



COMPREHENSIVE STUDY OF APPLICATIONS OF SPATIO TEMPORAL DATA MINING IN GIS

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Abstract: The advancement in database and internet technology has led to large debris of data being collected. The process of extraction knowledge led to coining of new term called data mining. In this paper we have discussed the spatio temporal dimension of data mining and its applications in field of Geographical Information Systems. The applications include forest fires, Maize yield, Weather forecasting etc.

Keywords: Spatio, Temporal, Data, Mining, Geographical, Information, Systems

1. INTRODUCTION

The advancement in technology has led to large amount of data being accumulated, not all the data is useful. The process of retrieval of useful knowledge from the data is known as Data Mining. There are various parameters linked with the data like spatial parameters including location and temporal parameters including time at which measurement was made. [12][14]The improvement in sensor technology also had large impact on the field of Spatio temporal Data mining as data from these networks contain both these parameters. The ST data has various applications ranging from the field of Climate Science, Traffic to environment. The basic steps of data mining include

Data Mining is the process of getting patterns from the data.

2. SPATIO TEMPORAL DATAMINING

The data can have multiple dimensions like space and time. The large amount of this spatio temporal data come from search engine, GPS etc. The task of spatio temporal datamining can be shown as

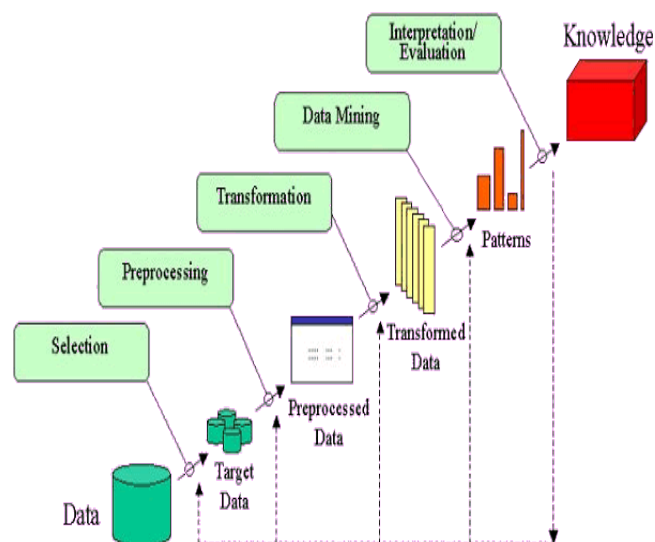


Figure 1 knowledge Discovery Process [11]

The terms Data mining and KDD are used in place of one another but in real sense Data Mining is the single step in KDD process [11].

KDD is the overall process of getting knowledge from the data.

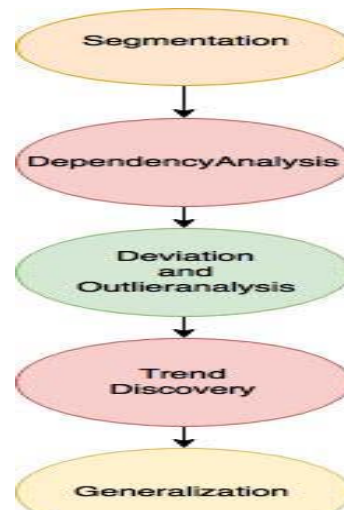


Figure 2 Spatio Temporal Datamining Process [12]

3. APPLICATION OF SPATIO TEMPORAL DATA MINING

- Climate Science:** The changes in climate can affect the lives drastically, Studying the patterns and predicting the changes accordingly can help serve the mankind a better way and STDM is one way to it. [7]
- Agriculture:** The STDM also helps in field of agriculture by helping in improving the yield and detecting plant diseases. [2]
- Neuroscience:** The brain data has both the parameters of space and time. The technologies like MRI, EEG are used for collecting data. The analysis of these help in

understanding the brain in better way and helps in finding the causes of disruptions.

4. **Traffic Analysis:** High traffic is causing lot of trouble; the analysis of these data can help administration to take necessary steps.
5. **Market Analysis:** The Data from companies if analyzed properly helps in understanding customer behavior and also helps in predicting the needs of customer.
6. **Crime Data:** The analysis of the previous crime data can help in reducing the crime rate and helping the Law Enforcement Agencies.

4. SPATIO TEMPORAL DATA MINING IN GIS

The geographical data can solve many problems of present day if analyzed properly [13]. The problems like forest fire, typhoons can be dealt in better way if we develop proper methodology for them. The prediction of these beforehand can solve many a problem.

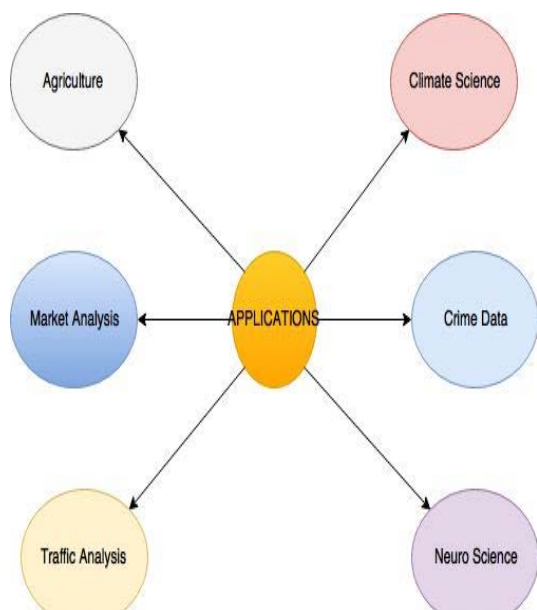


Figure 3 Applications Of Spatio Temporal Data [10]

5. LITERATURE SURVEY

Tao Cheng and Jiaqiu Wang have discussed the important issue of forest fire and devised a framework for prediction of forest fire known as Integrated spatio-temporal forecasting framework. It uses a neural network which is dynamic and recurrent in nature. The forecasting is based on historical observations. The results of this protocol is better than the other protocols that is they have higher accuracy for short-term prediction. This scheme has handled only one variable and in many cases, we may have different variables. This methodology can be used for other application domains [1].

Liyang Cao *et al*. have discussed an approach for prediction of maize yield using spatio temporal data mining. This method does two things first one being the prediction of the sequence of target objects and other one being the calculation of the effect of spatial distribution of soil-fertility on yield. The method uses the

concept of neural network and linear regression. The error rate in the method is about 5%. This is one of the fewest method that considers both time and space constraints. And results showed the significant increase in production [2].

Asanobu Kitamoto has discussed about the approaches for collection of data for Typhoons from satellites using spatio-temporal data mining. The principal component analysis is used for the spatial mining. The results revealed that the clustering procedures gave "birds-eye-view" visualisation. Also, a basic method for prediction of typhoons, that is Image mining Environment for typhoon analysis and prediction (IMET) is proposed, It uses K-NN and Euclidian metric to search for patterns [3].

Balakrishna Gokaraju *et al*. have discussed a scheme for detection of Harmful Algal Blooms, These blooms pose threat to habitation. The proposed scheme is based on Machine Learning, The SVM is used a classifier. Through the data sets the prediction was efficient and the false alarms were very less [4].

Xi-yong HOU *et al*. have discussed the issue of vegetation degradation. The circum-Bohai-Sea region is taken as the case study. The methodology used is Unary Linear Regression Model and Hust index. The results showed that the degraded area is mostly distributed in metros, coastalzone [5].

Sheng-Tun Li *et al*. have discussed about the cluster analysis in evaluation of air pollution. The SOM neural networks and multi-scale Wavelet transforms are used for this purpose. The key point to be noted here is that the scale plays an important role in cluster analysis. The result showed that due to increase in population and industrialization the places have more pollutants [6].

Folorunsho Olaiya and Adesesan Barnabas Adeyemo have discussed how data mining can be used for weather prediction. Artificial neural network and Decision tree algorithms are used. The classifier was trained using historical data to make predictions. The actual data and results are compared. The result was, if enough data is given to ANN to learn the prediction can be done in efficient way [7].

Fenzhen Su *et al* have discussed the impact of environmental factor on distribution of fishes. The model used here is STAMM (Spatio Temporal assignment mining model). The methodology uses neighbourhood rule. These along with relationships are used to create decision tables. The temperature is used as a parameter [8].

Ulanbek Turdukulov *et al*. have used the pattern generated moving flocks as frequent pattern. Their comparison with other real data sets, the results were far better than previous techniques [9].

6. CONCLUSION AND FUTURE SCOPE

The spatio temporal dimensions of data if dealt properly can help serve mankind in better way. We have analysed that the Artificial Intelligence techniques including Machine

Learning, Neural Networks etc. play a major role in this. This field has vast scope in predicting the events from the GIS data in more optimal way.

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