

## SYSTEMATIC LITERATURE REVIEW ON ABSTRACTIVE TEXT SUMMARIZATION USING KITCHENHAM METHOD

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**ABSTRACT.** *Research in text summarization has been done since 1970 and becomes one of the problems in natural language processing. The study has progressed from simple heuristics to neural networks and recently used a deep learning method on the development of these research topics. This progress happened at both extractive and abstractive methods. In this research we will research automatic text summarization in abstractive method and looking the implementation at various languages, we want to discover how much literature discusses abstractive text summarization, in what languages text summarization is applied, what methods are used and looking if there are any research limitations on abstractive text summarization. To find the answer to the research question, we conduct systematic literature reviews using the Kitchenham method.*

**Keywords:** Text summarization, Automatic text summarization, Abstractive, Kitchenham, Low-resource language

1. **Introduction.** Automatic Text Summarization (ATS) reduces the text to get meaningful sentences, and this reduction process is carried out by a machine that implements a specific algorithm or method. Luhn [1] started automatic text summarization in 1958 which was presented in an article entitled “The Automatic Creation of Literature Abstracts”. In this study, Luhn introduced the term word, word or indicative phrase, title, sub-title and sentence position. Furthermore, Edmundson [2] in 1969, developed Luhn’s research by giving weight to the extracted sentences. In 1980, research on automatic text summarization developed and was widely used for processing scientific articles [3,4]. However, because the application field was minimal, this field research was not very well known and developed, it was not until 1997 that research in this field again developed using data from various sources.

In general, text summarization aims to produce new text that is less than the original text but still contains some critical information from the original document. If the summarized document is a single document, the document summarization job is called “Single-Document Summarization” whereas the summarized document consists of several documents, and the document summarization job is called “Multi-Document Summarization”. Suppose the summarization is done by extracting several basic sentences or words verbatim from the source document. In that case, the summarization approach is called

the extractive approach, whereas if the summarization is done by using sentences that are not in the source document or trying to paraphrase the source document, the approach is taken, called the Abstractive approach.

Kitchenham [5] introduced a way to systematically conduct literature reviews; the method used by Kitchenham was then widely used to conduct literature reviews. One of the schemes of implementing the Kitchenham approach was carried out by Wahono [6] in his research; the application made by Wahono can be seen in Figure 1.

This study will apply the Kitchenham method [5] to conduct literature reviews in the field of text summarization, specifically on the topic of abstractive text summarization.

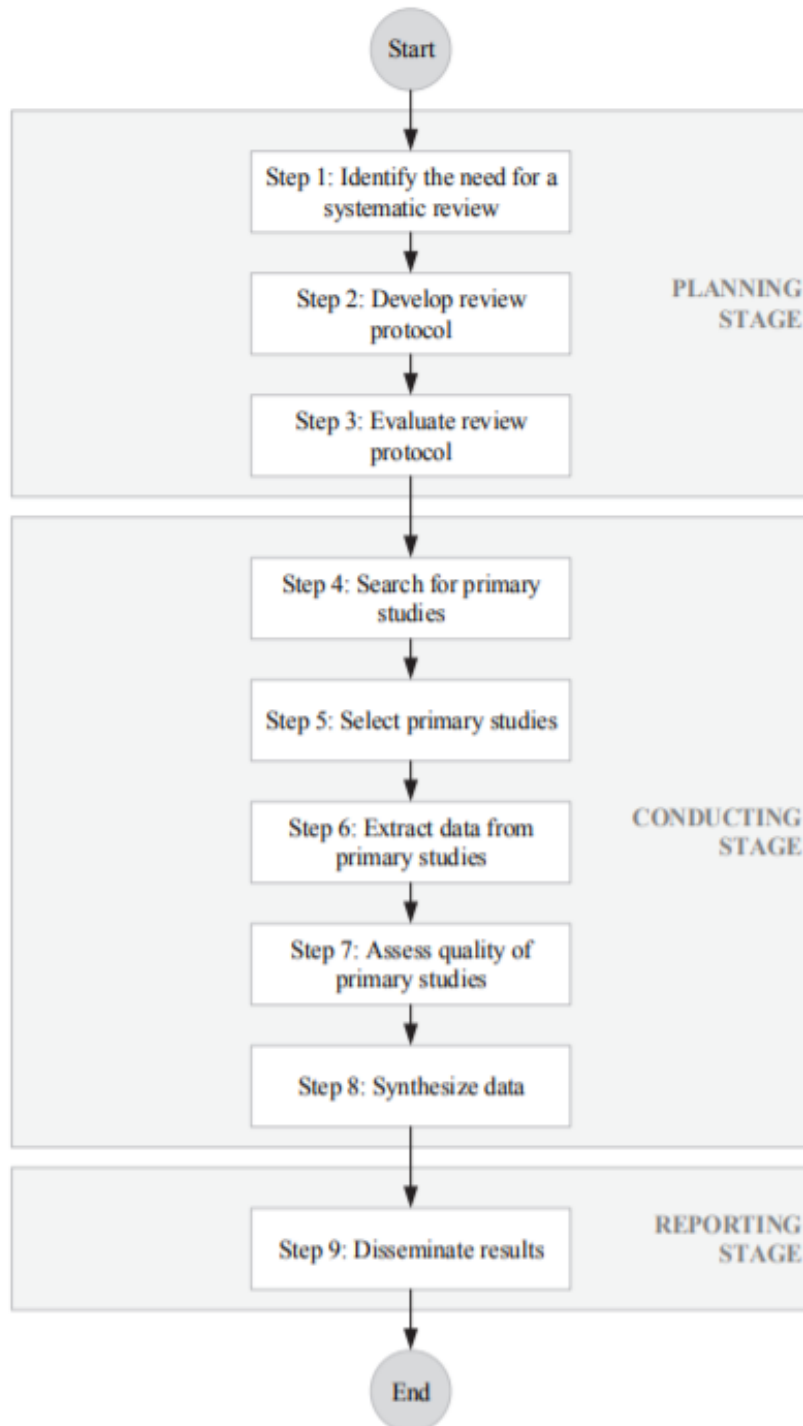


FIGURE 1. An application for Kitchenham method [6]

This study aims to review studies on abstractive text summarization; we explain the research methodology we use in Chapter two and present the results and answer our research questions in Chapter three, and in Chapter four we present the conclusions we get in this research.

**2. Problem Statement and Preliminaries.** This research was conducted to review the literature on abstractive text summarization using the Kitchenham method. The steps for the systematic literature review carried out in this study are as follows. The first process is carried out by determining the research questions. The research questions in this research are

RQ1. How much literature discusses abstractive text summarization

RQ2. In what languages is text summarization applied

RQ3. What methods are used

To answer RQ1, we identified articles that discuss the topic of abstractive text summarization, both those published through proceedings and in journals. Meanwhile, to answer RQ2, we classify the literature that we get based on the language in which the abstractive text summarization is applied. We also classify the literature that we get based on the method used. Meanwhile, the RQ3 enumeration was obtained after we were able to answer previous research questions.

The second stage is the process of searching and selecting literature. Literature search on abstractive text summarization is done manually, the literature used is obtained from several sources, namely: Elsevier, Science Direct, IEEE Xplore, DL-ACM, arXiv, International Journal Association for Computational Linguistic and International Journal of Natural Language Computing. We did the observation based on the text summarization keyword, and then the literature was filtered again using the abstractive text summarization keyword. Then the abstract of each article is read, and if it is deemed appropriate, we continue by reading the article until the end; finally, the list of selected references is reviewed to find other studies related to each article. We found 101 kinds of literature from the search results, but 47 literature relevant to this study, of the 47 kinds of literature after a more in-depth study, there is only 20 truly relevant literature. This relevant literature will be used to answer the next RQ.

In selecting this literature, we include articles that write about literature review abstractive text summarization, provided that the article defines the purpose of the literature study, describes the literature search process used and explicitly mentions the method used. Conversely, we do not include literature review articles that do not define the purpose of the literature study, do not describe the literature search process undertaken and do not mention the method used to conduct the literature review. The third stage is writing the systematic literature review; in this stage, we present the results of our research on the literature that discusses text summarization.

**3. Main Results.** The literature that we found when we did a search using the keyword text summarization was 101 articles. However, after filtering it again with the keyword abstractive text summarization we found that there were only 47 relevant articles and read the 47 articles in their entirety, and articles that are relevant to the purpose of this study are only as many as 20 articles.

Of the 20 articles, we classified them into two major groups: the first group based on the language studied and the second group based on the application domain. Based on the language abstractive text summarization is applied, we find application in Indian is carried out by Kallimani et al. [7], in Farsi it is carried out by Estiri et al. [8], in Arabic by Ismail et al. [9], in Malayalam conducted by Kishore et al. [10], in Vietnamese by Tran and Nguyen [11], in Bengali by Talukder et al. [12], in Japanese by Iwasaki et al. [13], in Urdu by Bhatti and Aslam [14]. Meanwhile, the application in Indonesian was carried

TABLE 1. Language-based abstractive text summarization

| No | Title   | Author               | Language domain         | Data and method  | Results  |
|----|---|----------------------|-------------------------|--|--|
| 1  | Information Extraction by an Abstractive Text Summarization for an Indian Regional Language   | Kallimani et al.     | Telugu Language, Indian | Opinion (product review, blogs and forum discussion) taken from an online source. Combining extractive summarization method to select sentence through keyword extraction and abstractive summarization to rephrase and read a summary | Telugu has more complex morphological variations when compared with English. The merits of automatic summarization of text are to control the size, and prediction of content, which could identify the relation between summarized text and the main text |
| 2  | Automatic Multi-Document Summarization for Indonesian Documents Using Hybrid Abstractive-Extractive Summarization Technique             | Yapinus et al.       | English-Indonesian      | Using WordNet dataset, combining extractive and abstractive summarization using LSA in multi-document summarization  | Hybrid abstractive-extractive summarization technique proven to be effective in summarizing multi-documents in order to gain a fast-generated, well-compressed, and readable summary   |
| 3  | Improvement of an Abstractive Summarization Evaluation Tool Using Lexical-Semantic Relations and Weighted Syntax Tags in Farsi Language | Estiri et al.        | Farsi Language          | Comparing auto-abstracts (abstracts created by machine) with human abstracts (ideal abstracts created by a human) and compare with WordNet   | Word level comparison using WordNet  |
| 4  | A Model for Generating Arabic Text from Semantic Representation   | Ismail et al.        | Arabic                  | Arabic text dataset using rich semantic graph  | RSG can be used in Arabic text   |
| 5  | Document Summarization in Malayalam with Sentence Framing   | Kishore et al.       | Malayalam, Indian       | Malayalam document processed using Karthav Karmam Kriya triplet extraction and Karaka tree construction  | To summarize Malayalam language needs a combination of extractive and abstractive method   |
| 6  | Text Generation from Abstract Semantic Representation for Summarizing Vietnamese Paragraphs Having Co-references                        | Tran and Nguyen      | Vietnamese              | Authors build dataset because there is no standard dataset in the Vietnamese language that can be used   | The results show that the model built by the author has a high-quality summary as nearly as human communication  |
| 7  | Bengali Abstractive Text Summarization Using Sequence to Sequence RNNs  | Talukder et al.      | Bengali, India          | Newspaper article and Facebook post in Bengali as dataset and use Bidirectional RNN using LSTM both in decoding and encoding layers  | Provide maximum accurate predicted summary   |
| 8  | Japanese Abstractive Text Summarization Using BERT  | Iwasaki et al.       | Japanese                | Using Livedoor news dataset processed with BERT that was developed in Kurohara and Kawahara laboratory of Kyoto College  | Japanese abstractive text summarization with a neural network model using BERT   |
| 9  | ISUTD: Intelligent System for Urdu Text De-Summarization  | Bhatti and Aslam     | Urdu, Pakistan          | Using Urdu datasets summarization and de-summarize the datasets  | The proposed method success even needs an improvement to get higher accuracy   |
| 10 | IndoSum: A New Benchmark Dataset for Indonesian Text Summarization  | Kurniawan and Louvan | Bahasa, Indonesian      | Build IndoSum as a new dataset benchmark in text summarization   | Present IndoSum, a new benchmark dataset for Indonesian text summarization   |

out by Kurniawan and Louvan [15] and Yapinus et al. [16]. The complete comparison of our research is presented in Table 1.

Based on the domain of application, text summarization is applied to summarizing the video's text as done by Dilawari and Khan [17]. Text summarization was also used to determine consumer ratings based on their opinion as was done by Nyaung and Thein [18] to create a caption from an image as did Feng and Lapata [19]. Text summarization is also used to summarize based on users' queries as done by Girthana and Swamynathan [20] and summarize conversations as Goo and Chen [21]. In real-world cases, text summarization is used to summarize patent data as done by Igde et al. [22] and summarize the recording of meetings as was done by Liu and Liu [23]. Sometimes, some method can also be used for another domain, like translating from Indonesian to Javanese, which is one of the tribal languages in Indonesia as was done by Wibawa et al. [24]. The most popular is

summarizing the Twitter microblog based on the discussion topic as conducted by Zhang et al. [25] and Rudra et al. [26], to summarize from one single document as done by Yousefi-Azar and Hamey [27].

**4. Conclusions.** From the literature review results, it was found that text summarization has been carried out in many languages, especially languages with large and structured literature sources such as in English and Arabic [28]. Automatic text summarization has been implemented in many languages, including traditional languages; this shows that automatic text summarization can be applied to low resources languages.

From the literature search results, especially in low resources language, researchers should make their own datasets to conduct research, it is also found that several researchers have carried out text summarization in Indonesian, but so far only one reference corpus has been found, namely the IndoSum corpus. Future researchers on low resource language can focus on basic research in terms of making a corpus that can be used for further research, and researchers can also develop special algorithms to handle certain languages.

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