DSIM

A Natural Language Processing-Based Question Answering System

RUPINDER KAUR[1], PERTIK GARG[2]
[1]Research Scholar, Department of Computer Science and Engineering, SVIET, Banur, Punjab, India
[2]Associate Professor, Department of Computer Science and Engineering. SVIET, Banur, Punjab, India
Corresponding author: Rupinder Kaur.

ABSTRACT
One of the most crucial aspects of learning is assessment. There are numerous technologies that have developed to manage evaluation automatically in this digital age. Automatic scoring is one of the system evaluations that researchers produced. The user enters information in Punjabi for automated question and response systems that use natural language. This system is mainly designed for users those are comfortable with the natural language they use in their daily life.

KEYWORDS Question, Answer, SQL, Punjabi, Machine learning

I. INTRODUCTION

THERE has been an increase in the number of Internet [1] users over the last decade. Users of QA send several kinds of queries in order to obtain precise answers from the Question Answering Systems. If the users pose their questions in natural language instead of posing queries, then the best solution for obtaining answers would be question answering itself. Researchers have been studying the field of QA in English, Chinese, Japanese, Korean, and others for quite some time now.

Question answering systems (QAS) have three parts in the current environment [2]: question classification, information retrieval, and answer extraction. These elements are essential to QAS. The primary function of question classification in a QA system is to classify questions according to their nature. By removing the most pertinent answers from posts using their intelligent question-answering system, information retrieval methods can determine success. In contrast to traditional information retrieval, which compares the information demand to the entirety of the documents, question answering only returns selected information as an answer. The user of a question-answering system is looking for a succinct, understandable, accurate, and most likely response, which could pertain to a single word, sentence, paragraph, image, audio clip, or whole document. An essential text mining application is the question-answering system. These systems use the extensive corpus of text data to extract more pertinent responses to a given inquiry. However, by categorising the questions into different groups, relevant answers may also be extracted, making it simple to determine whether a question and its responses are relevant. Multilingualism is a challenge the Internet nowadays must overcome.

The standard procedure for current information retrieval systems [3] is to specify some keywords in order to find the relevant information on the Internet. An information retrieval (IR) system responds to a query with a list of documents that may be relevant, which the user must then peruse to look for relevant information. Even though it is simple to build a retrieval service, this method was unable to meet the user's expectations to efficiently retrieve the necessary information from a large collection of electronic documents. Question Answering (QA) is a technology that seeks to locate the response to a question expressed in natural language throughout enormous document collections. Natural language queries are given to QA systems, and the desired reply is either the precise response found in a text or brief text snippets comprising the response.

In the course of a learning process, it is crucial to evaluate student performance. These evaluations will reveal the student's capacity for information absorption throughout the learning process. An objective or subjective test can be used to gauge a student's aptitude. Multiple choice is an example of an objective test, whereas a short or long test is an example of a subjective test. The capacity to assess students' higher order thinking skills is one of the benefits of using subjective tests during evaluations [4].

II. NATURAL LANGUAGE PROCESSING

In artificial intelligence, the "Natural Language Processing" (NLP) [6] area is defined as "a branch of study aimed at automating various tasks related to human (natural) language using mathematics and computer science." This domain includes two processes, namely, language processing and language generation [7]. While the former process is mainly concerned with language analysis, the latter focuses on language generation from the created representation. In order to enable human language processing in diverse situations and for a wide range of uses, natural language processing

is a theoretically grounded set of computational techniques that can evaluate and represent natural texts at varying levels of linguistic analysis. Various aspects are covered by the aforementioned description. One of them is that the term "range of computational procedures" implies the possibility of employing various approaches for the analysis of various types of languages.

III. NEED OF AUTOMATED SCORING

This technology [8] will help the teachers evaluate their students in class and solve issues regarding creating tests from the standpoint of time, cost, reliability, and validity. Teachers have to invest much time in the process of manually assessing the essays written by their students. Providing each student with feedback concerning his or her paper would be very time-consuming, especially if the class consists of many students and writing assignments are frequent enough. The computerized approach [9]–[11] would be really helpful since it allows giving feedback to the student and a grade within seconds.

IV. LITERATURE REVIEW

Immediately Information Retrieval and Information Extraction are crucial to completing the process of interacting between the user and the system, according to Nanda et al. [12]. The paper examines several methods and techniques for user and system interaction, as well as diverse strategies. One method that is preferred for the question-answering system is machine learning. In this case, supervised learning is given priority over unsupervised learning by utilising a variety of additional strategies. The abundance of information on the internet, according to Ramesh et al. (2013) [13], [14], creates a demand for organised data storage, which makes it simpler to search for, retrieve, and manage data. A database is a piece of technology that organises and logically stores data. Structures query language (SQL) expertise is necessary to run these databases effectively. However, the use of SQL limits access to databases for those who are unfamiliar with them. To make these databases accessible to users of all skill levels, an interface is required. This document outlines the plan for creating a Telugu language database interface. Telugu language interface is being developed using a case study of a bank database. The system has demonstrated satisfactory performance.

Grammar check, according to Soni et al. [15], is defined as the process of identification and correction of grammatical errors within written text. Being an imperative part of science and technology, knowledge of English grammar is vital especially for people who do not speak English natively but read, write, and communicate. For this reason, there is an increasing need for the use of automated grammar checkers. Despite numerous approaches suggested, there are still no comprehensive overviews of the field for the last several years. Thus, Soni et al. decided to fill this void by conducting a systematic literature review on the basis of 12 primary articles found with the help of a well-thought-out search strategy. In this study, a classification of grammatical errors and current grammar check methods is provided. It is concluded that there are currently no efficient and effective systems able to work in real time.

In their work, Ramalingam et al. [17] pointed out that essay writing is a very valuable way of measuring students' academic achievements as well as their ability to link and remember what they learned. Nevertheless, manual grading of essays takes up too much time, money, and effort. An automated essay evaluation approach can serve as an alternative that would accelerate the whole process of assessment, providing very similar results to human judgment. The purpose of the research was to design an automated essay grading model based on machine learning [18]–[23]. The suggested solution uses different methods of linear regression, classification, and clustering in order to classify text into specific groups based on the given grades. A number of datasets were used to estimate the performance of different models based on their ability to predict human ratings. The experiment was conducted in Java.

In their study on the increasing involvement of Automated Essay Scoring (AES) technology in ELT testing, Dogan et al. [24] investigated the viability of substituting the current writing assessment method at Zirve University's School of Foreign Languages with the E-Rater® AES. The study was based on evaluating essays from 50 level C students (similar to the B1 level of proficiency) through the use of the E-Rater software and three human scorers. The outcome showed that the traditional approach of manual scoring consumed much more time, energy, and finances. On the contrary, the AES was more practical in terms of cost and time savings while yielding accurate test results. Consequently, the scholars suggested AES implementation in Zirve University's School of Foreign Languages.

As a result, the proposed method correctly recognized the argument roles of answers in 32% of cases using PropBank and the frame elements in 19% of cases using FrameNet. The performance assessment of the technique involved testing on a test corpus consisting of 400 questions related to four specialized domains: UN inspections, thefts within Russia's nuclear navy, Indian Prithvi ballistic missile program, and Chinese participation in non-proliferation regimes. In spite of relatively low accuracy rates reported above, the question corpus was complicated and domain-specific which explains difficulties in classification of answer types. As an outcome, the system correctly found answers to the questions in 52% of all cases.

Sun et al. [25] and Schlaefer et al. [26] presented QA systems that took part in the TREC evaluation campaign. Both methods used ASSERT, an open source shallow semantic parser by Pradhan et al. [27] trained on PropBank, for annotating questions and answer sentences by predicate-argument structures. This information was further used for comparison of the annotated sentences in order to find the most relevant answers to the questions. Like many other QA techniques discussed in the literature, the works mentioned

introduced various improvements into existing QA systems and evaluated their performance.

However, neither of the considered works provided independent evaluation results regarding the effectiveness of the SRL-based approach used in the work. At the same time, both works pointed to problems with the recall ability of the ASSERT parser since the parser was often unable to produce enough role tags for the questions and possible answers. It means that the further processing steps often lacked the necessary information for successful answer extraction.

In particular, Shen et al. [28] improved an existing question-answering system with the help of adding a special module for assigning semantic roles based on FrameNet. This module is responsible for performing the comparison of the dependency paths in candidate answer sentences with relations between predicates and semantic roles obtained from FrameNet. As experimental results show, the use of the proposed method allows for obtaining a better result in answer extraction than a method that does not make use of semantic roles at all.

On the contrary, the researchers discovered that a baseline method based on Shalmaneser, the shallow semantic parser released to the public by Erk et al. [29], failed to contribute to improved QA performance. It is stated that the limitation stems from the use of an algorithm focusing more on precision than recall, thereby limiting the number of questions with potential answers. Such findings have also been noted by Sun et al. [30].

A. METHODOLOGY & RESULTS

We utilised SQL server as the backend and C#.net as the frontend to implement the algorithm.

B. QUESTION/ANSWER FORM

The "Question/Answer" form, which is depicted in figure 1, is displayed when the "Question/Answer" option is selected on the main form. Any question may be entered here. The response is typed into the answer field. After that, press the "Check Result" button. It will display the grade for the given response to the query. The student received a total score of 5 after providing a thorough and accurate response.

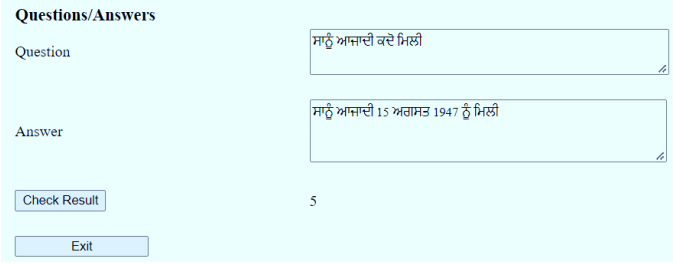

Figure 1. Question/Answer Form

If the student did not fill the complete answer (one word is missing in the answer), he got the total score as 4. If the two words are missing in the answer, then he got the total score as 3. Similarly, if the student given the incorrect answer, then he got the total score as 0.

V. CONCLUSION

One of the vital processes in the process of learning is the evaluation process. A lot of technologies have been introduced to make evaluation automated in this computerized era. One such system evaluation is automatic scoring. The user puts the information in Punjabi in automated question-and-answer systems based on natural language. The tokens in the sentence are extracted from the user input. The exact answer to the question will be found in the table through the keywords of the question. These tokens will be mapped to the keyword and its synonyms entered by the administrator. Further, translation will occur between the tokens to Punjabi words. Unwanted tokens will be removed. Next, an SQL query will be constructed using the required tokens generated by the keywords. The system will perform select query operations on databases. Through this, mapping of answers and comparisons using the keywords and their synonyms through a database maintained helped us find the output of the proposed algorithm in this paper.

References

[1] Khillare, S. A., Shelke, B. A. &Mahender, C. N. (2014). Comparative Study on Question Answering Systems and Techniques. International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, No. 11.

[2] Gupta, P. &Gupta, V. (2013). Algorithm for Punjabi Question Answering System. International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, No. 7.

[3] Hu, H. (2006). A Study on Question Answering System Using Integrated Retrieval Method. Doctoral Dissertation.The University of Tokushima, Tokushima, Japan.

[4] Pribadi, F. S., Adji, T.B., Permanasari, A. E., Mulwinda, A. &Utomo, A. B. (2017). Automatic Short Answer Scoring Using Words Overlapping Methods. AIP Conference Proceedings.

[5] Mengi, G., Singh, S. K., Kumar, S., Mahto, D., & Sharma, A. (2023, February). Automated Machine Learning (AutoML): The Future of Computational Intelligence. In International Conference on Cyber Security, Privacy and Networking (ICSPN 2022) (pp. 309-317). Cham: Springer International Publishing.

[6] Chopra, M., Singh, S. K., Aggarwal, K., & Gupta, A. (2022). Predicting catastrophic events using machine learning models for natural language processing. In Data mining approaches for big data and sentiment analysis in social media (pp. 223-243). IGI Global.

[7] Walia, T. S., Josan, G. S. &Singh, A. (2017). Semantic Features for Automated Answer Scoring. International Journal of Advanced Research in Science and Engineering, Vol. 6, No. 10.

[8] Liddy& Elizabeth D.(2001). Natural language processing. In Encyclopedia of Library and Information Science, 2nd Ed. NY. Marcel Decker.

[9] Kumar, S., Singh, S. K., Aggarwal, N., & Aggarwal, K. (2021). Evaluation of automatic parallelization algorithms to minimize speculative parallelism overheads: An experiment. Journal of Discrete Mathematical Sciences and Cryptography, 24(5), 1517-1528.

[10] Singh, I., Singh, S. K., Singh, R., & Kumar, S. (2022, May). Efficient loop unrolling factor prediction algorithm using machine learning models. In 2022 3rd International Conference for Emerging Technology (INCET) (pp. 1-8). IEEE.

[11] Kumar, S., Singh, S. K., Aggarwal, N., Gupta, B. B., Alhalabi, W., & Band, S. S. (2022). An efficient hardware supported and parallelization architecture for intelligent systems to overcome speculative overheads. International Journal of Intelligent Systems, 37(12), 11764-11790.

[12] Nanda, G (2016). Review: Hindi Question Answering System using Machine Learning Approach. International Journal of Latest Trends in Engineering and Technology, Vol. 7, No. 4, pp.254-258.

[13] Ramesh, D. &Sanampudi, S. K. (2013). Telugu Language Interface to Databases. International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, No. 7.

[14] A. Sharma et al., "Fuzzy Based Clustering of Consumers' Big Data in Industrial Applications," 2023 IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV, USA, 2023, pp. 01-03, doi: 10.1109/ICCE56470.2023.10043451.

[15] Soni, M., Thakur, J. S. (2018). A Systematic Review of Automated Grammar Checking in English Language. arXiv:1804.00540v1

[16] .

[17] Ramalingam, V. V., Pandian, A., Chetry, P. &Nigam, H. (2018). Automated Essay Grading using Machine Learning Algorithm. National Conference on Mathematical Techniques and its Applications (NCMTA 18).

[18] Aggarwal, K., Singh, S. K., Chopra, M., Kumar, S., & Colace, F. (2022). Deep learning in robotics for strengthening industry 4.0.: opportunities, challenges and future directions. Robotics and AI for Cybersecurity and Critical Infrastructure in Smart Cities, 1-19.

[19] Singh, I., Singh, S. K., Kumar, S., & Aggarwal, K. (2022, July). Dropout-VGG based convolutional neural network for traffic sign categorization. In Congress on Intelligent Systems: Proceedings of CIS 2021, Volume 1 (pp. 247-261). Singapore: Springer Nature Singapore.

[20] Kaur, P., Singh, S. K., Singh, I., & Kumar, S. (2021, December). Exploring Convolutional Neural Network in Computer Vision-based Image Classification. In International Conference on Smart Systems and Advanced Computing (Syscom-2021).

[21] Peñalvo, F. J. G., Maan, T., Singh, S. K., Kumar, S., Arya, V., Chui, K. T., & Singh, G. P. (2022). Sustainable Stock Market Prediction Framework Using Machine Learning Models. International Journal of Software Science and Computational Intelligence (IJSSCI), 14(1), 1-15.

[22] Gupta, S., Agrawal, S., Singh, S.K., Kumar, S. (2023). A Novel Transfer Learning-Based Model for Ultrasound Breast Cancer Image Classification. In: Smys, S., Tavares, J.M.R.S., Shi, F. (eds) Computational Vision and Bio-Inspired Computing. Advances in Intelligent Systems and Computing, vol 1439. Springer, Singapore. https://doi.org/10.1007/978-981-19-9819-5_37

[23] Khade, G., Kumar, S., & Bhattacharya, S. (2012, December). Classification of web pages on attractiveness: A supervised learning approach. In 2012 4th International Conference on Intelligent Human Computer Interaction (IHCI) (pp. 1-5). IEEE.

[24] Dogan, A., Akbarova, A. A., Aydogan, H., Gonen K. &Tuncdemir E. Automated Essay Scoring versus Human Scoring: A Reliability Check. International Journal of Linguistics, Literature and Translation, Vol. 3, No. 1.

[25] Sun, R., Jiang, J., Tan, Y. F., Cui, H., Chua, T.-S., and Kan, M.-Y. (2005). Using Syntactic and Semantic Relation Analysis in Question Answering. In Proceedings of the 2005 Edition of the Text REtrieval Conference (TREC-05).

[26] Schlaefer, N., Ko, J., Betteridge, J., Sautter, G., Pathak, M., and Nyberg, E. (2007). Semantic Extensions of the Ephyra QA System for TREC 2007. In Proceedings of the 2007 Edition of the Text REtrieval Conference (TREC-07).

[27] Pradhan, S., Ward, W., Hacioglu, K., and Martin, J. H. (2004). Shallow Semantic Parsing using Support Vector Machines. In Proceedings of the Human Language Technology Conference/North American Chapter of the Association for Computational Linguistics annual meeting (HLT/NAACL-2004).

[28] Shen, D. and Lapata, M. (2007). Using Semantic Roles to Improve Question Answering. In Proceedings of the 2007 Conference on Empirical Methods in Natural Language Processing (EMNLP-07).

[29] Erk, K. and Pado, S. (2006). Shalmaneser - A Flexible Toolbox for Semantic Role Assignment. In Proceedings of the Fifth International Conference on Language Resources and Evaluation (LREC-06).

[30] Sun, R., Jiang, J., Tan, Y. F., Cui, H., Chua, T.-S., and Kan, M.-Y. (2005). Using Syntactic and Semantic Relation Analysis in Question Answering", In Proceedings of the 2005 Edition of the Text REtrieval Conference (TREC-05).