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## Research on the Application of Terminology Extraction Technology in Professional Fields

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**ABSTRACT.** Terminology Extraction technology is one of the most basic work in the field of information processing. In many areas also has a very important significance. Extract the domain terminology can understand its development trend and dynamics, grasp the core of the field. Terminology extraction technology plays an important role in the fields of information retrieval, data mining, ontology construction, information processing and other natural language processing project. Term extraction has two characteristics that can be statistically measured: domain and unit. This paper summarizes the literature in recent years according to its domain. Firstly, the definitions of terms, terms extraction and domain terms automatic extraction are introduced. The characteristics of terms and the features and functions of terms extraction tools are compared in detail. The process of terms extraction is analyzed. Some fields are summarized simply in terms of terms automatic extraction methods and technologies, so as to be able to serve as domains. The automatic terminology extraction technology provides direction for the presentation and application in various fields.

Keywords: Syntactic Analysis, Software Natural Language Processing, Automatic Generation

1. **Overview.** The traditional term refers to the language reference of the concept in the field of expert knowledge [1]. With the deepening of knowledge engineering, Jie Chunyu and Feng zhiwei defined the domain ontology term as: "The term is the language expression of expertise in a specialized language."[2]

Domain ontology is a clear specification of the shared concept model in a professional domain[3], it reflects the knowledge and knowledge structure in its field with the accepted

term set and the relationship between terms, which is helpful to realize the semantic information interaction between human and machine as well as between machines[4].However, term extraction is the basis of natural language processing such as data mining, ontology construction, information retrieval and semantic integration. Automatic extraction of domain terms refers to the extraction of words that can reflect the characteristics and commonness of a certain scale of domain corpus [5].

2. Characteristics of the term. GB/T 10112-1999[6] had clear requirements for the characteristics of terms:

- 1) Single name of the single meaning. Before you create a new term, you should check for synonyms and choose a term that better meets the other requirements among the few synonyms that you already have.
- 2) As the name implies, it is also called transparency. Here "meaning" refers to the definition, and the term should be able to accurately and concisely express the essence of the definition.
- 3) Conciseness. Be as concise as possible to improve efficiency.
- 4) Derivative, also known as productive. Terms should be easy to form, especially basic terms used in combination with phrases. The shorter the basic terms, the better the word-formation ability.
- 5) Stability. The use of high frequency, a wide range, has been conventional terminology, there is no important reason. It should not be easily changed, even if it is not ideal.
- 6) Conform to the language habits of our own ethnic group. The term should be suitable for the native language habits, diction. In order not to cause ambiguity, do not have the meaning of praise or criticism and other emotional color.

The above requirements are detailed and comprehensive, but too abstract to be measured in detail. Kageura [7] Attribute the properties of terms to two features that are easy to measure:

- 1) Unit hood: it refers to whether a word or phrase can express an independent, complete linguistic meaning and has a stable structure.
- 2) Term hood: it refers to the correlation between a word or phrase and a specific field and is used to measure the ability of the word or phrase to express domain knowledge.

The domain nature of the term refers to the frequent occurrence of the term in a field, while it occurs less frequently in general areas and other areas. The completeness of domain terms is that a string must be meaningful and must be a separate language unit in the language. Specifically, the completeness of domain terms is tested by the combination of rules and mutual information, while the domain of terms is tested by the method of Word co-existing [8].

3. Process and analysis of automatic extraction of domain terms. The process of automatic domain term extraction is the extraction of external form and the calculation of

term domain degree. The extraction methods of external forms can be roughly divided into three types: 1) rule-based methods; 2) statistical method; 3) combination of rules and statistics. Rule based method is according to the filtering rules corresponding structural characteristics of language structure, matching candidate utilization mode [4]. The accuracy of the term extraction and recall rate can't be taken into account. If the rules are too strict, it will affect the recall rate and if the rule is too loose, it will produce a lot of noise, affecting the accuracy. The rule based on statistics is to select words or phrases whose eigenvalues meet the threshold conditions as terms according to the statistical features such as word frequency, mutual information, maximum likelihood estimation and hypothesis testing. The rule based on statistics is breaking through the limitations of the field, but the recognition effect of word terms and low frequency terms is not ideal. The combined methods include rule learning algorithm and conditional random field (CRF) and so on. The calculation method of term domain degree includes word frequency calculation; Reference prediction comparison; Coupling degree calculation based on domain term dictionary and method of clustering. Word frequency calculation is to use statistical information such as word frequency to calculate the domain degree of terms; Referential predictive contrast is a comparison of the distribution differences expected in different domains, reflecting the domain degree of terms; Coupling degree calculation based on domain term dictionary is only used to extend domain terms; Clustering is based on strong correlations between domain terms, describing the territoriality of terms. The evaluation criteria for the results of domain term extraction are accuracy, recall rate and F value.

4. **Research status.** By reading the field of Automatic Term Extraction Technology Research and application in the field of professional literature, I am understanding the scholars' research on automatic terminology extraction technology, and classifying and summarizing it. There are two ways to extract terms automatically. One is entity extraction and attribute extraction as a special case which is extracted with off-the-shelf software. Another, the domain terminology is obtained through word segmentation, statistics, filtering and selection of terminology sets. Following is a comparison of the characteristics between the existing terminology extraction tools at home and abroad and the functions of commonly used terminology extraction tools in China are summarized.

4.1. Comparison of the Characteristics of Terminology Extraction Tools at Home and Abroad. Characteristic comparison of terminology extraction tools: Table 1 below.

Word Segmentation Tools Performance	SDL Multi Term	Simple Extractor	Sketch Engine	Translated
Bilingual extraction	×		×	
Source and target context comparison	×			
Terms validation	×	×	×	
Bilingual dictionaries compilation	×			×
Context extraction	×	×	×	

TABLE 1

Support various file formats	×	×	×	
Rank terms by frequency	×	×	×	
Support for many languages	×			
Specify the minimal number of	×	×		
occurrences				
Show linguistic information	×			
Specify the maximum number of				
translations				
Stop word list option	×	×		×
Choose the minimum and maximum	×	×		
number of words per term				
Term statistics	×	×	×	×

# 4.2. Introduction to the Function of Automatic Terminology Extraction Tool.

4.2.1. **SDL Multi Term Extract's features: Available for individual translators and terminologists.** You can now save hours of time through automated terminology extraction, enabling you to quickly create terms and custom glossaries for your projects.

- Automatic monolingual and bilingual terminology candidate identification and extraction
- Two powerful term candidate extraction methods
- Statistical approach, based on term frequency with SDL Multi Term Extract
- Bilingual concordance to show the occurrence of the term in context, easing the term candidate approval process
- Flexible filtering ensures only the most relevant candidates are identified, excluding unwanted terms
- Displays attributes of candidate terms to assist with decision-making
- Support for excluded terms (including terms already stored in SDL Multi Term termbase)
- Support for any language, including Unicode languages
- Ability to compile a dictionary from one or more parallel texts in two languages.
- Updates an existing termbase in SDL Multi Term by creating new translations, in one or more languages, for corresponding terms already stored in the termbase.

As everyone knows SDL Multi Term Extract is the most popular automatic term extraction software in China.

4.2.2. **Term suite's function.** Term suite is widely used in Java, open source tools, no need money to use it. Its function are shown in table2.

TABLE 2
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Word tokenization	~
POS Tagging(3rd party: with Tree Tagger or Mate)	~
Lemmatization(3rd party: with Tree Tagger or Mate)	~
Lemmatization(3rd party: with Tree Tagger or Mate)	~
Stemming(Snowball)	~

Terminology extraction	✓
Efficient multiword term detection	$\checkmark$
Term syntactic variants detection	✓
Term graphic variants detection	✓
Term morphology extraction	$\checkmark$
Variant detection based on term derivations and term predication	√
Term semantic variants detection	√
Terminology export in multiple formats: json, tsv, tbx	~
Term specificity(Weirdness Ratio)computing and other term measures:	~
WR log, term frequency ,et	
Term alignment(distributional and compositional ,multilingual and	~
monolingual)	

## 4.2.3. Sketch Engine's function:

- Word sketches a one-page automatic derived summary of a word's grammatical and collocational behavior
- Word sketch difference compares and contrasts two words by analyzing their collocation
- Distributional Thesaurus automated thesaurus finding words with similar meaning or appearing in the same/similar context
- Concordance search finds examples of a word form, lemma, phrase, tag or complex structure
- Collocation search word co-occurrence analysis displaying the most frequent words (to a search word) which can be regarded as collocation candidates
- Word lists generates frequency lists which can be filtered with complex criteria
- N-grams generates frequency lists of multi-word expressions
- Terminology / Keyword extraction (both monolingual and bilingual) automatic extraction key words and multi-word terms from texts (based on frequency count and linguistic criteria)
- Diachronic analysis (Trends)-detecting words which undergo changes in the frequency of use in time (show trending words)
- Corpus building and management create corpora from the Web or uploaded texts including part-of-speech tagging and lemmatization which can be used as data mining software
- Parallel corpus (bilingual) facilities looking up translation examples (EUR-Lex corpus, Europarl corpus, OPUS corpus, etc.) or building parallel corpus from own aligned texts

4.3. Research Status of Terminology Extraction Technology Based on Rules and Statistical Methods. In recent years, more and more scholars are interested in terminology extraction. Terminology extraction has become the frontier and the hot of research in large data environment. The efficiency, coverage and result of terminology extraction tools are

demanded more and higher. Many people put forward word segmentation and part-of-speech tagging to clean the data and filter out the terminology set. The following is a summary of the current situation of the improvement of domain terms extraction methods by researchers in recent years.

Yu Yan [4] and others proposed a method to extract patent terms based on generic words and terminology components, and to pre-process the auxiliary set of the target set, such as word segmentation and part-of-speech tagging. Word segmentation and part-of-speech tagging are performed on target set and auxiliary set, and a candidate term is roughly segmented by common words generated from auxiliary set. Evaluate the possibility of candidate terms becoming terms based on Similar Term C-value. High-frequency terms are selected to form a patent terminology database. The specific flow of the patent terminology extraction model based on generic terms and terminology components is shown in Figure 1 below.



FIGURE 1. PATENT TERMINOLOGY EXTRACTION MODEL BASED ON GENERAL TERMINOLOGY AND TERMINOLOGY COMPONENTS

Wu Haiyan [5] also took Yunnan province domain terms as the research object. She used preprocessing, word segmentation and part-of-speech tagging, Named Entity Recognition and processing, except for nouns and stopped words, rule-based term candidate discovery, term filtering based on mutual information, and term extraction based on word co-occurrence to improve the accuracy, but could not effectively extract single and double words, the flow chart of automatic domain terminology extraction based on mutual information and word co-occurrence is shown in Figure 2. Qiu Yanxia [9] took the terminology of Yunnan tourism as the research object, using mutual information algorithm to construct anthology, combined word segmentation and rough segmentation to process corpus, identified candidate terms through T evaluation, and improved the effectiveness of word selection set, the flow chart of automatic extraction of domain terms is shown in Figure 3 below.



FIGURE 2. FLOW CHART OF AUTOMATIC DOMAIN TERMS EXTRACTION BASED ON MUTUAL INFORMATION AND WORD CO-OCCURRENCE



FIGURE 3. FLOW CHART OF AUTOMATIC TERMINOLOGY EXTRACTION IN DOMAIN

Du Bo [10] used Mutual-Information (MI) and log-like hood to extract terms from soccer and finance corpus, the experimental results show that although the method is better than the manual method, there are a lot of dirty data in the results, the accuracy is relatively low and the recall rate is not high. And then, Li Yong [11] used Mutual-Information and log-like hood to extract domain terms from biochemical corpus. Later, CBC (Cluster by Committee) clustering method is used to cluster these texts and select domain terms. The experimental results show that the clustering method has a good effect. The structure diagram of terms extraction and processing flow can be seen figure 4 below.



FIGURE 4. EXTRACTION AND PROCESSING FLOW STRUCTURE OF TERMS

Liu Li [12] added constraint rules based on term length and grammatical features into the method of extracting candidate terms by machine learning, and used statistical methods to confirm the domains of candidate terms. The ratio of word length is taken as an important weight to judge the domain of terminology. The aim is to solve the problem of incorrect segmentation of terms with larger word length in domain term extraction. The experimental results show that the accuracy of this method is 89.5%, and the recall rate is 62.6%, which is better than DR+DC (69.5%, 43.3%), mutual information + likelihood (67.0%, 40.1%) and C-value (67.9%, 38.1%).However, the constraints rule can't recognize the terminology of pure digital structure. The flow chart of statistical terminology based on length and grammatical features proposed by Liu Li is shown in Figure 5 below.



GRAMMATICAL FEATURES

Sun Shuihua [13] used the rule-based domain term extraction algorithm model to iterate the terminology in the field of traditional Chinese medicine acupuncture and moxibustion for a limited number of times, generated the terminology construction set in the field of traditional Chinese medicine acupuncture and moxibustion, and used the terminology construction set as a dictionary. Secondly he used the maximum forward matching algorithm to segment Chinese acupuncture and moxibustion medical literature and extract candidate terms. The language rules are used to filter the glossary, and the glossary which appears not only in the field of terminology construction, but also in the literature of traditional Chinese medicine acupuncture and moxibustion is obtained. The specific flow chart is shown in Figure 6. This method solves the problem of mixing common strings in the existing extraction technology, and improves the accuracy of terminology extraction in the field of acupuncture and moxibustion in traditional Chinese medicine.



FIGURE 6. PROCESS OF DOMAIN TERMINOLOGY GENERATION

Jiang Lin [14] proposed a term extraction method combining neural network algorithm

and word component extension algorithm to extract multi-word terms from literatures in the field of natural language processing, classic word segmentation tool was used to mark Chinese word segmentation and part of speech, plus the language model and the page rank algorithm, to extract and filter terms. The experiment turns out, compared with baseline, which uses N-Gram to establish the spatial vector model for the model, the baseline improves the accuracy by 2.3 percentage points, the logical framework for terms extraction is shown in Figure 7 below.



FIGURE 7. MULTI-WORD TERMINOLOGY EXTRACTION STRUCTURAL DIAGRAM

Pan hong [15] used the Longest Common sub-string (LCS) algorithm to extract the terms of academic papers in the pre-school education domain, and then identified the Longest Common sub-string algorithm by stopping word filtering, comparing the rules of domain word filtering and term nested sub-string filtering, so as to obtain the final term set. Experimental results show that the average accuracy of term extraction is 84.2%. The result of  $4 \sim 6$  character double word term extraction is excellent, the accuracy is close to 100%, the process diagram of LCS term extraction is shown in Figure 8 below.



FIGURE 8. LCS TERMINOLOGY EXTRACTION PROCESS DIAGRAM

Liang Yinghong [16] adopted the strategy of combining c-value with Mutual-Information to extract multi-word terms from texts in the field of biological information. The experimental results showed that the accuracy rate of long term extraction was 75.7%, the recall rate was 68.4%, and the measured F value was 71.9%, higher than other methods under the same corpus. Its structure model based on C-value and mutual information extracted from multiple terms is shown in Figure 9:



FIGURE 9. NOUN TERMINOLOGY EXTRACTION MODEL BASED ON C VALUE AND MUTUAL INFORMATION

Information Gain (IG) is a measurement method based on entropy. Ye Qiuyong [17] and other researchers focus on the domain of terminology. By comparing professional corpus with general corpus, a terminology extraction method based on information gain is proposed. Using ICTCLAS word segmentation and part-of-speech tagging of CAS. According to the rules of part-of-speech, the word string is filtered, stop words are deleted, MI and log-like hood values are calculated, and the selection threshold is calculated, and the glossary is finally obtained. Its flow chart is like figture10.

Web text information is the network corpus of domain term extraction, but the problem it faces has not been solved. So Yan Xinglong [18] and others use anchor text and query text instead of Web text information as domain terms to extract, using a number of domains suitable for various types of network data and network user behavior data. According to the extraction method, domain terms are extracted based on the extracted web page body data, web anchor text data, user query information data, user browsing information data, etc. Its structure flow chart is shown in Fig.11. Focusing on different types of network resources and user behavior information. The experimental results show that different corpora are in financial position. The accuracy of domain words query and anchor text is higher than that of full text information at different relative frequencies. The first 1000 results after filtering 60% of the relative frequencies are taken as a set to calculate recall rate. The recall rate of query is 39.9, the recall rate of anchor text is 51.2%, and the recall rate of text is 39.6%.

The method can be used in the construction of domain dictionary and the discovery of domain hot words.



FIGURE 10. DOMAIN TERMINOLOGY EXTRACTION PROCESS BASED ON INFORMATION GAIN

Chen Li [19] used the idea of building a dictionary, calculated the double-conditional probability between adjacent words according to the adjacency relation of login words, and used left-right entropy to determine the boundary of terms. The structure flow chart of the domain dictionary is shown in Fig12. The computational results of terminological measurement show that this method can not only extract new terms effectively, but also achieve better results in small corpus and low word frequency.



FIGURE 11. DOMAIN TERMINOLOGY EXTRACTION PROCESS BASED ON NETWORK RESOURCES AND USER BEHAVIOR INFORMATION

Because of the basic education discipline has a strong long tail characteristic, it is difficult to extract the terminology at the end by statistical method. Li Siliang et al [20] proposed a method to extract terminology by using terminology definition and terminology relationship mining, integrated word-building rules and boundary detection, and named it DRTE. The specific process is shown in figure 13. The experimental results of the junior and senior high school mathematics textbooks are analyzed. There are still errors in boundary detection, fixed collocation and word segmentation. But its F1 value is 82.7%, which is 40.8% higher than that based on information entropy and word frequency.



FIGURE 12. DOMAIN TERMINOLOGY EXTRACTION BASED ON DOUBLE CONDITIONAL PROBABILITY OF LOGIN WORD ADJACENCY RELATION



FIGURE 13. TERMINOLOGY EXTRACTION PROCESS FOR BASIC EDUCATION

Through the research and development of the general software for term extraction, it is found that besides SDL Multi Term, term suite and Sketch Engine, there are many other Frequently-used tools for term extraction, such as Simple Extraction, Translated, Terminus, Kea, Rainbow, JATE, Extphr32 and Lex term, One Term, Tmx mall and Language Sail Terminology Bao, etc. This article only gives a detailed overview of the performance and functions of SDL Multi Term, term suite, simple extraction and Sketch Engine, and does not elaborate on the other tools. Based on the investigation of terms extraction technology of statistical and rule-based methods, it is found that the process of terms extraction can roughly be used to pre-process the target corpus, use various algorithms or models to candidate terms, and then screen candidate terms based on rules or statistics to form a terminology database.

5. **Conclusion.** Automatic extraction of terms is an important issue in natural language processing [21], the research and implementation of term extraction is a rather complicated process [22]. With the deepening of knowledge engineering and the advent of the era of big data, automatic extraction technology of domain terms has made great progress, but there are still some deficiencies in some aspects.

The existing terminology extraction tools at home and abroad are constantly updated, and more and more functions are realized by the software. It can translate terminology, text, information and so on. As for extract terminology, it has strong versatility. It can support multi-language input and multi-format output. There is always a software suitable for you. However, the work of word segmentation needs further improvement. It is found that NLPR (TCLCLAS) is the most commonly used word segmentation software. A small number of documents use Ansj word segmentation tool. In the future, as for term extraction work, more word segmentation tools or more models such as PAT Tree model can be used to complete the pre-processing of corpus. More combinations of algorithms can be tried when filtering candidate terms, not just TF-TDF, C-value, MI and likelihood ratio.

By summarizing some literatures, it is found that there is hardly any method of using rules or statistics to study domain terminology. The combination of the two methods and the integration with other models has become a research hotspot. According to the experimental results in various fields, the accuracy, recall rate and F value have achieved good results, but still less than 100%. The extraction of low-frequency terms and tail-end terms is still a blind area at this stage, and the updating of thesaurus is also a relatively complex work. The work done in this paper is only a discussion of the existing work, and there is still a long way to go for future research. In future research, we can try to integrate multiple strategies, use two or more word segmentation tools to preprocess the corpus, find out the common candidate terms, and screen them. We can propose more rules to filter the terms, so as to achieve higher accuracy and recall rate.

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