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Arabic News Classification Using Field Association Words

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Text classification is a popular problem that has been studied extensively in the last four decades. Since many classification schemes can be used, the question of how to choose the best one among many for a designated task remains. In this work, we design a method for classification the Arabic news, the classification system that best fits data given a certain representation. We present a new method for Arabic news classification using field association words (FA words). The document preprocessing system will generate the meaningful terms based on Arabic corpus and Arabic language dictionary. Then, the field association terms will be classified according to FA word classification algorithm.

Keywords: Arabic information retrieval; field association words; document classification.

1. INTRODUCTION

The retrieval, information science is the science that is careful with searching for documents, information, and data from documents; and also for metadata relating to those documents also will search the databases and the Internet. The process of retrieving information depends on a lot of sciences like: Computer science, mathematics, libraries and information science,

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linguistics and information architecture, statistics, physics, cognitive psychology and other sciences.

Automatic retrieval information systems have been used to reduce the dumping informational process. At the present time there are a lot of universities and public libraries that use such systems for saving time that was spent to access to books and scientific journals as well as other documents. The most important examples of information retrieval systems, search engines, where such systems are used criteria for measuring the quality of the results of the research process in terms of accuracy and review.

Automatic Text Categorization (TC) is one of the important tasks in Information Retrieval (IR) and data mining which is the job of assigning text documents to pre-specified classes of documents, this is because of the significance of natural language text, the huge amount of text stored on the internet, and the available information libraries and document corpus. Further, TC importance rises up since it concerns with natural language text processing and classification using different techniques, in which it makes the retrieval and other text manipulation processes easy to execute. Arabic is one of the languages are widespread with an estimated number of 400 million native speakers. And is also, as in the other languages have the inflections and vocabulary and the order of the syntax (subject-verb-object and verb-subject-object), and the use of vowels and also words that are originally derived from the roots, whether these roots is composed of two characters, three or four, and triple roots are the most common and also the diacritical marks that are often omitted when writing, and names that may be single, collect, or double and masculine and feminine.

Note the increase of Arabic digital documents, whether on the Internet or electronic media, this is making us desperately need to find a retrieval system means in Arabic and their distinctive properties and is able to deal with it. With the existence of programs and databases in Arabic, but it is noticeable that there are problems hindering the process of search and retrieval, and these problems, is the main reason is due to the nature of the Arabic language, which has different characteristics from the rest of the languages, in terms of semantic and complex structural characteristics that affect the accuracy and the efficiency of the recovered data. However, observe that efforts to restore Arab documents are still incomplete and lacked the precision and efficiency and not such efforts in other languages.

Occupies the Arabic language seventh largest language on the Internet, and is one of the languages of the fastest growing in the last decade in terms of users, and because of the rate of use of Arabic Internet speaking, it must be the fourth-largest number of users on the Internet by the year 2020, and this is something which emphasizes the importance of language Arab and the need to retrieve information accurately and effectively. The main goal of text categorization is used to classify the documents into a number of pre-define classes. Text categorization is a research area in information retrieval and machine learning. A lot of supervised learning algorithms have been applied to the text categorization using a training data set of categorized documents. This consists of a training phase and a text classification phase. The previous includes the feature extraction process and the indexing process. The vector space model has been used as the conventional method for text representation.

Field Association (FA) is a limited set of the conditions terms that can identify Document fields. The Notion of FA words can recognize the subject of many documents fields by finding only some specific words without reading a document field and can be ranked as a super-field and a sub-field. FA terms have five different Stages to associate with the field. FA words are used especially for classifying Arabic documents. These words are extracted from the documents used at the classification process to get the FA word candidates. The reset of the paper are formulated as follows. Section 2 give an outline for the previous work. Moreover, the term of FA words are described in section 3 in detail. Section 4 discuss the Arabic document classification. In addition, section 5 explain our new idea for Arabic news classification using FA words. Section 6 is the experimental evaluation for new algorithm. Conclusion and future work are presented in section 7.

2. PREVIOUS WORK

There are techniques and algorithms used to classify Arabic documents. On paper [1] discuss the Effect of Stemming on Arabic Text Classification, Stemming the use of several

algorithms, including (SVM) the results showed when not in use. Support vector machine achieved (SVM) ranked the highest classification accuracy, using two test methods with 87.79% and 88.54%. On the other hand, when the use of stem impacted negatively on the accuracy where SVM using two test modes accuracy dropped to 84.49% and 86.35%.

At [2] An Automatic Filtering Method for Field Association Words by Deleting Unnecessary Words Delete unnecessary words using the information on the categories and experimental results, it turns out that unnecessary words are deleted automatically at 25% from 38,372 FA word candidates using the presented method. Furthermore, Precision and F-Measure are improved by 26% and 15%, respectively, over the traditional method. In the [3] Arabic Document classification Based on the Naïve Bayes Algorithm, There validation test evaluation set which consists of 10 documents overall classification accuracy achieved over all categories is 62%, and that the best result by category reaches 90%. There are also [4] Preprocessed data using Natural language processing, such as tokenizing, stemming, part of- techniques Speech. After that, they used the method of maximum entropy to classify the Arabic Documents. This paper deals with classification Arab News using field association. On the paper [5] a morphological matching dictionary of English that infers meaning of derivations by taking into consideration morphological afixes and their semantic classification. Document classification to assign a document to one or more on the categories based on its contents. This paper suggests the use of Field Association (FA) words Algorithm with Naïve Bayes Classifier to the problem of document categorization of Arabic language.

3. FIELD ASSOCIATION WORDS

It is natural people to identify the field of document when they notice peculiar words. These peculiar words are referred as Field-Associating words (FA words); specifically, they are words that allow us to recognize intuitively a field of text or field-coherent passage. Therefore, FA terms can be used to identify the field of a passage, and can be also used to classify various fields among passages. For these causes FA words can be used as a clue to identify a passage field [6]. FA words can be either words or phrases. For example, the word “President” can indicate the document filed <Politics News>.

Since the basic concept behind FA words involves the choice of a limited set of words that match a given document best, they describe a set of discriminating words. Moreover, FA words are not the same as subject words.

FA word is a minimum word which cannot be divided without wastage Semantic meaning [7]. Based on specific FA word information, topics of documents. All the previous studies are based on FA words in English and Japanese. FA terms are defiend as single FA terms or compound FA terms.

Field Tree: A field tree is a structure that represents relationships among document fields. A document field is defined as basic and common knowledge useful for human communication, Leaf nodes in the field tree correspond to terminal fields, nodes connected to the root are super-fields and other nodes correspond to median fields. For example, the path <SPORTS/Water Sports/Swimming> describes super-field <SPORTS> having subfield <Water Sports>, and terminal field <Swimming> [8,9]. In Fig. (1) the super field "Arabic News" , and medium fields "Medicine, Policy, Sport, Education, Economy, Community, Weather, Water sports", and terminal fields "long distance, short distance".

Definition 2.1

FA words have various scopes to associate with a field; five precision levels are used to classify FA words to document fields.

1. Perfect-FA words (PFA) combine with one terminal field.
2. Semi-perfect FA words (SPFA) combine with more than one terminal field in one medium field.
3. Medium-FA words (MeFA) combine with one medium field only.
4. Multiple-FA words (MuFA) combine with more than one terminal field and more than one medium field.
5. Nonspecific FA words (NSFA) do not specify terminal fields or medium.

Fields. Nonspecific FA words include stop words (e.g. Articles, prepositions, pronouns).

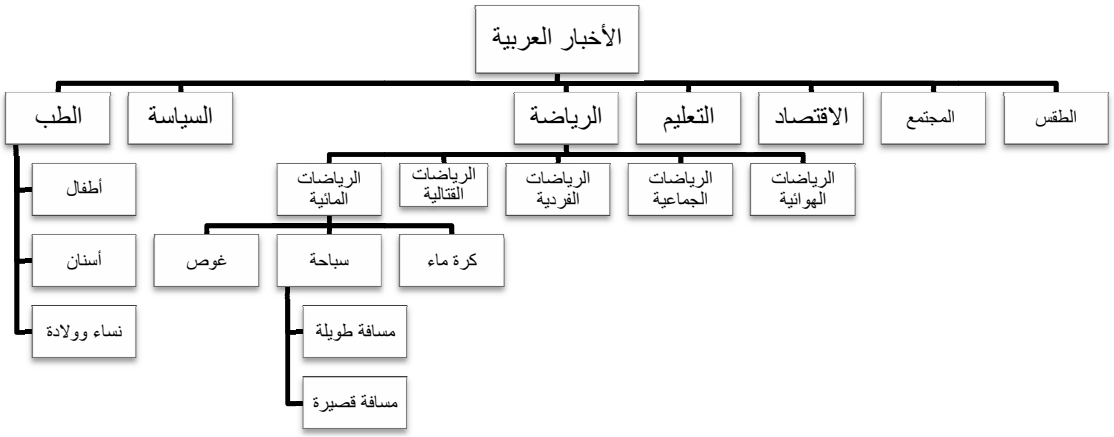

Fig. (1- a). Arabic field tree

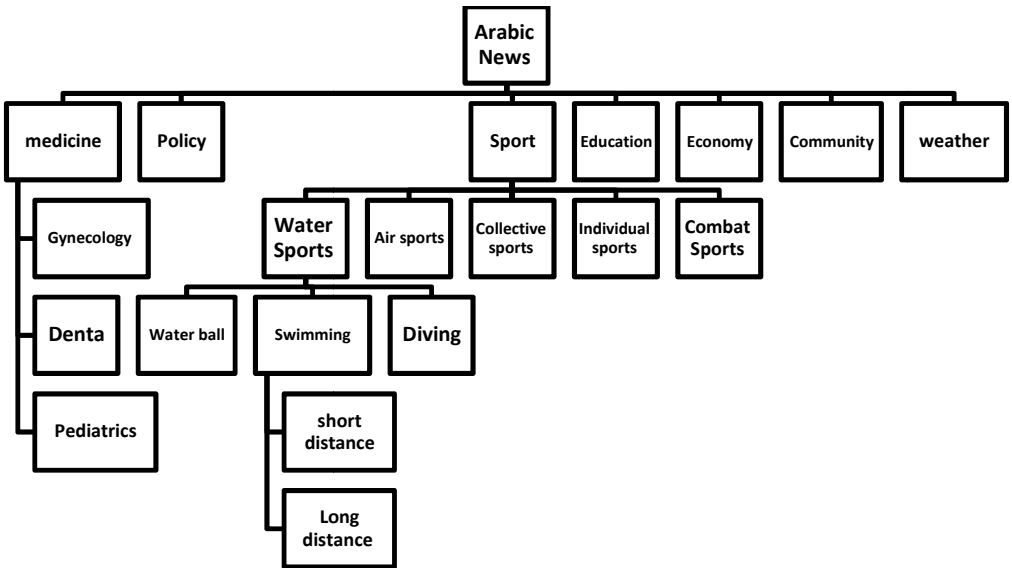

Fig. (1- b). The translated field tree in English

Table 1 explained every word associated with the field by example in level (1) key word " كوره"(korh Means Football in English)associated with one subfield Which is<الرياضه>(Alriyadih means sports In English). In level (2) key word " النووي" (Alnwawi Means Nuclear in English) associated with a few subfield Which is <العربيه> (al arabih Means Arabic In English) and < الدوليه> (aldolih Mean International In English) of super-field <الاخبار>(al akhbarMean news In English). In level (3) key word "جهاز" (Jehaz means Device in English) associated with one super-field< التكنولوجيا> (altoknolojia Mean Technology In English). In level (4) key word "نسبه" (nesbh means ratio in English) associated with a few subfield which is <اسهم> (ashum means stocks

Table 1. Examples of field association words

Levels	FA word	Field association path
1- perfect FA words.	"(korhكره" Means Football in English).	mean > -al akhbar \ Alriyadih < الرياضيه \ الاخبار>(< In English.> news\sports<
2-medium FA words.	Alnwaw"النووي" (Means Nuclear in English).	>)news\ Arabic< Means>-al arabih\ al akhbar < العربيه \ الاخبار>(< In English. Mean>-aldolih\ al akhbar <الدوليه \ الاخبار>(< In English.> news\ International <
3-super FA words.	Jehaz "جهاز"(means Device in English).	\altoknolojia Means >-al akhbar <التكنولوجيا\الاخبار>(< In English.> Technology\news<
4-multiple FA words.	nesbh"نسبه"(means ratio in English).	>) Economy \ stocks< Means>-ashum\ al egtesad < سهم الاقتصاد> In English. Mean>- aldolih \ alsyash <الدوليه \ السياسه>(< In English. > Politics \ International <
5-non-FA words	hum"هم"(means They in English).	

In English) and < الدوليه> (aldolih Mean International In English)of super-field < الاقتصاد > (al egtesad means Economy In English) and <السياسه> (alsyash means Politics In English). In level (5) key word "هم"((hum means Them in English) unable to specify the fields.

The new idea for use FA it can be applied on different earlier techniques such as, the vector space model, probabilistic model and language model to modify it and became efficient and suitable for Arabic language.

4. ARABIC DOCUMENT CLASSIFICATION

Arabic language in the pre processing stage more complex than it was in the case of the English language [10,11,12]. Arabic three genders: feminine, masculine, neutral.[13] Arabic words are generally classified into three main groups: the names, verbs and names of characters in the Arabic language can be derived from other names and deeds and letters. Verbs in the Arabic language are divided into a perfect, perfect duty. Character grouping includes pronouns, adjectives, weather, kindness, prepositions and input Interrogative[14]. Based on the patterns of "Awzan". Most of the Arabic words can be obtained from the stem or root word [15-19].

Classification is a allotment of documents to collect all of them shared a recipe similar groups, as a prelude to order them and save them under a single label.

5. ARABIC NEWS CLASSIFICATION USING FA WORDS

Classification of text techniques is used in many applications, including e-mail filtering, mail routing, filtering spam and watch the news and sorting through digital archive, the indexing mechanism, scientific articles, and the classification of the news and search for interesting information on www. These systems are designed to deal with documents written in English. Does not apply to documents written in Arabic. In this paper, we design an algorithm for classified Arabic news documents using field association words. First we need to extract field association words using algorithm 1, after that classify Arabic document using algorithm 2.

Algorithm 1: extract field association words

Let N is the field root, F is the super field , T is the frequency and R is represent the word , let

Normalization (R,< T >)=$[\frac{(R,T)}{<T>}]$(1)

Concentration (R,F) =

$$\frac{\text{normalization}(R,<E>)}{\text{normalization}(R,<N>)}$$

input

(a) R, for FA, word
(b) normalization (R,<F>) for R and for <F>
(c) threshold a ,to judge FA word ranks
(d) field tree

Output

FA word and their ranks for R.

Step 1: Select of perfect FA words.
For the root= <N>, the child field = <N/F> of the field tree
If (R, <N>) ≥ α (3)

So, AF word its perfect, if formula (3) is full field, <N/F> is perfect by <N>
And the same referred is carried out on the field <N/F>.
by repeating the Same selection operation, if <N/F> becomes terminal field, R is selected as perfect FA word in the field <N/F>. if the field <N/F> cannot full field the conation in formula(3), operation enter to step 2.

Step 2: selection of semi- perfect FA word if R is not selected as a perfect FA word in the field <N/F>, terminal field has not been reached. therefore, the field <N> should be as medium field and has at least 2 or more (m ≥2) F. From all F <N/Fi> (1< i <m)of the medium field <N >, Calculate the average value of i times F including word R as in the following :-

$$\left[\frac{\sum_{i=1}^{m} normalization(R,<Fi>)}{m}\right] \quad (4)$$

Accumulated concentration (R, <N/Fi>) ratio for F has higher normalized frequencies then the average value formula (4).

If the accumulated concentration ratio of i times(1< i<m) exceeds α and the F<N/Fi> are all terminal fields ,R is judged as a semi-perfect FA word in field <N/Fi>, if accumulated value does not exceed the threshold α , R is selected as a medium FA word of field <N>.

Algorithm2: FA word classification algorithm.

Input:

a)T={t1,t2,…….,tn} collection of FA word.
b)B={b1,b2,…..,bm} set of not sorted document.

Output:

Y the classification of B

Method:

1 Run Algorithem1 to get the set of FA words T.
2 T=T union of collection of derivation.
3 Determine Y= {}.
4 Determine Yi= {}.
5 For each Fi belong to F
6 For each Bk belongs to B, m
7 If Ti belong to Bk ,copy Bk to Ti .
8 Y=Y union Yi
9 Else goto step4
10 Return Y.

Example: Consider FA word candidates" دكتوراه" (Doctora- which means PhD in English). as in Fig. 1.The number of children fields in <root> is 15 field. We choosed, < تعليم > (talim - which means Education in English) are subfields A Threshold value α was chosen to be 0.90. In (Step 1), suppose that r is"دكتوراه" and < N> is <root>. The word "دكتوراه" appears the most frequently in the selecting field, < تعليم > then calculate the concentration ratio of the field <F> = <تعليم> on the field <N/F> = <root/ ,< تعليم > >

Concentration(< تعليم >, "دكتوراه") =0,90

Repeating the same process, select terminal field <الدكتوراه > (AL Doctora- which means PhD in English). in the medium field <التعليم> where " دكتوراه" appears the most frequently. As the determination is made only in the terminal field <F> =<الدكتوراه> and the concentration ratio is (0,40).

If Concentration(R,F) = $\frac{\text{normalization(R,<}E\text{>}}{\text{normalization(R,<}N\text{>)}} \geq \alpha$

then, r is a perfect FA word, means R is associate with only one subfield.

Else

if (conc (R,<N>) ≥ α ^ conc (R,<N/F>)) < α
then, R is a semi perfect FA word, means R associate with more than one subfield.

Else

R is a medium FA words if it is associated with one super-field.

So the word "دكتوراه" is determined as a semi perfect FA word in the terminal field.

So, when applying Algorithm 2 after this algorithm all documents that will check and have the same word as a semi perfect FA word return to the same field. Otherwise, if a document has the word as a perfect, a semi perfect or medium FA word then one or more children field will appear.

6. EXPERIMENTAL EVALUATION USING FA WORDS CLASSIFICATION ALGORITHM

Our experiments trained the system using Arabic news documents collected from the Internet. It mainly collected from Al-jazeera Arabic news channel which is the largest Arabic site, Al-Ahram newspaper, Al-watan newspaper, Al Akhbar, Al Arabiya and Wikipedia the free encyclopedia. The documents categorized into 8 super-field and 52 subfields. The number of files in our corpus is 786 file and it is about 5.6 MB.

6.1 Preprocess

Before applying the classification algorithm for testing data, some preprocessing in the text been performed. All the experiments are performed after normalizing the text. In *normalization*, the text is converted to UTF-8 encoded and punctuations and non-letters are removed. Also, some Arabic letters are normalized such as:

- Replace a final "ؤ" with,"ء"
- Replace a final " ئ" with,"ء"
- Replace a final "ت" with,"ة"
- Replace ,"إ","أ"or "آ" with,"ا"
- Replace "ى"with,"ي"
- Replace "ة"with,"ه"
- Replace "وء"with ,"ؤ"
- Replace "ئ"with ,"ى" and
- Replace "ا"with."ا"

In addition, all Arabic text contains redundant words or unnecessary word, these words called stop words. They are very common words that appear in the text that carry little meaning; they serve only a syntactic function but do not indicate subject matter. These stop words have two different impacts on information retrieval process. They can affect the retrieval effectiveness because they have a very high frequency and tend to diminish the impact of frequency difference among less common words. Deleting the stop words, the document changes length and affects the weighting process. Identifying a stop words list or a stop list that contains such words in order to eliminate them from text processing is essential to an information retrieval system. [12] explores the use of stop words and their effect on Arabic information retrieval. A general stop list[1] is created, base on the Arabic language structure and characteristics without any additions. The word categories that used are:

- Adverbs.
- Conditional pronouns.
- Interrogative pronouns.
- Prepositions.
- Pronouns.
- Referral names/ determiners.
- Relative pronouns.
- Transformers (verbs, letters).
- Verbal pronouns.
- Other.

For experimental evaluations, we used software written by JAVA with three versions from paper [6]. A classification on Arabic text using FA words was made. The application window is shown in Fig. (2).

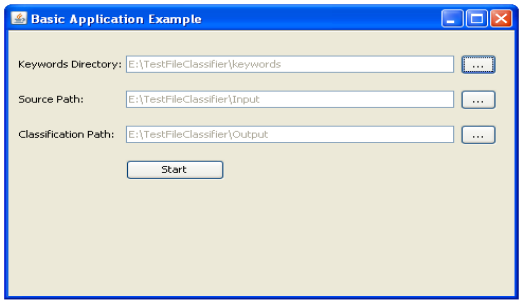

Fig. (2) Application window

Simulation results for classification

Input data: (keywords, text)
Output: classified data according to keywords.
We have used about 150 keywords selected by human from corpus.

Precision, Recall and F-measure are used to estimate relevancies of the presented methods and defined as follows:

$$\mathrm{Re}\,call(R) = \frac{Correct \cdots Classified \cdots Documnts}{Totall \cdots Corrected \cdots Classified}$$

$$\mathrm{Pr}\,ecison(P) = \frac{Correct \cdots Classified \cdots Documnts}{Totall \cdots \mathrm{Re}\,trieved \cdots Classified}$$

$$F - measure = \frac{2 \times P \times R}{P + R}$$

Precision, Recall and F-measure for six super-fields are measured using FA words. From the evaluation results it turns out that the best performance is recorded in classification with FA-words as shown in Table 2.

[1] *The stop lists for all the languages are available at* http://www.unine.ch/info/clef

Table 2. Classification using FA words

Name of field	Precision	Recall	F- measure
الطب(al Teb- which means the Medicinein English)	0.72	1	0.8
الرياضة(al Ryadah- which means sport in English)	0.74	0.69	0.71
السياسة(al Siasa- which means the Policy in English)	0.67	1	0.8
التكنولوجيا (al tecnologia- which means technology in English)	0.44	0.1	0.6
التعليم(al Taleem- which means the Education in English)	0.5	0.9	0.64
الاقتصاد(al Iqtesad which means Economy in English)	0.98	0.6	0.74

7. CONCLUSION AND FUTURE WORK

FA words are used to classify Arabic documents. Words are extracted from these document corpora to get FA word candidates. Furthermore, we used the FA classifier with our modification to refine Arabic document classification. From the experiential results, and the presented software can be automatically classifying Arabic news. F-measure is 81% of classification using FA words.

Future work could focus on automatic building of Arabic field association words using morphological analysis.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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