Discovering Concealed Semantics in Web Documents Using Fuzzy Clustering By Feature Matrix Methodology

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Abstract: ***Asthe data grows exponentially explodingon the 'World Wide Web', the orthodox clustering algorithms obligate various challenges to tackle, of which the most often faced challenge is the uncertainty. Web documents have become heterogeneous and very complex. There exist multiple relations between one web document and others in the form of entrenched links. This can be imagined as a one to many (1-M) relationship, for example a particular web document may fit in many cross domains viz. politics, sports, utilities, technology, music, weather forecasting, linked to e-commerce products etc. Therefore there is a necessity for efficient, effective and constructive context driven clustering methods. Orthodox or the already well-established clustering algorithms adhere to classify the given data sets as exclusiveclusters. Signifies that we can clearly state whether to which cluster an object belongs to. But such a partition is not sufficient for representing in the real time. So, a fuzzy clustering method is presented to build clusters with indeterminatelimits and allows that one object belongs to overlying clusters with some membership degree. In supplementary words, the crux of fuzzy clustering is to contemplate the fitting status to the clusters, as well as to cogitate to what degree the object belongs to the cluster.***

Keywords: Fuzzy Clustering, Fuzzy Logic, Weighted Matrix, Feature Extraction

1. Introduction

With an incredible circulation of several hundred million sites worldwide, the ever changing cluster of documents over the internet is getting bigger and bigger every day. This incorporates some very important and as well very difficult challenges. Over the preceding duration of ten years there has been incredible growth of data on World Wide Web. It has become a major source of information. Internet web generates the new defies of information retrieval as the amount of data on web as well as the number of users using web growing rapidly. It is challenging to quest through this tremendously large catalogue for the information desired by user. Henceforward the need for Search Engine ascends. Search Engines use crawlers to collect data and then store it in database maintained at search engine side. For a given user's query the search engines searches in the local database and very quickly displays the results.

Web Crawlers

Web crawling is an imperative method for amassing data on, and custody up with, the speedily intensifying Internet. Web crawling can likewise be baptised as a graph search problem as web is considered to be a large graph where nodes are the pages and edges are the hyperlinks. Web crawlers can be used in various areas, the most prominent one is to index a large set of pages and permit other people to search this index. A Web crawler does not really move all over the placeon the computers linked to the Internet, as viruses or bot agents do, as a substitute it only directsentreaties for documents on web servers from a set of already sites.

However the web crawlers have progressed, there has remained significant weakness in search engines outstanding to the complex, inter related (linked or cross domain documents) in the document assembly. Polysemies, synonyms, homonyms, phrases, dependencies and spam‟s act as hindrance to the search engines and therefore hampering the results returned. Also the vagueness or irrelevance of the user probes increases the ambiguous results fetched.

Pre-processing: Data pre-processing exists an often neglected step but very important and is of prime importance since data pre-processing forms the foundation step of additional analysis and dispensation of data. Data pre-processing involves following five steps:

1) Data cleaning: This step has operations like to fill values which are missing, smoothenout the noisy data, detecting or eliminating outliers, and decidingdiscrepancies.
2) Data integration: It involves integrating data using numerous databases, data cubes, or collections.
3) Data transformation: In this step we perform normalization and aggregation operations on data which has been integrated from various data sources.
4) Data reduction: In this step we condense the quantity of dataand produce the similarinvestigative results.
5) Data discretization: I this step of data pre-processing we perform discretization operations like replacing numerical attributes with nominal ones.

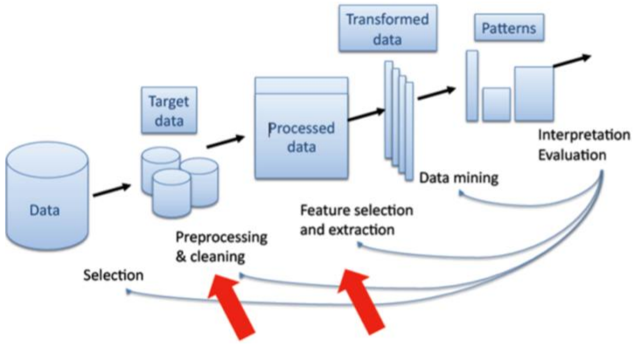


Figure 1: Data Mining Process

The phrase – If you input the junk data that is „Garbage In", then you be surely getting the junk output that refers to „Garbage Out" is particular to the domain of machine learning. Data congregation approaches are often range values, irregular, missing values. Analysing data that hasn"t been properly processed, such data can produce misleading results. Thus, pre-processing is primarily important step formerly running an investigation. Data fetched using a web crawler needs significant amount of processing before it is fed to the 'Fuzzy Clustering Algorithm' (FCA). Data in actual world is unclean which means it is incomplete. Incomplete data means it lacks attribute or the data in which we are interested in.The second part of dirty data is that it contains noise. Noisy data means that there are inaccuracies or outliers in it. The third part of dirty data is that it is inconsistent. Inconsistent means that the facts is not in correct format or the data lacks proper coding and naming format. If there is no good quality of data available then the data that would be eventually loaded in the data warehouse would be of low standards. Meaning that the mining algorithms would yield a junk result out of the data warehouse. For data to be in correct format for data mining it should possess some valuable qualities where the data mined would be of highest quality. These desirable qualities are precision, reliability, comprehensiveness, attribute value and most importantly timeliness. The most vital part of Pre-processing is cleaning the data. If the right data is not fed in we cannot expect the right output. Therefore cleansing of data is most vital. Missing data means computing the missing values. Adding missing values means filling the missing values with the average value derived by mean method. It also has a step of removing the noisy data. As discussed above noisy data means the data which comprises errors or outliers. Data cleaning also involves removing of inconsistencies. Inconsistent data removal means removing the data which falls into outlier range. Data can be collected from multiple formats like different databases, different file formats. The utmostvital part is to collate this data and then cleansing this data. It involves converting the dates to one particular format, converting numeric data to proper decimal format. It similarly involves performing binning on the numeric data. Filling the missing data is done by usually adding a tuple or replacing the missing data by a global constant. Applying the data cleansing task in my work the primary step is to remove the stop words from the data which has been fetched by the web crawler. Elimination of stop words and stemming: In this phase, data which has less semantic is removed. Meaning, the full stops, commas, conjunctions etc. are removed. The data of the web documents fetched by the web crawler is equated with a bag of words – Stop words. The matched records are eliminated from the data file. Stemming process is a pre-processing step making the data ready for the next step. It is very important in most of the Information Retrieval systems. The main perseverance of stemming is to decrease diverse grammar pertaining forms or the words like its noun forms, adjective forms, verb forms, adverb forms etc. to its root form.

The goal of stemming is to diminish deviational forms and occasionally derived various formations of a word to a conjoint base form. The available data is now further processed.

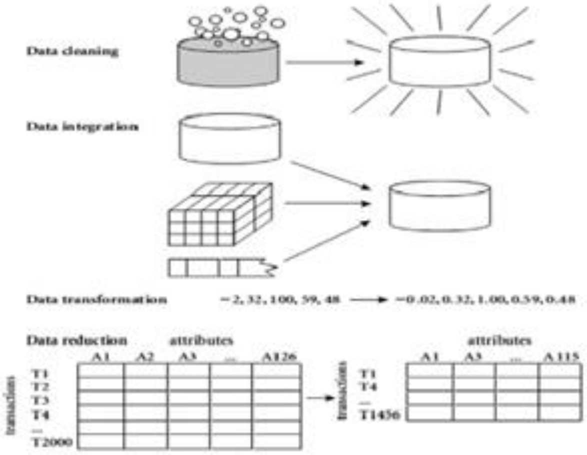


Figure 2: Data Pre-Processing

The next step of data pre-processing is integrating data from various databases, files, cubes together. Data integration means combining data into intelligible store. It also means schema integration. Schema integration means integrating metadata from different sources. It also includes identifying the attribute mismatch and performing a correcting action. This data is then fed to Data Reduction engine. In data reduction, the data which is redundant is removed. Data redundancy occurs because data is integrated from multiple databases, files etc. Meaning that same attribute might have been referred in a different way or the value of same attribute would have been derived or calculated. Redundant data is recognized by co relational analysis. Data reduction also involves performing numeosity reduction on data. It means to apply the linear regression model on data. This step is followed by Data Transformation. Data transformation means transforming the data in a format which is consistent throughout. It involves normalizing the data and aggregating it. The smoothening process of data transformation removes the noise from data. Aggregation step means aggregating the data into summarized cubes. Normalization activity means scaling the data such that it falls under particular range. It also includes construction of new attributes. It states that the data now has been fully transformed and ready to be loaded in the warehouse. We can conclude that data preparation is a critical issue for both data warehousing and data mining, as actual world data tends to be imperfect, noisy, and unpredictable. Data preparation involves data cleaning, data integration, data transformation, and data reduction. Data cleaning mechanism could be used to fill in missing values, lessen noisy data, detect outliers, and correct data in consistency.

Data integration loads data from multiples sources to form an intelligible data store. Metadata analysis, correlated data analysis, data skirmish detection, and the determination of semantic meanings add to smoothening the data. Data alteration techniques conform the data into appropriate forms for mining. Data reduction methods such as dimension reduction data cube aggregation, numeosity reduction, data compression and discretization could be used to get a reduced depiction of the data, while minimizing the loss of information content. Concept hierarchies establish the attributes by the values or dimensions into measured levels of abstraction. They are methods of discretization that is predominantly useful in multilevel mining. For numeric data, practices such as data segmentation by divider documentations, histogram analysis, and clustering analysis can be used.

Feature Extraction

Data mining is the cumulative task of data analysis and detection algorithms to perform automatic extraction of information from vast amounts of data. This process bonds many practical areas, counting databases, human-computer interaction, statistical analysis, and machine learning. A typical data-mining chore is to forecast an unidentified value of circa attribute of a new occurrence when the values of the supplementary qualities of the new occurrence are recognised and a collection of instances with known values of all the attributes is given. Most importantly in numerous applications, data is the subject of analysis and dispensation in data mining, is multidimensional, and presented by a number of topographies. There are moreover many dimensions of data that it is relevant to several machine learning algorithms and denote the extreme raise of computational complexity as well as classification error with data having high expanse of dimensions. Hence, the dimensionality of the feature space is habitually a bridged a forecataloguing is commenced. Feature extraction is one of the dimension measure for lessening techniques. Feature extracts a subset of novel features from the unique feature set by means of some functional mapping possessing as much information in the data as possible. Many of the definite world applications has numerous features those are used in an effort to safeguard accurate cataloguing. If all those features are used for build up classifiers, then they function in high dimensions, and the learning process becomes complex, which leads to high cataloguing error. Therefore, there is a necessity to condense the dimensionality of the features of data before classification. The key objective of dimensionality reduction is to convert the high dimensional data samples into the space of low dimensions such that the core information contained in the data is preserved. Once the dimensionality isreduced, it aidsus to improve the heftiness of the classifier and also to decrease the computational complexity.

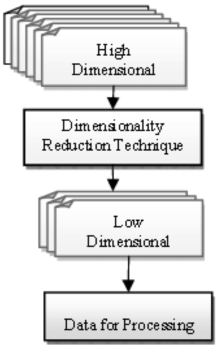


Figure 3: Dimensionality Reduction Technique

Feature assortment is a technique to find good quality of germane features from the unique dataset using some data reduction and feature extraction measures. Feature extraction involves selection a feature, this is called as Feature Selection, Feature Selection step has turned out to bea thought-provoking concern in the field of Pattern Recognition , Data Mining ,Machine Learning and Case Based Reasoning .Feature Selection is process of finding an ideal or suboptimal subset of „n‟ features from the unique „Features. It requires a large search space to get the feature subset. The ideal feature subset is analysed by evaluation criteria. The key objective of the feature selection is to decrease the amount of features and to remove the irrelevant, redundant and noisy data. Feature Selection includes various steps. These steps are portrayed in a diagrammatic state as below

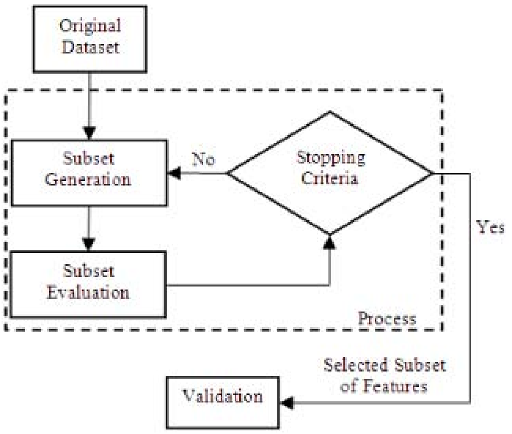


Figure 4: Feature Extraction Engine Type I

Feature selection mechanism is mostly classified into three types. They are, Filter Approach, Wrapper Approach and Hybrid Approach. Feature selection method of „Filtering‟s an arithmetical measure used as a criterion for choosing the relevant features. This approach is calculated easily and very efficiently.

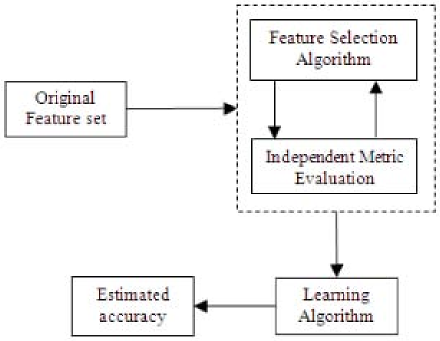


Figure 5: Feature Extraction – Filter Approach

The Wrapper methodology follows the learning algorithm is choose the appropriate featuressince the massive dataset.

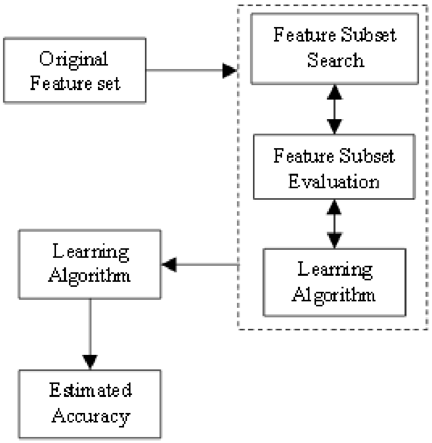


Figure 6: Feature Extraction – Wrapper Approach

The Hybrid methodology is developed by combining the above filter methodology and wrapper methodology to handle larger datasets. In this methodology the feature set is assessed using together independent measure and a data mining algorithm. The sovereign measure is used to select the best subset or a specified cardinality and the data mining algorithm selects the finest subset among the best subsets across diverse cardinalities.

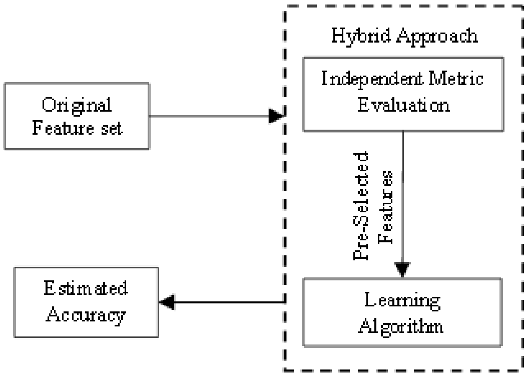


Figure 7: Feature Extraction – Hybrid Approach

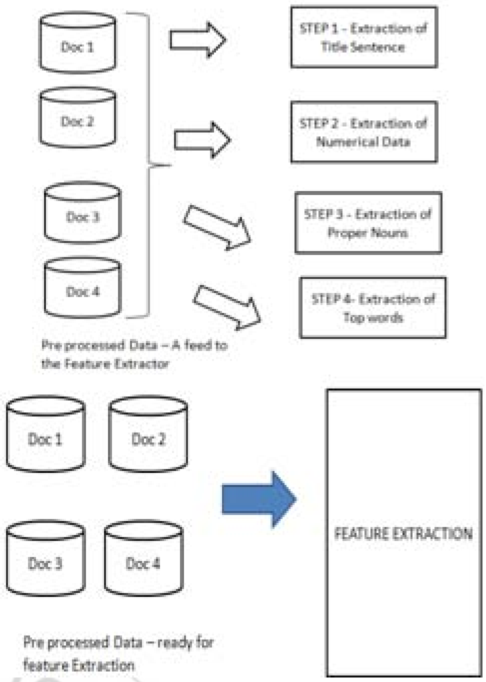

Doc 1
Doc 2
Doc 3
Doc 4
STEP 1 - Extraction of Title Sentence
STEP 2 - Extraction of Numerical Data
STEP 3 - Extraction of Proper Nouns
STEP 4- Extraction of Top words
Pre processed Data – A feed to the Feature Extractor
Doc 1
Doc 2
Doc 3
Doc 4
FEATURE EXTRACTION
Pre processed Data – ready for feature Extraction

Figure 8: Feature Extraction Process implemented in our work

With the processed data now available, we now extract the important „features‟ available. The first step in feature extraction process is to fetch the „Title Sentence‟. The first line of the document is rendered as the „Title Sentence‟. The second step is extracting the numerical data in the data file. A scan is performed and all the numerical data present in the data files is counted. Next, all the nouns present in all the data files are listed. Only proper nouns are to be used. The last scan is done for the „top words‟. Each document now is scanned. The word whose count is highest is regarded as top word. A list of such words is made in descendant order rendering to the web documents.

Fuzzy Logic: Fuzzy Logic System are those which produce satisfactory but definite output in rejoinder to imperfect, vague, partial, or imprecise (fuzzy) input. Fuzzy Logic is a technique of perception that it is similar or resembles anthropological reasoning. The methodology of Fuzzy Logic tries to inherit the way of conclusion making in humans that encompasses all transitional possibilities between digital values Yes and No. The predictable logic that a system can comprehend takes exact input and gives a certain output as true or false, which is corresponding to human‟s YES or NO. The creator of fuzzy logic term, Lotfi Zadeh, detected that dissimilar computers, the human conclusion making embraces a range of likelihoods between YES and NO, such as : CERTAINLY YES,POSSIBLY YES, CANNOT SAY, POSSIBLY NO, CERTAINLY NO.

Fuzzy logic contains of four vital phases: A Fuzzfier, Rule Base mapper, An Inference Engine and Defuzzifier.

Fuzzy Logic Systems Architecture is as follows:

1. Fuzzification module: This unitalters the input to the systems, which are in the form of crisp numbers, into fuzzy sets. For example it transmutes the supplied crisp values to a linguistic variable by making use of the membership functions warehoused in the fuzzy knowledge base. Fuzzy linguistic variable is used to epitomise qualities straddling a particular spectrum or cross domain. It also ruptures the input sign in five phases such as:

L.P	Large Positive
M.P	Medium Positive
S	Small
M.N	Medium Negative
L.N	Large Negative

2. Fuzzy Knowledge Base module: It stocks the conditions established on the If and then rules provided by experts. The fuzzy knowledge base is constructed on linguistic and membership functions.

a) Linguistic Variables: Linguistic variables act as input or output for the system. Their values are articulated in a natural language as an alternate to numerical values. A linguistic variable exists as a generally disintegrated into a group of linguistic terms.
b) Membership Functions: It is used for 'quantifying' the linguistic term. Membership functions are used in the fuzzification and defuzzification phase to plot the non-fuzzy variable as input to fuzzy linguistic terms as well as the reverse way round.

3. Inference Engine module: It feigns the human cerebral method by creating fuzzy interpretation on the inputs and IF-THEN rules.

4. Defuzzification Module: It transmutes the fuzzy variable set gained by the corollary engine to a definite value.

The exponential growth of the Web has led to extensive expansion of web content. The enormous area of product data on the internet poses inordinate task to both users and online commerce. More users are turning towards online shopping because it is relatively convenient, reliable, and fast; yet such users usually experience difficulty in probing for merchandises on the internet due to information overload. Online selling have often been stunned by the rich data they have collected and find it challenging to endorse merchandises suitable to precise users. There is also the problem of futile consumption of the available huge amount of merchandise data from online transactions to support better decision making by both consumers and suppliers. To discourse these information overload problems, e-learning, e-commerce, e-newspapers data stores are now smearing mass customization ideologies not to the merchandises but to their staging in the online.

Fuzzy Logic System could be understood as a system which maps nonlinear data as an input to a scalar output data set. Fuzzy sets obligate powerful decision making ability and hence attracted rising consideration and curiosity in recentIT, data generation method, decision building, pattern acknowledgement, and diagnostics and data analysis among others. When a problem has vibrantor evolving behaviour, fuzzy logic is a suitable contrivance that deals with such problem. In short to say, fuzzy logic hasmetier in providing precise solutions to problems that encompass the manipulation of numerousvariables.

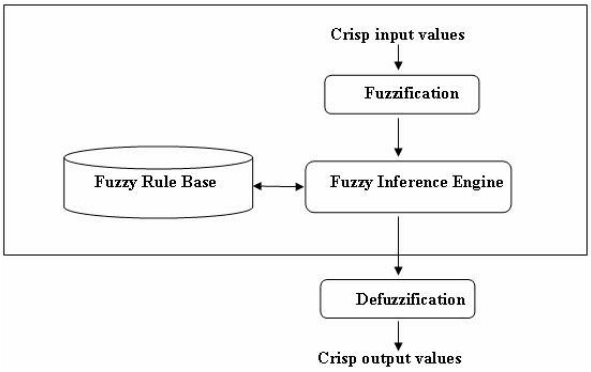


Figure 9: Fuzzy Logic System

The method of fuzzy logic systems are as follows:
1) Define input and output crisp variables
2) Define the membership function
3) Convert crisp input data into linguistic fuzzy values, using membership function, called fuzzification
4) Evaluate the rules, using inference engine
5) Construct the output crisp data, from fuzzy linguistic values, called defuzzification.

Fuzzy logicbids several unique features that makes it a predominantly decent choice for many control problems.

1) It is inherently robust since it does not require precise, noise-free inputs and could be programmed to fail safely if a feedback sensor quits or is destroyed. The output regulator is a smooth control function not withstanding a extensive assortment of input variations.
2) Since the Fuzzy logic checker processes the user-defined rules prevailing the target control system, it can be altered and tweaked easily to improve or radically alters system performance. New sensors can straightforwardly be fused into the system merely by engenderingapt governing rules.
3) Fuzzy logic is not restricted to a few feedback inputs and control outputs, nor is it essential to measure or calculate rate-of-change restrictions in order to implement. This permits the sensors to be economical and imprecise thus keeping the inclusive system cost and intricacy low.
4) Due to the rule-based process, any equitable number of inputs can be administered and numerous outputs engendered.
5) Create Fuzzy logic membership functions that express the implication (values) of Input / Output relationships used in the rules.

Fuzzification is conversion of crisp variables into linguistic variables, and it is the central unit for fuzzy logic system. Variable pertaining to linguistic sense such as age might obligate a value such as 'young' or 'old'. However, the noteworthy efficacy of linguistic variables is that they can be amended via linguistic verges pragmatic to primary terms. Prof. Zadeh has recommended the notion of fuzzy variables. Although variables in arithmetic typically gross data which in the form of numbers, if the data which is not numeric then linguistic variables are often used to simplify the countenance of rules and facts. The usage of linguistic variables in numerous applications cuts the overall computation complexity of the application. Linguistic variables obligate to be predominantly useful in complex non-linear applications.

2. Literature Survey

[1] The paper communicates to apply Fuzzy logic algorithms to the e-commerce space to drill to exact customer requirement. They carried out the experiments using laptops of various brands and configurations that customers usually search on various e-commerce sites. It defines the Fuzzy near compactness concept is engaged to measure the resemblance between customer needs and merchandise features. The ever-increasing figure of E-retail, e-commerce websites on the internet has led to data overload with over hundreds and thousands of customers. So itis challenging for customers of certain merchandises to discover information regarding merchandises in an attempt to purchase products that best satisfies them. This has led in reduction of the amount of product sales in the e-commerce domain. The work in this paper highlights a personalized recommender system motivated by fuzzy logic method. The offered system intelligently mines data about the features of laptop computers and offers professional services to potential consumers by endorsing deal merchandises grounded on their distinct requirements. Order to recommend optimal products to potential buyers. They measured the result of the offered system by means of fifty laptop computers brands and configurations from Acer, HP, Sony, Dell and Toshiba.

[2] Implements a Collaborative Filtering method which is the abstract framework for endorsing one-and-only items. It practices fuzzy logic, which permits to reflect the graded/uncertain data in the domain, and to range the CF paradigm, overcoming limitations of existing practises. The conceivable use of this Collaborative Filtering is in the e-government application. There is a personalization of e-government facilities intended at custom-tailoring the content government made available to the end user. In several countries, e-government applications are increasing speedily and the quantity of e-government websites, as well as the assets and services provided, are dynamically increasing. This has caused a delinquent wherein citizens may find it more and tougher to locate relevant data from these websites. Matching specific citizens and businesses interests and needs is therefore one of the main trials for e-government services, and intelligent decision support

[3] Describes the recommender system which is grounded on fuzzy logic and fuzzy clustering mechanism. It related to construction of an architecture for recommender system which can be used in e-Democracy and e-Elections applications.
The use of this system enhances and succour voters in making verdicts by providing data about contenders close to the voter‟s preferences and tendencies. The usage of recommender systems for e-Government is used to decrease data overload, which might help to advance self-governing processes. Fuzzy clustering investigation differ from classic clustering where the interpretations belong to only one cluster. Moreover, classic clustering makes no use of plodding membership. The recommender system approach fluctuates from collaborative filtering. The later one is built on historical experiences. It is suitable in the one and only scenario where events such as voting and election processes occur only once.

[4] Sheds a light on use of fuzzy logic clustering the e-Learning domain. It employs fuzzy insinuation mechanisms, reminiscence cycle updates, apprentice preferences and systematic hierarchy process. The system has been used to cram any language. By using fuzzy corollaries and personal reminiscence cycle updates, it is possible to find an editorial best suited for both a learner‟s ability and their need to review vocabulary. After reading an article, a test is instantaneously provided to enhance a learner‟s reminiscence for the words newly learned in the editorial.

The methodology uses a questionnaire to realise a learner‟s predilections and then uses fuzzy inference to find editorial of suitable exertion levels for the learner. It then employs review values to compute the fraction of editorial vocabulary that the learner must evaluate. It cartels these three parameters to establish the article‟s suitability formulae to compute the suitable level of articles for the learner. It uses memory to update the words so that the person seeking learning learns for the first time and also the words that appear that need to be reviewed based on the learner‟s learning feedback. The consequences of these experiments vitrinethat with intensive reading of pupil ages as recommended by the approach, student can reminisce together new words and the words learnt in past easily and for longer time, thus competently enlightening the vocabulary ability of the learner.

[5] States recommender systems which are built on intelligent computational abilities. From the topical past with the rise of data balloon on the internet, there is a consistent demand for the data processing engine for solving the problem of information overloading and information filtering. Present-day recommender systems hitch context-awareness with the personalization to deal the most accurate endorsements about diverse merchandises, services, and possessions. However, such systems arise across the issues, such as cold start, sparsity, and scalability that lead to vague endorsements. Computational Intelligence means not only improve endorsement accuracy but also markedly mitigate the above-mentioned issues. Computational Intelligent system as based onpractices, such as: (i) fuzzy sets (ii) Artificial Neural Networks (iii) Evolutionary Computing, (iv) Swarm Intelligence, (v) Artificial Immune Systems.

3. Proposed and Implemented system:

Here in this section we are giving comprehensive emphasis on the design of the system. Each and every stage of the offered system is well narrated here. Along with the elucidation the complete system is well presented using the architecture. The complete system is dissected in four steps as discussed below.

1) Pre-processing.

Pre-processing is vital step in data mining systems as it condenses the scope of the data required for processing. This condensed size minimizes the cost and space complexity of the system as fewer quantities of data are needed to be processed. Generally pre-processing encompasses of three steps.

- Special symbol removal.
  Here all the special symbols from the content are removed e.g.!,@,#,$,% etc. These special symbols do not contribute in result generation, hence it is worth to remove all the special symbols.
- Stop words removal.
  Stop words are the words used as a supporting word in content to bring the semantics in the sentence. However after this discarding the meaning of the sentence is not changing too much extent. Hence they are removed here by maintaining one repository for comparison. This repository contains the 500+ stop words.
- Stemming.
  Stems are used to derive word. Generally the words are derived for making the correct use of tenses. Unnecessarily this stems increase the system costing hence they are removed over here. No stemming algorithm is there which gives 100% accuracy.

2) Feature Extraction.

As data contains tons of features it‟s not worth to consider the complete content for the further operations. Feature extraction is essentials step in data mining. It is used for fetching the required data i.e. features from the huge set of data. In our proposed work four features are extracted.

- Title sentence.
  Title sentences are the one which represents the first sentence of the file content. The reason behind this extraction is to give a proper name to the cluster. Because each cluster is named by the title sentences.
- Numeric data.
  Numeric data plays vital role in file content as the most of the important data are represented using numerical values only. So by considering this thing we extracted numerical values from the file content.
- Proper nouns.
  Proper nouns are the words which represent the person or place. For extraction of this feature a dictionary is used. So to access this dictionary jxlapioffers all the necessary functionalities.
- Top words.
  Top words are the important words of the sentence. Here in this feature the frequency of the each word are found out. The word which repeat more time is needed to consider as it have the more weightage in the file content.

3) Master matrix creation

Here in this step all the extracted features are taken as an input. From these entire features a one matrix is created. So particular feature of each file is compared with the respective feature of the other file. In this way all the four features are compared with four features of other file. This comparison led to a score of each file with other file.

Matrix creation process:

A weighted matrix is built, feature values are calculated against the every document in following way:

Table 1: Weighted Feature Matrix

		D 1	D 2	D 3
		(T,N,P,Tw)	(T,N,P,Tw)	(T,N,P,Tw)
D 1	(T,N,P,Tw)	0		
D 2	(T,N,P,Tw)		0	
D 3	(T,N,P,Tw)			0
D n	(T,N,P,Tw)			

4) Fuzzy logic

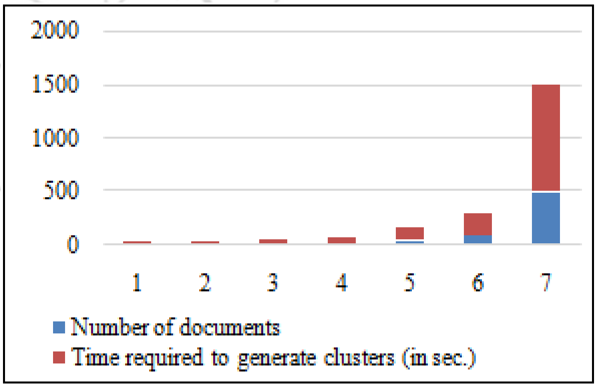
The generated score from matrix is taken as input. The smallest and biggest score is calculated. Exactly five ranges are calculated starting from smallest value and end to largest value. Now the score is assigned to each of the scores calculated in master matrix step by checking the occurrence of the score in these five ranges. Once score is calculate a threshold of 2 is set. The file having threshold more than 2 is added to cluster and discards the file which fails to satisfy the condition.

4. Results and Discussions

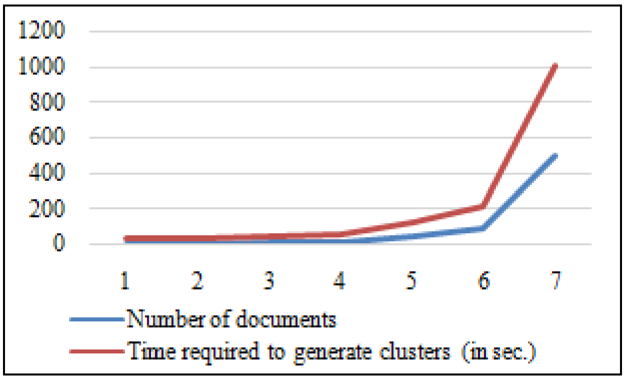
To show the efficiency of the system on experiment is conducted on java 1.6 based machine using Net beans as an IDE on windows machine having 2GB rom and 500GB HDD. After doing the experiment by providing the files from different categories such as text, pdf, and doc the following observation is led.

Table 2: Time required against numbers of documents

Number of documents	Time (seconds) to generate overlapping clusters
5	30
10	34
15	41
20	47
50	117
100	209
500	1004



Graph 1: Performance measurement -1



Graph 2: Performance Measurement – Linear exponential depiction

The graph above signifies the clustering time. From the graph we can determine that as the numbers of documents increase exponentially the required time to generate the clusters also increases in folds.

5. Declaration

"The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper."

References

[1] Kotsiantis, S. B., D. Kanellopoulos, and P. E. Pintelas. "Data pre-processing for supervised leaning." International Journal of Computer Science 1.2 (2006): 111-117.

[2] The wall, Mike. "A web crawler design for data mining." Journal of Information Science 27.5 (2001): 319-325.

[3] M. Ram swami and R. Bhaskaran, "A Study on Feature Selection

[4] T.L. Hu, and J.B. Sheu, "A fuzzy-based customer classification method for demand-responsive logistical distribution operation", Journal of Fuzzy Sets and Systems, Vol. 19, 2003.

[5] Frakes, William B. "Stemming Algorithms." (1992): 131-160.

[6] Agrawal, Rakesh, and RamakrishnaSrikant. "Fast algorithms for mining association rules." Proc. 20th int. conf. very large data bases, VLDB. Vol. 1215.1994.

[7] Fayyad, Usama, Gregory Piatetsky-Shapiro, and Padhraic Smyth. "From data mining to knowledge discovery in databases." AI magazine 17.3 (1996): 37.

[8] Munk, Michal, JozefKapusta, and Peter Švec. "Data preprocessing evaluation for web log mining: reconstruction of activities of a web visitor." Procedia Computer Science 1.1 (2010): 2273-2280.

[9] Khasawneh, Natheer, and Chien-Chung Chan. "Active user-based and ontology-based web log data pre-processing for web usage mining." Proceedings of the 2006 IEEE/WIC/ACM International Conference on Web Intelligence. IEEE Computer Society, 2006.

[10] JH Paik, MandarMitra, Swapan K. Parui, KalervoJarvelin, "GRAS: An effective and efficient stemming algorithm for information retrieval", published in ACM Transaction on Information System (TOIS), Volume 29 Issue 4, December 2011, Chapter 19, page 20-24

[11] M. Bacchin, N. Ferro, and M. Melucci 2005. "A probabilistic model for stemmer generation". Inf. Process. Manage. 41, 1, 121–137.

[12] WB Frakes, 1992, "Stemming Algorithm ", in "Information Retrieval Data Structures and Algorithm", Chapter 8, page 132-139.

[13] A. K. Jain, M.N. Murthy, and P. J. Flynn 1999. "Data clustering": A review. ACM Comput. Surv. 31, 3, 264–323.

[14] The wall, Mike. "A web crawler design for data mining." Journal of Information Science 27.5 (2001): 319-325.

[15] Castillo, Carlos. "Effective web crawling." ACM SIGIR Forum. Vol. 39. No. 1. ACM, 2005.

[16] Olston, Christopher, and Marc Najork. "Web crawling." Foundations and Trends in Information Retrieval 4.3 (2010): 175-246.

[17] Liu, Jin-Hong, and Yu-Liang Lu. "Survey on topic-focused Web crawler."Appl. Res. Computer 24.2629 (2007): 25.

[18] T.V.Mahendra,,N.Deepika,N.KesacaRao," Data Mining for High Performance Data Cloud using Association Rule Mining",International Journal of Advanced Research in Computer Science and Software Engineering, Vol2, Issue 1, January 2012.

[19] T.SunilKumar,Dr.K.Suvarchala, "A Study: Web Data Mining Challeneges and Application for Information Extraction",IOSR Journal of Computer Engineering (IOSRJCE), Vol 7,Issue3,Nov-Dec 2012,pp 24-29.

[20] DarshnaNavadiya, Roshni Patel," Web Content Mining Techniques-A Comprehensive Survey", International Journal of Engineering Research & Technology (IJERT), Vol. 1 Issue 10, December- 2012, pp.1-6

[21] GovindMurariUpadhyay, KanikaDhingra,"Web Content Mining: Its Techniques and Uses", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 11, November 2013,pp.610-613

[22] Sandhya,MalaChaturvedi,AnitaShrotriya,"Graph Theoratic Techniques for Web Content Mining", The International Journal Of Engineering And Science (IJES), Vol 2,Issue 7 July 2013,pp.35-41

[23] XiaoqingZheng,YilingGu,YinshengLi,"Data Extraction from Web Pages Based on Structural SemanticEntropy", International World Wide Web conference Committee (IW3C2),April 2012,pp.93-102

[24] GengxinMiao,JunichiTatemura, Wang-pin Hsiung, ArsanySawires, Louise E.Moser, Extracting Data Records from the Web Using Tag Path Clustering", International World Wide Web conference Committee (IW3C2), April, 2009, pp.981-990.

[25] M. Ramaswami and R. Bhaskaran, "A Study on Feature Selection

[26] HuanLiu,HiroshiMotoda, Rudy Setiono and Zheng Zhao, "FeatureSelection: An Ever Evolving Frontier in Data Mining",JournalofMachine Learning Research, volume 10, june 2010, Hyderabad, pp. 4-13.

[27] Le Song, Alex Smola, Karsten M. Borgwardt, Justin Bedo, "SupervisedFeature Selection via Dependence Estimation", procedingsInternationalconferenceof MachineLearning (ICML), June 2007, USA.

[28] Seoung Bum Kim, PanayaRattakorn, “Unsupervised feature selectionusing weighted principal components”, International journal of ExpertSystems with Applications, Volume 38 Issue 5, May, 2011, pp. 5704-5710.

[29] AshaGowdaKaregowda, M.A.Jayaram, A.S. Manjunath, “Feature Subset Selection Problem using Wrapper Approach in Supervised Learning”, International Journal of Computer Applications, Volume 1, No. 7, 2010, pp.13-17, ISSN: 0975 – 8887.

[30] Sven F.Crone, NikolaosKourentzes, “Feature Selection for time series prediction–A combined filter and wrapper approach for neural networks”, Journal of Neurocomputing, Volume 73, Issues 10-12, June-2010, pp. 1923-1936, ISSN: 0925-2312.

[31] “Effective and Efficient Feature Selection for Large-scale Data Using Bayes' Theorem”, International Journal of Automation and Computing, Volume6, Issue 1, Feb 2009, pp. 62-71.

[32] Peng Liu, Naijun Wu, Jiaxian Zhu, Junjie Yin, and Wei Zhang, “A Unified Strategy of Feature Selection”,The Second International Conference on Advanced Data Mining and Applications (ADML 2006), China, August 2006, pp. 457 – 464.

[33] Khalid, Samina, Khalil Tehmina, NasreenShamila, A Survey of Feature Selection and Feature Extraction Techniques in Machine Learning, IEEE Science and Information Conference, 2014, pp. 372-378.

[34] SitanshuSekharSahu, Ganapati Panda, RamchandraBarik,A Hybrid Method of Feature Extraction for Tumor Classification Using Microarray Gene Expression Data, International Journal of Computer Science & Informatics, Volume 1, Issue 1,2011,pp. 22 -26

[35] Tomasz Kajdanowicz, PrzemysławKazienko, Piotr Doskocz, Label-Dependent Feature Extraction in Social Networks for Node Classification, Lecture notes in computer science (Springer), volume 6430, 2010, pp.89-102

[36] L. Huang, L. Dai, Y. Wei, and M. Huang, “A personalized recommendation system based on multi-agent”, Proceedings of the 2nd International Conference on Studies in Computational Intelligence 2010.

[37] R. Burke, “Knowledge-based recommender systems”, Encyclopaedia of Library and Information Systems, Pp. 32-69, 2000.

[38] J. B. Schafer, J. Konstan, and J. Riedl, “Electronic commerce recommender applications”, Journal of Data Mining and Knowledge Discovery, Vol.5, Pp. 115–152, 2001.

[39] T.L. Hu, and J.B. Sheu, “A fuzzy-based customer classification method for demand-responsive logistical distribution operation”, Journal of Fuzzy Sets and Systems, Vol. 19, 2003.

[40] I. Forenbacher, D. Perakovic, and I. Jovovic, “Model for Classification and selection mobile terminal devices applying fuzzy logic”, International Conference on Intelligent Computing, University of Zagreb, Russia

[41] S-S. Weng, and M-J. Liu, “Personalized product recommendation in e-commerce”, Proceedings of the 2004 IEEE international conference on e-technology, e-commerce and e-service, Pp. 413–420, 2004.

[42] H. Ying, “A Fuzzy Systems Technology: A Brief Overview” IEE Press, 2000.

[43] J. Mendel, “Fuzzy Logic Systems for Engineering”, A Tutorial Proceeding of IEEE, Vol. 83, Issue 3, Pp. 345-377, 1995.

[44] D. Dubois and H. Prade, “An introduction to fuzzy systems”, Clin. Chim. octa 270, pp 3–29, 1998.

[45] A. Ali, and N. Mehli, “A Fuzzy Expert System for Heart Disease Diagnosis”, Proceedings of the International MultiConference of Engineers and Computer Scientists, Vol. 1, Pp. 134-139, 2010.

[46] G.J. Klir, T.A. Folger, Fuzzy sets, uncertainty and information, Prentice Hall International, Englewood Cliffs, NJ, 1988.

[47] R.R. Yager, Fuzzy logic methods in recommender systems, Fuzzy Sets Syst. 136 (2003) 133–149

[48] R.R. Yager, F. Petry, A framework for linguistic relevance feedback in content-based image retrieval using fuzzy logic, Inform. Sci.173 (4) (2005) 337–352

[49] Guo, X., Lu, J.: Intelligent E-Government Services with Personalized Recommen-dation Techniques. International Journal of Intelligent Systems 22, 401–417 (2007)

[50] Bezdec, J.C.: Pattern Recognition with Fuzzy Objective Function Algorithms.Plenum Press, New York (1981)

[51] Gavalas, C. Konstantopoulos, K. Mastakas, and G. Pantziou, “Mobile Recommender Systems in Tourism,” Journal of Network and Computer Applications, 39, 2014, pp.319-333

[52] O. Khalid, M. Khan, S. U. Khan, and A. Zomaya,“OmniSuggest: A Ubiquitous Cloud based Context Aware Recommendation System for Mobile Social Networks,” IEEE Transactions on Services Computing, vol. 7, no. 3, pp. 401-414, 2014

[53] M. Deshpande, and G. Karypis, “Item-based top-n recommendation algorithms,” ACM Transactions on Information Systems, 22, no.1, 2004, pp. 143–177.

[54] P. H. Chou, P.H., Li, K. K. Chen, K.-K., and M. J. Wu, “Integrating web mining and neural network for personalized e-commerce automatic service,” Expert Systems with Applications 37, no. 4, 2010, pp. 2898–2910.

[55] Airasian, P. W., & Gay, L. R. (2003). Educational research: Competencies analysis and application. Englewood cliffs, N. J.: Prentice-Hall.

[56] Bai, S. M., & Chen, S. M. (2008). Automatically constructing concept maps based on fuzzy rules for adapting learning systems. Expert Systems with Applications, 35(1-2), 41-49.

[57] Baker, F. B. (1992). Item response theory: parameter estimation techniques. New York: Marcel Dekker.

[58] Chen, C. M., & Chung, C. J. (2008b). Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. Computers &Education, 51(2), 624-645.

[59] Carlsson, C., Fedrizzi, M., & Fuller, R. (2004). Fuzzy Logic in Management. Kluwer Academy Publisher. Ebbinghaus, H. (1885). Über das Gedächtnis. UntersuchungenzurExperimentellenPsychologie. Leipzig: Duncker&Humblot, Germany.

[60] Essalmi, F., Ayed, L. J. B., Jemni, M., Kinshuk, & Graf, S. (2010). A fully personalization strategy of E-learning

scenarios. Computers in Human Behavior, 26(4), 581-591.

[61] Ferreira, A., & Atkinson J. (2009). Designing a feedback component of an intelligent tutoring system for foreign language. Knowledge-Based Systems, 22(7), 496-501.

[62] Hajek, P. (2006). What is mathematical fuzzy logic. Fuzzy Sets and Systems, 157(5), 597-603.

[63] Huang, Y., &Bian, L. (2009). A Bayesian network and analytic hierarchy process based personalized recommendations for tourist attractions over the Internet. Expert Systems with Applications, 36(1), 933-943.

[64] Hsu, M. H. (2008). A personalized English learning recommender system for ESL students. Expert Systems with Applications, 34(1), 683-688.

[65] S. Lawrence and C. L. Giles, Searching the World Wide Web," Science, vol. 280, no. 5360, pp. 98–100, 1998.

[66] Yuefeng Li and NingZhong, "Mining Ontology for Automatically Acquiring Web User Information Needs,"IEEE Transactions On Knowledge And Data Engineering, VOL. 18, NO. 4, APRIL 2006.

[67] Yuefeng Li, Wanzhong Yang, Yue Xu,"Multi-Tier Granule Mining for Rep-resentations of Multidimensional Association Rules," 0-7695-2701-9/06 Proceedings of the Sixth International Conference on Data Mining IEEE 2006.

[68] Shady ShehataFakhriKarray Mohamed Kamel, "Enhancing Text Clus-tering using Concept-based Mining Model," 0-7695-2701-9/06 Proceedings of the Sixth International Conference on Data Mining IEEE 2006.

[69] Wai Lam, Miguel Ruiz, and PadminiSrinivasan,"Automatic Text Catego-rization and Its Application to Text Retrieval," IEEE Transactions On Knowl-edge And Data Engineering, VOL. 11, NO. 6. NOVEMBER DECEMBER 1999.

[70] Helena Ahonen, OskariHeinonen, Mika Klemettinen and A. InkeriVerkamo, "Applying Data Mining Techniques for Descriptive Phrase Extraction in Digi-tal Document Collections," IEEE 1998.

[71] Sheng-Tang Wu Yuefeng Li Yue Xu Binh Pham Phoebe Chen,"Automatic Pattern-Taxonomy Extraction for Web Mining," Proceedings of the IEEE/WIC/ ACM 0-7695-2100-2/04 International Conference on Web Intelligence.

[72] A Fuzzy, Incremental, Hierarchical Approach of Clustering Huge Collections of Web Documents Int'l Conf. Internet Computing and Big Data COMP'13

[73] Web Document Clustering Using Fuzzy Equivalence Relations -Journal of Emerging Trends in Computing and Information Sciences

[74] Retrieval of Web Documents Using a Fuzzy Hierarchical Clustering - International Journal of Computer Applications (0975 – 8887) Volume 5– No.6, August 2010