Service Recommendation Using Genetic Approach

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Abstract- *Service recommendation systems are one of the most important areas of the research and application development. The need of personalization and filtering systems is growing permanently due to the immense information available online. Recommendation systems form or establish a specific type of information filtering approach that attempt to present items according to the interest of a user. In this paper, we propose a method by which finest services are to be suggested. This technique is used collaborative filtering to compute user necessity and produces more relevant services for end user applications. The proposed solution is implemented by genetic approach for searching the most relevant services. Consequently, the system is implemented in JAVA and for performance evaluation we produce result based on time and memory consumption.*

Keywords- Data Mining, Big Data, Service Recommendation, Genetic Algorithm, Searching, Datasets

I. INTRODUCTION

Progress in digital data acquisition and storage technology has resulted in the growth of huge databases. Data mining is the analysis of (often large) observational data sets to find unsuspected relationships and to summarize the data in novel ways that are both understandable and useful to the data owner. The relationships and summaries derived through a data mining exercise are often referred to as models or patterns. Examples include linear equations, rules, clusters, graphs, tree structures, and recurrent patterns in time series.In this present reality, colossal measure of information is accessible in instruction, restorative, industry and numerous different regions. Such information may give learning and data to basic leadership. For instance, you can discover drop out understudy in any college, deals information in shopping database. Information can be break down, outlined, comprehend and address to difficulties [1].

With the drastically quick and dangerous development of information available over the Internet, World Wide Web has turned into a strong stage to store, spread and recover information in like manner as mine accommodating information. Because of the properties of the expansive, assorted, dynamic and unstructured nature of web information, web information examination has experienced loads of difficulties, similar to versatility, mixed media framework and fleeting issues and so on. Because of this expansive measure of data finding fascinating data is a dull and time spending undertaking for the client. The extent of Recommendation system here comes into light. Proposal Systems are programming devices and strategies that arrangement with data over-burden by giving intriguing recommendations and suggestions to client [2].

A. Service Recommendation System

The continuous growth in the size and use of the World Wide Web imposes new methods of design and development of online information services. Most Web structures are large and complicated and users often miss the goal of their inquiry, or receive ambiguous results when they try to navigate through them. Therefore, the requirement for predicting user needs in order to improve the usability and user retention of a Web site can be addressed by personalizing it. The huge and ever increasing amount, complexity and heterogeneity of available digital information overwhelm the human processing capabilities in a wide array of information seeking and e-commerce tasks. The goal of a Recommender System is to generate meaningful recommendations to a collection of users for items or products that might interest them. Suggestions for books on Amazon, or movies on Netflix, are real world examples of the operation of industry-strength recommender systems.

Recommender systems are an important part of the information and e-commerce ecosystem. They represent a powerful method for enabling users to filter through large information and product spaces. Recommender systems are beneficial to both service providers and users. They lessen exchange expenses of finding and choosing things in an internet shopping condition. Suggestion frameworks have likewise demonstrated to enhance basic leadership process and quality. In online business setting, recommender frameworks improve incomes, for the way that they are powerful methods for offering more items [3, 4]. In logical libraries, recommender frameworks bolster clients by enabling them to move past index looks. Hence, the need to utilize productive and exact suggestion strategies inside a framework that will give pertinent and tried and true proposals to clients can't be over-underscored [5].

B. Categories of Service Recommendation System

A recommendation system can be developed in a number technique. According to behaviour of recommendation system can be classify into following categories [6]:

- ***Content based Recommendation:*** Similar items to the ones the user preferred in the past are generated as a recommendation.
- ***Ccollaborative Recommendation:*** Items preferred by the people who have the similar taste to the user are generated as a recommendation.
- ***Hybrid Approach:*** The above recommendation methods are combined in this approach.

C. Challenges and Problems of Recommendation Methods

1. Cold-Start Problem: When you create a profile in a few recommender systems have solved this problem with the survey. They are new in the system and when the item has not previously been declared a cold start it can be. Both of these problems can be solved with the hybrid approach.

2. Believe: With a brief history of the people's voice in their rich history, which is as the voice of those that may not be relevant? The issue of trust arises to evaluate a particular client. The problem can be solved by the users for the distribution of preferences.

3. Scalability: With the increase of number of users and items, and recommendations for the formation of information processing systems need more resources. This problem also filters and systems are solved by combining different types of physical improvement. Many parts of the computations in order to accelerate the assurance of online recommendations can be applied offline.

4. Sparsity: Users and a large amount of items that online stores those users have rated only a few items are almost always there. Collaborative recommender systems using other methods to access their profiles, users typically create neighbourhood. If a user has rated only a few items, it is very difficult to determine his taste and he / she may be wrong neighbourhood.

5. Privacy: The most important issue is privacy. To get the most accurate and recommendation systems, demographic data, and the data about the location of a particular user with the most amount of information possible about the user, should receive. Naturally, the information's reliability, security and privacy questions arise. Many online stores by using special algorithms and programs provide effective protection of users' privacy [7, 8].

D. Applications of Recommendation Systems

There are various application of recommendation systems are available, several important applications of recommendation systems are given as [9]:

- Product Recommendations:Maybe the most essential utilization of proposal frameworks is at on-line retailers. Noticed how Amazon or comparable on-line sellers endeavour to give each returning client a few proposals of items that they may get a kick out of the chance to purchase. These proposals are not irregular, but rather depend on the buying choices made by comparative clients or on different methods.
- Movie Recommendations:Netflix offers its clients proposals of films they may like. These proposals depend on evaluations gave by clients, much like the appraisals recommended. The significance of foreseeing appraisals precisely is high to the point, that Netflix offered a prize of one million dollars for the first calculation that could beat its own particular suggestion framework by 10%. The prize was finally won in 2009, by a group of analysts called "Bellkor's Pragmatic Chaos," after more than three years of rivalry.
- News Articles:News administrations have endeavoured to distinguish articles important to per users, in view of the articles that they have perused before. The comparability may be founded on the similitude of critical words in the records, or on the articles that are perused by individuals with comparable perusing tastes. Similar standards apply to suggesting websites from among a huge number of web journals accessible, recordings on YouTube, or different destinations where content is given frequently.

The rest of this paper is planned as follows: Section II describe Literature Survey of recent work of recommendation system, Section III includes the solution domain of proposed system. Moreover, section IV illustrates result of evaluated performance. Finally, the paper is concluded in Section V.

II. LITERATURE SURVEY

This section provides the recently made efforts and contributions to enhance the techniques of service based Recommendation. Therefore, different articles and research papers are included in this section.

Shared separating methods assume an essential part in outlining the suggestion frameworks. The synergistic separating procedure based recommender framework may endure with frosty begin issue i.e. new client issue and new thing issue and versatility issues. Customary K-Nearest Neighbor Technique likewise endures with client and thing icy begin issue. In this paper *Saurabh Kumar Tiwari [10]* proposed a recommender framework which creates proposals for client by consolidating teaming up separating on exchange information with rating anticipated with client socioeconomics and thing closeness. The last appraising is weighted total of evaluations figured from exchange information, client information and thing information. The upside of proposed framework that recommender framework can manage icy begin in the event of "new client" or "new thing" .and Furthermore framework has low MAE and RMSE in examination of customary community oriented sifting in view of K-Nearest Neighbor approach.

With the developing extent of the E-trade industry, a recommender framework puts a basic part in foreseeing right element to the client. Exactness and level of trust are most essential parameters of a recommender framework. Numerous recommender calculations are proposed in the writing to improve the precision of proposals to the client. *Immidi Kali Pradeeet al. [11]* is centered around upgrading the soundness of recommender framework utilizing hereditary and monotonous smoothening approach. Security decides the level of trust by the client to utilize the things suggested by a recommender framework. SVD and incline one recommenders frameworks are utilized alongside the proposed approach and it has been demonstrated that dependability is improved utilizing the hereditary monotonous calculation. Hereditary approach has demonstrated huge changes in the field of research and is viewed as one of the strong methods.

Online recommenders are generally alluded to those utilized as a part of internet business sites for proposing an item or administration out of numerous decisions. The center innovation actualized behind this kind of recommenders incorporates content examination, synergistic separating and some half and half variations. Since they all have certain qualities and constraints, consolidating them might be a promising arrangement gave there is a method for defeating a lot of info factors particularly from joining diverse strategies. Hereditary calculation (GA) is a perfect enhancement seek work, for finding a best proposal out of a huge populace of factors. In this paper *Simon Fong et al. [12]* exhibited a GA-based approach for supporting consolidated methods of community oriented separating. Specifically, we demonstrate that how the info factors can be coded into GA chromosomes in different modes. Bits of knowledge of how GA can be utilized as a part of recommenders are determined through our tests with the information taken from Movielens and IMDB.

Recommender frameworks have been assessed in numerous, regularly exceptional, ways. In this article, *Jonathan L. Herlocker et al. [13]* survey the key choices in assessing cooperative separating recommender frameworks: the client undertakings being assessed, the sorts of examination and datasets being utilized, the courses in which forecast quality is measured, the assessment of expectation characteristics other than quality, and the client based assessment of the framework in general. Notwithstanding exploring the assessment methodologies utilized by earlier scientists, creators exhibit exact outcomes from the examination of different precision measurements on one substance space where all the tried measurements fallen generally into three comparability classes. Measurements inside every equivalency class were firmly corresponded, while measurements from various equivalency classes were uncorrelated.

III. PROPOSED SOLUTION

In order to enhance the solution for computational ability and for the optimization of recommendation system quantum genetics based solution is proposed in this work. The proposed methodology of the proposed technique is demonstrated using the figure 1. In the given system the two different kinds of inputs are accepted namely the list of requirements and second the list of services offered by the service providers. In this phase the given problem space is extended by the quantization process and a number of solutions are generated for the different number of problems. Finally the problem and solution strings are encoded in the binary string. These strings are working as the population of the genetic algorithm. The genetic algorithm applies the operators and genetic processes optimize the solutions for minimizing the execution cost of the service offered for the end user and maximize the user requirements for more suitable service selection. The given approach is a formal process of the proposed solution.

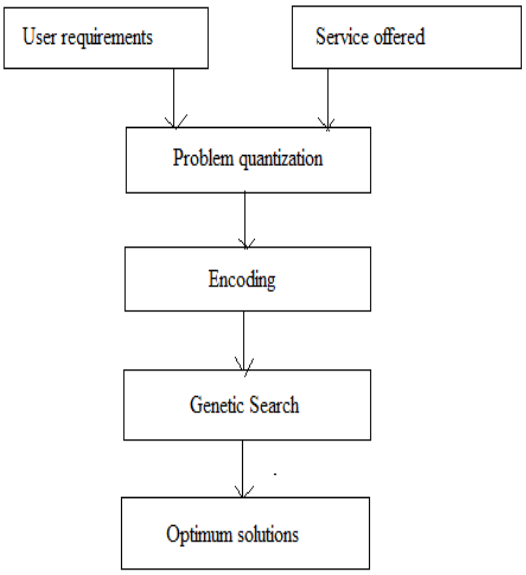

Figure 1:Proposed Working Flow

IV. RESULT ANALYSIS

A. Memory Consumption

Processes which are required some amount of main memory for execution of the current task. Additionally that is assigned dynamically according to the requirements of processes. The memory usages of the process or algorithm also termed as the memory consumption or the space complexity of algorithms. The memory requirements of the algorithm are computed using the following formula: Figure 2 Shows the Memory Usages.

Memory Used = (Total Assigned Memory – Total Free Space)

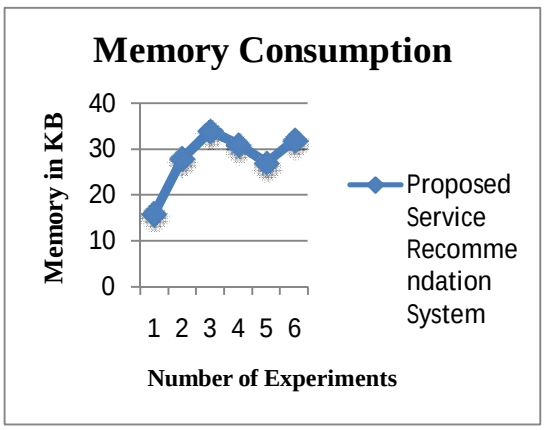

Figure 2 Memory Usages

Table 1 ConsumedMemory

Number of Experiments	Proposed Service Recommendation System
1	16
2	28
3	34
4	31
5	27
6	32

The amount of space required for proposed service recommendation model is demonstrated using Table 1 and Figure 2. The table provides the values of memory requirements in KB (kilobytes) and figure visualize the pattern of requirements on the basis of values. In this figure X axis includes the number of experiments performed and Y-axis shows the corresponding memory consumption. According to the obtained performance the requirements of the system is increases as the amount of data increases for processing. But according to the variations observed the amount of requirements are considerable according to the data size.

B. Time Consumption

Processes take an amount of time for processing the input data according to the algorithms evaluation. This time requirement of the algorithm is termed as the time consumption of algorithm processing or the time complexity of the system. The time of the search processing is computed using the following formula:

Time Consumption = Algorithm StartTime – Algorithm End time

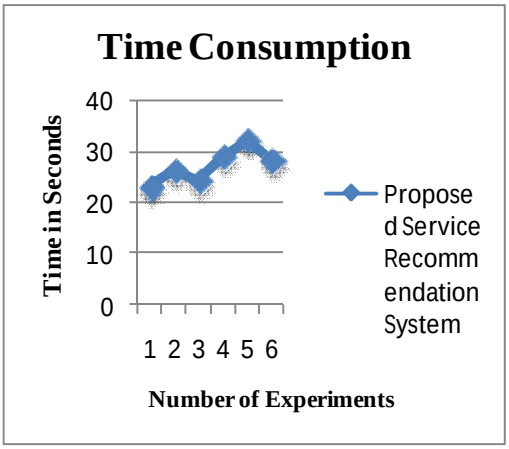

Figure 3 Time Consumption

The time requirement for the proposed service recommendation model is provided in figure 3 and table 2. Table includes the two attributes first the size of data for processing and second is the amount of time required for performing the evaluation. The time is measured herewith in terms of seconds The X-axis of figure includes the experimentation and the Y-axis provides the time requirements to visualize the figure. According to the obtained results performance of the proposed recommendation system is varying in time for the same dataset. Therefore, we included different experiment for the same graph and observed resulting values. Time consumption is depends on the data size which we taken for processing of algorithm.

Table 2 Time Consumption

Number of Experiments	Proposed Service Recommendation System
1	22.98
2	26.11
3	24.26
4	28.88
5	32.16
6	28.01

V. CONCLUSION

The quick development of data on the web and volume of data and furthermore expanding the quantity of clients exhibit the necessity of the recommender frameworks. The evaluation of the services based on the reviews of the services offered by the service provider is the main aim of the proposed work. Therefore the proposed technique involves a simulation of the hotels recommendation based on the offered services and their client's review. Hence this paper is providing the overview and implementation of service recommendation on hotel dataset. Finally, the outcomes of the work are satisfactory as compared to other previous approaches in terms of memory and time complexity.

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