THE IMPORTANCE OF NATURAL LANGUAGE RECYCLING IN AUTOMATING CUSTOMER SERVICE

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Abstract: *The use of artificial intelligence and natural language processing (NLP) in customer service is growing quickly. Technology is being used to interact with users and answer their questions. Using NLP in customer services is in the form of artificial intelligence applications that allow users to communicate with models using different languages through text or speech, and the model will provide answers to the users. The main goal of this systematic review is to locate and analyze the existing articles and studies on the use of NLP technology in customer service in terms of research domain, applications, datasets used, and evaluation methods. Also, this systematic review looks at the future directions in the field and where it is going in addition to the existence of any significant limitations. The time period covered by the study is from 2015 to 2022. During the systematic review, all related papers were found, extracted, and analyzed using five major scientific databases. To create the final review article, relevant papers were sorted and filtered based on inclusion/exclusion standards and quality assessment. According to our findings, chatbots and question-answering systems were used in 10 main fields and mostly utilized in general, social networking and e-commerce areas. In addition, we discovered that Twitter dataset was the second dataset in terms of the most often used datasets. The majority of the research used their own original datasets in addition to Twitter dataset. For the evaluation, most of the researchers used Accuracy, Precision, Recall, and F1 as the methods to evaluate the performance. Also, future work is discussed including the need to improve the performance of the models and the size of the datasets used, as well as it aims to better understand users’ behavior and emotions is included. Moreover, there are limitations faced by the researchers and those limitations are diverse.*

Keywords: *Systematic review, Natural language processing, NLP, Customer service, chatbot.*

INTRODUCTION

In the era of rapidly evolving services, customer services are the next important technological advancement. Customer services are the help a company provides to its clients before, during, or after they purchase or utilize its goods or services. Over the past ten years, the internet expanded the number of channels and chances for customer service. In addition to calling a business with questions, customers may visit websites, send emails and use social media like Facebook and Twitter to communicate with companies. Lately, prospects for customer service are fast rising due to breakthrough technologies like

artificial intelligence and natural language processing (NLP). Artificial intelligence is expected to have the largest impact on the future of customer service enabling organizations to provide more personalized offers and more predictive responses to quickly resolve customer concerns. Many businesses use artificial intelligence and natural language processing tools to better understand and utilize all aspects of client relationship management. There are several advantages of NLP in customer services such as the business will be able to adjust their plans, increase customer retention, make new relationships, and accelerate growth. The business can utilize customer input and use it to constantly develop and offer more precise human-machine interactions. The research done on customer services finds out whether customers have experienced good or poor customer service. It showed that nearly 75% of customers have experienced poor customer service. This paper provides a systematic review of natural language processing in customer services in all categories using text and speech in different languages. As per our knowledge in recent years, the available systematic reviews on natural language processing in customer services cover certain categories of customer services such as chatbot. Our review will identify the techniques and methods of using NLP in customer services. It will also collect resources and datasets that may be useful for researchers attempting to begin in this field of research. Moreover, this systematic review will aid in understanding what limitations and problems are faced by researchers in this area. The ultimate goal of this research is to provide a roadmap to researchers in this field. The rest of the paper is organized as follows: Section 2 describes the applied systematic review methodology. Section 3 shows the systematic review results of the studies. Section 4 explains the discussion that summarizes the main findings from the review. Section 5 explicate the conclusion of this systematic review and its limitations. Customer service using NLP is being used in a wide range of fields as Figure 5 shows. The most common field is the general customer service which represents 41% of the total number of studies, the research are based on NLP for chatbots applications and question answering systems. The second most common field is the social media which represents 18% in the research, where Twitter takes the majority of the platforms, and one research on Facebook platform and one research used WhatsApp. The E-commerce field is next in the studies where researcher used the NLP for product recommendation, supply chain queries, answer customers questions and to support sales and marketing. In medical sector, the research proposed an online question-and-answer (QA) Healthcare Helper system for answering complex medical questions. To determine the topic of spoken question asked by telecom customers an automated task-oriented Arabic dialogue system was created in telecommunications. To enable the users to ask for many services some like ticketing service through conversation interaction, the research proposed a chatbot as a solution. In banking sector, a chatbot is used to help the customers to resolve their queries with appropriate response in return. In constructions, engineers, for

example, were unable to retrieve information for domain-specific needs in a timely manner therefore, a question answering system was proposed in the research . In the energy utility field, a company aimed to identify unknown customer intents in the research, they developed a chatbot to detect that. In the marketing sector, a study examines whether high-end fashion retailers can maintain their commitment to provide individualized service via chatbots rather than via more conventional face-to-face encounters.

Technologies used A wide range of techniques and methods are commonly employed in the field of customer service. As a result, this systematic review discovered that deep learning and machine learning techniques were the most utilized in the methodology and implementation stages. The most widespread method that has been used is term frequency-inverse document frequency (TF-IDF), which is used to quantify the importance or relevance of string representations. The second most common method was the Support Vector Machine (SVM) algorithm, which is used for both classification and regression. The Random Forest (RF) classification

18%Additionally, the approach is used for natural language processing. Another common method is web crawling used to index pages for search engines, and XGBoost (eXtreme Gradient Boosting), which is used for regression, classification, and ranking problems. Another common method is latent semantic analysis (LSA) which is used for computer modeling and simulation of the meaning of words and passages through the analysis of representative corpora of natural text. Additionally, the bag-of-words (BOW) model used in methods of document classification and the logistic regression (LR) models used for prediction and classification problems. Neural networks are used to solve problems in supervised learning, e.g., reinforcement learning. Recurrent neural networks (RNNs) and convolutional neural networks (CNNs) were used.

Finally, the k-means clustering algorithm is used to find groups that have not been explicitly labeled in the data. The following methods were used in the remaining studies: the Knuth-Morris-Pratt (KMP) algorithm, the cross-entropy loss metric, the AdaBoost algorithm, the intelligent knowledge base (KB), the LUIS (Language Understanding) model, the QnA (Questions and Answers) list, the DBSCAN clustering algorithm, the Latent Dirichlet Allocation (LDA) method, Tuning the Hyper-Parameters Algorithm, the linear regression model, the LightGBM classifiel, the hidden Markov model (HMM), the Aho–Corasick algorithm, the unigram language model, the Correlation based (CR) approach, and the Continuous Bag of Words (CBOW) model, the Gradient boosting technique, the TextCNN algorithm ,the Vector space model(VSM). At last, another common studies used other methods. epicts the techniques and methods used in customer service research.

CONCLUSION

In recent years, developments in artificial intelligence and natural language processing (NLP) technologies have grown to help improve customer service. which has led

to positive enhancements in various fields, in providing more personalized offers and more predictive responses to the customer

in a rapid timeframe. This systematic review was undertaken that involved 26 relevant papers by analyzing and synthesizing studies on natural language processing in customer services from 2015 to 2022 of papers available in relevant databases, and we answered 5 research questions. In this paper, the research papers focusing on main fields in the customer service sector where NLP has been used, including social media, e-commerce, the medical profession, telecommunications, booking, the construction industry, banking, energy utilities, marketing, and general studies that don't fall under any of the aforementioned categories. Furthermore, most research papers used datasets created by the authors themselves. For the popular evaluation measures, we found that Accuracy, Precision, Recall, and the F1 measure are the most used and are widely used. Another important aspect of this systematic review is its discussion of the limitations facing NLP applications in customer service. On another hand, this paper discussed future directions that are as needed for increasing the sample sizes of the dataset to avoid a negative impact on the outcomes. The limitations of this paper are mainly related to the dataset and evaluation measures, which were not mentioned by the researchers.

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