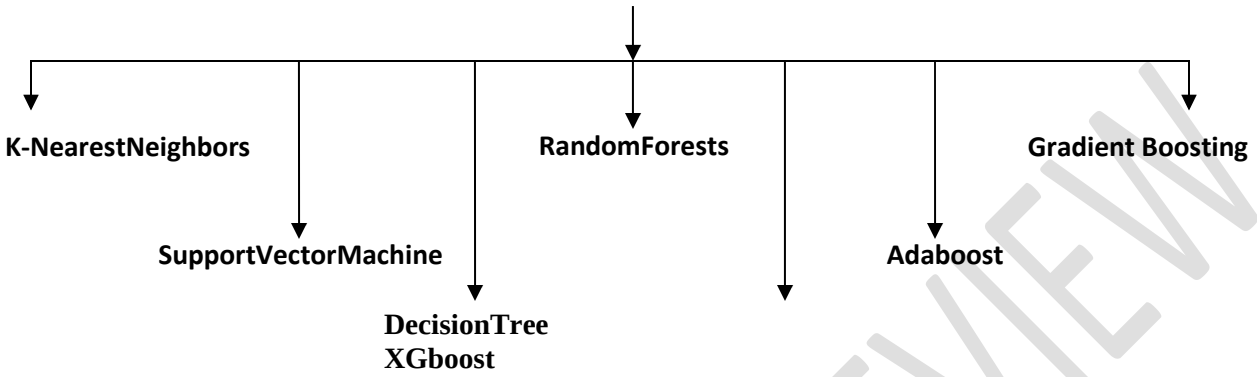

Chart 1. The techniques that are used inmachine learning process.

(i) K-nearestneighbors(KNN)

KNN method may be used for both regression and classification. Mainly it is utilized forclassification.Therightclassoftesting dataisbeingpredictedbyKNNofagivensetofdataofvariousclasses by calculating the distance between both the testing data and all training points. After that Kpoint ischoosen whichare mostsimilartothetest.

(i) SupportVectorMachine

This technique is used for the predictive data processing. Also for the purpose of classificationthe supportvectormachineisutilized.

(ii) DecisionTree

Amongtheeffectivetechniquesofmachinelearning,decisiontreeisthemosteffectiveandbestused techniques. An item or scenario with a set of attributes is used as an input and provides a 'yes/no'decisioninthedecisiontree method.

(iii) RandomForests

ACollectionofdecisiontreesiscalledasRandomforeststrategywhichgeneratesmore treevariety.

(iv) XGboost

Thismethodisalsoknownas"ExtremeGradient Boosting."ToSolveanumberofdata scienceproblemmorepreciselyXGboostuseparalleltreeboostingtechnique.

(v) Adaboost

Adaboost a statistical categorization method which is used for the improvement of theresultsandiscombinedwithanumberoflearningalgorithms.

(vi) GradientBoosting

Among the other boosting techniques,Gradient Boosting is the prominent techniquewhichcorrectstheformermistakes.

Analysis of Results:

Thedifferentmodelshavebeen usedheretopredicttheweatherdataof21years(1996-2017). For a particular given region, the data of the accuracy of the different models is summarized inTable1andits percentage of accuracy is shown infig.1withgraphicalrepresentation.BasedupontheF1scoreofthemodelsused,theperformanceofallthemodelis summarizedintheTable2andrepresented inthefig.2

Table 1:Dataset used in the experiment

SL	Temp.	Dew	Humidity	Pressure	Visibility	Wind	Event
01	28	24	76	1002	05	11	NoRain
02	29	26	85	1003	05	08	NoRain
03	32	26	78	1004	05	11	NoRain
04	31	26	81	1003	04	13	NoRain
05	31	26	86	1001	04	10	Rain,thunderstorm

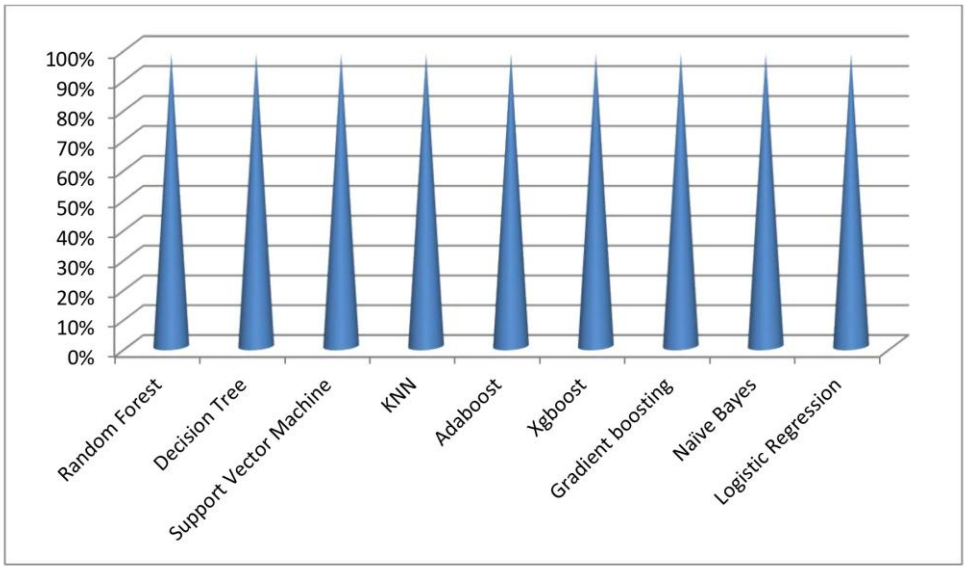

Fig 1: Graphical comparison of the accuracy of different models

Table2: F1Scoreofdifferentmodels

Sl No	Modelname	F1score
1	Randomforest	0.81
2	DecisionTree	0.75
3	SupportVectorMachine	0.74
4	KNN	0.80
5	Adaboost	0.74
6	Xgboost	0.80
7	Gradientboosting	0.83
8	NaïveBayes	0.79
9	Logisticregression	0.80

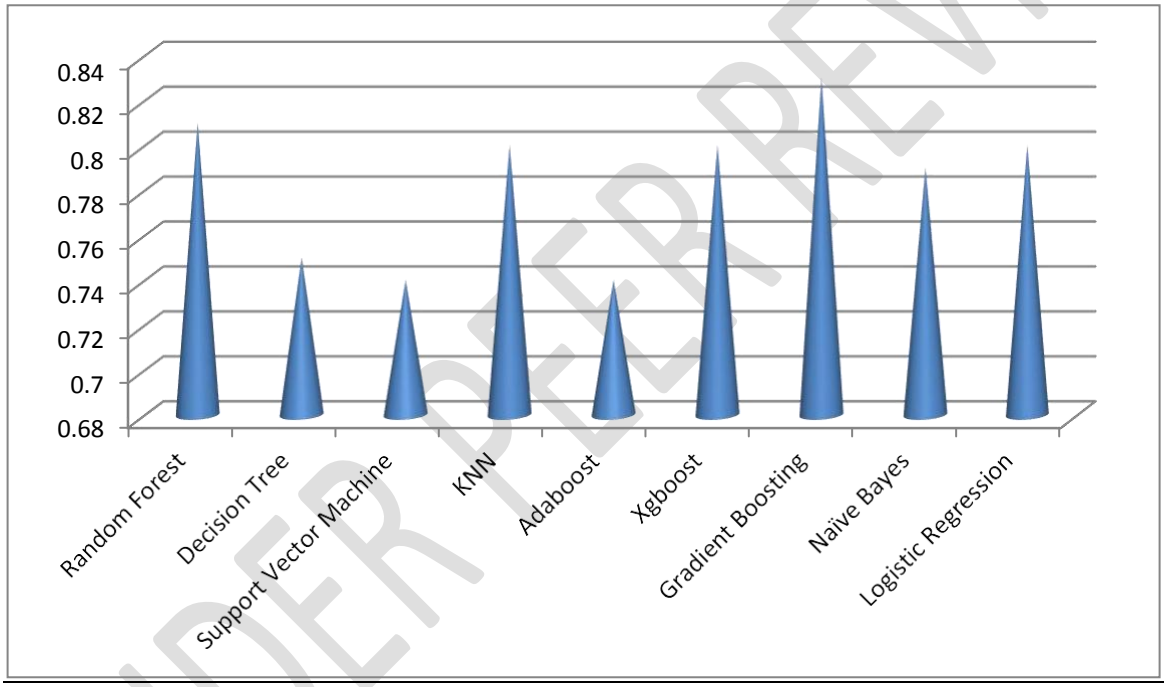

Fig. 2 The graphical comparison of F1 score of different models.

A maximum accuracy upto81.67% observed in these models which needs dataset from predefined resources. Highest accuracy level is observed in Gradient Boosting method. It is evident to uselow cost internet of things (IoT) devices in near future such as temperature and humidity sensors to collect the weather data from different parts of a place or an area and to be fed in the machine learning methods.

Conclusions:

Machine learning technology can easily be run on almost all thecomputersincludingMLdevices.Traditionalphysicalmodelsaremoreresourceorientedthanmachinelearning technology. It can provide intelligent models and are much more simpler in comparison tomachine

learning technique. ML technique can predict weather parameters more precisely andaccuratelythanthe traditional models.

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