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Estimation of Pan-Evaporation using Spatiotemporal Data Mining Approach

Mrs.L.A Bewoor, Prof.S.N Londhe, Akshay Kamble, Nehal Solanki, Pranali Nimbalkar, Nitesh Singh

Abstract—Weather forecasting has been one of the most scientifically and technologically challenging problems around the world. Hence, we aim to predict the event before days or can say before weeks thus increasing response time with which we can prevent huge losses to the society that are caused due to uncertain climatic disasters.Therefore, we find an efficient technique for discovering patterns for nonlinear attributes and retrieve the significant measures for close prediction of climatology using spatiotemporal data for pan evaporation.

Keywords—PanEvaporation, Spatiotemporal, Non-linear attributes.

I. INTRODUCTION

Weather is one of the meteorological data that is rich by important knowledge.Pan evaporation is a measurement that combines several climate elements such as temperature,humidity,rainfall,drought,dispersion and wind.An evaporation pan is used to hold water during observations for the determination of the quantity of evaporation at a given location.

Our system is related to finding an efficient algorithm for discovering pattern for spatiotemporal data and retrieving the significant measures for close prediction of climatology. The project deals with the idea of determining the uncertainties or anomalies of the climate from the spatiotemporal dataset.The major task include finding co-relation between the climate elements such as temperature,wind,humidity etc using AMI function. To extract relations using spatiotemporal data mining approach and predict the uncertain natural calamities. Assisting in taking precautionary actions by predicting sudden anomalies in the weather.Developing function for observing the different climatic conditions and the co-relation between them. Designing efficient algorithms using the AMI function.

II. LITERATURE SURVEY

Shreenivas Londhe et al.Estimation of pan evaporation using soft computing tools[1] discussed
Estimation of evaporation is important in managing water resources projects.Evaporation can be measured by pan evaporation as well.it is difficult to put up evaporation pans at every location,that is why it is necessary to use an approach which can use readily available data and estimate evaporation rate with the available data.The main objective of the present study is to measure evaporation using soft computing tools of artificial neural networks and genetic programing.To use different measured parametetrs and obtain results and compare them with the traditional techniques.The output resulted that the models developed using soft computing tools worked well for estimation of evaporation rate.genetic programing worked better for higher values than the artificial neural networks.

Shreenivas Londhe et al.Spatial mapping of pan evaporation using linear genetic programming[2]
In this paper they discussed pan evaporation is very important for water resources .This paper involves the study of estimation of pan evaporation at a particular region.It covers over ten surrounding regions cover six districts of Maharashtra state(India) with changes the weather conditions.The surrounding region was added one by one based on the correlation of the output of the previous region.The soft computing technique of linear genetic programing was used for this spatial mapping.Eleven models were developed with one output region and ten input regions added one by one.In all 110 models were developed to examine how well linear genetic programming worked as virtual pans when the exisiting evaporimeters become inoperative.

Aytac Guvena et al. Monthly pan evaporation modeling using linear genetic programming[3]
In this paper comparison was done between the accuracy of linear genetic programin(LPG),fuzzy genetic(FG),adaptive neuro-fuzzy inference system(ANFIS),artificial neural network(ANN)and Stephens-Stewart(SS)methods in modeling pan evaporations.The climatic data including various parameters such as solar radiation,air temperature,relative humidity,wind speed and pan evaporation from Antalya and Mersin station in Turkey are used.The study is divided in two parts in first part comparison of linear genetic programming(LPG) with FG,ANFIS,ANN and SS in estimating pan evaporation.From the comparison result it is concluded that LPG is better than others.It is seen that pan evaporation can be successfully estimated by LPG.

Mark Hall et al.Logistics Model tree[4] uses Tree induction methods and linear models are popular techniques for supervised learning tasks, both for the prediction of nominal classes and numeric values. For predicting numeric quantities, there has been work on combining these two schemes into model trees, i.e. trees that contain linear regression functions at the leaves. In this paper, we present an algorithm that adapts this idea for classication problems.

HANA Alouaoui et al.Mining spatiotemporal associations using queries[5] is a paper, in which we present our approach for mining spatiotemporal knowledge. The proposed method is based on the computation of neighborhood relationships between geographical objects during a time interval. This kind of information is non-explicitly stored in spatio-temporal database and is extracted by the means of special mining queries enriched by time management parameters. The general aim of our approach is to develop a method that utilizes the inherent structure of spatiotemporal information as well as its rich semantics to derive spatiotemporal association rules in order to improve the decision making process about land changes and resulting prohibited risks.

G.Vamsi Krishn et al.Weather Forecasting Models-Based on Data Mining and Artificial Neural Networks[6] discussed A large amount of the worlds population relies mostly on the monsoons. These monsoons have a great impact on the livelihood of the Indian families where cultivation is a major source of livelihood. Many models have been developed and utilized for prediction, forecasting of the weather data based on techniques such as data mining, time series analysis, neural networks. In this paper a brief review of the works carried out in this area in the recent past are presented.

Shakil Ahmed et al.Assessment of Temporal and Spatial Variation of Pan Evaporation with Related Climatological Factors in Bangladesh[7]

In this paper they proposed pan evaporation is an effective way to analyze the multidimensional impact of climate change on irrigation water requirement since pan evaporation measures the integrated effect of radiation, wind, temperature and humidity on the evaporation from an open-water surface. The characteristic trends of pan evaporation and related climatological factors, as developed in this paper, indicate that most of the regions of Bangladesh have undergone a signifcant amount of decrease in evaporation through the years. The reduction in sunshine duration as a consequent of climate change can be attributed to be the principal reason for the decrease in evaporation. The spatial distribution of seasonal variation of pan evaporation along with solar radiation and humidity was analyzed, and solar radiation seemed to have the major influence on evaporation. The study also reveals that summer and spring are the seasons of highest evaporation in most of the regions. The characteristic trend and spatial distribution of seasonal pan evaporation correlated with related climatological factors developed in this study could aid in water resources development and planning for irrigation purposes.

C.H. Chung et al.A spatial neural fuzzy network for estimating pan evaporation at ungauged sites[8] discussed Evaporation is an essential reference to the management of water resources. In this study, a hybrid model that integrates a spatial neural fuzzy network with the kringing method is developed to estimate pan evaporation at ungauged sites.This hybrid model demonstrates its reliability in estimating the spatial distribution of Epan and consequently provides precise Epan estimation by taking geographical features into consideration.

P.Stolorz et al.Fast Spatio-Temporal Data Mining of Large Geophysical Datasets[9] studied the mining of large datasets. The important scientific challenge of understanding global climate change is one that clearly requires the application of knowledge discovery and data mining techniques on a massive scale.Advances in parallel super computing technology, enabling high resolution modeling, as well as in sensor technology, allowing data capture on an unprecedented scale, conspire to overwhelm present day analysis approaches. We present here early experiences with a prototype exploratory data analysis environment, CONQUEST, designed to provide content-based access to such massive scientific datasets. CONQUEST (CONtent-based Querying in Space and Time) employs a combination of workstations and massively parallel processors (MPP's) to mine geophysical datasets possessing a prominent temporal component. It is designed to enable complex multi-modal interactive querying and knowledge discovery, while simultaneously coping with the extraordinary computational demands posed by the scope of the datasets involved.

Ozlem Terzi et al.Modeling of Daily Pan Evaporation[10] proposed

Pan evaoporation can be estimated by Artificial Neural Network(ANN) model for meteorological data recorded from Automated GroWeather meteorological station in lake districk of western Turkey.In this different parameters like air temperature,water temperature,solar radiation,air pressure,wind speed and relative humidity.Since the purpose is to estimate the evaporation rate the ANN architechture has only one output with four inputs representing air and water temperature,air pressure and solar radiation.The correlation study indicated the insignificance of wind speed and relative humidity in the Egirdir lake area.The ANN model provides good results with least Mean Square Error(MSE)

III. METHODOLOGY

A. Data and Selection of Area

The data in our project is collected from IMD (Indian Metrological Department).Amongst the overall data,we have considered dataset over a certain period.

B. Evaluation of Weather Conditions

Changes in weather conditions over few years are observed and accordingly evaluated.

IV. PROPOSED METHOD

By using Average Mutual Information, patterns for nonlinear attributes are discovered.These patterns will help to estimate evaporation rate and forecast the weather conditions.

A. Input

Set of n non-linear attributes.All attributes are numeric.

B. Output

Evaporation rate through discovered patterns.

V. CONCLUSION

Weather forecasting has been one of the most scientifically and technologically challenging problem around the world in the last century. Scientists have tried to forecast meteorological characteristics using a number of methods, some of these methods being more accurate than others. This paper surveys existing methods and proposing a system for weather forecasting by using Average Mutual Information for obtaining accurate results for large datasets.

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