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ADAPTIVE LEARNING METHOD FOR WEB RECOMMENDATION

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ABSTRACT

The proposed approach involves the utilization of Web Usage Mining to develop a recommender system for web personalization and enhancing user experience. The first step is to extract features from web documents and create relevant concepts, which are then used to build an ontology for the website. This integrated system supports learner reviews by providing a review dashboard that recommends adaptive review content based on the individual learner's level of understanding. Additionally, the system recommends pages related to the digital learning materials that the learner may have difficult in understanding. To identify these pages, the system extracts pages related to questions that were answered incorrectly.

Keywords: Web Usage Mining, Web Personalization, Website, Ontology, Recommendation.

I. INTRODUCTION

Web search engines are designed to fulfill user's information needs by receiving queries that represent their search intentions. However, queries can often be ambiguous and cover broad topics, leading to different users having diverse information needs even if they submit the same query. This can result in search engines providing irrelevant or inadequate results, frustrating users and leading to a poor user experience.

To address this issue, capturing user search goals can greatly enhance search engine relevance and user experience. User search goals refer to the different aspects of a query that user groups want to obtain. These goals can be considered as clusters of information needs for a query. By understanding and analysing these clusters, search engines can provide more relevant and targeted results that satisfy users' search intentions.

Analyzing user search goals has numerous advantages for improving search engine performance and user experience. One such advantage is the ability to restructure search results based on user search goals. This involves grouping search results according to the search goals they fulfill, allowing users to easily find what they are looking for. This can enhance search engine relevance and efficiency, as well as making the search process more intuitive and user-friendly. Another advantage of analyzing user search goals is the ability to improve query recommendations. User search goals represented by some keywords can be utilized in query recommendation, suggesting more precise and relevant queries that better capture users' search intentions. This can save users time and effort, as well as improve the accuracy and relevance of search results. Finally, analyzing user search goals can also be useful in enhancing re-ranking of search results. The distributions of user search goals can be used to identify which search results are more relevant to which goals. By re-ranking the search results based on user search goals, the search engine can provide more accurate and targeted results that better satisfy users' search intentions. Overall, analyzing user search goals can greatly enhance search engine relevance and user experience. By understanding users' search intentions and clustering them into meaningful search goals, search engines can provide more targeted and accurate results, improving user satisfaction and engagement.

II. METHODOLOGY

Waterfall Approach

Analysis

Current recommendation systems face challenges such as cold-start, sparsity, overspecialization, and domain-dependency, with their performance relying on the size of the training datasets. Ontology construction can be

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done manually or with automated models but requires professional expertise during initial design and implementation.

The proposed personalized-recommendation system utilizes ontologies and Web Usage Mining to extract features from web documents, construct relevant concepts, and cluster them into different semantic themes to provide more accurate and personalized recommendations for semantic applications.

Design

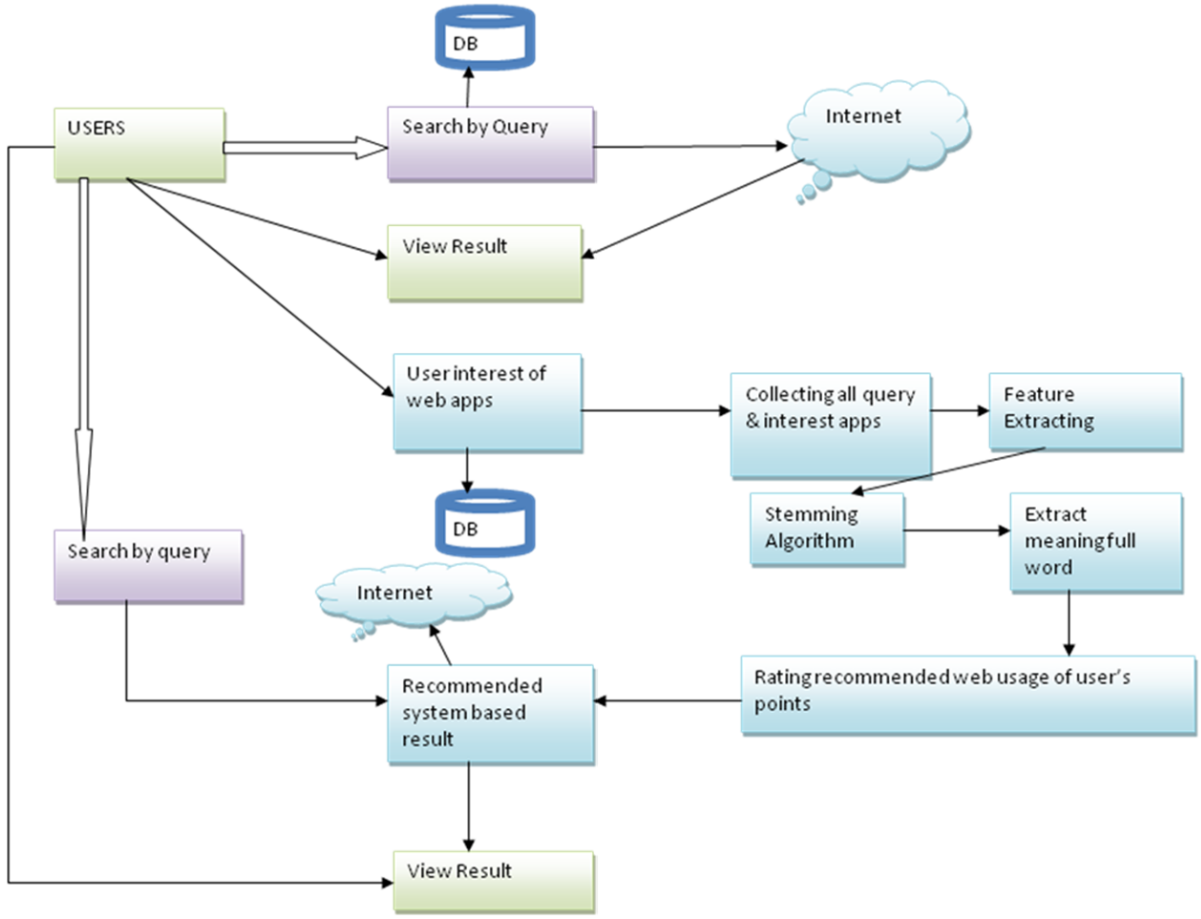

Figure 1: System Architecture

To start, the user must log in using their credentials. Once logged in, they can search for a query, and the search results page will be shown. From there, the user can click on a link to view more details and select the "click through submit" option. After that, the user can perform the same search query to collect all related queries and interesting applications by Stemming Algorithm. The results of this subsequent search will then be displayed as shown in Figure 1.

Coding

The personalized recommender system employs Java for its backend, JSP for its front-end, and utilizes a MySQL database to store URL and profile information.

Testing

The personalized recommender system undergoes evaluation through both functional testing, which verifies that each function operates as intended, and performance testing, which measures the system's response time, stability, and scalability under various load conditions.

Integration

The individual software modules are combined and tested as a group to verify that they function correctly together.

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III. MODELING AND ANALYSIS

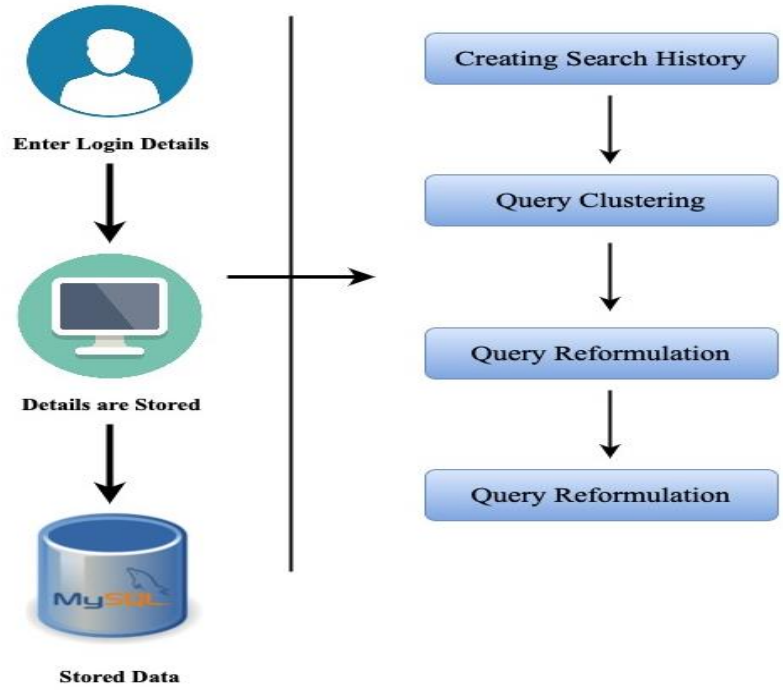

Figure 2: System Modules

Creating Search history:

The data source for creating user profiles can include personal documents such as browsing history and emails stored on a user's computer. By focusing on frequently occurring terms within these documents(as shown in Figure 2) ,the dimensionality of the document set is reduced, enabling a clearer understanding of the user's interests. This module enables search engines to gain a deeper understanding of a user's session and potentially customize their search experience based on their specific needs. After identifying query groups, search engines can accurately interpret the search context behind the current query by analyzing queries and clicks within the corresponding group.

Query clustering:

To achieve personalization, users' queries are grouped into various query clusters using concept-based user profiles in the clustering process(as shown in Figure 2). The clustering process involves identifying the most similar pair of concept nodes, merging the most similar pair of query nodes, and continuing the process iteratively. Each user's individual query is considered a separate node with a unique user identifier. The grouping process is carried out dynamically by initially assigning the current query and clicks to a query group.

Query reformulation:

For effective grouping of queries and clicks, it is crucial to establish appropriate relevance between query groups. The assumption is that users tend to make similar queries and clicks within a brief timeframe. Analyzing the search history of numerous users provides signals about query relevance, such as which queries are frequently issued in conjunction with each other. This highlights the connection between queries that typically result in clicks on similar URLs. The query reformulation graph and query click graph derived from search logs are instrumental in determining the relevance between queries or query groups in a user's search history(as shown in Figure 2).

History grouping:

One approach to grouping queries is to initially consider every query in a user's history as a query group, and then merge these groups iteratively using a k-means algorithm(as shown in Figure 2). However, this approach is not practical in our scenario for two reasons. Firstly, it could potentially disrupt a user's existing query groups, thus undoing their manual efforts to organize their search history. Secondly, it involves a high

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computational cost as a large number of query group similarity computations would need to be repeated for every new query.

IV. RESULTS AND DISCUSSION

Result

By integrating domain knowledge with Web usage knowledge using ontology-based Web mining techniques, recommender systems can achieve improved performance. The model construction process is semi-automated, which helps to reduce the development efforts required from developers. The user-profile learning algorithm, responsible for expanding and maintaining a user's long-term interests, leverages a domain-based inference method along with other relevance feedback methods to quickly populate the user profile and address the cold-start problem. The filtering algorithm, which uses a stemming approach, refines the item-user matching score calculation by employing a semantic similarity method based on the hierarchical structure of the ontology.

Test Case

Sl. No	Input	Pass/Fail	Expected Result
1	Input password validation Must have at least 6 characters	Passed	True
2	Login Password Matching	Passed	True
3	Search Queries	Passed	True
4	Click Through	Passed	True

V. CONCLUSION

This paper proposes a method to infer user search goals by clustering feedback sessions represented by pseudo-documents, which allows for a more efficient reflection of user information needs. The method maps feedback sessions to pseudo-documents and uses them to discover user search goals, which can then be depicted with keywords. The approach has a low complexity and can be easily used in reality, with the search engine categorizing results into different groups according to user search goals.

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