

Fuzzy-Based Recommendation System for Research
Topic in the Final year

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Introduction

Most University students are uncertain which research topic to choose for their final year research projects. The students are supposed to learn and demonstrate exceptional skills in problem solving, Analysis, Implementation, presentation and Communication and write reports to graduate with good grades. But the selection of research topics can be overwhelming. Hence, they usually look for guidance and support by reaching out to Professors, Seniors and colleagues. However, the problem lies in finding an expert available to help the students. Also, some experts' opinions tend to be related to their experience as well, without taking the students' mindset into consideration.

In this Project, a Fuzzy based recommendation system was implemented to suggest the Final year research topics for the students who are needing it. Recommender systems provide suggestions of items to be used by the user. Fuzzy logic is used to handle uncertainty arising from similarities between the majors. Fuzzy logic can provide an effective means for conflict resolution of multiple criteria and better assessment of options. The specific objectives are:

- To identify the features that contribute to maximizing student satisfaction on the Topic choice.
- To propose an Intelligent Decision Support System (IDSS) to aid students in the decision making process

Related Work

Recommendation systems have performed a necessary function in education. One of these structures is a Markov Chain Collaborative Filtering Model for Course Enrollment Recommendations by way of (Elham S.Khorasani, 2016). Another recommendation system is the course recommender system the use of affiliation rules through (Narimel Bendakir, 2006). Another recommendation gadget is designed via (Desi Purwanti Kusumaningrum, 2017) entitled Recommendation System for Major University Determination Based on Student's Profile and Interest.

There are also, range of studies that have addressed the research resolution problem. One of these research is The Recommendation System of Thesis Topics Selection Based on Fuzzy-AHP and Fuzzy-ANP by Panca Mudjirahardjo; A. Fauzi; Herman Tolle. The highlight is the study primarily based on the students capability and encounters the identical issues that can be encountered in our problem.

A graphical person interface used to be also used to retrieve on-line information. Hence, the equal factors are used in developing the FRS for the university predominant decision trouble in this paper. Even though the previous studies have used fuzzy professional structures to resolve this problem, it is useful to boost an environment-friendly IDSS for tackling actual world foremost selection, for students applying to Taif University in Saudi Arabia. The meant contribution focuses on the use of fuzzy logic to enhance the overall performance of knowledge-based recommender systems. The mixture harnesses its strength with the fuzzy specialist system.

Methodology

Implementation

The Aim is to define a set of available research areas for each student, i.e the topics where the skill set of a student matches the research topic requirements.

First the Students skills must be identified as for the Computer engineering student the most needed skills are Maths, coding , networking, embedded systems and Database related skills. Since the research topics rely on these skills. These skills are the results of their self evaluation so that they can evaluate themselves with their past experience in the department.

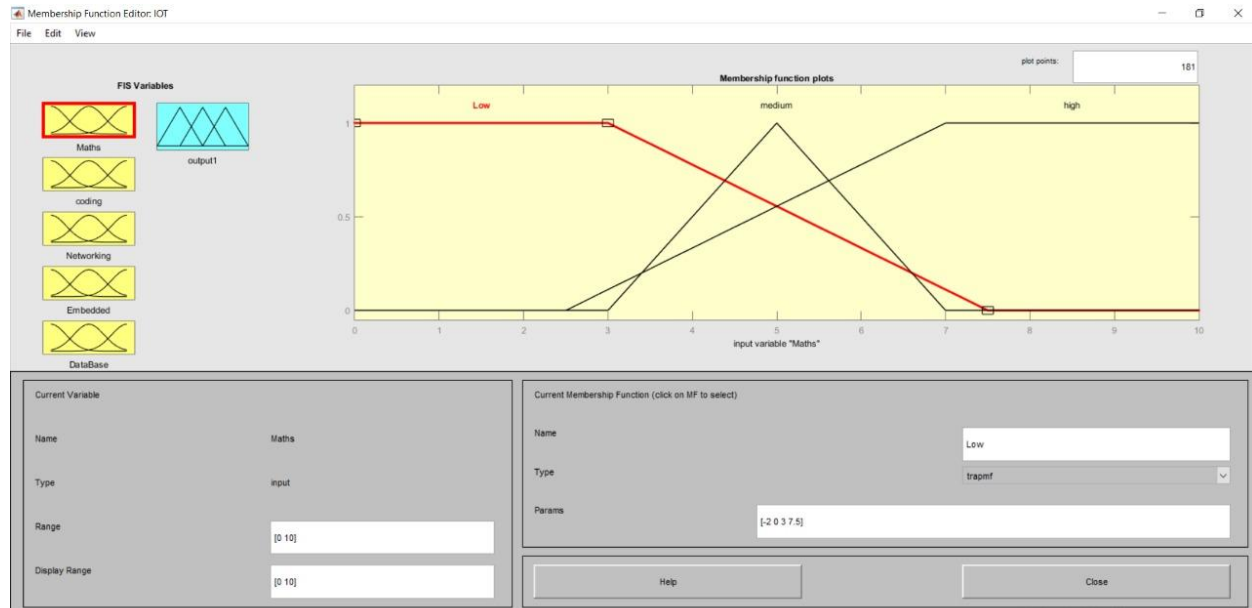
Fuzzy Logic

Inputs : Maths Skills , Coding Skills, Networking Skills , Embedded System skills and Database skills.

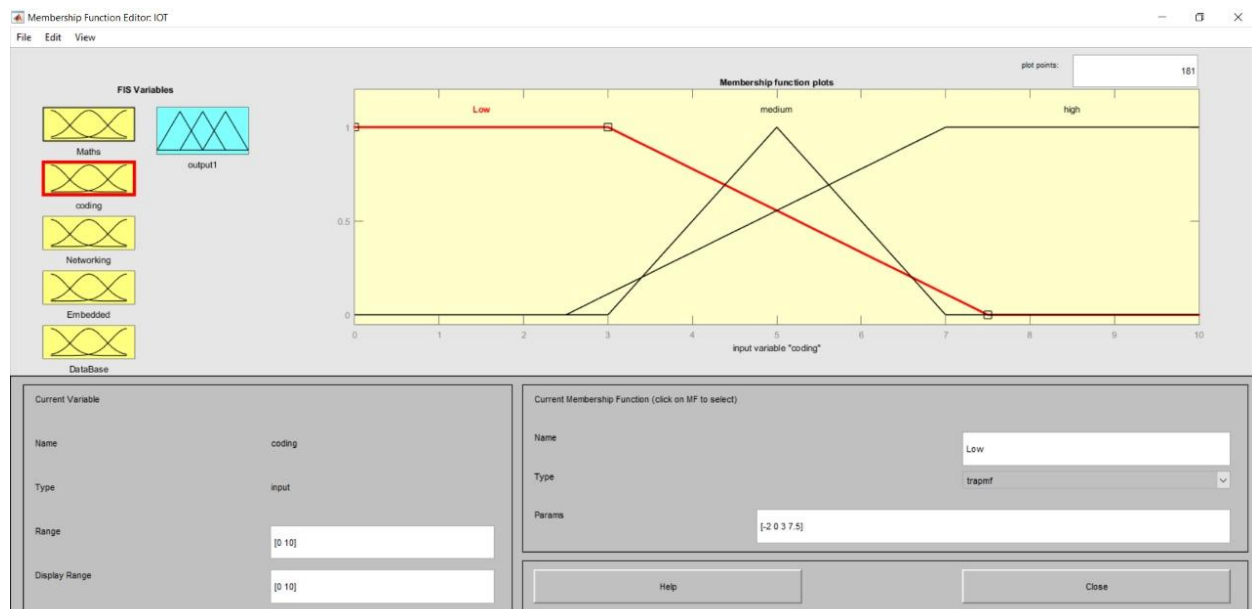
| Type | Linguistic Variable | Linguistic Value |
|--|---|-----------------------------------|
| <ul style="list-style-type: none"> Input | Maths Coding Networking Embedded System Database | High, Medium or Low |
| <ul style="list-style-type: none"> Output | Cryptography Machine Learning Embedded Design Cloud Computing IOT | Recommended or Not recommended |

Identifying the linguistic variable and linguistic values were done at first. In the above table we can see the variables and values that are being used.

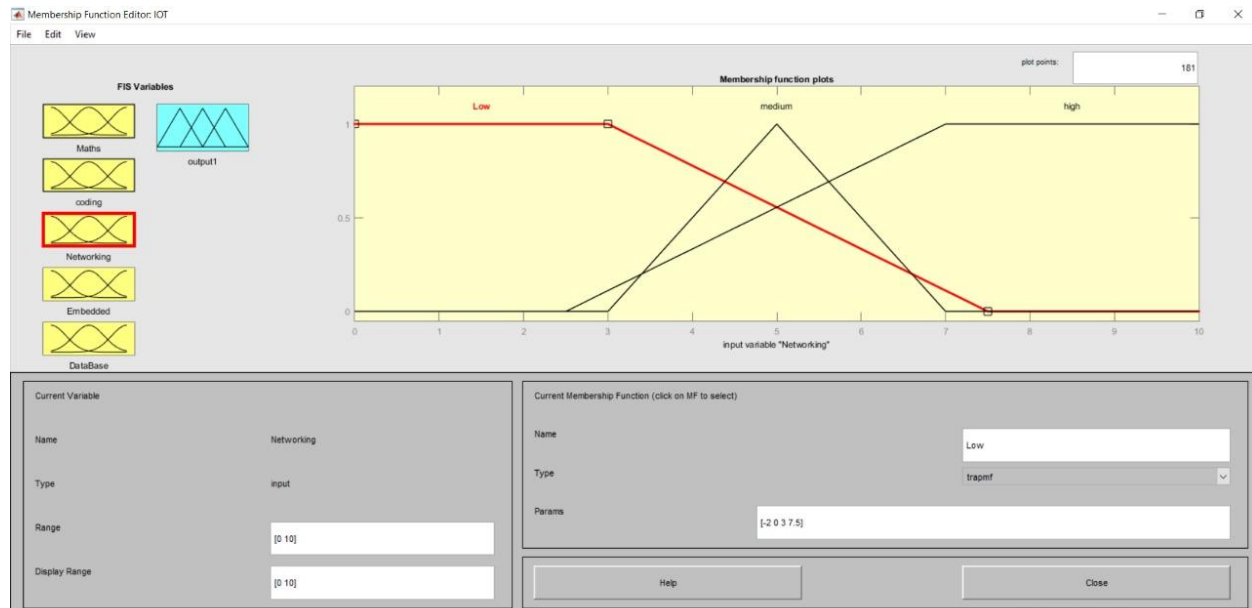
Identifying the fuzzy sets and their corresponding membership functions. The antecedent fuzzy sets represent the overall scores that are given by self evaluations done by the students with their past marks from the department courses.



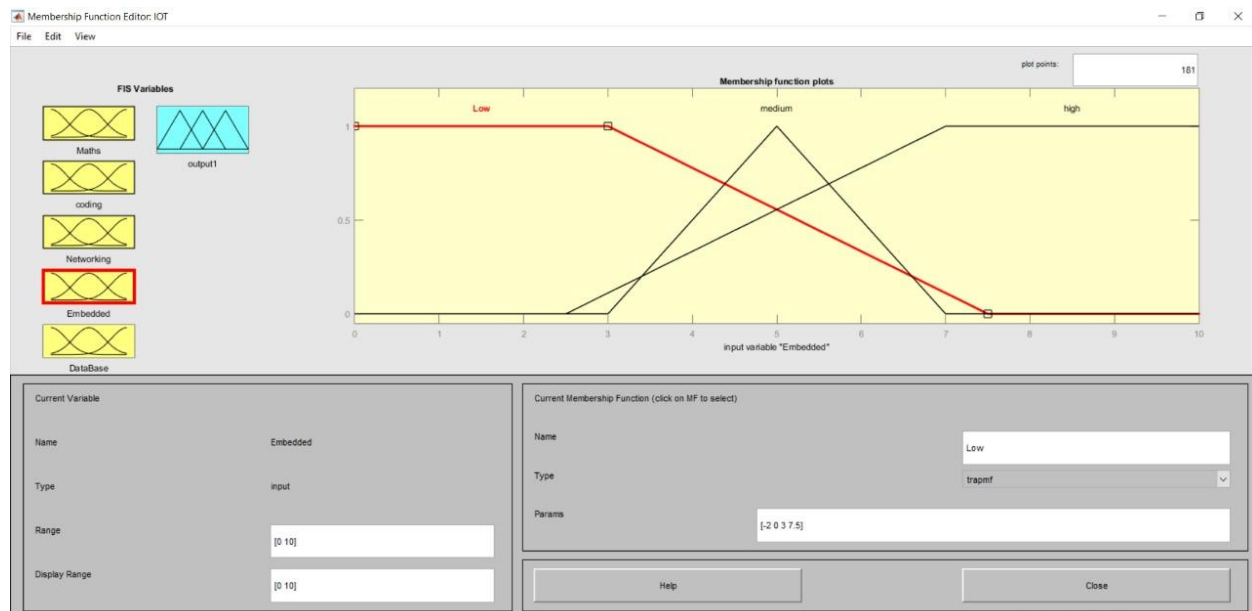
Maths



Coding



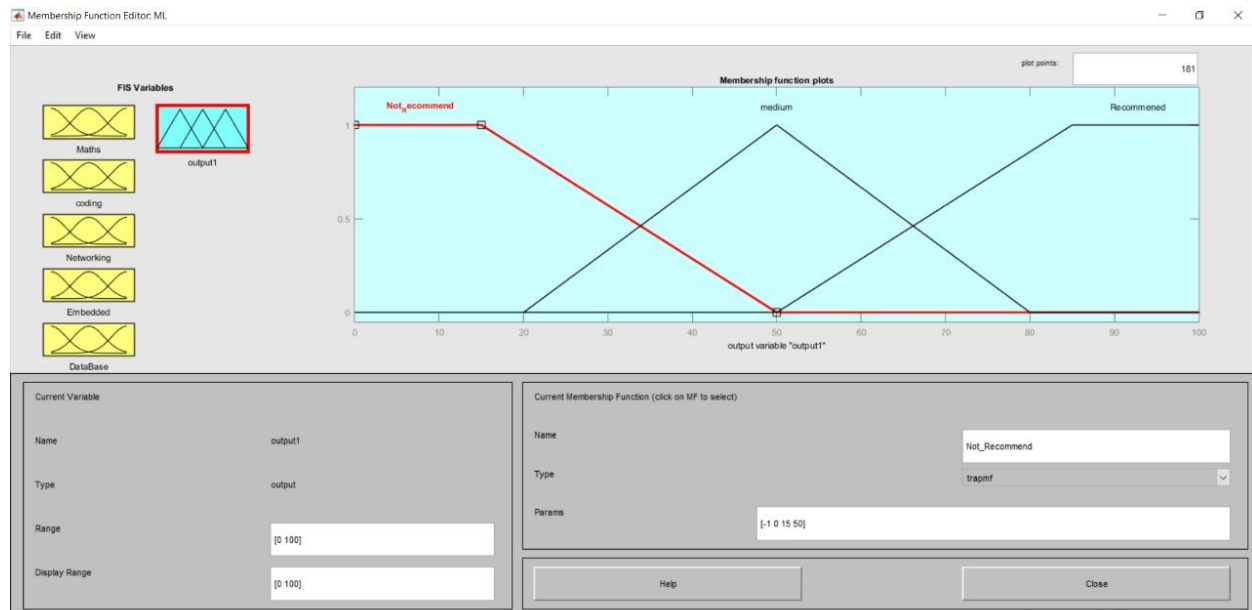
Networking



Embedded Systems

They depend on the past scores that they got from the related course and the number of available resources that they got in learning related skills. The universes of discourses for the input

$$U \rightarrow [0 \ 10]$$



Output for the research topic

From the scores from the past experience the skills must be rated between 1 to 10 and according to that and the research importance it will be fallen between High Medium and Low. Because it is self evaluation for all the skills the linguistic values are given similarly to all the skills.

Because we can't get 5 outputs at the same time 5 fuzzy systems were created for each research topic. The universes of discourses for the output

$$U \rightarrow [0 \ 100]$$

Inference mechanism

1. If (Maths is Low) and (coding is Low) then (output1 is Not_Recommend) (1)
2. If (Maths is Low) and (coding is medium) then (output1 is Not_Recommend) (1)
3. If (Maths is Low) and (coding is high) then (output1 is medium) (1)
4. If (Maths is medium) and (coding is Low) then (output1 is Not_Recommend) (1)
5. If (Maths is medium) and (coding is medium) then (output1 is medium) (1)
6. If (Maths is medium) and (coding is high) then (output1 is Recommended) (1)
7. If (Maths is high) and (coding is Low) then (output1 is medium) (1)
8. If (Maths is high) and (coding is medium) then (output1 is Recommended) (1)
9. If (Maths is high) and (coding is high) then (output1 is Recommended) (1)

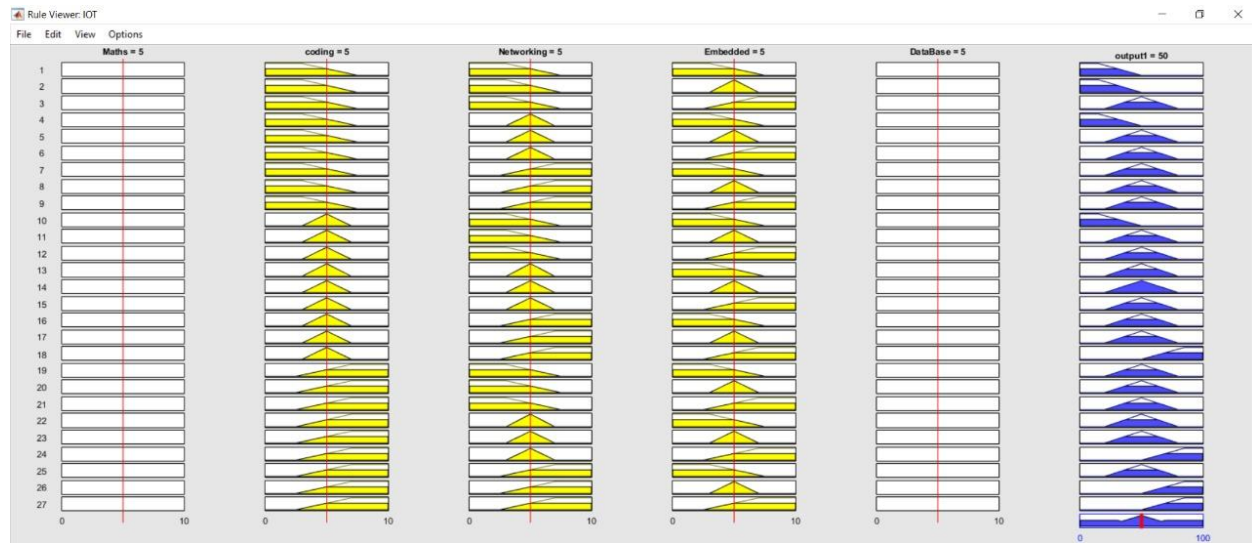
Here the Output 1 is Machine Learning The input variables that depend on Machine learning are Maths and Coding like this model the rules are in the same model for Cryptography ,Embedded processor design and Cloud computing.The Variables that are dependent on that are mentioned below.

| | |
|---------------------------|----------------------------|
| Cryptography | Networking Maths |
| Embedded processor design | Coding Embedded Systems |
| Cloud computing | Networking Database |

As for the IOT research topic 3 variables are related so the Rules as follows

1. If (coding is Low) and (Networking is Low) and (Embedded is Low) then (output1 is Not_Recommend) (1)
2. If (coding is Low) and (Networking is Low) and (Embedded is medium) then (output1 is Not_Recommend) (1)
3. If (coding is Low) and (Networking is Low) and (Embedded is high) then (output1 is medium) (1)
4. If (coding is Low) and (Networking is medium) and (Embedded is Low) then (output1 is Not_Recommend) (1)
5. If (coding is Low) and (Networking is medium) and (Embedded is medium) then (output1 is medium) (1)
6. If (coding is Low) and (Networking is medium) and (Embedded is high) then (output1 is medium) (1)
7. If (coding is Low) and (Networking is high) and (Embedded is Low) then (output1 is medium) (1)
8. If (coding is Low) and (Networking is high) and (Embedded is medium) then (output1 is medium) (1)
9. If (coding is Low) and (Networking is high) and (Embedded is high) then (output1 is medium) (1)
10. If (coding is medium) and (Networking is Low) and (Embedded is Low) then (output1 is Not_Recommend) (1)
11. If (coding is medium) and (Networking is Low) and (Embedded is medium) then (output1 is medium) (1)
12. If (coding is medium) and (Networking is Low) and (Embedded is high) then (output1 is medium) (1)
13. If (coding is medium) and (Networking is medium) and (Embedded is Low) then (output1 is medium) (1)
14. If (coding is medium) and (Networking is medium) and (Embedded is medium) then (output1 is medium) (1)
15. If (coding is medium) and (Networking is medium) and (Embedded is high) then (output1 is medium) (1)
16. If (coding is medium) and (Networking is high) and (Embedded is Low) then (output1 is medium) (1)
17. If (coding is medium) and (Networking is high) and (Embedded is medium) then (output1 is medium) (1)
18. If (coding is medium) and (Networking is high) and (Embedded is high) then (output1 is Recommended) (1)
19. If (coding is high) and (Networking is Low) and (Embedded is Low) then (output1 is medium) (1)

8. If (coding is Low) and (Networking is high) and (Embedded is medium) then (output1 is medium) (1)
 9. If (coding is Low) and (Networking is high) and (Embedded is high) then (output1 is medium) (1)
 10. If (coding is medium) and (Networking is Low) and (Embedded is Low) then (output1 is Not_Recommend) (1)
 11. If (coding is medium) and (Networking is Low) and (Embedded is medium) then (output1 is medium) (1)
 12. If (coding is medium) and (Networking is Low) and (Embedded is high) then (output1 is medium) (1)
 13. If (coding is medium) and (Networking is medium) and (Embedded is Low) then (output1 is medium) (1)
 14. If (coding is medium) and (Networking is medium) and (Embedded is medium) then (output1 is medium) (1)
 15. If (coding is medium) and (Networking is medium) and (Embedded is high) then (output1 is medium) (1)
 16. If (coding is medium) and (Networking is high) and (Embedded is Low) then (output1 is medium) (1)
 17. If (coding is medium) and (Networking is high) and (Embedded is medium) then (output1 is medium) (1)
 18. If (coding is medium) and (Networking is high) and (Embedded is high) then (output1 is Recommended) (1)
 19. If (coding is high) and (Networking is Low) and (Embedded is Low) then (output1 is medium) (1)
 20. If (coding is high) and (Networking is Low) and (Embedded is medium) then (output1 is medium) (1)
 21. If (coding is high) and (Networking is Low) and (Embedded is high) then (output1 is medium) (1)
 22. If (coding is high) and (Networking is medium) and (Embedded is Low) then (output1 is medium) (1)
 23. If (coding is high) and (Networking is medium) and (Embedded is medium) then (output1 is medium) (1)
 24. If (coding is high) and (Networking is medium) and (Embedded is high) then (output1 is Recommended) (1)
 25. If (coding is high) and (Networking is high) and (Embedded is Low) then (output1 is medium) (1)
 26. If (coding is high) and (Networking is high) and (Embedded is medium) then (output1 is Recommended) (1)
 27. If (coding is high) and (Networking is high) and (Embedded is high) then (output1 is Recommended) (1)



Rules for IOT

From the figure the rule can be clearly seen if there were 3 variables related to a research topic.

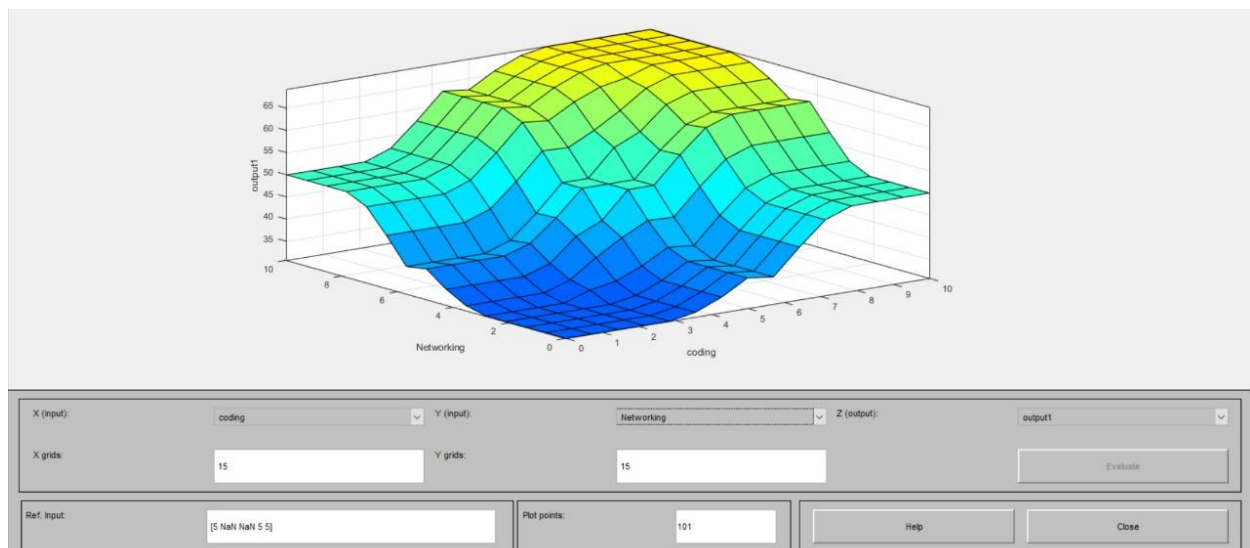
Defuzzification

The Center of Sum method was used to defuzzify the system. As shown in the equation, the Center of Sum (COS) algorithm is commonly used in the defuzzification process and there are many studies that have used it such as [Why Triangular Membership Functions? And Design and implementation of a hardware fuzzy inference system](#)

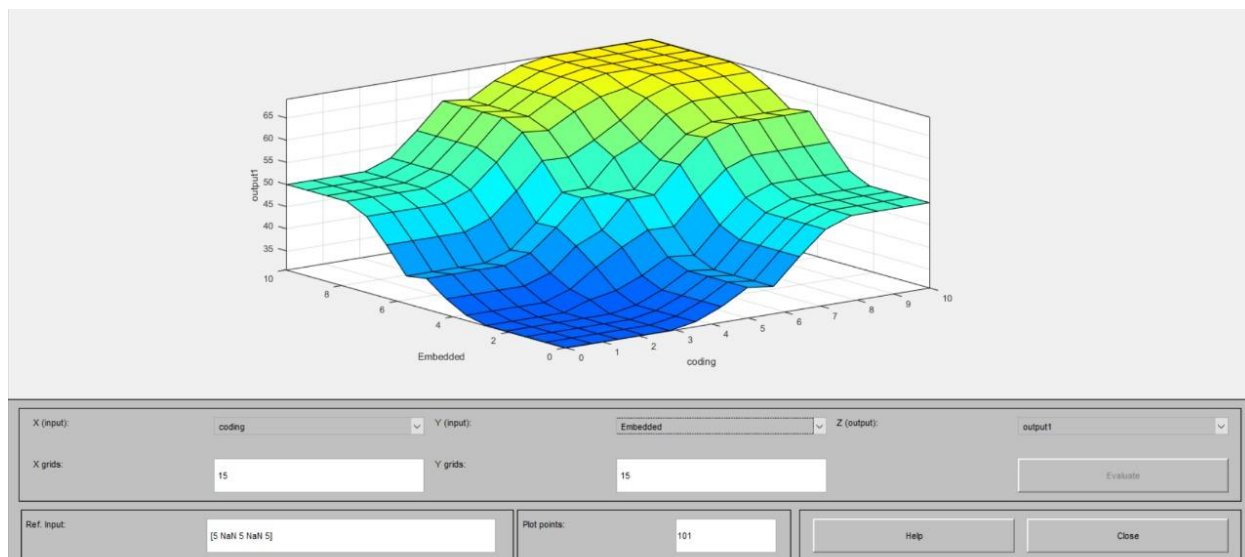
$$X^* = \frac{\sum_{i=1}^n x_i \cdot A_{c_i}}{\sum_{i=1}^n A_{c_i}}$$

Results and Discussions

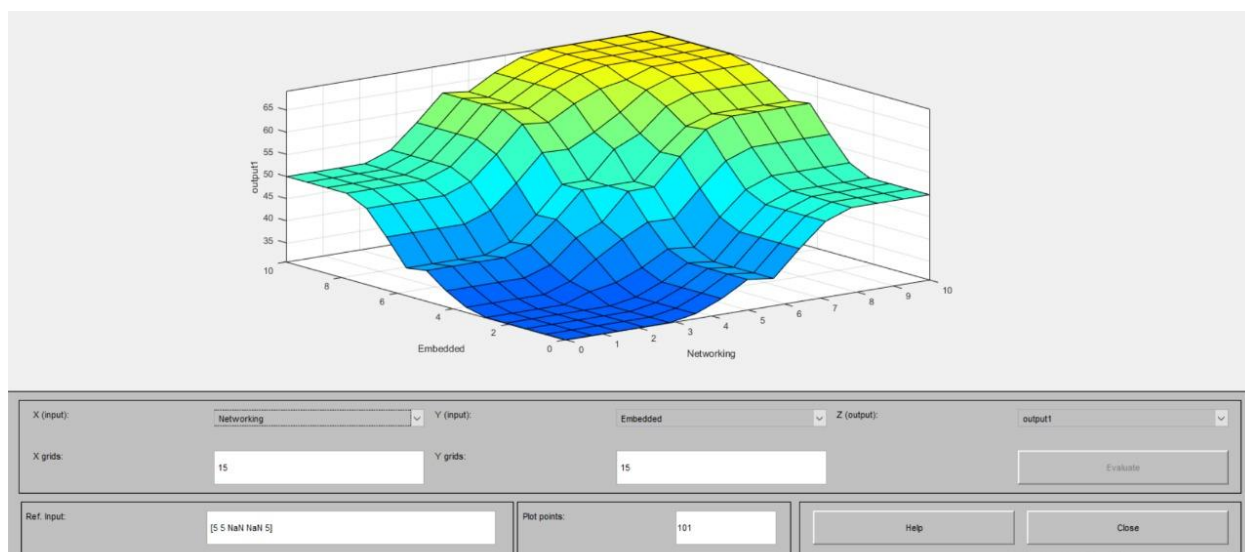
If we looked at the results of the IOT research topic we can understand how the results are in respect to the rules that were given to the fuzzy system from the figures below we can see that the results are distributed for all the instances that can occur for all the probabilities. From that we can get to a conclusion that Every type of input has an percentage answer to the related topic. The graphs also follow the same pattern in all the research topic fuzzy systems.



Networking vs Coding vs IOT percentage



Embedded vs Coding vs IOT percentage



Embedded vs Networking vs IOT percentage

In a nutshell the whole system looks as follows .

DECISION MAKING PROGRAMME

Enter your skill levels

Maths Skills(1-10)

Coding Skills(1-10)

Networking Skills(1-10)

Embedded Sys Skills(1-10)

Database Skills(1-10)

Press "Calculate" Button

Calculate

PERCENTAGE OF SUBJECT SKILLS

CRYPTOGRAPHY %

MACHINE LEARNING %

EMBEDDED DESIGN %

CLOUD COMPUTING %

IOT %

RECOMMENDED SUBJECTS

DECISION MAKING PROGRAMME

Enter your skill levels

Maths Skills(1-10)

Coding Skills(1-10)

Networking Skills(1-10)

Embedded Sys Skills(1-10)

Database Skills(1-10)

Press "Calculate" Button

Calculate

PERCENTAGE OF SUBJECT SKILLS

CRYPTOGRAPHY %

MACHINE LEARNING %

EMBEDDED DESIGN %

CLOUD COMPUTING %

IOT %


RECOMMENDED SUBJECTS

MACHINE LEARNING
EMBEDDED DESIGN

References

Fuzzy-Based Recommendation System for University Major Selection, Shaima Alghamdi, Nada Alzhrani and Haneen Algethami , *Department of Computer Science, College of Computers and Information Technology, Taif University, Taif, Saudi Arabia*

https://www.researchgate.net/publication/220256660_Simple_computation_for_the_defuzzifications_of_center_of_sum_and_center_of_gravity

 How to Create a GUI with GUIDE - MATLAB Tutorial

CO542 Lecture Notes.

Group Contribution

| | |
|-----------------------|------------------------|
| Karikaran V | - Fuzzy model Creation |
| Girishikan S | - UI Implementation |
| Bragadeeshan S | - Full Report |