Different Application Areas of Fuzzy Logic: A Review

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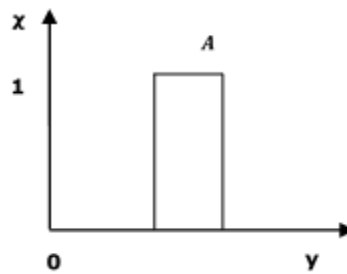
Abstract

Fuzzy logic is the primary component of soft computing. Fuzzy logics have the solution of each any every non-linear problem of this real world. Fuzzy sets are used to create the fuzzy logics. In this paper we have discussed the basic concept of fuzzy sets and fuzzy logics. This paper also contains the different application area of fuzzy logic.

Introduction

Fuzzy sets are an extreme oversimplification and extension of classical sets. It is most easily comprehended in terms of set membership. It permits partial membership, which means that it can have components with varying degrees of set membership. This contrast between a classical set and a fuzzy set is explained. The classical set contains components that adhere to precise membership requirements, whereas the fuzzy set contains elements that adhere to imprecise membership requirements.
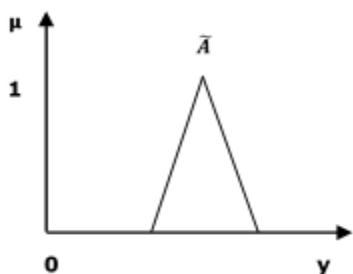
Membership Function of Fuzzy set $\tilde{A}$ Membership Function of classical set A

It is compost for Eight Application,

- Image Processing
- Robotics Processing
- Management Processing
- Agriculture Processing
- Education Processing
- Home Appliance
- Health Care Processing
- Software Engineering

Image Processing:

Image modelling establishes the initial connection. On the one hand, an n-dimensional image can be thought of as a mapping between a universe X (a finite subset of Rn, typically a M N-grid of points called pixels) and a collection of values. The collection of possible pixel values is determined by whether the image is binary, grayscale, or colour. Binary images have values between 0 and 1 (black = 0; white = 1), grayscale images have values between [0, 1] (values correspond to shades of grey), and colour images have values between [0, 1] (values correspond to shades of grey); the representation of colour images varies depending on the colour model used, for example RGB, HSV, or Lab. On the other hand, a fuzzy set A is defined in a universe X by a membership function that associates each element x in X with a degree of membership A (x) [0, 1]. A fuzzy set A, like grayscale pictures, can be represented as an X [0, 1] mapping. As a result, grayscale images can be processed using techniques from fuzzy set theory. A second relationship is apparent in the nature of (the data contained in) photographs. Because image processing is inherently uncertain and imprecise, whether it is determining whether a pixel is an edge pixel or not, determining whether a pixel is polluted with noise or not, or describing the degree to which two images are similar, fuzzy set theory and fuzzy logic are effective models for imprecise data.

Robotics Processing:

Robots are highly versatile machines capable of incredible motions, but are simply too difficult to use and hard to setup. Omrane, et al. (2016) suggested a Fuzzy Logic Based Control for Autonomous Mobile Robot Navigation approach. The author used two fuzzy logic controllers in the robot i.e., navigation fuzzy controller to enhance the navigation performances and second fuzzy controller is used to avoid the obstacles. It is possible to use this fuzzy logic controller in an intelligent wheelchair to assist the

elderly or crippled in their navigational efforts. In 2017, Akmal et al. developed a Simulink-MATLAB simulation-based fuzzy logic controller for stabilising the two-wheeled EV3 Lego robot.

Management Processing:
To manage the things in banks, business or any kind of field the fuzzy logic is playing very important role. In 2015 Mazlum, et al. has invented fuzzy PERT and Fuzzy CPM techniques, which can be used in fuzzy project handling. Online internet branches can use these techniques to improve the quality of the projects. The authors have tested these fuzzy techniques to check the performance. Kłosowski, et al. presented the concept of selecting staff for production tasks with the employment of fuzzy logic. This Mamdani-type fuzzy deduction technique was utilized to structure a controller whose undertaking was to help the basic leadership process. A simulation model of a discrete assembling framework with an executed fuzzy controller was produced

Agriculture Processing:
Under this area the fuzzy logic techniques are used to enhance the fertility and to analysis the environmental parameters like light, temperature and humidity which can affect the crops. In 2017 (Hernández-Vera, et al.) in a Mexican coffee company, a fuzzy logic based expert system was created to strengthen basic decision making on the kind of creation process thinking about factors for example, weight, pellets, green aspect and the level of minor and major abandons, this data got from organoleptic examination.
In 2018 (Kurniasih, et al.) the writers have directed an examination to decide the results of potential Bulurejo town dependent on criteria, like the potential in the field of agriculture, field of extensive cattle and domesticated animals and poultry utilizing fuzzy logic strategy. Because of this, the application of fuzzy logic method in determining the potential estimation of the town in accordance with the criteria has been successfully resolved, with the goal being that the fuzzy logic method is appropriate for the counting of indexed lists from the potential of Bulurejo town.

Education Processing:
The use of fuzzy logic approaches is becoming increasingly popular as a means of discovering new ways to evaluate student and instructor performance and determining the root causes of low performance. In 2018 (Pazil, et al.) the four main considerations which are based on the physical aspect, socio-emotional, spiritual, and intellectual of preschool kids are used to evaluate the performance of the student. This paper displays a technique to move forward these four factors by examining the execution of individual understudies in Malaysia. The ponder centres around 17 preschools in Johor which comprise of five chose schools in the year 2015. The entire information from the four perspectives is isolated into different extents. The fuzzy logic system is used to perform the same. It has been demonstrated that the execution of the five chose schools is effective in their procedure of learning.

Home Appliances:
In many home appliances like television, washing machines, microwaves and refrigerators the fuzzy logic techniques has been used to provide the advancement in the field. The demonstrating performed for the working put light control in conditions near genuine home condition affirmed the conceivable viable productivity of the examined system. In 2017 (Collotta M. and Pau G.) an Artificial Neural Network (ANN) called Blu HEMS is introduced to manage the energy utilization conditions. This system is used to forecast the home energy usage at various occasions of the day or on various days of the week. MATLAB and NS-2 simulations are used to test the system and to check the performance of the proposed system [10]. Today almost all well-known companies like Philips, LG, Samsung etc.

Health Care Processing:
Diagnosing any disease in medical field is very difficult for a medical expert. They need to perform different task for find out the cause of problem. In 2016 (Chanamool, et al.) the researchers proposed an application of utilizing Fuzzy FMEA, meant to build up the type of prioritization and evaluation on the failures for the working procedure in emergency by examine and recognizing proof of the failures as indicated by the philosophy of Failure Mode and Effects Analysis (FMEA). Besides, the prioritization and evaluation of the issues are enhanced with the usage of Fuzzy technique. The emergency department can easily adopt this application.

Software Engineering:
Developing any software or any application is very important and difficult task. Fuzzy logic is playing a vital role in the field of software engineering to solve the problems of software development process. In 2018 (Hsieh, et al.) a fuzzy risk impact rating (FRIR) was produced for deciding the level of risk in a New Software Development (NSD) as indicated by risk attributes related with the task, for example, authoritative condition, clients, prerequisites, complexity, group, planning and control. The FRIR is made out of qualities conceivable evaluations and relating seriousness levels, and is accumulated utilizing fuzzy weighted average. The testing of the given application confirms that the fuzzy logic-based risk assessment model can proficiently help administrators in managing equivocalness, imprecision, and multifaceted nature in NSD risk assessment.

Conclusion
In this work the fuzzy sets and fuzzy logics have been reviewed. From this detailed survey we have found the importance of using fuzzy for any nonlinear kind of problem. This is also observed that the fuzzy utilizes the limited resources like time and money very well. The optimal solutions of any problem in any field of life can be taken by implementing fuzzy sets. The fuzzy is already implemented successfully in the field of robotics, banking, education, software engineering, image processing, and mechanics, medical etc. and so on. The results of these implementations are remarkable.

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