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Rainfall Rate Prediction Using an Artificial Neural Networks

Mrs Kolisetti Navatha[1] V.Janani[2] G.Sritha[2] Ch.Sri Lekha[2] M . Sai Siddharth[2]
[1]Professor, Department of CSE,[2]Final year B.Tech. Students, Department of CSE,
Sreyas Institute of Engineering and Technology, Hyderabad, Telangana, India

Abstract
A model for rainfall rate prediction using an artificial neural network. It is used to determining an appropriate fade counter-measure, for instance, digital modulation scheme.The prediction model is found to predict an immediate future rain rate when given three adjacent historical (Instant) rain rates. In this Regard, our model validate error analysis via root mean square technique.
Keywords: K-Means Clustering Algorithm,Image Processing Techniques,ANN.

1.Introduction

As the mobile communication industry takes a leap into the world of 5G, the millimeter wave is the way to go towards achievement of large bandwidths and subsequently high data rates. As is forecasted, the internet traffic will reach 1.6 Zettabytes by 2018 and one alternative to satisfying this demand for larger bandwidths is by utilizing communication channels using electromagnetic waves from Ka-band and above in conjunction with multi-bit digital modulation schemes in the M-ary QAM and others. Unfortunately, link fading and signal outages due to rain attenuation cannot be disregarded when operating radio links in these higher frequency bands. In the past, several mitigation techniques have been employed to ensure that the channel is available to the user under various channel conditions. These mitigation techniques include space diversity, frequency diversity, power control, adaptive coding modulation (ACM). Most of these techniques monitor the signal level on the link and then use an alternative feedback channel back to the transmitter to indicate the state of the channel for an action to be effected as is the case with frequency diversity and power control. However, the feedback signal might itself become a victim of fading, hence lacking integrity itself. Hence, we need to predict the future state of the link, in preparation for the next appropriate measure to counter fading.

2.Objective

This predictive model focuses on predicting rainfall rate based on previous historic rainfall rates.Attenuation resulting from the predictedrainfall rate is then used to select an appropriate

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digital modulation technique that will ensure availability of the link andthe quality of service being offered.

3. Architecture Description

This system consists of two users admin and user. The data can be uploaded by admin without any particular scenario but with the details of satellite data. The most importantly large amount of can be handled in order to do practically. The data that are handling throughout the project can be done in this module. Users have permission to view data but not edit the data in online they can request the user to get the data.

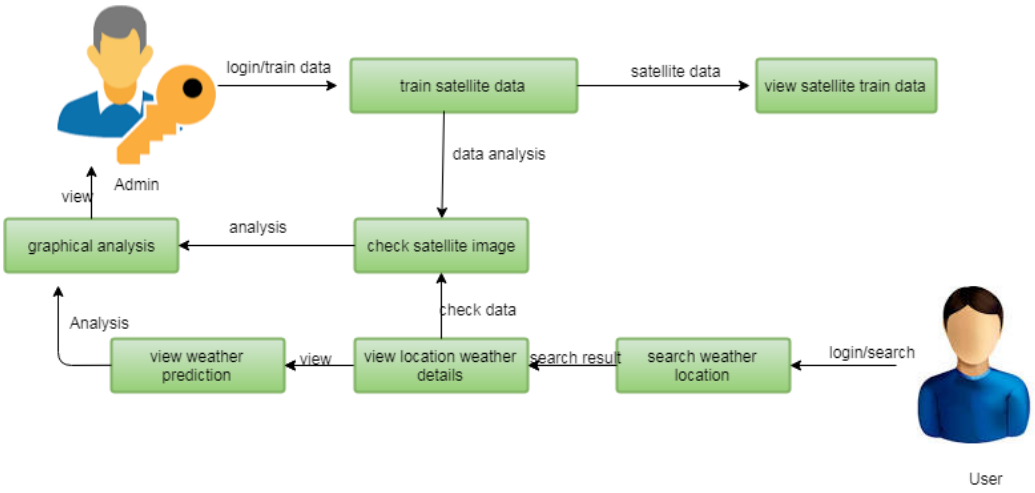

Fig : 1 Architecture

4.Problem Statement

A model for rainfall rate prediction using an artificial neural network. It is used to determining an appropriate fade counter-measure, for instance, digital modulation scheme.The prediction model is found to predict an immediate future rain rate when given three adjacent historical (instant) rain rates. In this regard, our model validate error analysis via root mean square technique.

5.Existing System

As the mobile communication industry takes a leap into the world of 5G, the millimeter wave is the way to go towards achievement of large bandwidths and subsequently high data rates. As is

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forecasted, the internet traffic will reach 1.6 Zettabytes (ZB) by 2018 and one alternative to satisfying this demand for larger bandwidths is by utilizing communication channels using electromagnetic waves from Ka-band and above in conjunction with multi-bit digital modulation schemes in the M-ary QAM and others. Unfortunately, link fading and signal outages due to rain attenuation cannot be disregarded when operating radio links in these higher frequency bands (above 10 GHz) . In the past, several mitigation techniques have been employed to ensure that the channel is available to the user under various channel conditions. These mitigation techniques include space diversity, frequency diversity, power control, adaptive coding modulation (ACM) . Most of these techniques monitor the signal level on the link and then use an alternative feedback channel back to the transmitter to indicate the state of the channel for an action to be effected as is the case with frequency diversity and power control.

5.1 Disadvantages:

- Weather Prediction is not accurate so result is not perfect in the prediction system.
- Satellite image training procedure is complicated.
- Pre-Processing analysis is not satisfied the Prediction Process.

6. Proposed System

A neural network is a distributed processor that consists of artificial neurons as primary processing elements. Neural networks can be used for many applications including pattern classification, function approximation, clustering, prediction/forecasting, optimization, content addressable memory. Rainfall, being a highly non-linear phenomenon, requires a more complex non-statistical method for its prediction, such as an artificial neural network . An artificial neural network can be trained either via supervised or unsupervised learning. In the former method, the network is presented with a set of inputs and their corresponding desired output(s), also referred to as targets, for each iteration. Thereafter, the outputs are compared with targets for determination of the magnitude of errors that are then used in the adjustment of the network weights in the negative direction (gradient descent). On the other hand, in the unsupervised learning, the neural network is capable of drawing inferences from a dataset consisting of only inputs with no targets. This paper presents a predictive model approach that focuses on

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developing a prediction technique that can predict the rainfall rate ahead of time. Attenuation resulting from the predicted rainfall rate is then used to select an appropriate digital modulation technique that will ensure availability of the link and the quality of service being offered.

6.1 Advantages:

- Weather Prediction time consequence is very fast.
- Prediction result is very accurate and clearly process.
- Dataset analysis and management is high level process and image pre-Processing one of best analysis process in weather prediction system.

7.Implementation

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

7.1.K-Means Clustering Algorithm:

k-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. k-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells. The problem is computationally difficult (NP-hard); however, there are efficient heuristic algorithms that are commonly employed and converge quickly to a local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both k-means and Gaussian mixture modeling. Additionally, they both use cluster centers to model the data; however, k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes. The algorithm has a loose relationship to the k-nearest neighbor classifier, a popular machine learning technique for classification that is often confused with k-

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means due to the k in the name. One can apply the 1-nearest neighbor classifier on the cluster centers obtained by k-means to classify new data into the existing clusters. This is known as nearest centroid classifier or Rocchio algorithm.

7.2.Image Processing Techniques:

The basic definition of image processing refers to processing of digital image, i.e removing the noise and any kind of irregularities present in an image using the digital computer. The noise or irregularity may creep into the image either during its formation or during transformation etc. For mathematical analysis, an image may be defined as a twodimensional function f(x,y) where x and y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y, and the intensity values of f are all finite, discrete quantities, we call the image a digital image. It is very important that a digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are called picture elements, image elements, pels, and pixels. Pixel is the most widely used term to denote the elements of a digital image.

8.Expected output:

In this application, first the user login into the application with user id and password. Now he searches for current weather location details. These location details are stored in the database. Using K-means algorithm we cluster the datasets and analyse the weather data. Image processing technique used will process the images and provide necessary details of particular location we have provided and predicts the weather details.Finally,rainfall prediction results will be provided to the user.

9.Conclusion

Using three past rainfall rates the neural network based rainfall prediction model developed in this study was successful in predicting a rainfall rate ahead of time in a sliding window format. Error analysis using RMSE values as low as 0.1542 for a drizzle rainfall event were realized and this confirms that the backpropagation neural network can be trained and used to predict rainfall rates for estimation of rain fade attenuation on an earth-satellite link. The estimated attenuation

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can then be used in setting up a fade counter-measure in due time for provision of continuous reception of quality service on a microwave link.

Test Cases

s.no	Summary	Field	Inputtype	Example	Expectedresult	Actualresult	Status
1	Registration	Username	Rams	Rams	Accepted	Accepted	Pass
2	Registration	Password	123	123	Accepted	Accepted	Pass
3	Registration	Address	Hyderabad	Hyderabad	Accepted	Accepted	Pass
4	Registration	Phone	Hyderabad	Hyderabad	Accepted	Accepted	pass
5	Registration	Email	rams@gmail.com	rams@gmail.com	Accepted	Accepted	pass
6	User Login	Username	Rams	Rams	Accepted	Accepted	Pass
7	User Login	password	123	123	Accepted	Accepted	Pass
8	Admin Login	Username	Rams	Rams	Accepted	Accepted	Pass
9	Admin Login	password	123	123	Accepted	Accepted	Pass
10	User info	username	rams	Rams	Accepted	Accepted	Pass
11	User info	Password	123	123	Accepted	Accepted	Pass
12	User info	Address	Hyderabad	Hyderabad	Accepted	Accepted	Pass
13	User info	Phone	Hyderabad	Hyderabad	Accepted	Accepted	pass
14	User info	Email	rams@gmail.com	rams@gmail.com	Accepted	Accepted	Pass

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