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Analysing the applicability of fuzzy logic in computer and engineering: A meta-analysis

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Abstract
The fuzzy set theory and fuzzy logic was an extensive overview of increasingly important application of mathematics. In the contemporary era, fuzzy logics has emerged a fundamental tool in dealing with time consuming and complex process. In present era engineers and scientist are facing the complex load of numerical calculations which are not possible to solve with the help of classical approach. In consonance to same, the investigator in this research study is intended to explore the role of fuzzy logic in the domain of engineering and science. This study has been carried out with the help of meta-analysis. So, keeping in view, the researcher has selected the secondary data for generalising the applicability of fuzzy logics. Hence, after making the meta-analysis of the national and international level research studies, the researcher found that the applicability of the fuzzy logics is having immense value in the domain of engineering and science. High applicability of fuzzy logics has been found in both disciplines.

Keywords: Fuzzy logics, applicability of fuzzy logics, engineering and science

Introduction
Fuzzy logics are emerging as backbone for entire disciplines of the present era. The fuzzy logic is a qualitative computational method which describes vagueness or partial truth. The innovative idealistic mathematical approach had been improved to accommodate partial truth by the introduction of fuzzy set theory invented by Zadeh (1965) [28], unlike classical set theory, fuzzy set theory is flexible, which is focuses on the degree of being a member of set. The most successful approach is based on the fuzzy set notation proposed by Lotfi A. Zadeh (1965) [28] He had observed that conventional computer logic could not manipulate data that represented subjective or vague ideas. Zadeh (1965) [28] developed the fuzzy control system that is a based on fuzzy logic, a mathematical system that analyse the input values in terms of logical variables that take on continuous value between 0 and 1 (false or true). He proposed the concepts of fuzzy algorithms in 1968. In 1973, he published another seminal paper which established the foundation for fuzzy control. He introduced the concept of linguistic variables and proposed to use fuzzy IF-THEN rules based to formulate human knowledge. Application of fuzzy sets and fuzzy logic were helped by Mamdani (1975) [16]. In 1980, the fuzzy sets, fuzzy logic were used for mathematics and engineering. Japanese engineers developed a new technology and they found that fuzzy controllers were very easy to design and work for many problems. The fuzzy systems and control progressed rapidly in the decade 1980 to 1990 and new techniques (neural networks techniques) were used to determine membership functions in a systematic manners and demanding constancy analysis of fuzzy control systems was performed. In 1995, the technology of fuzzy set theory and its application to systems using fuzzy logic has moved rapidly and development of other. Fuzzy logic has emerged as a very powerful tool in dealing with complex problems. Recently the role of inference in handling uncertainty in engineering applications is gaining importance. Engineers and scientists are generally confronted with problems which are impossible to solve numerically using traditional mathematical rules. By making use of fuzzy logic, one can characterize and control a system whose model is not known or is ill-defined Construction management has always been necessary for organizations to deliver project results that meet or exceed performance objectives, such as time, cost, productivity, quality, and safety. Managing the construction process requires the development and application of techniques that improve organizations' abilities to plan, structure, forecast, control, and evaluate projects.

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The decisions and processes involved in managing construction projects are complex and contain considerable uncertainty. Construction management also involves challenges that arise because all projects are to some extent unique, so knowledge and data cannot be directly transferred from one project to another for use in predicting future project outcomes. Therefore, construction organizations rely heavily on experts to make quick decisions, which are characterized by subjective reasoning. Although most decision making in construction requires the use of modelling techniques that can capture and process subjective uncertainty and linguistically expressed expert knowledge, uncertainty has been treated as a random phenomenon in traditional modelling approaches. To address these challenges, researchers have applied fuzzy logic to construction process modelling and decision making. Although fuzzy logic alone has a number of limitations, researchers have integrated fuzzy logic with other techniques that have complementary strengths, leading to the development of advanced and powerful fuzzy hybrid techniques. The suitability of these methods is dependent on degree of precision required, available database, clarity of data etc. Fuzzy logic is the basic approach towards the all those software being used for modelling and forecasting. In the present task, this article represented some of the area related to fuzzy logic, which would be useful for solving any uncertainty in the various filed.

Problem in hand
Keeping the above relevance under consideration, the researcher found that there is dire need to carry the research problem on fuzzy logics. So, keeping in view, the statement of the problem is as under:

Analysing the Applicability of Fuzzy Logic in Computer and Engineering: A Meta-Analysis
Purpose of the study: The purpose behind this researcher study is to explore the applicability of the Fuzzy logics in the field computer and engineering.

Research assumption
The researcher make an assumption by arguing that how fuzzy logic is useful in the field of computer and engineering.

Rational of the study: The justification of this study is given as under:

Computer
The digital image processing has been increasingly used in several fields with great impact. This paper describes the basic design and working of a knowledge-based system based on fuzzy logic using the digital image processing techniques for identification of hidden or misplaced objects. The advancements in the fields of artificial intelligence (AI), data mining and digital image processing. It is possible to develop a system where in users are able to input the sketches or image of object under search and then scan for them. The system can also be automated to scan the area and compare the obtained image with that in the database, thus minimizing human inference. The automated system will aid in search and rescue missions among other image processing applications. This will help in bringing down the search time and help in faster identification of concerned objects Tibrewala, M. (2015) [26]. The hybrid fuzzy logic-neural network (HFNN) model used in this research to solve credit

risk management problem is capable of self-learning similar to the traditional neural network. It is capable of discriminating the "good" and the "bad" accounts with better accuracy compared to the traditional neural network. Unlike the neural networks "black box" configuration, which is an undesirable feature for credit evaluation, the HFNN model is capable of generating the rules behind the discrimination of each account subject to it. The results showed that the performance of the proposed HFNN model is very accurate, robust and reliable Dadios, S., (2012) [5]. The quality of service is a tool to measure the efficiency of the Ad-hoc network. of service is a complex function because it depends mainly on four factor say throughput, packets delivery ratio, end-to-end delay and jitter. This four factor are function of internal factor and are variables with the time. In the result the quality of service an ambiguous tool. They proposed a brand new method to solve this ambiguity, it will use the fuzzy technique to simplify the quality of service factor and summarize it in a simple form or in a single value for each application. They proposed that method on Mobile Ad-hoc network with different protocols. The new algorithm will summarize the efficiency of each protocol in a single (crisp) value for all applications. Finally, an important conclusion is proved, by experimental result, implying that higher throughput does not usually mean high quality of service supported by the protocols (Zaghar, D.R. Aldeen; A. Wahab, T.S. 2015) [30]. The navigation of autonomous mobile robots in dynamic and unknown environments needs to take into account different kind of uncertainties. Type-1 fuzzy logic research has been largely used in the control of mobile robots. However, type-1 fuzzy control presents limitations in handling those uncertainties as it uses precise fuzzy sets. Indeed type-1 fuzzy set cannot deal with linguistic and numerical uncertainties associated with either the mechanical aspects of robots or with dynamic changing environment or with knowledge used in the phase of conception of a fuzzy system. As control using type-2 fuzzy sets represents a new generation of fuzzy controllers in mobile robotic issue, it is interesting to present the performances that can offer type-2 fuzzy sets regards to type-1 fuzzy sets. The work presented deep and new comparisons between the two sides of fuzzy logic and demonstrated the great interest in controlling mobile robot using type-2 fuzzy logic. It deals with the design of new controllers for mobile robots using type fuzzy logic in the navigation process in unknown any dynamic environments. The dynamicity of the environment is showed by the presence of other dynamic robots. The performance of the proposed controllers is represented by both simulations and experimental results and discussed over graphical path and numerical analysis Baklouti R. John; A. M. (2015) [3].

Engineering
The proposed work of an automatic bandwidth control method for the performance improvement of Binary Amplitude Shift Keying (BASK) system for Giga-bit Modem in millimetre band. To improve the performance of the BASK system with a fixed bandwidth; the proposed method is to adjust a bandwidth of low pass filter in receiver using the fuzzy system. The BASK system consist of a high-speed shutter of the transmitter and a counter and a repeater of receiver. The repeater consists of four stage converters, and a converter is constructed with low pass filter and a limiter the inputs to the fuzzy system are the remainder and integral remainder of counter, and output is bandwidth. They used a

Viterbi algorithm to find the optimum detection from output of the counter. The simulation results showed that the proposed system improves the performance compared to the fixed bandwidth. They developed intelligent flow measurement technique by using ultrasonic transducers with the help of optimized fuzzy logic controller. The main objectives of this work was to make the intelligent flow measurement technique adaptive to variations in pipe diameter liquid density and liquid temperature and make a

linear relationship between input and output parameter by using optimized fuzzy logic model system. They proposed technique was the subjective to the practical data which was done with the help of actual flow rate and output of the intelligent technique (Eom, K. Hyun, K. Jung, S. 2018) [9]. The importance of implementing a fuzzy inference system to support objective decision making when the kind of variables of the phenomenon to be modelled are vague and subjective.

Table 1: Showing the overview on the applicability of the Fuzzy logics in the surveyed research studies

Discipline	Researchers	Applicability in fuzzy logics	Ratings
Computer	1. Baklouti R. John; A.M. (2015) [3]. 2. Zaghar D.R. Aldeen A. Wahab T.S. (2015) [30]. 3. Dadios, S., (2012) [5]. 4. Tibrewala, M. (2015) [26].	▪ Faster Identification of Concerned Objects. ▪ Gaining Accuracy and Reliability. ▪ Simplifying the Quality of Service Factor and Summarize. ▪ Faster Identification of Concerned Objects.	1=1 2=1 3=1 4=2
Engineering	5. Eom K. Hyun, K. Jung, S. 2018 [9].	▪ Support Objective Decision Making and reducing Vagueness and Subjective.	5=2

Index:
- 1= Denotes the researcher who explored that Fuzzy logics with single applicability.
- 2=Denotes the researcher who explored that Fuzzy logics are holding diversified applicability.
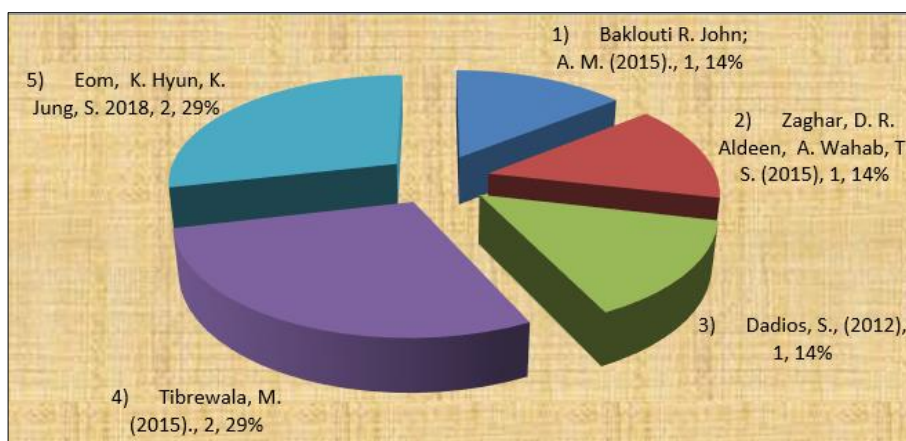
Fig 1: Showing the applicability of the Fuzzy logics in the surveyed research studies

Conclusion
The researcher in this research study concluded that the applicability of the fuzzy logics is having immense value in the in the domain of engineering and science. High applicability of fuzzy logics has been found in in the domain of engineering and science. Apart from this, the researcher concluded that the impact of Fuzzy logics in the domain of engineering and science is high and diversified in nature.

Computing interest: The researcher declare that there is no any conflict of interest with regard to all spheres of this research article.

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