Construction of a generic stopwords list for Hindi language without corpus statistics

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Abstract
Most of the research in the field of information retrieval (IR) has focused on the English language, but recently there has been a considerable amount of work and effort to develop IR systems for languages other than English. Research and experimentation in the field of IR in the Hindi language are relatively new and limited compared to the research that has been done in English, which has been dominant in the field of IR for a long while. A fundamental tool in IR is the employment of stop word lists. Stop words have no retrieval value in IR. Till now, many stop word lists have been developed for English, European and Chinese languages. However, there is no standard stop word list which has been constructed for Hindi language. In this paper an approach to construct a generic stop word list for Hindi language have been presented. Our list contains more than 800 stop words.

Keywords
Stop word, Stop words list, Hindi language, Information retrieval, Text mining, Corpus statistics.

1. Introduction
Our ability to access and store information has grown tremendously since the web became popular. It is possible to store several million webpages and hundreds of thousands of text files. Unless a topic was very broad, we were unlikely to be overwhelmed with a large volume of information. With the increasing popularity of digital media, searching over the internet to gather information has also become a common task.

Although most of the research in the field of IR has focused on the English language, recently there has been a considerable amount of work and effort to develop IR systems for languages other than English. Research and experimentation in the field of IR in the Hindi language are relatively new and limited compared to the research that has been done in English, which has been dominant in the field of IR for a long while.

Text mining is a rapidly expanding field that attempts to extract important information from natural language text.

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the first stages in typical IR systems. On English Web searching stop words are removed and they do not influence the retrieval process significantly. Till now, many stop word lists have been developed for the English language. However, there is no standard stop word list which has been constructed for Hindi language.

1.2 Hindi language
Hindi is certainly one of the most widely spoken languages of India and is written in Devanagari script. In many states of India it is a dominant language and is also used in various countries all over the world. It is, along with English, the official language of the Indian Union. Hindi is also widely used in mass media: a significant number of newspapers, magazines, films, music, radio and television programs, advertisements etc. are produced in Hindi. In North India, Hindi is often the medium of instruction in government schools. It is also extensively used in administration, the legislature and lower judiciary. Thus, Hindi is a very important language at local, regional, national and international levels.

2. Related studies
First stop word list of English language was created by Fox [3] based on word usage in English. His stop word list consists of 421 words and his method of creating the list is most frequently used method. The issue with this method is that several arbitrary decisions are taken while constructing the list such as the word frequency threshold to demarcate between stop words and non-stop words. Generally the elimination and insertion of few words are based on personal judgement, which requires certain expertise in the concerned language.

Research suggests that greater than 50% of all the words in a typical small English passage are from a list of about 135 common words [4]. These words were considered to be noise words by Van Rijsbergen [5], and should be removed before any pre-processing in text analysis. Stop words contribute almost no information in the text classification task. Elimination of stop words would contribute in reducing the size of the text space considerably and help in speeding up the accuracy and efficiency of text classification [6].

Many stop word lists have been developed in English language and the most commonly used stop word lists are the Van Rijsbergen stop word list and the Brown corpus stop word list. These stop word lists were traditionally extracted from frequency analysis of the words in large corpus [7].

There exists a disparity among different stop word lists for different document corpuses and different text processing tasks. Recently [8] proposed aggregation technique for automatic construction of general stop words of Malay language using three different approaches viz. statistical, word distribution in documents using variance measure and using the entropy measure. An evolutionary technique was proposed by [9] to extract the optimal set of stop words from the critical infrastructure domain.

Two methodologies using word frequency and statistics were proposed by [10] to generate stop words for Chinese patents. An approach was proposed by [11] for generating stop word list from online social network corpus in Egyptian dialect to assess the effect of removing dialect stop words on the sentiment analysis task. Another approach was presented in [12] for stop word removal from Hindi language using a deterministic finite automata. Since generally the stop words list is constructed from the statistics of a standard large-scale corpus, which is unavailable for Hindi language, therefore the issue of Hindi stop words has not been addressed yet properly.

3. Properties of stop words
Following are some of the properties of stop words:
1. Stop words are the common words with low discriminatory power to distinguish between documents.
2. Usual elements in a stop word list are articles, prepositions and conjunctions, although specific nouns, verbs or other grammatical types could be of low importance in terms of IR in specific domains.
3. Stop words almost never have any predictive capability and they serve only a syntactic function, but do not indicate the subject matter.
4. They can affect the efficiency of the IR process because they have a very high frequency.
5. Stop words tend to diminish the impact of frequency differences among less common words, thus affecting the weighting process.
6. The removal of the stop words changes the document length and subsequently affects the weighting process.
7. They can also affect efficiency due to the fact that they carry no meaning, which results in a large amount of unproductive processing.
8. The removal of the stop words can increase the efficiency of the indexing process as 30 to 50% of the tokens in a large text collection can represent stop words.

4. Some issues with Hindi documents
There are various limitations and handicaps present while working with a language like Hindi such as:
1. Hindi or Indian languages are highly inflected and provide rich and challenging set of linguistic and statistical features.
2. Indian languages are of highly free word order.
3. Hindi/Indian language is very resource poor language. Annotated corpora, named dictionaries, POS taggers etc. are still not available in the required quality and quantity. In contrast to this for English and many other European languages we have a large set of tools and corpora available to work on.
4. Although Indian languages have a very old and rich literary history, technological developments are recent.
5. Even very basic preliminary resource such as list of stop words in Hindi is not available and whatever is available is neither complete nor authentic.
6. Another problem is that it is difficult to use stemming to reduce the size of the vocabulary.
7. Standard statistical analysis tools with support for Indian languages are simply not available for all the standard renowned tools were made in English or allied languages and hence handle ASCII characters only, whereas we require a tool which can handle the Unicode character encoding to deal with Indian languages.

5. Methodology
There is no standard document independent measure of word frequency count to remove stop words which dominate the top positions in the list. Also, there is no similar lower level threshold to remove non-keywords which form the bulk of the terms in the text. Also, quality of stop words list has an important bearing on the effectiveness of any text mining approach.

5.1 Types of stop words list
There are two kinds of stop words: generic and domain specific. Generic stop words are those which are not common in general literature, but they have very low discriminatory power in a collection of domain specific documents because they are representative of that corpus. They are good candidates for inter-domain classification, but inferior candidates for intra-domain classification. For example “algorithm” and “scheduling” can be among the candidates of a domain specific stop word list if the document collection deals in scheduling algorithms. In this paper, we have focussed upon constructing a generic stop word list for Hindi language without using the corpus statistics.

5.2 Stop words list construction for Hindi
We have created a generic stop word list of 800+ words of Hindi language with the help of linguistic experts. The reason for having a large number of stop words in the list is due to the characteristics of the Hindi language. The steps as outlined in Figure 1 have been followed to create a Hindi stop words list. As stemming is difficult in Hindi and there are no standard stemming algorithms available as in English such as a porter’s stemming algorithm, we have added the various possible inflected variants of a particular stop word in the list for completeness.

5.3 Result: Hindi stop words list
अंत, अंतिम, अंदर, अकेला, अकेली, अकेरे, अक्सर, अगर, अग्र, अगला, अगली, अगले, अच्छा, अच्छी, अच्छे, अच्छाई, अत., अतिरिक्त, अधिक, अधिकतर, अधिकतम, अधिकांश, अनुमान, अनुसार, अने, अन्य, अन्यथा, अपना, अपनी, अपने, अपनो, अपनापन, अपनेपन, अपेक्षाकृत, अब, अबकी, अभी, अभ्यास, अन्तर, अन्तर्गत, अरे, अलग आंदोलन, आई, आई, आऊ, आऊंगा, आऊंगी, आईए, आंगा, आंख, आग, आज, आजकल, आता, आती, आते, आदि, आम, आप, आपका, आपकी, आपके, आपको, आपने, आपने, आपसे, आमतौर, आया, आथात, आए, आएगे, आए, आएगी, आए, आएगी, आए, आएगी, आएगे, आए, आएगी, आएगे, आए, आएगी, आएगे, आए, आएगी, आएगे, आए, आएगी, आएगे.

In English and “the”, “and”, “of” etc. in English and “और”, “का”, “के” etc. in Hindi)
उदाहरण, उपर, उन, उनका, उनकी, उनके, उन्हे, उन्हें, उनको, उनकी, उन्होंने, उन्हें, उन्हीं, उठ, उठा, उठना, उठने, उठाओ, उठाया, उठता, उठती, उठते, उठाए, उठाएँ, उठाकर, उठायें, उठायेंगे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायेंसे, उठायेंकर, उठायेंपर, उठायें
6. Discussion

A Generic stop word list for Hindi has been constructed (e.g. “और”, “का”, “के” etc.) and to make the list as complete as possible, we have also added the inflected variants of a stop words (for stop word “उन” following words are its inflected variants such as “उनका”, “उनकी”, “उनके”, “उनहें”, “उनसे”, “उनको”, “उनमें” etc.).

Domain specific stop word list can be constructed by adding more number of common words on top of this list. For example “नदियाँ” and “बाँध” can be added to this list if the document collection related to rivers of India. This list has been constructed without using the corpus based statistics because no standard substantial dataset is available in Hindi like Brown Corpus for English language and thus frequency based analysis cannot be performed reliably.

Figure 1 Details of stop word list construction for Hindi

6.1 Evaluation of list

A very small list of 97 stop words is available at forum for information retrieval evaluation (FIRE) (http://www.isical.ac.in/~fire/data/stopwords_list_hin.txt).
Another list of 225 stop words is available on the website (https://github.com/stopwords-iso/stopwords-hi/blob/master/stopwords-hi.txt)

A list of 299 stop words is available on website of Indian language technology proliferation and deployment centre (http://tdil-dc.in/index.php?option=com_download&task=showresourceDetails&toolid=1637&lang=en).

These lists lack in quantity of stop words as well as in the quality of stop words due to unavailability of various possible inflected forms of stop words. In contrast to these lists, we have created a generic stop word list of 800+ words of Hindi language and we have also added the various inflected variants of stop words for completeness.

7. Conclusion
In recent times there has been a considerable amount of effort to develop IR systems for languages other than English. A frequently used resource in IR is the stop word list. Till now there is no standard stop word list which has been constructed for Hindi language and whatever list is available is very limited and incomplete. In this paper, we have presented an approach to construct a generic stop word list for Hindi language. We have constructed a large stop word list for Hindi language and our list contains more than 800 stop words. We hope that this list would be beneficial to researchers working with Hindi documents.

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Conflicts of interest
The authors have no conflicts of interest to declare.

References
[1] Sebastiani F. Machine learning in automated text categorization. ACM Computing Surveys. 2002; 34(1):1-47.
[2] Luhn HP. The automatic creation of literature abstracts. IBM Journal of Research and Development. 1958; 2(2):159-65.
[3] Fox C. A stop list for general text. In SIGIR forum 1989 (pp. 19-21). ACM.
[4] Hart GW. To decode short cryptograms. Communications of the ACM. 1994; 37(9):102-8.
[5] Rijssbergen CJV. Information retrieval. London: Butterworths; 1979.
[6] Fox C. Information retrieval data structures and algorithms. Lexical analysis and stopwords. Prentice Hall; 1992, p.102-30.
[7] Yang Y. Noise reduction in a statistical approach to text categorization. In proceedings of the international ACM SIGIR conference on research and development in information retrieval 1995 (pp. 256-63). ACM.
[8] Chekima K, Alfred R. An automatic construction of Malay stop words based on aggregation method. In international conference on soft computing in data science 2016 (pp. 180-9). Springer Singapore.
[9] Amarasinghe K, Manic M, Hruska R. Optimal stop word selection for text mining in critical infrastructure domain. In resilience week 2015 (pp. 1-6). IEEE.
[10] Na D, Xu C. Automatically generation and evaluation of stop words list for Chinese patents. TELKOMNIKA (Telecommunication Computing Electronics and Control). 2015; 13(4):1414-21.
[11] Medhat W, Yousef AH, Korashy H. Egyptian dialect stopword list generation from social network data. Egyptian Journal of Language Engineering. 2015; 2(1):43-55.
[12] Jha V, Manjunath N, Shenoy PD, Venugopal KR. HSRA: Hindi stopword removal algorithm. In international conference on microelectronics, computing and communications 2016 (pp. 1-5). IEEE.

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