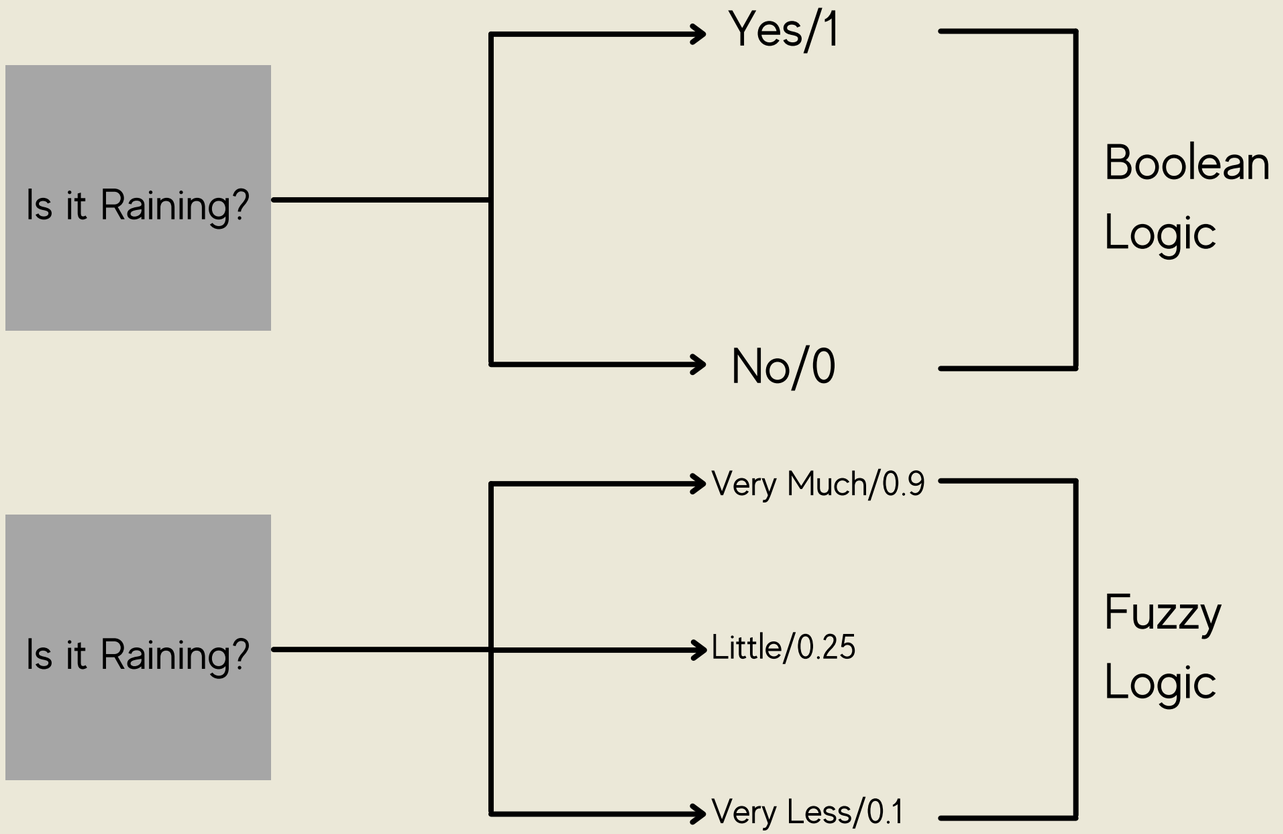
NEURO-FUZZY: ARTIFICIAL NEURAL NETWORKS & FUZZY LOGIC

Presented by:

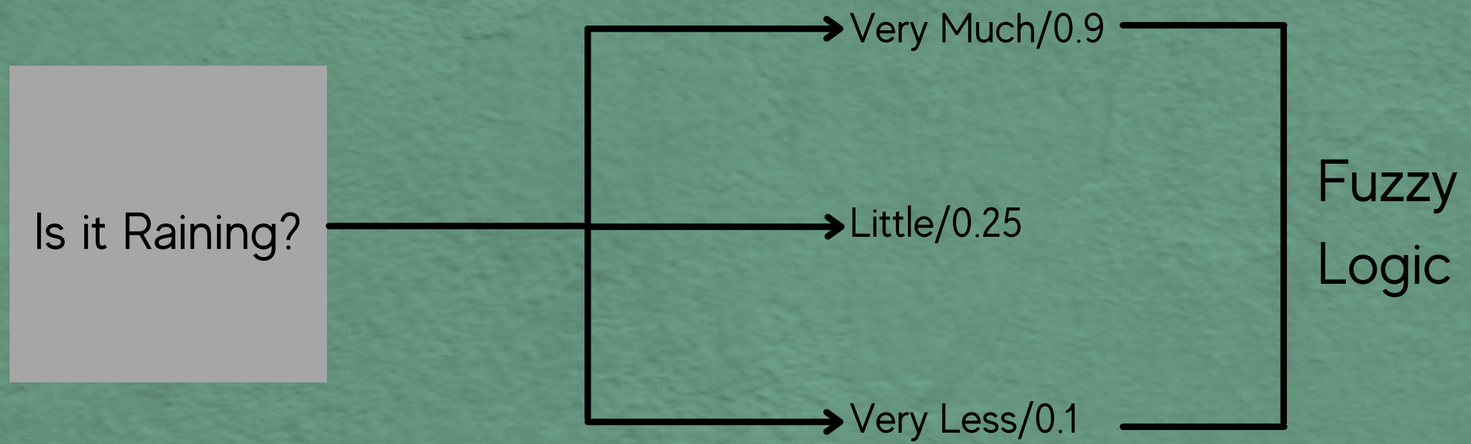
KARAN S. DHIMAN	B-28
MAYURESH D. PHANSIKAR	B-31
AMEY M. THAKUR	B-50

INTRODUCTION

Fuzzy Logic (FL) is a type of reasoning that is similar to human thinking. This approach is similar to how humans perform decision-making and it involves all other intermediate possibilities between yes and no. In the Boolean logic the answer can either be yes or no i.e. it only takes the value to be as 1 or 0. But when it comes to fuzzy logic and if we ask the same question, is it raining? we will get different answers like it's very much raining or it's a little rain or very less so we will also get the intermediate possibilities between yes and no. The computer won't just take the values 0 & 1.



WHAT IS MEANT BY FUZZY LOGIC?



- Certainly Yes
- Possibly Yes
- Cannot Say
- Possibly No
- Certainly No

USES OF FUZZY LOGIC

The fuzzy logic system is used for both commercial and practical purposes such as it controls machines and also the consumer products and if not accurate reasoning it at least provides acceptable reasoning so at times when we say Certainly Yes or Possibly Yes it's not giving accurate reasoning whether the answer is yes or no but at least it gives acceptable reasoning where you are saying that it might be or it can happen something like that. It helps in dealing with the uncertainty in engineering in case we are unsure or we don't know if the answer can be yes or no, we can find a middle path that is where it helps in dealing with the uncertainty. These are the different reasons for which we actually need to use fuzzy logic.

CHARACTERISTICS OF NEURO-FUZZY & SOFT COMPUTING

1. Human Expertise
2. Biologically inspired computing models
3. New Optimization Techniques
4. Numerical Computation
5. New Application domains
6. Model-free learning
7. Intensive computation
8. Fault tolerance
9. Goal-driven characteristics
10. Real-world applications

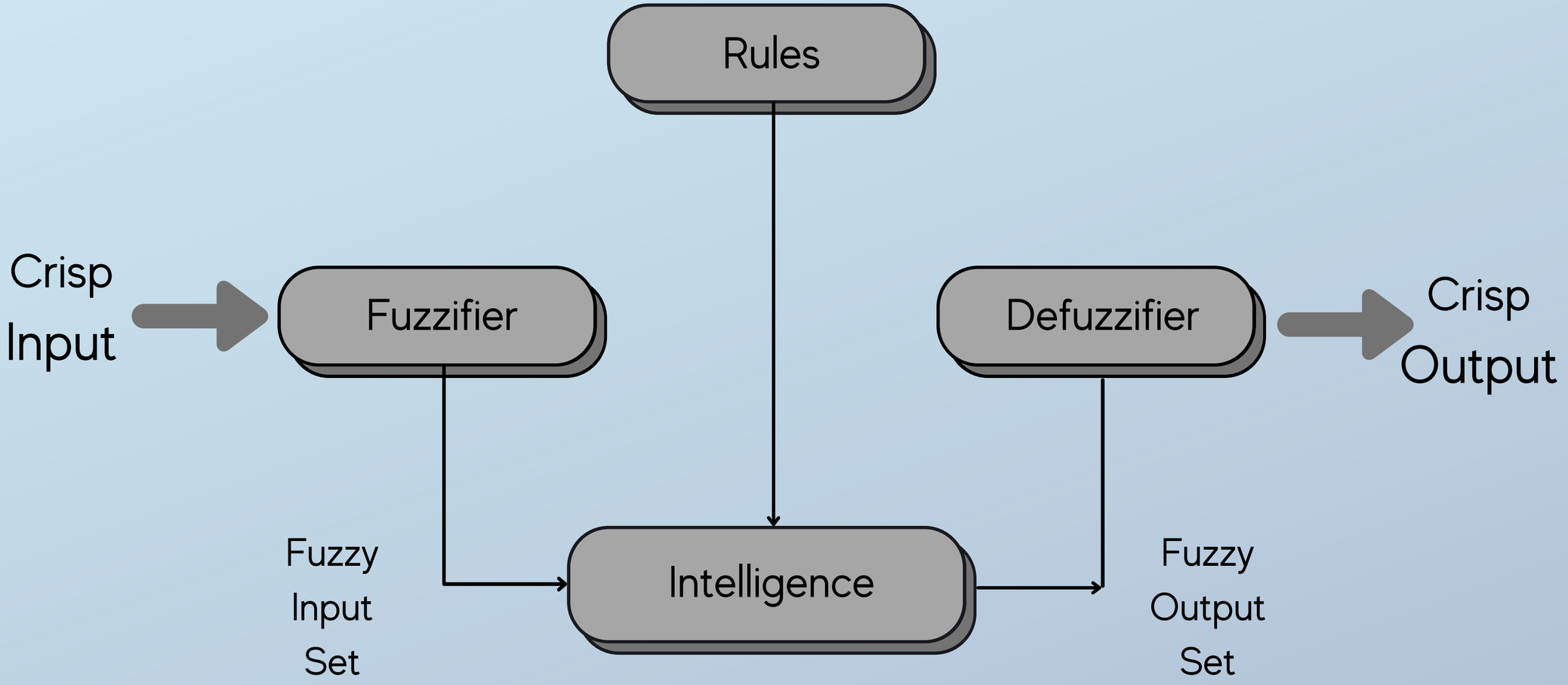
FUZZIFICATION & DEFUZZIFICATION

Fuzzification is the process of converting a sharp input value to a fuzzy value using knowledge base information. It is the process of allocating a system's numerical input to fuzzy sets with varying degrees of membership. This level of membership might be anything between [0,1]. If it is 0, the value does not belong to the specified fuzzy set, and if it is 1, the value belongs entirely to the fuzzy set.

For example, if the temperature is given to be 25-degree Celsius as the crisp input value, then it can be converted into a linguistic variable like a pleasant temperature for the human body or even hot or cold.

It is the inverse of fuzzification, where mapping is done to convert crisp results to fuzzy results, while here mapping is done to convert fuzzy results to crisp results. This technique can provide a non-fuzzy control action that depicts the probability distribution of an inferred fuzzy control action. The centre of area technique (COA), also known as the centroid method, is the most widely used defuzzification method. This function finds the centre of the fuzzy set's area and returns the matching crisp value. The centre of sums (COS) technique and the mean of maximum method are two defuzzification approaches.

ARCHITECTURE OF NEURO-FUZZY



- Rules contain all the rules and the if-then conditions offered by the experts to control the decision-making system.

- In Fuzzifier, fuzzification takes place. In this step, the inputs or the crisp numbers are converted into fuzzy sets. We can measure the crisp inputs by sensors and pass them into the control system for further processing.

- Inference Engine which is the intelligence which determines the degree of match between fuzzy input and the rules. According to the input field it will decide the rules that are to be fired combining the fired rules form the control actions.

- The Defuzzification technique transforms fuzzy sets into crisp values. There are different types of techniques available and you need to select the best suited one with an expert system so here first we have a crisp input going to the fuzzyfier where fuzzification takes place and the crisp input is converted into a fuzzy input set. This fuzzy input set passes through the inference engine and we have a fuzzy output set. This fuzzy output set goes through defuzzification where again we get a crisp output.

It is used in various fields such as automotive systems, domestic goods, environment control, etc. and some of the common applications in fluid to the use in the aerospace field for altitude control of spacecraft and satellites. When words like Fuzzy Logic are thrown at you, you'd be forgiven for thinking it's simply marketing jargon. However, while purchasing a washing machine, fuzzy logic is a crucial factor to consider. Washing machines that use fuzzy logic are becoming extremely popular. Performance, productivity, simplicity, and productivity are all advantages of these devices. In basic terms, Fuzzy Logic, in the context of a washing machine, combines sensors to evaluate shifting situations within the machine and adapts its operation correctly. In essence, sensors in the washing machine will supervise the whole washing process, conducting activities based on the various water input, wash interval, rinse performance, and spin speed.

APPLICATION OF FUZZY LOGIC.

ADVANTAGES

1. The structure of this logic system is very easy and understandable.
2. Fuzzy logic is widely used for commercial and practical purposes.
3. It helps to control machines and consumer products.
4. It helps to deal with uncertainty in engineering.
5. If the feedback sensor stops working, one can program it into the situation.
6. It can be easily modified to improve or alter the system performance.
7. Inexpensive sensors can be employed, lowering the total system cost and complexity.

DISADVANTAGES

1. Fuzzy logic is not always accurate.
2. It cannot recognize machine learning as well as neural network type patterns.
3. Validation and verification of a fuzzy knowledge-based system necessitate significant hardware testing.
4. Setting the exact fuzzy rules and membership functions is a difficult task.
5. At times the fuzzy logic is confused with probability theory.

THANK YOU!