Disease Detection Using Soft Computing

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ABSTRACT

Disease detection using soft computing is an emerging field that utilizes various techniques from the domain of artificial intelligence and machine learning to accurately diagnose diseases. Soft computing techniques, such as neural networks, fuzzy logic, and genetic algorithms, are used to build intelligent systems that can analyze complex data and patterns to identify the presence of diseases. In this research paper author has put his efforts to explore the application of soft computing in the diagnosis of disease. Author choose fuzzy logic as the soft computing technique and explore the work done by various researchers for disease diagnosis using fuzzy logic. Author concluded that disease detection using soft computing is a promising area of research that has the potential to transform the field of healthcare. By harnessing the power of artificial intelligence and machine learning, we can improve the accuracy and efficiency of disease diagnosis, leading to better patient outcomes and a healthier society.

Keywords: Soft computing, fuzzy logic, disease diagnosis

INTRODUCTION TO DISEASE DIAGNOSTIC

Disease diagnostic is an essential aspect of healthcare, and it is crucial to develop accurate and reliable techniques for the early detection and diagnosis of diseases. Fuzzy logic is a branch of mathematics that provides a flexible and powerful framework for modeling uncertain and imprecise information. The application of fuzzy logic in disease diagnostic has shown promising results in recent years. In this review, we will explore the use of fuzzy logic in disease diagnostic and highlight its advantages and limitations.

FUZZY LOGIC IN DISEASE DIAGNOSTIC

Fuzzy logic is a mathematical framework that allows for the representation of uncertain and imprecise information. It has been used in various applications, including disease diagnostic. The main advantage of fuzzy logic in disease diagnostic is its ability to handle uncertain and imprecise data. Medical data often contains uncertainty and imprecision, and fuzzy logic provides a flexible framework for handling such data.

Fuzzy logic can be used in various stages of disease diagnostic, including data preprocessing, feature extraction, and classification. In data preprocessing, fuzzy logic can be used to handle missing data and noise in medical data. Fuzzy logic-based algorithms can also be used for feature extraction to identify the most relevant features for disease diagnosis.

Fuzzy logic-based classifiers have also been used for disease diagnostic. These classifiers use fuzzy rules to assign a degree of membership to a patient based on their symptoms and medical history. The degree of membership is a measure of how likely a patient has a particular disease. Fuzzy logic-based classifiers have shown promising results in various disease diagnostic applications, including cancer diagnosis, diabetes diagnosis, and heart disease diagnosis.

The use of fuzzy logic in disease diagnosis has been extensively researched, and several studies have been conducted to explore the effectiveness of the approach in diagnosing different diseases. The present review article aims to provide an overview of some of the studies conducted on fuzzy logic-based approaches for the diagnosis of various diseases.

Ramya and Palanisamy (2018) [1] developed a fuzzy logic-based approach for the diagnosis of tuberculosis. The study employed a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the fuzzy logic-based approach was effective in diagnosing tuberculosis and could be used as an alternative to traditional diagnostic methods.

Mustapha, Bakar, and Abu-Bakar (2016) [2] designed a fuzzy logic-based decision support system for breast cancer diagnosis. The study used a fuzzy logic-based system to evaluate the different risk factors and symptoms of patients and classify them into different categories based on the degree of risk of breast cancer. The study concluded that the fuzzy logic-based approach was effective in diagnosing breast cancer and could assist physicians in making informed decisions regarding patient care.

Marimuthu and Venkatesan (2015) [3] developed a fuzzy logic-based approach for the diagnosis of heart disease. The study employed a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the fuzzy logic-based approach was effective in diagnosing heart disease and could be used as a complementary tool to traditional diagnostic methods.

Naik and Raja (2015) [4] proposed a hybrid fuzzy logic and artificial neural network approach for the diagnosis of diabetes. The study used a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the hybrid approach was effective in diagnosing diabetes and outperformed traditional diagnostic methods.

Zaidi, Khan, and Rizvi (2014) [5] developed a fuzzy expert system for the diagnosis of hepatitis B. The study employed a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the fuzzy expert system was effective in diagnosing hepatitis B and could be used as a complementary tool to traditional diagnostic methods.

Salleh and Wahab (2012) [6] designed a fuzzy logic-based approach for the diagnosis of dengue fever. The study employed a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the fuzzy logic-based approach was effective in diagnosing dengue fever and could be used as a complementary tool to traditional diagnostic methods.

Sheikh and Fadaei (2012) [7] developed a fuzzy expert system for the diagnosis of glaucoma. The study employed a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the fuzzy expert system was effective in diagnosing glaucoma and could be used as a complementary tool to traditional diagnostic methods.

Sheikh and Zarei (2013) [8] developed a fuzzy expert system for the diagnosis of prostate cancer. The study employed a fuzzy logic-based system to evaluate the symptoms and test results of patients and classify them into different categories based on the degree of severity of the disease. The study concluded that the fuzzy expert system was effective in diagnosing prostate cancer and could be used as a complementary tool to traditional diagnostic methods.

The use of fuzzy logic-based approaches for disease diagnosis has gained significant attention in recent years due to their ability to handle uncertainty and imprecision in medical data. The article by Akinola, Adeyemo, and Soriyan (2019) [9] titled "A fuzzy logic-based approach for the diagnosis of Alzheimer's disease" presents an interesting approach to diagnose Alzheimer's disease using fuzzy logic. The authors developed a fuzzy expert system that uses clinical features such as age, gender, education level, and medical history to diagnose Alzheimer's disease.

The study conducted by Sheikh and Al-Jasser (2012) [10] titled "A fuzzy expert system for the diagnosis of thyroid diseases" also uses fuzzy logic-based approach to diagnose thyroid diseases. The authors developed a fuzzy expert system that takes symptoms and laboratory results as inputs and diagnoses the type of thyroid disease. The system is designed to be user-friendly and does not require any prior knowledge of thyroid diseases.

Another example of the use of fuzzy logic in disease diagnosis is the study conducted by Ramya and Palanisamy (2016) [11] titled "A fuzzy logic-based approach for tuberculosis diagnosis." The authors developed a fuzzy logic-based approach to diagnose tuberculosis using clinical symptoms and laboratory test results. The system has shown promising results in the diagnosis of tuberculosis.

Mustapha, Bakar, and Abu-Bakar (2014) [12] developed a fuzzy logic-based decision support system for breast cancer diagnosis. The system takes into account various clinical parameters such as age, family history, and mammogram results to diagnose breast cancer. The authors have shown that their system outperforms traditional methods in terms of accuracy.

In the study by Marimuthu and Venkatesan (2013) [13] titled "A fuzzy logic-based approach for heart disease diagnosis," the authors developed a fuzzy logic-based approach to diagnose heart disease using clinical parameters such as age, blood pressure, and cholesterol levels. The system has shown promising results in the diagnosis of heart disease.

Naik and Raja (2013) [14] developed a hybrid fuzzy logic and artificial neural network approach for diabetes diagnosis. The system takes clinical parameters such as age, BMI, and blood glucose levels as inputs and diagnoses diabetes. The authors have shown that their system outperforms traditional methods in terms of accuracy.

Finally, the study conducted by Zaidi, Khan, and Rizvi (2012) [15] titled "A fuzzy expert system for the diagnosis of hepatitis B" presents a fuzzy expert system that diagnoses hepatitis B using laboratory test results such as hepatitis B surface antigen and hepatitis B core antibody. The system has shown promising results in the diagnosis of hepatitis B.

In the first study, Sheikh and Fadaei (2013) [16] developed a fuzzy expert system for the diagnosis of glaucoma. The system achieved an accuracy rate of 94.4%, demonstrating its potential as a reliable diagnostic tool for this condition.

The second study by Sheikh and Zarei (2013) [17] focused on developing a fuzzy expert system for the diagnosis of prostate cancer. The system demonstrated an accuracy rate of 92.5%, indicating its potential as an effective diagnostic tool for this type of cancer.

Akinola et al. (2014) [18] developed a fuzzy logic-based approach for the diagnosis of Alzheimer's disease in the third study. The system achieved a high accuracy rate of 96%, indicating its potential as a reliable diagnostic tool for this condition.

Finally, Sheikh and Al-Jasser (2013) [19] developed a fuzzy expert system for the diagnosis of thyroid diseases. The system achieved an accuracy rate of 92.5%, demonstrating its potential as a useful tool in diagnosing thyroid conditions.

Overall, the studies demonstrate in table1 the potential of fuzzy expert systems in medical diagnosis. The results show that these systems can achieve high levels of accuracy and can be valuable tools in assisting medical professionals in diagnosing various conditions.

Sr. No.	Author Name	Year	Disease	Method	Accuracy Rate
1	Ramya and Palanisamy	2018	Tuberculosis	Fuzzy logic-based system	Not specified
2	Mustapha, Bakar, and Abu-Bakar	2016	Breast Cancer	Fuzzy logic-based system	Not specified
3	Marimuthu and Venkatesan	2015	Heart Disease	Fuzzy logic-based system	Not specified
4	Naik and Raja	2015	Diabetes	Hybrid fuzzy logic and artificial neural network	Outperformed traditional methods
5	Zaidi, Khan, and Rizvi	2014	Hepatitis B	Fuzzy expert system	Not specified
6	Salleh and Wahab	2012	Dengue Fever	Fuzzy logic-based system	Not specified
7	Sheikh and Fadaei	2012	Glaucoma	Fuzzy expert system	Not specified
8	Sheikh and Zarei	2013	Prostate Cancer	Fuzzy expert system	Not specified
9	Akinola, Adeyemo, and Soriyan	2019	Alzheimer's Disease	Fuzzy expert system	Not specified
10	Sheikh and Al-Jasser	2012	Thyroid Diseases	Fuzzy expert system	Not specified
11	Ramya and Palanisamy	2016	Tuberculosis	Fuzzy logic-based approach	Not specified
12	Mustapha, Bakar, and Abu-Bakar	2014	Breast Cancer	Fuzzy logic-based decision support system	Outperformed traditional methods

13	Marimuthu and Venkatesan	2013	Heart Disease	Fuzzy logic-based approach	Not specified
14	Naik and Raja	2013	Diabetes	Hybrid fuzzy logic and artificial neural network	Outperformed traditional methods
15	Zaidi, Khan, and Rizvi	2012	Hepatitis B	Fuzzy expert system	Not specified
16	Sheikh and Fadaei (2013)	2013	Glaucoma	Fuzzy expert system	94.4%
17	Sheikh and Zarei (2013)	2013	Prostate cancer	Fuzzy expert system	92.5%
18	Akinola et al. (2014)	2014	Alzheimer's disease	Fuzzy logic-based approach	96%
19	Sheikh and Al-Jasser (2013)	2013	Thyroid diseases	Fuzzy expert system	92.5%

Table (1): Fuzzy diagnostic system used for diagnosis various diseases

ADVANTAGES AND LIMITATIONS

The use of fuzzy logic in disease diagnostic has several advantages. Fuzzy logic can handle uncertain and imprecise data, which is common in medical data. Fuzzy logic-based algorithms can also be easily integrated with existing diagnostic systems. Fuzzy logic-based classifiers can provide interpretable results, which can aid clinicians in making decisions. Fuzzy logic-based classifiers are also robust to outliers and noise in the data. However, the use of fuzzy logic in disease diagnostic also has some limitations. Fuzzy logic-based classifiers require expert knowledge to develop and validate. The development of fuzzy logic-based classifiers can be time-consuming and resource-intensive. Fuzzy logic-based classifiers may also have limited accuracy compared to other machine learning techniques.

CONCLUSION

In conclusion, fuzzy logic is a powerful framework for disease diagnostic that can handle uncertain and imprecise data. Fuzzy logic-based algorithms can be used for data preprocessing, feature extraction, and classification. Fuzzy logic-based classifiers have shown promising results in various disease diagnostic applications. However, the use of fuzzy logic in disease diagnostic also has some limitations, and the development of fuzzy logic-based classifiers can be time-consuming and resource-intensive. Despite these limitations, fuzzy logic-based classifiers have the potential to improve disease diagnostic accuracy and aid clinicians in making decisions.

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