Indian Journal of Pure & Applied Physics
Vol. 58, January 2020, pp. 44-49

Relationship between qualitative physics and fuzzy logic in natural subsystems

G Prabakaran[a*], D Vaithiyanathan[b] & Madhavi Ganesan[c]

[a]Department of Electronics and Communication Engineering, College of Engineering, Guindy, Anna University, Chennai 600 025, India
[b]Department of Electronics and Communication Engineering, National Institute of Technology Delhi, Delhi 110 040, India
[c]Centre for Water Resources, College of Engineering, Guindy, Anna University, Chennai 600 025, India

Received 5 August 2019; accepted 28 November 2019

The purpose of this research is to present a comparison between the two ad hoc appearance and control techniques of conceptual systems. In that respect, it is a description of the interconnected notion between the principle of qualitative physics and of ambiguous quality. On that basis the first point is to determine the key feature of each approach is significant. In the early stages of the product development and forecasting process, a large number of input energies were used for its creation. However, they are still being used in nature, though not subjectively impure. Therefore, this research presents the concept of the relationship between qualitative physics and fuzzy logic in terms of developing predictive outputs and using logical resources. Finally, the relationship between qualitative physics and fuzzy logic processes has been proven with the support of the selected natural subsystem.

Keywords: Qualitative physics, Fuzzy logic, Natural subsystems

1 Introduction

In general, how do we define statements of mild fever, low blood sugar, or high blood pressure, or feeling unbearable pain or feeling a little hungry? Fuzzy logic (FL) is a decision reached by a computer program that recognizes that all values are yes or no, and not absolute, such as black and white. Fuzzy logic treats calculations with varying degrees of completeness. For example, it may be a color-based (black or white) indicator, but at the same time assessment is done on its own. It is based on ambiguous and inaccurate data, causing the need to find an easy way to achieve a definite result. For example, How to solve problems by representing the attitude of a person to make decisions very quickly. Remember what happens when you go in a shower and the temperature is too cold, you make the water very comfortable with little trouble. Fuzzy logic refers to this kind of behavior. It is based on a simple, rule-based structure and empirical basis, (e.g., X and Y means Z). Fuzzy logic can be used to know if it is difficult or impossible to set up with simple, linear math. The controller is a tool that includes a set of control processes that have adjustable inputs, outputs, and a mechanism to change them. It consists of two loops, one a control ring and the other a parametric adjustment ring. It helps to install any automated system, including a range, depending on the target. An example is blood pressure (BP) control during surgery. The ambiguous control device can monitor the patient's BP, and if it is too low, the pressure value of the fluids will rapidly reach until the vein is satisfied with blood.

Fuzzy logic was invented in 1964 by Lofty Zadeh as a technique of "approximate reasoning", which refers to knowledge as "the closest to natural language "and due to quantum mechanics, its main ideas are well known to physicists. In fact, the well-known Heisenberg uncertainty relationship began with the creation of the scientist and ceased to consider basic particles, of which our world is "accurate", objects[4]. According to quantum physics, an electron (or other subatomic particle) with a certain energy cannot be positioned properly in space. Instead of exact coordinates, we can only talk about the probability of finding a particle in a given region. In classical physics, an electron is located at point A or point B, but never at both. In quantum physics, two-valued Boolean logic ("one or the other") does not apply to a variety of auxiliary processes, so it is possible to find an electron at more than one point. Such similarity between quantum physics and fuzzy logic can be applied profoundly to fuzzy-based natural subsystems. In fact, when creating a natural subsystem to improve productivity, one of the first challenges is to engage different properties on the

*Corresponding author (E-mail: kgp.com@outlook.com)

same site. Usually, this is seen as having something different, a condition that varies from 0 to 1. We really need to fill the attitude. At the beginning of the approach, a real value is converted to linguistics values, and the linguistics values are converted to real values, which are very common in the fuzzy system. Meanwhile, the mathematical apparatus of quantum physics is a well-developed measurement tool, thereby making a formal process very close to ambiguity. Therefore, it is a case study to show the validity of the relationship between qualitative physics and fuzzy logic.

2 Optional Numbers of Treats for Capita

Natural subsystem offers optimum conditions for world, human health, and quality of life. At the same time, they are one of the biggest energy consumers. Therefore, the energy consumption system in that place constitutes their high demands. Consumption is aimed at reducing energy consumption while ensuring the yield of control and outputs. The classic control technique cannot be satisfactorily coded because it contains basic structure, meteorological parameters, growth response, seasonal response, and plant nutrients. Thus, the fuzzy logic approach provides the right medium for dealing with the internal and other characteristics of such a vague object substances and provides an intellectual mechanism for compliance[1-2]. A model-free system is designed to control the proportional integration of multiple variables into eight tight constraints, such as growth, climate, soil property variables, seasonal variations, water variables and insect infection variables of natural subsystems[3]. In such a situation, we know that even in natural phenomena there is a relationship between quantum physics and fuzzy logic.

Therefore, classical views on the approaches and the possibilities of quantum physics have been reported in literature[5-6]. They then begin a qualitative physics explanation for physical systems and the introduction of its effects provides a consistent physics explanation and reduces the valence of the effects[7]. It builds on the theory of the qualitative physics process with the concept of the active process of controlling the equations, thus introducing the influence of rationality on commonsense quality modeling, mainly by considering natural subsystems. The interval-based time model has been studied specifically in the natural subsystem model, which can be extended to include both the physical and linguistic aspects of the experiment. The main application of qualitative physics in approximate reasoning is the concept and mainly aims to explain the world of qualitative physics. Accordingly, the key variables include static variables, values, rules, and assumptions. In general, these values are assumed to be a finite set of constants. In addition, these values may in some cases belong to a set of values that are sorted. A standard real value, in this case, a correspondence introduces the values of symbols and generates the values of the quality.

The fuzzy model we have just described in previous section can be easily adapted to design natural subsystems for agriculture. Take, for example, here the parameters of this method as an agricultural base. The design is installed for the following unavoidable reasons. Farmers generally face many obstacles in getting their investment back, and in many cases, they failed. This is a systematic approach to recovering from their repeated failures. The proposed approach to this is the Smart embedded decision support system (DSS). This ensures the minimum benefit-cost ratio (BCR) of agricultural land. In addition, the proposed work attempts to explain such a long-standing problem in long-term monitoring to prevent repeated failures through a systematic approach. Initially, two agro-climatic zones (ACZ) were selected to determine site testing. Selected ACZs are further divided into drip irrigation systems where soil fertility and water quality are studied and techniques for crop cultivation[8-9]. Similarly, an assistant agricultural officer has been set up to help the area where the farmers are located to recover from these recurring problems. The area assistant agricultural officer knows if the farmers can get at least one. Perhaps, they can meet their own needs and get a fifth of the cost. They are designed by industry experts to make a one-time income, not foreseeable, for their counterfeit needs. In particular, decision making has undergone significant changes in agriculture over the past few years. The decision-support system is a tool for measuring the yield of crops with vague notions. It aims to provide a complete decision support system to farmers. In addition in such an event, the fertility of the soil will not be affected in any way.

In modeling such a system A_1 is given and a second system towards A_2 is constructed using some of the necessary conditions to achieve target output on system A_1. A_2 is said to be a model of A_1. Its formal structure is shown in Fig. 1. Prediction is more

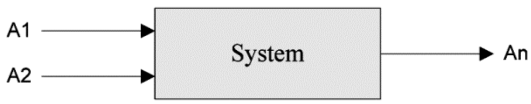

Fig 1 – Formal system.

complex than controlling the process than simulation in that sense prediction uses modeling simulation were used[10]. Formally, a control problem can be characteristics and denote by natural subs system is cascaded system < A_1 $A_{2.....}$ A_n> where A_1 and A_2 is the system and A_n is the goal of the system targeted output. To find a prediction and development of system is to design the modeling pattern in such a way that a composite system constituted by the systems A_1 and A_2 conditions and output A_n. Modeling is a valid platform that can be used to identify and control problems, for example, checking a factor-based target output function, which affects the input of many factors, including a large number of input variables. The conceptual distinction between modeling, forecasting, and development is basically the same when comparing the two approaches to dealing with underlying ambiguity and ambiguity. The formal structure is given in Fig. 1.

The case of a natural subsystem, i.e., agricultural productivity system is used to demonstrate the qualitative physics concepts and fuzzy logic reliability estimation and modeling method. The new design is based on the current state of the agricultural production system and some of these changes are made based on field-level analytical data. Field-level analysis data or test results in the latter stages of the proportional directives provide valuable information on agricultural productivity. In addition, it helps to deal with changes in decision issues, to eliminate and improve on existing problems. Therefore, in that cases of fixing the error and predicting the productivity relationship between qualitative physics & fuzzy logic scenarios are essential. For this purpose, different productivity influenced parameters are significant. Since, the designed qualitative physics and fuzzy logic-based system design were analyzed and following major problems identified for future actions:

(i) predict the exact productivity,
(ii) reduce the consumption of input and
(iii) provides the appropriate time period for operations.

Changes have been implemented with appropriate designs to alleviate their problems. An example of a proportional derivative process of a natural subsystem is a real-life scenario, but other details and real numbers have been partially altered due to the proprietary nature of the information and the applicability of the structure.

3 Case Study Examples

Let us consider the natural subsystems reported above. Generally, the purpose of research is to minimize the loss to farmers. In this example, the main purpose is to design the member function of the linguistic variable to achieve higher productivity. Now we will construct the fuzzy-based decision support system if a land profile is perfect and other influencing factors are prioritized and the land produces higher productivity. This goal is achieved by handling various functions related to the system.

The database will already have localized and terrestrial system data, such as the dynamite line, linear elements and the factors that can participate in the operating effects of the plants. The quintessence of the system is that the expert appearance does not need in every farmer’s field and several related laboratory tasks adequately sized form professional appearance, reducing the vegetative growth of side effects with the past and real-time database for a definitive performed bought the breeder is based on the effective cost rate to calculate is to. Benefit-cost ratio is the number of the crop production wheel and the cost of this benefit is a concept of economic background. This is to find the conditions in which the farmers are able to get their investment without losses in a particular soil landscape, regardless of the importance of product improvements and benefits on a systematic basis. As the farmer may not be able to withdraw their investment evenly, this application is found to be based on the recommendations of the proposed system and the appropriate recommendations are given on the basis of experts and expertise. Here, the smart embedded DSS is basically to represent the fuzzy logic system. A database of profiles about agricultural lands is used. At least three entities required to direct the smart agriculture DSS. The soil is the first entity, which includes primary, secondary and micronutrients. All other factors that are involved in determining the growth of the crop are the second entity. First and second entity interconnects the DSS to ensure the minimum income required. Finally, the smart decision support system is viewed as a third entity because this is only to predict the future yield in advance. This agricultural data is nothing but all constants that are subdued are uncertain and ambiguity. Crop essential factors not only describe the overall growth and production of the crops, since it also associated with other influencing factors. This system is compatible with all the predictability of suitable or appropriate crop production. The present work comprises of analyzing the agriculture data of zone and predicting the future throughput of to be cultivable crops. Experts are more eager in knowing whether the farming data are low, moderate, high and very high and also the trend of farming parameters. It would much easier and better used to install the constraints in linguistic variables and to fit fuzzy ideas in different ways and it is best to build a predictive models to predict the crop throughout fuzzy set in which rather than ordinary variables. Hence, the agriculture data has been fuzzified such many as primary nutrients, secondary and micronutrients, climate parameters, and soil and water variables with the linguistic variables of low, ideal, moderate and high. The design of fuzzy membership function has been followed by the regulation of food and agriculture organization (FAO). Furthermore, several instructions for handling some strange situations have been derived from two or more peasants. It is the obvious parameter ranges of fuzzy sets (low, moderate, high and excellent) where farmers falls into the fuzzy type sets as the same parameter values are the same universe. The most commonly used defuzzification method was used. The possibility and its production output are computed as the low, moderate, high and excellent. Therefore, a high-level programmed gateway array was used to accelerate the computation speed of the system. This is because the involvement of FPGA is numerous such as model prototype designs, automatic vehicle, temperature measured machines in line with industrial control equipment’s. Moreover, FPGA was implemented in robotics, satellite, spacecraft equipment’s likewise minimum complexity of usages in many domains. The smart DSS based embedded system has been implemented in FPGA Zynq family xc7z010-2clg400 target device. For FPGA implementation the Xfuzzy platform has been used. Xfuzzy is the platform it has been created the automatic RTL netlist for given specific fuzzy logic system[11-13]. Therefore, used the Xfuzzy created netlist platform corresponding bitstream pattern was generated for overall system and same was synthesis in FPGA board. Fuzzy based decision-making in the hardware occupies excessive logic evidence when establishing a support system. It is, therefore, possible to reduce the efficiency of the designing system and reduce the speed, but occupying the general logic resource utilization of Xfuzzy is completely avoided. The table1 illustrates the logical utilization of resource usage of smart embedded DSS.

The system was tested for 80 farmlands. In this actual experiment the primary nutrient, secondary nutrient, micronutrients and other factors of seasonal conditions such as temperature, humidity, rainfall, water and soil condition, and environmental impacts are affected by plant diseases were taken into account. Initially, the soil nutrients reports of the land are given. Based on the soil nutrients reports the throughput of the crop and needed fertilizer levels are computed by the system. Using the parameter the corresponding membership functions has been computed and followed by depends on the availability of soil nutrients the system may be suggested exact nutrient needs. The essence of this creation, however, is that if it cultivates a crop in favorable seasoning, how much yield it is, how much production can be achieved in soil conditions. For instance, humidity, temperature, and rainfall can generate good yields in average levels. Similarly, whether it is micronutrient or nutrient, the own scale of ppm are untouched or when it exceeded, it causes visual defects to the plant for example as far as boron is concerned, it does not affect the plant only when it is 0-5 ppm scale. Based on these criteria, the decision support system is set up and tested in farmers' field and productivity can be achieved if the other factors cooperate. The Table 1 shows the influence of the decision support system on the benefit cost ratio. In some cases the production has been greatly affected by the tragic circumstances. The annual production of northeast region decreased and their income was hampered due to the heavy rainfall in 2015. The climate required to grow a plant is shown in Figs (2-4). The productivity scenario of BCR is listed in Table 2.

Table 1 – Logical resource utilization summary of the smart embedded DSS Logic

Logic utilization	Total used
Number of occupied slices	26
Number of slice flip flops	64
Number of slice registers	27
Number of bounded IOB’s	14

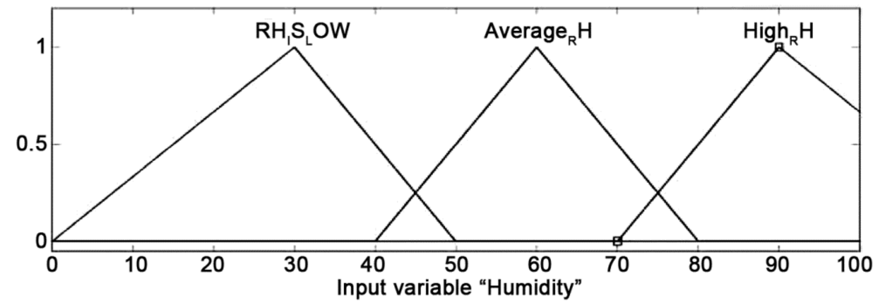

Fig 2 – Humidity fuzzy membership function.

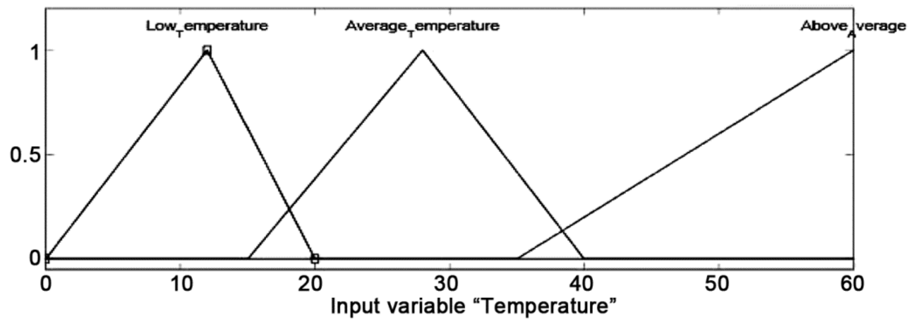

Fig 3 – Temperature fuzzy membership function.

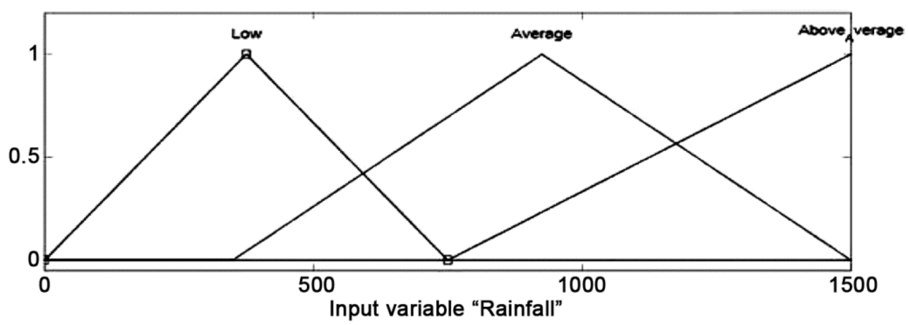

Fig 4 – Rainfall fuzzy membership function.

Table 2 – BCR scale for with and without DSS

S No	Year	Benefit cost ratio			
		Without DSS		With DSS	
		Prediction	Productivity	Prediction	Productivity
1	2013-2014	-	1-2	5-8	6
2	2014-2015	-	1-3	5-9	8
3	2015-2016	1-3	6-10	4	

4 Trend of Benefit Cost Ratio

It is placed here to illustrate the similarity between qualitative physics and fuzzy logic. Using fuzzy logic, fuzzy rules for both the productivity factor and the benefit measure of agriculture productivity were developed and converted into linguistic constants. Here, we avoid the ambiguous models. Finally we deal with the trend data of the agricultural benefit cost ratio. For this purpose we use the agrarian productivity data collected at the field level. The benefit-cost ratio is an inventory box of economic background that is particularly used to define agricultural product outputs. Two types of factors are considered qualitative models of rental data, one is the agricultural productivity influence factor and the other is the amount of agricultural benefit cost that determines production. This implies that we are subjected to qualitative analysis by looking at data within the context of the overall cost-benefit economy.

5 Conclusions

An interesting inference of this research is that even if they are in accessible areas, they need to overlap and met it. In addition, this study clearly shows that within the confines of the eye-head coordination system both qualitative physics and fuzzy packages are interdependent. Besides, the system illustrates appropriate techniques for modeling the various features of these natural subsystems. Furthermore, this qualitative physics and fuzzy logic is used as a hierarchical model of the eye-head coordination system to create a more promising field to investigate. These natural subsystems are the physical model for the different processing stages in which the neural properties of the traditional models (transactional functions), along with the neural networks, participate in the ambiguous and the qualitative. This step-by-step approach is applicable, but at the same time, the appearance of different complex systems is associated with high-level strategic decisions and low-speed control systems.

Acknowledgment

This work was conducted by Centre for Water Resources and the reported results were obtained within the framework of the National Agriculture Development Program (NADP) funded by the Government of India, Under the Government of Tamil Nadu through the surveillance of Department of Horticulture and Plantation Crops.

References

1 Neill D M & Freiberger P, *Fuzzy Logic*, Simon & Schuster, New York, (1993).
2 Zadeh L A, *Soft Computing and fuzzy Logic*, IEEE Software, Los Alamitos, CA, (1994).
3 Prabakaran G, Vaithiyanathan D & Ganesan M, *Comput Electron Agricul*, 150 (2018), 88.
4 Bohr N, *Atomic Theory and Human Knozulcdge*, John Wiley, New York, (1958).
5 Michie D, Expert systems in the micro-electronic age Edinburgh, *Edinburgh University Press*, (1979).
6 Hobbs J R & Moore R C, *Formal theories of the commonsense world*, Intellect Books, 1 (1985).
7 De K J, & Brown J S A, *Artificial Intelligence*, 24 (1984) 7.
8 Jayaram M A & Netra M, *J Intelligent Syst*, 21 (2012) 363.
9 Kawtrakul A, Rudeemas A & Hutchatai C, *In Proceedings of the 7th International Conference on Management of computational and collective intelligence in Digital Eco Systems*, ACM, (2015) 250.
10 Schmitt I, Nürnberger A & Lehrack S, *On the relation between fuzzy and quantum logic*, In Views on Fuzzy Sets and Systems from Different Perspectives Springer, Berlin, Heidelberg, (2009) 417.
11 Brox M, Santiago S S, Ernesto D T, Piedad B & Francisco J M V, *IEEE Trans Indus Inform*, 9 (2013) 1635.
12 Sánchez-Solano S, Brox M, del Toro E, Brox P & Baturone I, *IEEE Trans Indus Inform*, 9 (2013) 1361.
13 Barriga A, Sánchez-Solano S, Brox P, Cabrera A & Baturone I, *Int J Approx Reas*, 41 (2006) 164.