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Personalized Travel Recommendation Based On Hybrid Approach

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Abstract- Personalized recommendations help users in getting the list of items that are of user preference. Majority of systems use Collaborative Filtering techniques to generate recommendations to their users. This system implements a filtering technique called as hybrid approach for generating personalized recommendations for user. Hybrid Approach is the combination of content-based filtering and collaborative filtering. Collaborative Filtering encounters the problems of Scalability when the number of users increases and sparsity problem for new users. Geo tags predict locations based point of interests to user. Social media are extensively used, based on this; the travel recommendations and point of interests of users are calculated. Based on Travel history user predict the Point of interest. Topic based tags and geo tags help in getting detailed information of places and users. Our proposed hybrid approach has improved the accuracy of the predictions generated.

Keywords — Recommender system, Hybrid Approach, Singular value decomposition (SVD), Iterative Dichotomiser , Collaborative filtering(CF) , content-based filtering

I.INTRODUCTION

Advances in technology leads to revolution of Internet, this leads to user targeting and user preferences. Users are recommended the interests of their preferences based on history and behavior. Hence, there's a desire for a system that learns behavior of the user and recommends supporting his interest. Several algorithms have to been implemented as a planning and recommender system tool. The aim is to build a system that helps travelers to identify locations and recommend the visited places with rating and comments. Geo location of users is used to track current location and nearby places is recommended. Application gives brief introduction of locations and places according with weather conditions. A user not only gets to write comment, review, uploads related photos and also follows known, similar users [1, 18].

Our system first constructs the user profile from relevant data and finds similarity from it. These are taken as input to system and nearby POI's are calculated with similarity with other users. Content based filtering technique is used to extract user pattern and behavior. If user visits a museum frequently then he must be interested in museum, then system will predict him nearby museum with rating and comments. The similar users are analyzed and the comparison is done, the results are then recommended to the similar users based on ranking and rating [5].

CF methods are used vastly among them the user – based CF is used for mining the user relevance, it uses building profiles, compute similarities and rating from the users. The profile is build from user feedback and ratings with preference profile. Flickr and picasa the community-contributed photos increased eventually these contain meta data as tags, geo-locations etc. These data are useful for travel recommendation. The two aspects can be common recommendation and personalized recommendation A hybrid recommendation system can be implemented for content based and demographics [10, 12].

Fig 1 – Tagging of photos.

The aim is to automatically rank the locations for travelers. Using geo-tag information, metadata of photos and users. We build user profile and location from social data and analyze regular sequences of locations. These sequences are then reviewed by the system and the user recommendations are modified based on it. Preferences are obtained by weight assigned and ranked accordingly. The top ranked are then recommended to the users with same interest [11, 12].

II. BACKGROUND

Location based recommendations are used widely, Li et al [1] used travel sequences hierarchical sequences of locations to find similarity from location history. Zheng et al [2] proposed user centric model for personalized friend and location recommendation. Y Zheng and X Xie [3] mined GPS of users and behavior of region are taken into consideration to find locations. Leung et al [4] formed a graph with user activity location relations to recommend locations to users. Agrawal et al [5] first item sets mined through association rules to find frequent on, later presented apriori algorithm to find frequent item sets depending user. Topic model based method are used for personalized travel recommendation. Bao et al. presented a location based system that offers geospatial range. Each individual preference is modeled with weighted category using iterative model. Zheng et al. use GPS to suggest travel locations. In [11] kori et al. represented a extraction framework into account sections. Registration information is vital for mining [3].

It is blend of substance based separating and cooperative sifting approach. The substance separating depends on relationship in the middle of substance and depictions. While community separating depends on client's inclination and the similitude with dynamic client [9].It embraces closest neighbor calculation, so compute separation between the clients as per clients 'inclination and discover focus on client's closest neighbor. The proposal framework prescribes assets to client personalized and this framework helps clients discover the required assets [4].

This procedure enhances the proposal precision however assorted qualities are not considered. The fundamental imperative strategy in proposal framework is synergistic separating techniques that discover a gathering of individuals who have the same enthusiasm with you. These individuals could be dictated by the comparable positioning on things. These individuals are known as the area of the present client.

In the event that a thing is preferred by numerous individuals in this area, then it is extremely conceivable to be enjoyed by current client. Netflix is utilizing community oriented separating technique. On the off chance that a proposal framework includes rating on things then it is likely utilizing communitarian sifting strategy. Another sort of collective separating technique is called thing to-thing synergistic sifting strategy. Synergistic sifting proposal framework is further grouped into two calculations. They are portrayed beneath [5, 11].

1. Memory based CF: This collective separating strategy suggest the things in view of the past exercises of clients.

2. Model based CF: This collective separating strategy has a capacity to take in a prescient model in view of the past client exercises utilizing measurable or machine learning model.

III. METHODOLOGY

Recommendation is suggesting users based on predicted user behavior and prediction is estimation of future behavior based on historical statistics. For predictions various approaches are used. Among them content based filtering, collaborative filtering, demographic filtering are used [19, 20]. This system gives recommendations based on user categories and prediction categories. User can be new or existing, new user is the one who uses the system for first time. For new users there is no behavior history present, as no recommendations can be generated due to no history present. In this scenario recommendations are given based on the demographic profile that matches with the user. Recommendations can be customized based on the age of user. The existing user is the one with whom the system is familiar and knows the history and behavior of user. The profile reflects the interest and user intent which shows behavior pattern. For eg – if a user has interest in visiting temples, the system will consider his interest as temple and recommend him temples in new travel locations. A hybrid system enables using advantages of a model and overcome disadvantages of other models used. For example collaborative filtering fail in giving recommendations to new user, this can be overcome by content based prediction, if new attributes match the location match then the user is recommended it the same behavior pattern [5].

Clustering is used for cities to find POI for specific sets with local grouping, The POI within the small radius are grouped together, for each grouping the number of must contain specific photos and user information about it. Based on visual features the clusters are formed. Visual features give enhanced clustering on the features and grouping is done easily [3].

3.1City level POI Clustering

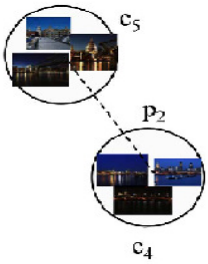

Fig 1.1 – City Level POI Clustering

System map the city level POI, based on this sets of POI's of city are generated $P_m = \{p_{1,\ldots\ldots,}P_j\}$ where Pj is the j-th POI of the city and geo tag clustering $G_m = \{G_{1,\ldots\ldots,}G_j\}$ landmarks within small radius within same cluster. With community contributed photos are noisy and crowded with geo-tag and tags. the cluster set $C_m = \{C_{1,\ldots\ldots,}C_j\}$. Based on visual feature the set of visual feature is denoted by $V_m = \{V_{1,\ldots\ldots,}V_j\}$.
Cluster has various POI, these are optimized for the post processing considering the geo location and interest of user, these clusters are used to recommend the locations within the same radius, it is feasible as the POI in same radius are mapped and recommended based on the ratings and comments. Each cluster contains the set of POI with visual feature the SIFT is used, it performs visual feature matching based on cluster merging [1 , 3].

3.2Cosine Similarity function

$$sim(i,j) = \cos(\vec{i},\vec{j}) = \frac{\vec{i}\cdot\vec{j}}{\|\vec{i}\|_2 * \|\vec{j}\|_2}$$

User similarity is found on basis of cosine similarity measure, the users with similar scores will be getting similar POI as their behavior of travel may be same as the similarity between score matches [3][7]. Here i refer to similar users who visited the same locations and j refers to topic distribution.

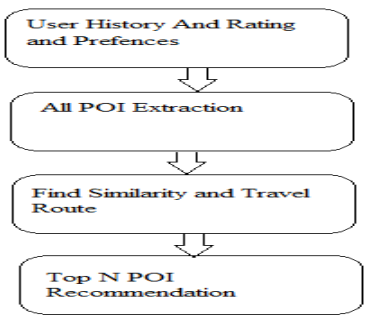

Fig 2 Flow chart of recommender system

3.3 Visual Feature Extraction

Feature might be raw pixels, but it is not enough feature extraction is needed for the delivery of visually matching images, SIFT (scale invariant feature transform) detects the edges & corners of images. It extracts histogram; these histograms are concatenated into smaller groups like k-means. These extraction results into similarity of images and once these are extracted the recommendation for the same can be given [3].

3.4 Prediction

The user prediction rely on the user profile and user interests, the user interests can be beach, a park, religious place, zoo etc. These attributes can be taken into consideration and are selected based on history. The selection plays important role as the recommendation that is to be given to the user who might find the recommendation usefuls[19].

Prediction algorithm

1-Create history patterns for user.
2-Create location profile for user.
3- Check for new user or existing user.
4-For each user.
Update user history
Update location history
Update user interests
5-Analyze frequent user patterns.
6-Predict user behavior and interests.

Explanation -

The user history for travel is a analyzed and this is recorded, based upon this the user patterns are evaluated, these patterns are saved. Based on these patterns it is easy to predict used interest. Upon patterns location profile of the user will be created, this location profile contains the location history of user based on the locations travelled which helps to recognize location patterns which helps in recommendation evaluation. Check for new user else existing user based on this the user history, location history and user interests are updated these records are evaluated for analyzing the user patterns and behavior based upon the history. These can improvise the results and predictions upon user's interests. After the results are evaluated the predication can be given to user for the interested point of interest.

3.4 Recommendation

Individual preferences are used for recommendations. The model is made based on the rating and ranking and individual preferences. Recommendations get generated upon the correct user predictions [8]. This is based on the user location and user preferences. Individual preferences are generated and upon the GPS location the user interests are calculated.

Recommendation algorithm [9][7].

1. *Input the Results of output of prediction process.*
2. *Analyze user category*
   a. *For new users – calculate the user demographic; calculate similarity between users by cosine function.*
   b. *For existing users – use content based filtering for user as history, analyze location and predict the high ranked results to user.*
3. *Produce recommendations and display [2, 8, 9].*

Explanation –

The predication process output is analyzed, on this analysis the output is evaluated. User category is tested for new users, for new users the demographic is checked and the similarity is calculated using cosine function and for existing users the content based filtering based upon history of user, analyze the locations and predict the results to users. Finally recommend the output and display them.

IV.IMPLEMENTATION & RESULT

Architecture

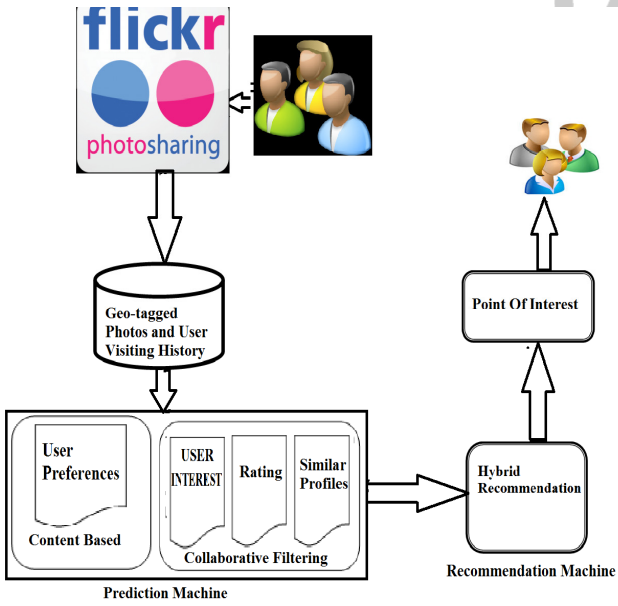

Fig 3 Architecture of Proposed System

Steps in Architecture

Users upload their photos and comments with tags on flickr community photo sharing.

1. This meta data about images is stored in data ware house of the system.
2. This meta data is evaluated and geo tags, user history, user interests and preferences are stored.
3. Upon storing the prediction machine evaluates based on content based and collaborative filtering techniques. Content based filtering consists of the User Preferences and Collaborative filtering consists of User interests, rating and similar profiles.
4. Recommendation machine calculates the results based on the prediction machine output and evaluates the recommendation for the user.
5. Point of interests is given to users.

This section explain overall architecture, strategy etc.

A. Architecture – It serves as a backbone of system, it perform data management and recommendation process. It gives recommendations based on the user preferences. These recommendations are presented to user that shows past places that visited and future predictions to visit [17].

B. Prediction Machine - here the user preferences are calculated based on the type of user new or existing, content based filtering is applied on it. User interest and similarity profile is checked with the ratings for nearby location of interest. Once these are calculated the collaborative filtering is applied [13 , 14].

C. Hybrid Recommendation – here the results are generated based on demographics, location and preferences. POI for user is calculated and recommended.

D. POI – here the recommendation for the user are generated and displayed, User is given point of interests on basis of hybrid approach [2, 5].

Output

Average precision is calculated as below:

Average Precision:-

$$AP@n = \left(\sum_{i=1}^{n}\left(\sum_{j=1}^{i} rel_j\right)/i\right)/n$$

The graph shows the comparison output of the algorithms for a particular search query and maps. SVD algorithm seems to give more accurate results than other algorithms.

SVD uses 3 steps to evaluate results

1. Data representation – The missing data is found, average of column and row is replaced for the missing values. Find row centered matrix and roe mean.
2. Low rank approximation - similarity matrices are generated using diagonal entries.
3. Prediction is generated.

Here are some snapshots that show the result that will be produced; it shows the recommendations based on locations [15].

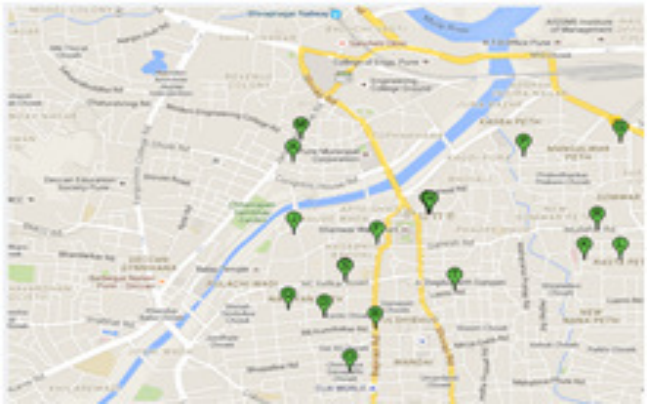

Fig 5 Collection of POI

The refined POI are shown and the results are calculated based on the ranking and user ratings.

Fig 6 Top N POI Recommendation.

Fig shows the location based POI, when hotels are searched the nearest POI are shown based on the rating the results are refined and top results are shown [6, 16].

Performance	ID3	LDA	SVD
Map1	0.4138	0.4121	0.4871
Map2	0.4239	0.4332	0.4567
Map3	0.2389	0.2873	0.321
Map4	0.271	0.4321	0.443

Table 1 POI Recommendation Performance

Table shows the MAP and POI based on the user rating. Accuracy calculated for the maps with the comparison of the recommendations for user based on the search query. The hybrid approach seems to give more precise output for the search query.

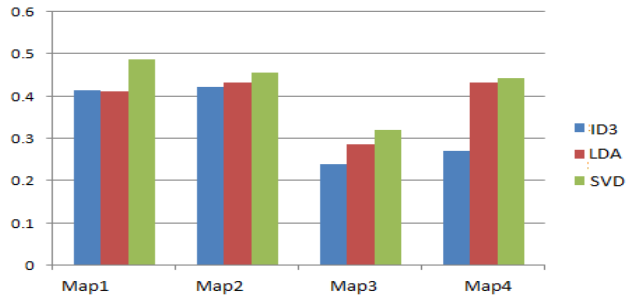

Fig 4 A comparison of accuracy between the ID3,LDA and SVD.

V. CONCLUSION

In this paper the proposed personalized recommendation system by using Hybrid approach consisting demographic and content based filtering with use of geo tags and user preferences to find the recommendations for user based on his history has been successfully implemented. The system evaluates the travel recommendations on the behavior of the user and the travel history. The predictions successfully implemented to recommend the point of interests to user based upon the travel patterns and history. The top recommendations are evaluated and ranked accordingly to the interests of user . In future the recommendations for user travelling alone or in group or couple can be evaluated, as each member will have own preference and aligning these preferences to group is challenge.

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