A NOVEL LOCALE DETECTION APPROACH FOR LOCATION BASED SERVICES USING SUBSPACE CLUSTERING OF THE LOCATION TRACES

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Abstract: Emerging needs lead to detect user's location for providing the various targeted services to the user. Location detection of the user has become important and it has indulged many researched in this field. Application uses the location information to provide the targeted service to the user accurately. The clustering of location data based on frequent position deviation, leads to discrete large cluster with huge gap, which is considered as challenging issue. In order to reduce the inter distance between the clusters, in this paper, a new locale detection approach is proposed. This is based on subspace clustering model on the location traces. The proposed clustering model removes irrelevant location information by reducing the dimensionality of data point. Further the gap between the clusters is reduced by using cooperative discovery model such as fingerprint matching and activity matching. In addition, proximity of the user is computed to gather the location data between users in order to reduce the inner cluster distance. Finally Spatio Temporal clustering is employed on the generated location data to produce the targeted service to user on place of interest. The experimental analysis of the proposed approaches on the simulated dataset proves that it is reliable and accurate against performance computed with existing solutions.

Keywords: Targeted Services, User patterns, Location Mining, Spatio Temporal Clustering.

I. INTRODUCTION

Now days, the location based service has gained a strong attraction among recent technologies. The proposed work uses the location acquiring sensor, which gets continuous stream of location information, which results in large collection of location information with more dimensions. Using this continuous stream of location information, different clusters are formed and which represents the location of interest. While clustering, the cluster gaps are formed due to certain circumstances and these gaps split the clusters into small individual clusters. To resolve this, a relatively low threshold fixing calculation has to be computed and then merge co-located small clusters into fewer larger clusters.

Many Spatio temporal constraints based clustering model has been projected. Still challenges have existing in fixing the threshold value. In order to eliminate the gaps, 3D subspace clustering model has been proposed which reduces the dimensionality of data by removing irrelevant information. The hierarchical localization and co-localization has been employed to share location points among the closely co-located cluster and then using the borrowed/shared location point data from the co-located cluster, merge the consecutive stay points of the cluster.

This paper is organized as follows; the work related problem has been analyzed in depth in section 2. Section 3 describes the proposed framework. In section 4, experimental results are presented. Finally section 5 concludes the paper.

II. RELATED WORKS

In this section, many approaches related to location mining has been analysed in depth, to resolve the challenges in existing system. In terms of gaps in the existing cluster and organizing for predicting the large volume of GPS (Global Positioning System) data for user significance. The approaches is given as follows

2.1. Hierarchical Cooperative Discovery of Personal Places

M. Pavan et. al, says, user's patterns with respect to mobility have been accurately detected. The model incorporates the Self-reported location check-ins. This used to cluster the frequent position variations and to eliminate the yields of large number of small clusters. The cooperative diversity constraints has been incorporated to eliminate the gap between the cluster results and to predict the accurate location of user.

2.2. Centroid-Based Actionable 3d Subspace Clustering

A. Striegel et. al, says, 3D subspace clustering has been employed to cluster the actionable data by eliminating the non-actionable data. The dimensionality reduction approach using SVD (Singular Value Decomposition) carries above mentioned requirement. The cluster is evaluated with Euclidean distance to verify the data points in the cluster to yield the significant user location to provide actionable data by eliminating the gaps.

III. PROPOSED MODEL

In the proposed model, a new locale detection approach has been designed and implemented with several constrains as follows.

3.1. Preliminaries of the Clustering location significance

The preliminaries employed to gather the location information and to place condition for clustering has been specified. They are

- **Location Point:** A Location mentions the geographic coordinate such Latitude and longitude of the specific user. These values are provided by GPS coordinates.
- **Staying point:** The time stamp information of specific location point to determine the significance of the user.

3.2. Spatio Temporal Clustering

The location traces has been clustered by employing the spatial constrainst and temporal constraints on the density based algorithm [6]. The algorithm yields the sp cluster and opportunistic cluster based on the threshold fixing calculation

Threshold > Tmax
  Compute Spatial Constrainst
If (U (Lat, Long) = Neighbor (lat, Long))
  Merge (Neighbour (lat, long) into Vector (u)
  ReCluster (Vector)

Where Tmax, U, Lat, and Long are represented as Maximum time difference allowed between successive locations, User, latitude value and Longitude value.

Stay point clustering is carried on employing spatial temporal clustering mechanism, which implies on upper bound time constraint on successive samples to improve the clustering results for threshold fixing.

3.3. Subspace Clustering

The Subspace Clustering is developed to eliminate the non-actionable data (previously clustered) and it reduces the gap between the small cluster generated using the spatio temporal opportunistic clustering on varied threshold values. The subspace clustering uses the principle component measure on the vector analysis to yield the large cluster for continuous growing data [7]. The figure 1 represents the architecture of proposed framework.

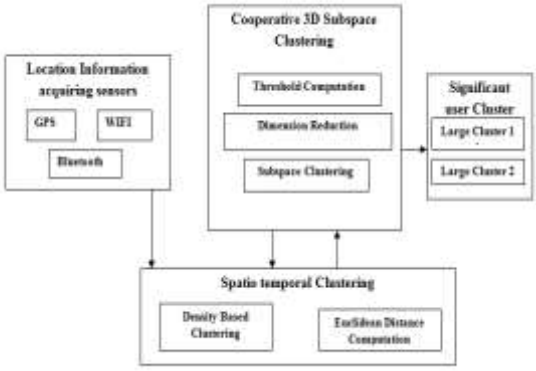

Figure 1: Architecture of the proposed method

On clustering of spatial constraints, the location information by fingerprint matching of Bluetooth and wifi, generates the missing segment of the user information due to loss of the GPS coordinates. It forms appropriate form of cluster, since the points in that segment can also be within the maximum distance threshold to cluster. Location points have been merged from co-located users on successive stay point clusters that have been generated with a relatively low time threshold on determining the covariance and correlation.

Algorithm: Subspace Clustering

//Data pruning
 SVD ()
  If (Lat, Long < Specified Time Period)
    Eliminate the data from the small cluster

//clustering
While (distance > Threshold)
Cluster (correlation)
Merge the Two instance similar cluster

IV. EXPERIMENTAL RESULTS

In this section, the performance evaluation of the proposed clustering model is been analyzed and compared with existing state-of-the-art approaches on various data size and experimental setup.

4.1. Experimental Setup

The results are experimented on the different data size in the Dotnet technology. The proposed framework has been developed using c# programming and location information has been stored in the sql server database. The location data consist the wi-fi and bluetooth signal strength , access point name ,MAC address and device usage time .

4.2. Performance Metrics

The performance of the proposed model is computed using location accuracy and faster execution time.

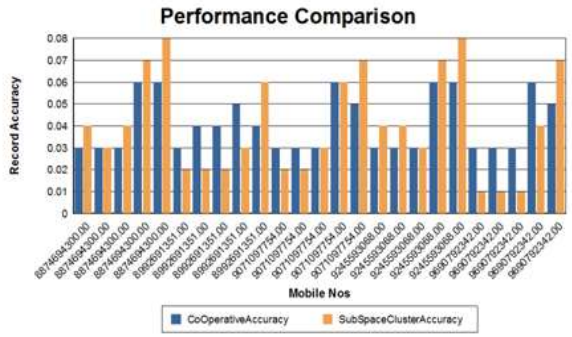

Figure 2: Performance Comparison of the different methodologies of prediction

The accuracy determines with help of precision and recall on the cluster results and execution time determined with respect to the time of processing.

Table 1: Performance Comparison

UniquePerson Id	Signal StrengthBars	coOPerativeAccuracy	SubSpaceClusterAccuracy
8,569,391,144	0	0.00	0.00
8,569,391,144	1	0.01	0.01
8,569,391,144	2	0.00	0.00
8,569,391,144	3	0.00	0.01

The figure 2 and Table 1 represents the performance evaluation of the methodologies developed in this research. The spatial and temporal position, a non-spatial value related to them is added to data item. And their movement during that time has been computed.

V. CONCLUSION

The proposed work is designed and implemented subspace clustering for prediction of user significance of a specified location. In addition, Spatio Temporal Clustering approach that fills constrainst for gaps management has been incorporated**.** The non-actionable data filtered using SVD increase the clustering quality and covariance and correlation computation improves the accuracy and efficiency of the proposed model. Finally it is found to more appropriate model on centroid selection for clustering and prediction of the user significance place to generate the location based service to any kind of data services.

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