Fuzzy Logic for Student Performance Evaluation

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Abstract— In educational systems/institutions typically the success is measured by academic performance or how well students Evaluation must be done in best possible fairer manner if not degrade their future prospects and career opportunities. This study proposes a new performance evaluation method based on Fuzzy logic systems . Results of our methods for some real samples shows that our approach can be practical method for evaluating students performance in the university.

The objectives of proposed system is to provide more transparent and fairer result to all students. To achieve this makes use of Fuzzy logic.

Keywords—student performance evaluation ,Fuzzy logic system, data.

I.　INTRODUCTION (*HEADING 1*)

- Student performance evaluation is one of the most important tasks in an evaluation institute. In educational institutions the success is measured by academic performance, or how well a student meets standards set out by governmental educational policies and/or the institutional rules and regulations. As career competition growing ever fiercer day by day the importance of students doing well in all sectors including academic institutes has caught the attention of parents, legislators and government education departments.

- Fuzzy logic was put forward earliest in 1965 by L.A. Zadeh. One of the primary applications of fuzzy logic was subway systems in Sendai city of Japan . Educational assessment is the process of documenting, usually in measurable terms, knowledge, based on the criteria incorporated. The assessment is formally defined as a measure of skills, attitudes and belief. In recent times, towards describing what a student has learned or can do in greater detail different types of documentations are in use.

- This can be done in performance evaluation by Fuzzy logic technique . In order to apply the fuzzy set in

education domain effectively, there have been a lot efforts in defining the effective membership. Bai and Chen define fuzzy membership functions for fuzzy rules. The Fuzzy Logic techniques were proposed for determining the level of a student's understanding of a certain subject matter in the context of Intelligent Tutoring System, and in a fuzzy approach was

- proposed to assess student performance based on several criteria with a strong suggestion that the method be applied to Computer Assisted Instruction.

- We'll simply clean the data from the info set during pre-processing. It is conventional to separate the desired knowledge from the undesirable knowledge. With historical knowledge, the RECURRENT Neural Network-based model is trained. Then, during the next 6 hours, we'll construct a graph that will help us predict accurately. Given the enormous number of techniques available, we have chosen to use two primary algorithms: pre-processing and RECURRENT neural network (RNN). Preliminary process of information is to prepare it for further analysis by the primary processor. This term refers to any initial process stage in which multiple steps are required to organize knowledge for the user. A RECENT Neural Network (RNN) is a Deep Learning rule that processes incoming images and is capable of distinguishing one image from others. When compared to other classification methods, the amount of pre-processing required is significantly less.

II. MOTIVATION

Academic performance, or how effectively a student satisfies requirements set out by governmental educational policy and/or the curriculum, is used to gauge achievement in educational institutions. Institutional policies and procedures. As far as career competitiveness goes, The value of students is increasing every day. Performing well in a variety of fields, including academic institutions, has parents, legislators, and the government's attention Departments of education and the like The goal of this proposed method is not to replace the current classical method of evaluation; rather, it is to supplement the current system by offering more information for educational institutions to use in making decisions. This method was developed in a university that was directly endowed by the author.

III. APPROACH

Fuzzy Methodology involves the steps as shown in

Fig. 1:semester 1, semester2, and semester3 are all taken here, hence there are three input variables. Then there are two performance-related output variables.
Three steps were involved in evaluating academic performance using fuzzy logic:
1. Inputs are fuzzed to examine outcomes and output performance value.
2. Tables 2 and 4 indicate the relevance rules and inference method that were determined.
3. Performance value de-fuzzification.

IV. FUZZY LOGIC

[1]Fuzzy logic is an extension of Boolean logic by Lotfi Zadeh in 1965 based on the mathematical theory of fuzzy sets, which is a generalization of the classical set theory. By introducing the notion of degree in the verification of a condition, thus enabling a condition to be in a state other than true or false, fuzzy logic provides a very valuable flexibility for reasoning, which makes it possible to take into account inaccuracies and uncertainties. One advantage of fuzzy logic in order to formalize human reasoning is that the rules are set in natural language.[1]

[2]In classical logic, the arguments are of the form:
{If p then qp true then q true. In fuzzy logic, fuzzy reasoning, also known as approximate reasoning, is based on fuzzy rules that are expressed in natural language using linguistic variables which we have given the definition above. A fuzzy rule has the form: If belongs to A and y belongs to B then z belongs to C, with A, B and C fuzzy sets[2]

The outcome of applying a fuzzy rule is thus determined by three factors:
1. the fuzzy implication definition chosen
2. the membership function of the fuzzy set of propositions placed at the fuzzy rule's conclusion,
3. the degree of validity of propositions located at the premise. Fig 2(fuzzy system architecture)

RULE BASE: This section comprises the experts' set of rules and IF-THEN conditions for governing the decision-making system based on linguistic data. Recent advances in fuzzy theory have resulted in a number of useful strategies for designing and tuning fuzzy controllers. The majority of these advancements lessen the quantity of ambiguous regulations.

FUZZIFICATION: This is a technique for transforming inputs, such as crisp numbers, into fuzzy sets. Crisp inputs, such as temperature, pressure, and rpms, are the exact inputs detected by sensors and delivered into the control system for processing.

INFERENCE ENGINE: It assesses the degree of matching between the current fuzzy input and each rule, as well as which rules should be fired based on the input field. The control actions are then formed by combining the fired rules.

DEFUZZIFICATION: This step converts the fuzzy sets generated by the inference engine into a crisp value. There are numerous defuzzification strategies available, with the optimal one being used in conjunction with a certain expert system to minimize error.

V. FUZZY CONTROL

It's a method of incorporating human-like reasoning into a control system. It isn't designed to provide exact explanation, but it is supposed to provide acceptable reasoning. It can mimic human deductive reasoning, which is the method through which people draw inferences from what they know. With the use of fuzzy logic, any uncertainties may be readily dealt with.

VI. FUZZY SYSTEMS

The Fuzzy Inference System (FIS) is a method for interpreting the values of an input vector and assigning corresponding values to the output vector based on a set of fuzzy rules. This is a fuzzy logic method for mapping an input to an output. The system makes decisions and recognizes patterns based on this mapping process.

Mamdani FIS and Sugeno FIS are the two basic types of fuzzy inference systems

Mamdani FIS - Ebhasim Mamdani proposed the Mamdani fuzzy inference system. It was first created to operate a steam engine and boiler combination using a set of linguistic control rules gathered from skilled human operators. The result of each rule in the Mamdani inference system is a fuzzy logic set.

Sugeno FIS-Takagi, Sugeno, and Kang presented the Sugeno FIS fuzzy inference system to provide a systematic approach for creating fuzzy rules from a given input-output dataset. In a first-order Sugeno fuzzy model, a typical fuzzy rule looks like this:.

IF x is A and y is B THEN z = f(x, y)

Where,
- A and B are fuzzy sets in the antecedent
- $z = f(x, y)$ is a crisp function in the consequent.

VII. FUZZIFICATION OF INPUTS

Input variables and their membership functions of fuzzy sets were used to fuzzify the results of input investigations. Each student has three examination results, each of which is based on fuzzy logic input variables. a knowledge-based expert system There are five triangle membership functions for each input variable (Fig2,3). Three parameters (a, b, and c) define a triangle membership function, as indicated in the

diagram (Fig1). Table 1 shows the fuzzy sets of the input variables.

Using a triangular membership function, this function computes fuzzy membership values. A fismf object can also be used to compute this membership function. See fismf Object for further information. The trapmf membership function is similar to this membership function.

$y = \text{trimf}(x, \text{params})$ returns fuzzy membership values computed using the following triangular membership function

$$f(x; a, b, c) = \max(\min(x\text{-}a/b\text{-}a , c\text{-}x\backslash c\text{-}b), 0)$$

To specify the parameters, a, b, and c, use params.

Membership values are computed for each input value in x

VIII. RULES AND INFERENCE GENERATION

In fuzzy inference, input data triggers one or more rules, resulting in an integrated pattern of output membership functions . This corresponds to a student's hazy assessment of his or her performance value.
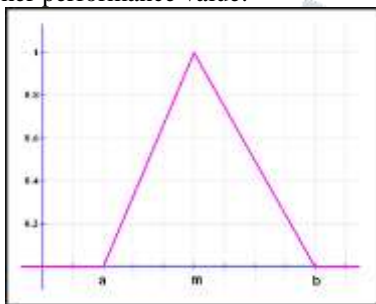

Fig 2: High level perspective(Left: pixel representation of filter, Right: visualization of curve detector filter.)
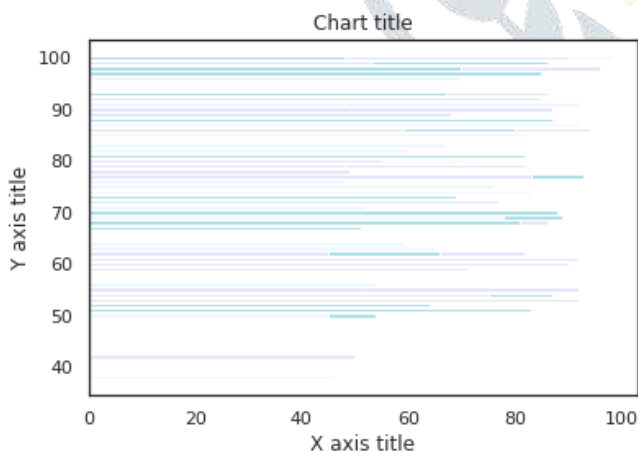
IX. RESULTS

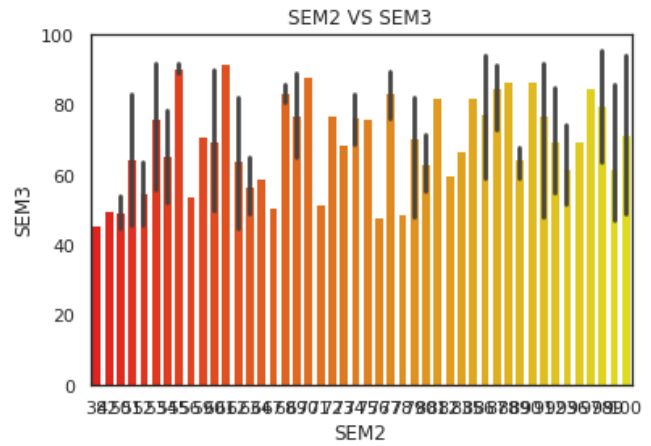**Figure3 : Plot the title between X-axis and Y -axis**

Fig4:This graph represent the semester marks of the student with the comparison of semester2 versus semester3.
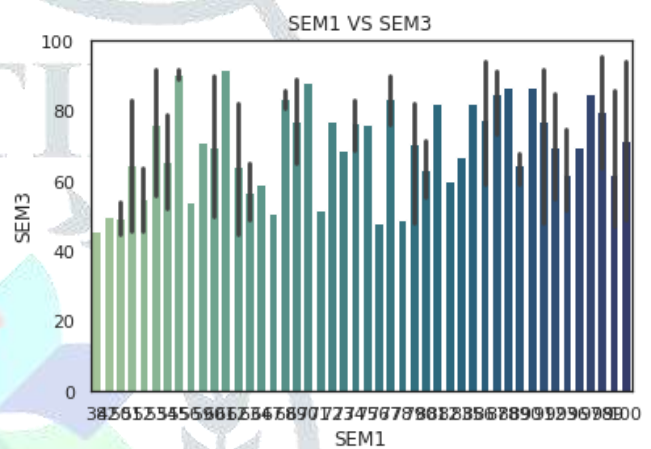

Fig5: This graph representation shows that the comparison between semester1 vs Semester3.
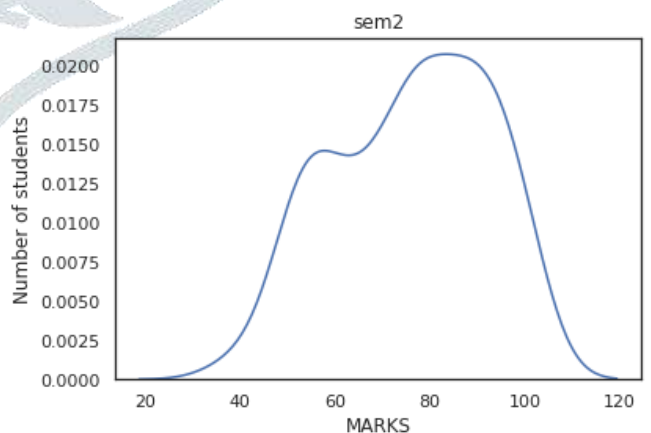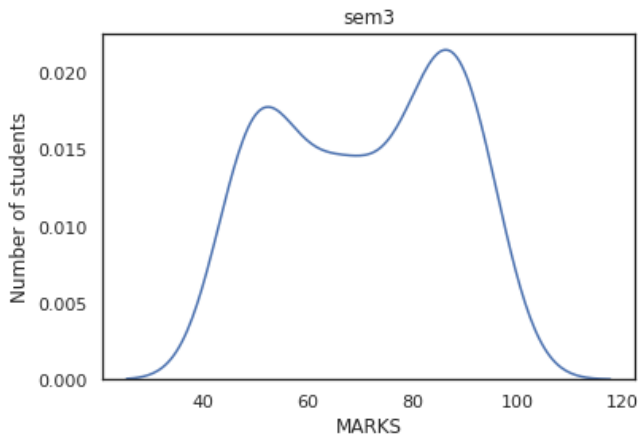

Figure :5 No of Students vs Marks

Fig5: This distribution graph contains the frequency of number of students with marks of the students

Fig6: This is the distribution plot with frequency of students marks with the number of students.

X conclusion

Fuzzy logic is a very good approach to evaluate uncertain and inaccurate results. Therefore it is more better than the traditional statistical method because the input can be weighted in applying the membership function .On a critical look on the inputs of the Fuzzy model an external score helps to determine the exact student's quality since the

possibility of influencing the score will be an insignificant value.

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