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Document Ranking using Customized Semantic Networks of Text Documents and the User Query

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Abstract: As technology is advancing in each area ,effective and efficient retrieval of documents is a basic need.Classic Information Retrieval systems does not only aims at finding the relevant information but they are supposed to retrieve the most relevant documents as well as rank or organize retrieved documents according to its degree of relevancy with the given query.The main task is to decide which documents are relevant and which are not so as to satisfy users' information need.Traditional ranking approaches mostly rely on exact 'bagof-words' strategy to decide the relevancy of the data with the given query. The relevancy score was defined in terms of number of times the words that is in the query appear in the document i.e. term frequency. A semantic search framework could be the solution for this problem which is then adopted in several studies.While retrieving documents for any query contextual meaningsofwordsfromdocumentsandqueriesshouldbeconsidered to match non-matching terms. Semantic search framework uses such core semantics of data exploiting domain ontology.Here a semantic search framework for semantic pre-processing of documents and queries is adopted which considers relationships amongthewordsinthedocumentalsointhequery(e.g.is-a,partof, sub-part etc.) with the help of semantic network generation algorithm.The probability of matching users' information needs with stored documents can be increased by considering meaning of terms from data thus by exploiting relationships among terms.

KEYWORDS: Document semantic network, Domain ontology, Engineering document, Personalized search, Ranking, Semantic search, Retrieval, User profile

I. INTRODUCTION

Major improvement is required in the existing document retrieval approaches to fulfill engineers' information needs.Most of the traditional methods uses 'bag-of-words' strategy since it is very popular and easy to execute.In this strategy documents are retrieved by keyword-based method by comparing exact matching terms only between document and query.Such approach fails to find most relevant documents in engineering domain,since engineering documents differs from other documents in terms of syntax formulations and core semantic complexities. Most of the engineering based documentscontains large number of acronyms and abbreviations, which results in high brevity of documents. These characteristics disablesthesystemtoretrieverelevantdocumentsforallusers' information needs.Thus to improve retrieval performance of existing systems various techniques can be applied such as document partitioning, query expansion, or document ranking methods.But it is necessary to compare and investigate among all these techniques, to improve classic document ranking methods; domain ontology helps not only to represent the core semantics of document more precisely but to calculate the relevance score of each document.Thus in the proposed study, a domain ontology based new document ranking technique is used.

II. MOTIVATION

Semantic search approach represents documents and queries in the form of graphs by exploiting ontology, where each node represents each terms and edges represents relationships among them on the basis of which dependencies between two terms can be recognized.Most of the times, non-matched terms could be the important factor to decide documents'

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relevancy.Thus, recovery of such semantically related nonmatching words to exact matched words can be done with the help of domain ontology.However, to improve performance of existing approaches a more elaborative and efficient relevancy decision schemes are necessary.One of the major advantage of semantic based approach is that it helps to improve the accuracy of retrieved results for any user query by considering users' intent and the actual meaning of the terms present in the given query so as to output most relevant documents ,which results in the betterment of search engines' performance.Now,one of the important decision is to evaluate semantic similarity between any two terms either from query or document, for that various methods can be used which are further explained in the literature survey.In many approaches, Wordnet is the most widely used reference database for calculation of semantic relationships between terms. In the field of huge semantic network, various algorithm have been proposed for ranking multiple semantic paths between any two nodes, as there is a chance of more than one relationship could be present between those two terms.So, deciding relevance score for each semantic path is an important factor which uses various weighting schemes to find out the accurate relevance score.Hence, these weighting schemes contributes majorly in document various document ranking techniques.

III. REVIEW OF LITERATURE

QE is considered a viable solution, expanding process by expanding query keywords with related terms. AHP is an effective tool for dealing with complex decision making; it aids the decision maker to determine the priorities of used criteria.[1]
Learning to Rank is applied to automatically learn a Ranking function from the training data. In this paper, a new hybrid learner is introduced based on NN and SVM that gives better performance than learning using NN alone [2].
Proposed system presents an improved Semantic Similarity technique to rank a web page from a set of given web page which access the user history to rank the webpage according to the user query. An online interface is developed using asp.net web technologies and c#.net is being used as a programming language tool [3].
The proposed algorithm calculates page rank value or importance of web pages based on the visits of incoming links on a page. It observed that the page which has more visits of incoming links is carrying more rank value than less Visited pages [4].
The method proposed in this paper uses the concepts and relationship between the concepts that exists both in the document and the user query to improve the retrieval of relevant document. A different method is used for keyword extraction, hence it leads to better results [5].
The proposed paper explores the problem of maintaining the semantic relationship between different plain documents over the related encrypted documents and give the design method to enhance the performance of the semantic search [6].
In this paper, we have proposed a new ranking strategy known as SemRank which uses the SI measure to calculate the image relevancy weights against the query. It has an advantage that it can employ the semantics inside the image and the query in determining the ranking order [7].

Most of the traditional document retrieval methods have some major drawbacks which majorly influence the performance of the relevant document retrieval process are listed below:-

- Bag of words concept never considers semantic relationships between terms, though those terms are semantically related to each other(e.g. 'has-a', 'under-this', etc.)
- Relevance score of a document with respect to any query is dominated by number of exactly similar terms between a query and a document completely.

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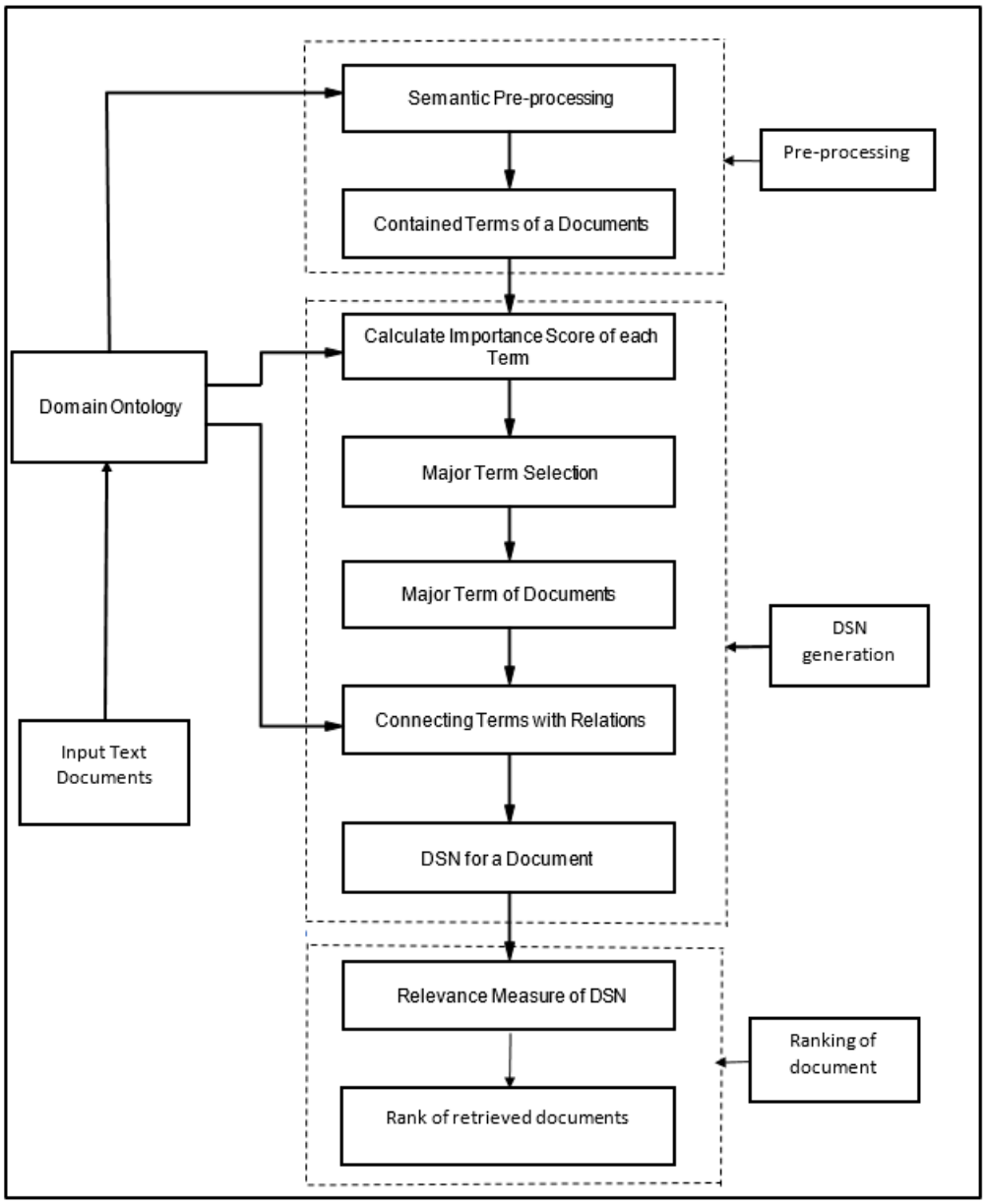
IV. SYSTEM ARCHITECTURE



V. SYSTEM OVERVIEW

In the proposed work, document's relevance score is calculated using a DSN (Document Semantic Network) generated from a document. After forming DSN for each document ,relevancesocre is measured for that DSN which ultimately decides the ranking of the particular document to user query. If a DSN for any document contains more number of relationships between terms that are related to users' intent, then document will be considered as highly related to that

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particular query. Various measures are exploited to estimate the weight of each relation against the information needs.Personalized ranking can be also provided to each user by considering its all previous searches which is nothing but user profile.This complete work can be done by following two steps

1) Generation of document semantic network for a document.

2) Relevance score measurement for each document semantic network of a document.

Generally, in all existing models Boolean model matching concept is used for retrieving documents after submission of an query by user. But, after retrieving documents, ranking them in a correct order is a major task to do, for that purpose document semantic networks are generated. DSN's enables ranking the retrieved documents efficiently by considering semantics of the document and the given query. During this process,personalized relevance score for each user is also provided by exploiting user profile.After all this processing, retrieved document result are arranged in descending order of the relevance score.

VI. PROPOSED METHODOLOGY

As shown in system architecture , documents are firstly pre-proccesed in which various tasks such as stopwordremoval,stemming etc. are performed. Properly pre-proccesed documents also might contains large number of words which makes it difficult to form DSN for each document. Thus, representing the core semantics of document with minimum number of words or terms from the document is an important and difficult task.Thus, following various emasures are used to decide important terms from document to be considered.
Importance measurement for terms in a document:-
To decide which terms are minor or major information elements in the document, term weighting schemes using three measures are introduced. The three measures are:-

- Structural Score
- tf–idf Score, and
- Semantic Score

VII.RESULTS AND ANALYSIS

The main goal of the DSN generation process is to connect separated term-groups so as to represent the semantics of a document precisely. To make a DSN in which all major terms in the document are connected, the algorithm iteratively gathers a term one by one to make a connected graph. Since some of terms can be omitted in a document for brevity, those terms should be considered in the relevance measuring process. To provide personalized ranking results, we exploit user's highly accessed documents to build a user profile. Using the algorithm, each of the DSNs for accessed documents are combined together to form a connected graph. Thus, the user profile, a portion of the ontology, represents which parts the user frequently handles and which properties the user mainly considers.
Following example will clear the idea of how the Document Semantic Network of text document will be generated:-
Example:- Tom is a cat.Tom caught a bird.Tom is owned by John.Tom is ginger in colour.Cats like cream. The cat sat on the mat.A cat is a mammal. A bird is an animal. All mammals are animals.Mammals have fur.
Following diagram shows the DSn for above text document:-

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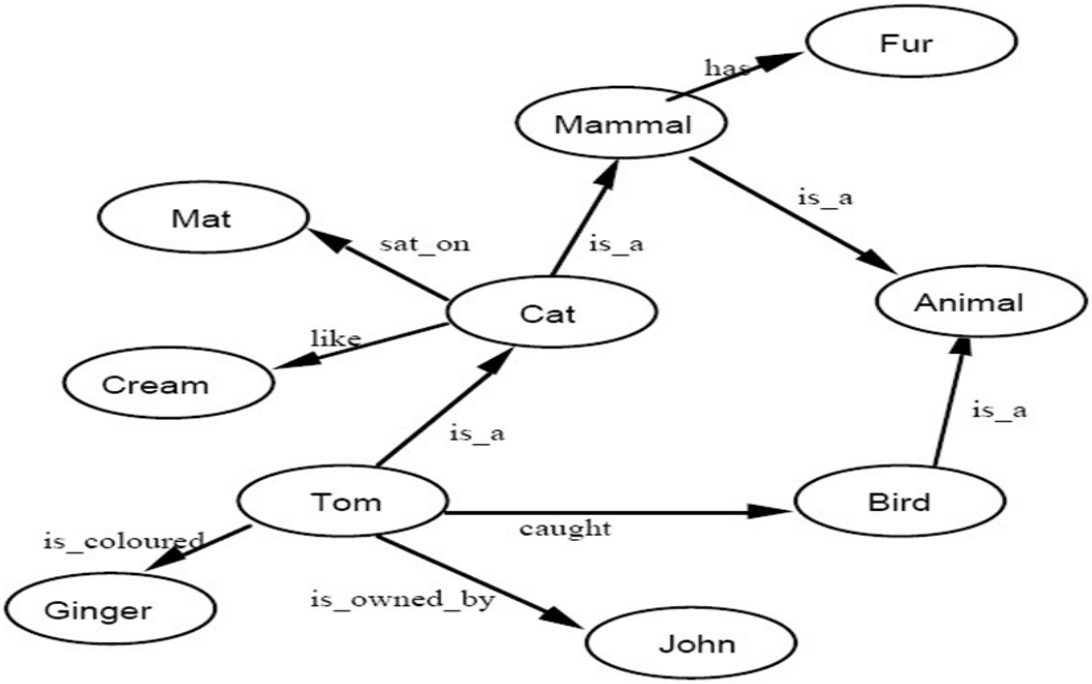

VIII. CONCLUSION

The basic idea behind this proposed work is to measure the impact or influence of relationships between terms in documents.Proposed method considers relationships between terms as an important factor for calculating the relevance score and ranking of the particular document.The proposed work provides mainly two advantages over the traditional approaches, which are: (1) Document semantic network enables to represent the core semantics of document which includes important terms and the relationship between them and (2) users' intent and interest are considered by exploiting user profile for calculating ranking function.By considering these relationships more relevant document can be retrieved even if they they do not have exactly matching term with the user query.Users' satisfaction is improved by providing more accurate ranked and retrieval results relevant to query.

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