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CONCEPT ON FUZZY SET THEORY

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Abstract: The concept of fuzzy magic labeling is introduced.Fuzzy magic labeling for some graphs like path, cycle and star graph are defined. It is proved that, every fuzzy magic graph is a fuzzy labeling graph, but the converse is not true. And we show that the removal of a fuzzy bridge from a fuzzy magic graph G, such that G* is a cycle with odd number of nodes is a fuzzy magic graph.And also some properties related to fuzzy bridge and fuzzy cut node have been discussed.

Keywords: Fuzzy labelling, Fuzzy magic labelling, fuzzy bridge and fuzzy cut node

Introduction: In a world of insecurity where systems are allied in a complex and incompatible manner, a conventional mathematical device with its strict limits of truth and falsity has not entrenched itself with competence of reflecting the reality. When the complication of the real life system increases, the human ability to make conscientious and yet major statement about its conduct decreases. However, if a threshold is reached, precision and significance become practically exclusive characteristics in a mutual manner. As a result, our concern with the discernment of problems and efforts of solutions are of a different order than in the past. As we become aware of how much we know and how much we do not know, information and uncertainty themselves become the focus of our concern. This doubt will be of particular interest, leading to a different way of giving structure to the point set, known as fuzzy set.

The notion of fuzzy set systems from the observation made by Zadeh that "more often than not; the classes of objects encountered in the real physical world do not have precisely defined criteria of membership". This surveillance emphasizes the gap that exists between theoretical representation of realism and usual mathematical representations.

The mathematical representations are based on binary logic, precise numbers, differential equations and the like. Classes of objects referred to in Zadeh's citation exist onlythrough such mental representations through natural language terms such as high pressure, tall boy, small size, etc. and also with nouns such as animal, ladder etc. Classical logic is too rigid to account for such categories where it appears that membership is a gradual perception rather than an all/or nothing matter. The power of clarity of real numbers is far beyond the incomplete level of precision found in mental representations. The latter are meaningful summaries of perception phenomenon that accounts for the complexity of the world.

Analytical representation of physical phenomena can be fruitful as models of reality, but are sometimes difficult to appreciate because they do not explain much by themselves, and may remain unclear to the non-specialist.

The theory of fuzzy sets can be considered as the phenomenon of ambiguity across allsystems displaying this property and its consequences. Fuzzy set theory is the mathematical development that holds great promise in becoming the meta language of ambiguity in the context of the systems paradigm which has been offered as a counter part to the traditional science paradigm. Fuzzy set theory offers generalizations of set theoretic concepts such as intersection and union. Thus it brings categorical concepts into the dimensional realm. The notion of fuzzy set is a technical tool to mathematically grasp the use and the effect of vague notions in a manner completely different from the way classical mathematics is treating them.

Fuzzy set is a newly emerging mathematical framework to exemplify the phenomenon of uncertainty in real life tribulations [85]. A mathematical framework to describe the phenomena of uncertainty in real life situation is first suggested by L.A.Zadeh in1965. Probability is inadequate for dealing with "certain kinds" of uncertainty [92]. Thus alternatives are needed to fill the gap. One such alternative is Zadeh's possibility theory- 1978, the genesis of which lies in his theory of fuzzy sets. Because probability theory prescribes a calculus for the treatment of uncertainty about the outcomes of a random phenomenon, but not about the uncertainty of classification (or the placement of an outcome in a given class). In 1986, Zadeh has claimed that "probability lacks sufficient expressivenessto deal with uncertainty in natural language". In contrast, fuzzy set theory prescribes a calculus for the treatment of uncertainty associated with classification, or what has been termed "imprecision" [92]. Because it is possible that both uncertainty and imprecision canbe present in the same problem, Zadeh (1995) has also claimed that "probability must be used in concert with fuzzy logic to enhance its effectiveness. In this perspective probability theory and fuzzy logic are complementary rather than competitive" [92]. Fuzzy sets were introduced by Zadeh in 1965 based on the premise that an exact description of many real world situations is virtually impossible, and that imprecisely defined "classes" play an important role in human thinking and natural language. Examples are commonly used adjectives, such as "substantial", "significant", "accurate", "approximate", "small" and "medium" [92].

Furthermore, such activities as the communication of information, speech recognition, knowledge representation, medical diagnosis and assessment of rare events suggest that the human brain often reasons with vague assertions, a fact that one needs to accept and to adjust to. All the same, computers that permeate our everyday lives do not reason as brains do and it has been argued that the main distinction between human intelligence and machine intelligence lies in the ability of humans to manipulate imprecise concepts and imprecise instructions [92]. The notion of fuzzy sets strives to balance exactness and simplicity in such a way that complexity can be reduced without over simplification. There are situations, however, in which the meaning of a word or symbol cannot be captured adequately by an ordinary set. The term cold for example denotes the range of cold temperatures, which may vary from context to context but, clearly, always lacks a sharp boundary [83].

Analogously, the set of people one might call ones friends is not as sharply defined aswould be required if classical sets were to be used. It is Zadeh's contribution that he providedus in 1965 with a formal framework that allows it to capture the meaning of vague concepts: the theory of fuzzy sets. Fuzzy set theory is very much a paradigm shift that first gained acceptance in the Far East and its successful application has ensured its adoption around the world [83]. A paradigm is a set of rules and regulations which defines boundaries and tells uswhat to do to be successful in solving problems within these boundaries. For example the useof transistors instead of vacuum tubes is a paradigm shift – likewise the development of fuzzy set theory from conventional bivalent set theory is a paradigm shift [83]. A fuzzy set is defined mathematically by assigning to each possible individual in the universe of discourse a value, representing its grade of membership, which corresponds to the degree, to which that individual is similar or compatible with the concept represented by the fuzzy set [87]. In contrast to classical crisp sets where a set is defined by either membership or non-membership, the fuzzy approach relates to a grade of membership between [0,1], defined in terms of the membership function of a fuzzy number. Alfred L.Guiffrida, Rakesh Nagi discussed the applications of fuzzy set theory in production management. Fuzzy set theory is now applied to problems in engineering, business, medical and health sciences and the natural sciences. Fuzzy relation on a set was first defined by Zadeh in 1965.

Fuzzy Set Theory finds in image processing a growing application domain. This may be explained not only by its ability to model the inherent imprecision of images together withexpert knowledge, but also by the large and powerful toolbox it offers for dealing with spatial information under imprecision [21]. Various fuzzy related algorithms in the domain ofimage processing and pattern recognition have been discussed in [93]. Graph theory is proved to be tremendously useful in modelling the essential features of systems with finite components. Graphical models are used to represent telephone network, railway network, communication problems, traffic network etc [34]. Graph theoretic models can sometimes provide a useful structure upon which analytic techniques can be used. A graph is also used to model a relationship between a given set of objects. Each object is represented by a vertex and the relationship between them is represented by an edge if the relationship is unordered and by means of a directed edge if the objects have an ordered relation between them. Relationship among the objects need not always be precisely defined criteria; when we think of an imprecise concept, the fuzziness arises [34].

In the current time, especially in the computer world, the security of data becomes an important issue. A novel fast method for encrypting and decrypting images, based on fuzzy graph mapping technique, the fuzzy graphs are obtained from a matrix of image's pixels, and then they are used to encrypt an image. The experimental results show that this method ismore efficient, high level security, low loss, less and high speed [34].

FUZZY LOGIC

The theory fuzzy logic is based on the notion of relative graded membership as by theprocess of human perception and cognition. Fuzzy logic can deal with inspired information arising from computational perception and cognition that is uncertain, imprecise, vague, partially true, or withoutsharp boundaries. Fuzzy logic allows for the inclusion of vague human assessments incomputing problems [46]. For example, the vehicle travel time or vehicle capacity on a road network may not be known exactly. In such cases, it is natural to

deal with the uncertainty using the methods of fuzzy logic [83]. Also, it provides an effective means for conflict resolution of multiple criteria and better assessment of options. New computing methods based on fuzzy logic can be used in the development of intelligent systems for decision making, identification, pattern recognition, optimization, and control [46].

Fuzzy logic is extremely useful for many people involved in research and development including engineers (electrical, mechanical, civil, chemical, aerospace, agricultural, biomedical, computer, environmental, geological, industrial, mechatronics), mathematicians, computer software developers and researchers, natural scientists (biology, chemistry, earth science, physics), medical researchers, social scientists, economics, management, political science, psychology, public policy analysts, business analysts, jurists, etc.[46] .

Indeed, the applications of fuzzy logic, once thought to be an obscure mathematical curiosity, can be found in many engineering and scientific works. Fuzzy logic has been used in numerous applications such as facial pattern recognition, air conditioners, washing machines, vacuum cleaners, antiskid breaking systems, transmission systems, control of subway systems and unmanned helicopters, knowledge-based systems for multi objective optimization of power systems, weather forecasting systems, models for new product pricing or project risk assessment, medical diagnosis and treatment plans, and stock trading. Fuzzylogic has been successfully used in numerous fields such as control systems engineering, image processing, power engineering, industrial automation, robotics, consumer electronics, and optimization [46]. This branch of mathematics has instilled new life into scientific fields that have been dormant for a long time.

The objective of this special issue entitled “Real-Life Applications of Fuzzy Logic” is toexplore the advances of fuzzy logic in a large number of real-life applications and commercial products in a variety of fields. Although fuzzy logic has applications in a number of different areas, it is not yet known to people unfamiliar with intelligent systems how it can be applied in different products that are currently available in the market[46]. The authors present a novel fuzzy deterministic non-controller type (FDNCT) system and an FDNCT inference algorithm (FIA). The FDNCT is used in an intelligent system for detecting and eliminating potential fires in the engine and battery compartments of a hybrid electric vehicle [75]. They also present the simulation results of the comparison between the FIA and singleton inference algorithms for detecting potential fires and determining the actions for eliminating them. Rahul Dixit and Harpreet Singh, compare various logic analysis methods and present results for a hypothetical target classification scenario. They show how preprocessing can reasonably preserve result confidence and compare the resultsbetween Boolean, multi-quantization Boolean, and fuzzy techniques. They look at techniques to simplify data analysis of large multivariate military sensor systems[98-99].

Faisal Kaleem, Abolfazl Mehbodniya, Kang K. Yen, and Fumiyuki Adachi, present the design and implementation of a fuzzy multi-criteria scheme for vertical handoff necessity estimation. Their method determines the proper time for vertical handoff while considering the continuity and quality of the currently utilized service and end-user satisfaction [31].Arati M. Dixit and Harpreet Singh, a fuzzy inference system to automate crack detection and impact source identification (CDISI) and present their work on a microchip for automated CDISI

[6] . Amiya Kumar Dash proposes a method for multi-crack detection of structure using a fuzzy Gaussian technique [5]. Debasish Pal and Debasish Bhattacharya examine the reduction in human work efficiency due to growing road traffic noise pollution. Using fuzzy logic, they monitor and model disturbances from vehicular road traffic and the effecton personal work performance [27].

Abolfazl Doostparast Torshizi and Jamshid Parvizian present an innovative failure analysis approach that combines the flexibility of fuzzy logic with the structural properties of stochastic Petri Nets. This algorithm has a diverse range of industrial applications [2]. Ki-Young Song, Janusz Kozinski, Gerald T.G. Seniuk, and Madan M. Gupta introduce an innovative mean-variance neural approach for group decision making in uncertain situations. Also theyprovide a case study with the excluded-mean-variance approach that shows this approach can improve the effectiveness of qualitative decision making by providing the decision maker with a new cognitive tool to assist in the reasoning process[63]. Ashu M. G. Solo shows how the moderator and presidential candidates in a presidential forum needed fuzzy logic to properly ask and answer a debate question. They shows how an understanding of fuzzy logic is needed to properly ask and answer queries about defining imprecise linguistic terms. Then Solo distinguishes between qualitative definitions and quantitative definitions of imprecise linguistic terms and distinguishes between crisp quantitative definitions and fuzzy quantitative definitions of imprecise linguistic terms[11]. Mohammad Hossein Fazel Zarandia, Neda

Mohammadhasanb, and Susan Bastanic describe their fuzzy expert system for evaluating intellectual capital. This assists managers in understanding and evaluating the level of each asset created through intellectual activities[79]. This special issue describes many importantresearch advancements in real-life applications of fuzzy logic. Also, it creates awareness of real-life applications of fuzzy logic and thereby encourages others to do research and development in more real-life applications of fuzzy logic. There are numerous other applications of fuzzy logic that have yet to be researched and developed.

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