iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XII **Month of publication:** December 2022

DOI: https://doi.org/10.22214/ijraset.2022.48163

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

Applications of Fuzzy in the Field of Medicine

Dr. Arun Kumar Gali
Associate Professor, Department of Mathematics, Government First Grade College Sector no-43,Navanagar, Bagalkote-587103, Karnataka State , INDIA.

Abstract: In this paper fuzzy sets have been applied to many fields in which uncertainty plays a key role. Medicine, often on the borderline between science and art, is an excellent exponent: vagueness, linguistic uncertainty, hesitation, measurement imprecision, natural diversity, subjectivity all these are prominently present in medical diagnosis.
Keywords: Fuzzy logic, Fuzzy Controller

I. INTRODUCTION

Fuzzy logic means approximate reasoning, information granulation, computing with words and so on. Fuzzy logic provides an inference structure that enables the human reasoning capabilities to be applied to artificial knowledge-based systems.
It provides a means for converting linguistic strategy into actions and thus offers a high- level computation.Fuzzy logic provides mathematical strength to the emulation of certain perceptual and linguistic attributes associated with human cognition, whereas the science of neural networks provides a new computing tool with learning and adaptation capabilities. The theory of fuzzy logic provides an inference mechanism under cognitive uncertainty; computational neural networks offer exciting advantages such as learning, adaptation, fault tolerance, parallelism, and generalization. Fuzzy logic has been applied to many different and diverse applications, including categorization of weather patterns and of sea gull behaviors, control of cement kilns, passenger trains, and elevators, scheduling of subway trains and service technicians, and as a prediction mechanism in risk management. Empirically, five general categories have emerged within which a fuzzy logic based system is beneficial, and often even necessary:
Complex systems, where an adequate system model is difficult or impossible to define.

1) Human expert controlled systems.
2) Systems with moderately to very complex continuous (or semi- continuous) inputs and outputs, for example PID based control systems.
3) Systems with human observations as control rules and/or inputs.
4) Systems where vagueness is common, for example in economic systems, natural sciences, and behavioral sciences.

As a mathematical foundation, a generalization on the age-old but quite limiting concept of absolute truth, fuzzy logic can be successfully applied across a broad range of disciplines, and has the potential of having as significant an impact on the types of systems developed.Applications of fuzzy logic may also be found, among others, in the areas of Environmental Protection, Economy, Picture Processing, Power Systems, Social Sciences, Music, Hardware and Telecommunications. Special mentions deserve the many applications of fuzzy logic in Medicine like example in support of diagnosis, in Medical Image Processing, in medical data mining, and in medical modeling. This list is by all means not exhaustive; it only pretended to show the wide spectrum of applications that have been developed in the last decade.

II. FUZZY LOGIC IN MEDICINE

Starting from the pioneering publication of Lotfi Zadeh [1965], fuzzy sets have been applied to many fields in which uncertainty plays a key role. Medicine, often on the borderline between science and art, is an excellent exponent: vagueness, linguistic uncertainty, hesitation, measurement imprecision, natural diversity, subjectivity—all these are prominently present in medical diagnosis.
Perez-Ojeda [1976] designed prototype system to be used in the search for an adequate strategy to simulate an approximate reasoning model in medical decision making and he gave examples of typical elements of medical knowledge.
Sanchez [1979] invented a fully developed relationships modeling theory of symptoms and diseases using Fuzzy sets. The intuitionistic fuzzy set (IFS) theory, originated by Atanassov [1986] has been used in a wide range of applications, such as logic programming, medical diagnosis, pattern recognition, and decision making, etc.

©IJRASET: All Rights are Reserved

Linkens and Mahfouf[1988] and later Westenskow [1997] have proposed a fuzzy logic knowledge based control of muscle relaxation. Astanin [1989] has described a modeling of the functional status of a human operator based on fuzzy logic which is used to predict and evaluate the operator's behavior.

Different methods have been used which utilize fuzzy logic, the first being a real-time expert system for advice and control (RESAC) based on fuzzy logic reasoning proposed by Greenhow et al.,[1992] Oshita et al., [1993] have analyzed and used the concept of fuzzy logistic controller for treatment of hypertension during anesthesia.

Ying and Sheppard [1994] have initiated a model for regulating mean arterial pressure in postsurgical cardiac patients. Most of the fuzzy logic control applications in the field of artificial organs are concerned with artificial hearts. A fuzzy controller has been implemented by Kaufmann et al., [1995] for adaptation of the heart pump rate to body perfusion demand by pump chamber filling detection.

Zbinden et al., [1995] have used fuzzy logic to monitor the Arterial pressure control with isoflurane and experimentally proved that fuzzy logic is a promising new technique for control of isoflurane delivery during routine anesthesia.

Schaublin et al.,have examined fuzzy logic control of mechanical ventilation during anesthesia . Massaro and Cohen have analyzed the effect of face expression on speech perception in direct communication. Wolf et al.,have utilized fuzzy logic for improved monitoring in pre-term infants. Another more advanced system based on neural and fuzzy controller for artificial heart was developed by Lee et al., [1996].

Naranjo et al.,have studied and measured the prediction of patient response to new pharmacotherapies for alcohol dependence using fuzzy logic since it has been not successful using standard statistical techniques. Future prospects for cardiac assist patients involving fuzzy logic was described by Mussivand.

The field of anesthesia is where most of the applications of fuzzy control have been reported. It involves monitoring the patient vital parameters and controlling the drug infusion to maintain the anesthetic level constant. Abbod and Linkens, have studied the depth of anesthesia.

Lowe, Harrison and Jones have proposed a method to focus on detection of specific problems during monitoring of anesthesia, e.g. inadequate analgesia, malignant hyperpyrexia, increased intracranial pressure, pulmonary shunt, cardiac output failure, absolute hypovolaemia, and relative hypovolaemia and to give a warning or an alarm.

Supriya Kumar De et al.,have proposed a method to extend the research and using the idea of intuitionistic fuzzy set theory and introduced the case study of some patients, collected the data of their symptoms and used this data in IF theory and gave the result in tabular form.

This research work proposed a diagnosis of the hemorrhage and brain tumor disease to show the probability of the disease. The simulation of fuzzy logic results shows the probability of the disease to occur and normal result probability. Hemorrhage and tumor occur by the abnormal increase or decrease of blood cells in the cerebrospinal fluid. The data range of the blood cells includes red blood cells, lymphocytes, protein, neutrophils, and eosinophils. These cells are used as input parameters for the fuzzy logic system.

Cells make inputs which are to be fuzzified. On the basis of fuzzy rules fuzzified outputs are collected. The output describes which disease is probable and the chances of the normality by the change in the input parameters that are blood cells. The fuzzy surfaces are obtained and graphical relationship between the input parameters and output are shown. Shieh et al., have proposed the hierarchical fuzzy-based support system for anesthesia monitoring and control. Mahfouf et al., have explained the use of fuzzy logic in the neuro medical field, fuzzy logic evaluation on the basis of facial expression and human behavior etc., surveyed different fuzzy techniques using the data analysis of medical science.

Mahfouf et al.,have conducted a survey on the utilization of fuzzy logic control and monitoring in medical sciences with an analysis of its possible future penetration. Barro and Marin have used fuzzy logic in diagnostics for cancer and diabetes. Scott et al.,have discussed the design of Fuzzy logic controller (FLC) for medical device based on software using fuzzy logic.

FLC used for controlling the regulator to apply air pressure to the skin of human consisting of analogue-to-digital convertor for the collection of data, pneumatic valve and sensor to control air pressure. Schuh et al.,have described the use of fuzzy logic in medical human health care system and the medical data of patient. He Yue et al.,have studied the immune system that protects the human body, on the basis of the immune algorithm using a flow chart and Fuzzy Cognitive Map (FCM)

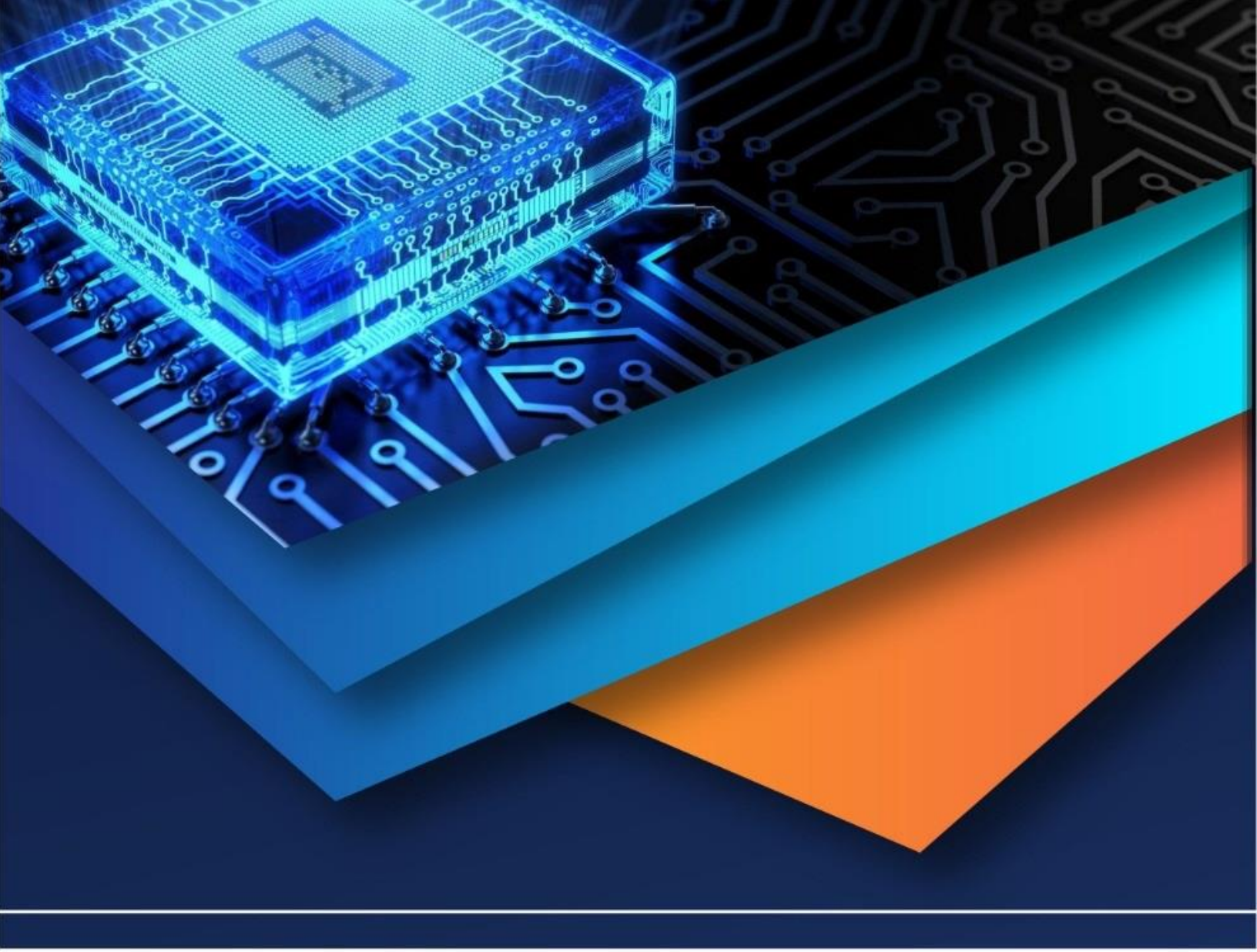
Christian et al.,have proposed a survey related to the fuzzy logic, fuzzy sets and relations and fuzzy control and their application in medical science and explained GlucoNotify patient glucose data setting, fuzzy automata concept for ARDS therapies. Yataka Hata et al.,have described the practical application of management system for human health and worked on the scheme to concentrate medical diagnosis and health management.

Khanale and Ambilwade have proposed a fuzzy logic controller to maintain the normoglycaemic for diabetic patient of type I. Djam et al.,have developed a decision support system for diagnosing TB and proved that Fuzzy logic for medical diagnosis provides an efficient way to assist inexperienced physicians to arrive at the final diagnosis of TB more quickly and efficiently.
Soundarajan et al.,have designed a fuzzy rule based system to serve as a decision support for tuberculosis diagnosis. This system is designed to detect class of tuberculosis and these fuzzy rules are updated using rule mining techniques.
Based on this method that generates classes of tuberculosis suits the needs of pulmonary physicians and reduce the time consumed in generating diagnosis Arthritis is a chronic disease and about three fourth of the patients are suffering from osteoarthritis and rheumatoid arthritis which are undiagnosed and the delay of detection may cause the severity of the disease at higher risk.
Thus, earlier detection of arthritis and treatment of its type of arthritis and related locomotry abnormalities are of vital importance. MirzamansoorBaid et al., have designed a system for the diagnosis of Arthritis using fuzzy logic controller (FLC) which is, a successful application of Zadeh's fuzzy set theory and proved it is a potential tool for dealing with uncertainty and imprecision.

REFERENCES

[1] Zadeh. L.A. [1965]: Fuzzy sets. Inf Control, Vol. 8,pp. 338–53.
[2] Naranjo, C.A., Bremner, K.E., Bazoon, M, and I.B, Turksen[1997]: Using fuzzy logic to predict response to citalopram in alcohol dependence. Clinical Pharmacology Therapeutics, Vol.62, No.(2), pp.209-24.
[3] Sanchez, E. [1979]: Inverse of fuzzy relations, application to possibility distributions and medical diagnosis. Fuzzy sets and Systems, Vol. 2, No.1, pp.75-86.
[4] Adlassnig .K.P. [1986]: Fuzzy set theory in medical diagnosis. IEEE Transaction on systems, Man and Cybernetics, Vol. 16, pp.260-265.
[5] Linkens, D.A., and M. Mahfouf [1988]: Fuzzy logic knowledge based control of muscle relaxation. IFAC Proc on Modeling and Control of Systems, pp. 185-190.
[6] Naranjo, C.A., Bremner, K.E., Bazoon, M, and I.B, Turksen [1997]: Using fuzzy logic to predict response to citalopram in alcohol dependence. Clinical Pharmacology Therapeutics, Vol.62, No.(2), pp.209-24.
[7] Astanin, S.V. [1989]: A complex approach to modeling the functional status of a human operator based on the theory of fuzzy sets,Kosm Biol Aviakosm Med, Vol. 23, No.4,pp. 29-33.
[8] Greenhow, S.G., Linkens, D.A., and A.J.Asbury [1992]:Development of an expert system advisor for anaesthetic control. Comput Methods Programs Biomed, Vol. 37, No.3, pp. 215-229.
[9] Oshita, S., Nakakimura, K, Kaieda, R, Murakawa, T,Tamura H, and I, Hiraoka [1993]: Application of the concept of fuzzylogistic controller for treatment of hypertension during anaesthesia. Masui, Vol.42, No.2, pp.185-189.
[10] Ying, H., and L. C. Sheppard [1994]: Regulating mean arterial pressure in postsurgical cardiac patients. A fuzzy logic system to control administration of sodium nitroprusside. IEEE Engineering in Medicine and Biology-Magazine, Vol. 13,No.5, pp. 671-677.
[11] Zbinden, A.M., Feigenwinter, P., Petersen-Felix, S. and S. Hacisalihzade [1995]: Arterial pressure control with isoflurane using fuzzy logic. British Journal of Anaesthesia, Vol. 74, No.1, pp. 66-72.
[12] Benz, R., Menzl, S. and M.Stühler [1996]: A self adaptive computer based pH measurement and fuzzy control system. Wat. Res., Vol. 30, No. 4, pp. 981-991.
[13] Wolf, M. [1996]: Improved monitoring of preterm infants by Fuzzy Logic. Technol Health Care, Vol. 4, No. 2, pp. 193-201.
[14] Ahn, J.Y., Han, K.S., Oh, S.y. and C.D.Lee [2011]: An Application of interval-valued intutionistic fuzzy sets for medical diagnosis of headache. International Journal of Innovative computing, Information and control, Vol. 7,pp. 2755-2762.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)