

Chapter 4

Applications of Fuzzy Expert Systems in Farming

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ABSTRACT

Agriculture, cattle breeding, and poultry farming constitute the backbone of the Indian economy. Today, India is ranked first worldwide in terms of milk production, second in terms of farm output, and third in terms of poultry output (eggs production). Over the year, agriculture, poultry farming, and cattle breeding have contributed towards India's GDP but is narrowly declining with the country's economic growth due to lack of initiatives. Fuzzy expert systems are used for various activities with an objective to get better results and good yield. Expert systems combine the experimental and experiential knowledge with the intuitive reasoning skills of a multitude of specialists to aid farmers in making the best decisions to improve the quality and increase the production. Weather and climatic changes play important roles. Thus, any changes in them affect the quantity and quality of production. Therefore, weather prediction plays an important role and helps the farmers to take right decisions and precautions to safeguard the production.

INTRODUCTION TO FUZZY LOGICS AND FUZZY EXPERT SYSTEM

The fuzzy concept means the vague and lacking the exact and clarity, which means the values or boundaries can vary according to context or conditions, instead of being fixed once and for all. Actually, the fuzzy has different semantics, but these can become clearer only through further specification, including a closer definition of the context in which they are operationalized.

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The reasoning of fuzzy logic looks like human reasoning, instead of the entire data to be relying on crisp line and to have only two values, which may incomplete or ambiguous, Fuzzy logic able to process this situation and to provide approximate solution. A conditional fuzzy proposition or rule has the form: IF w is Z then x is Y , this rule should be interpreted: x is a member of Y to the degree that w is a member of Z , for example; IF experience is high then salary is high. The membership value of salary in the fuzzy set high is specified by the membership value of experience in the set high. Rules are usually expressed in the form: IF variable is 'property' then 'action'.

Practically, the fuzzy inference system can be described in the five steps:

- **Fuzzifying Input:** Initially, once inputs are available, the degrees of the inputs to which they belong to each of the appropriate fuzzy sets are determined via membership functions.
- **Applying Fuzzy Operators:** If the rule consists of multiple parts (antecedent), there are need to apply logical operators to evaluate the degree of the strength for the rule.
- **Applying the Implication Process:** The implication is a process whereby the output membership functions based on the strength of the rule are shaped. The output is a fuzzy set of the consequence, whereas the input for the implication process is a single number given by the antecedent.
- **Aggregating All Outputs:** Aggregation is unifying the outputs of each rule. The aggregation is performed only once for each output variable. The output of the aggregation process is a single fuzzy set, which is the combination of a list of truncated output fuzzy sets returned by the implication process for each rule.
- **Defuzzifying:** Finally, the output of the defuzzification process is a crisp value whereas; the input is the aggregated output fuzzy sets. Recently, many of various methods in defuzzification process have been proposed by investigators including, the maximum, the means of maxima, height, and modified height method, and the centroid.

A fuzzy expert system is an expert system that uses fuzzy logic instead of Boolean logic. In other words, a fuzzy expert system is a collection of membership functions and rules that are used to reason about data. Unlike conventional expert systems, which are mainly symbolic reasoning engines, fuzzy expert systems are oriented toward numerical processing shown in the Figure 1.

FUZZY EXPERT SYSTEM IN AGRICULTURE

Agriculture decision making activates are often vague and based on intuition. This makes agriculture a complex problem and thus requires very complicated optimization and modeling steps when agriculture is attempted through conventional techniques. The agricultural production management problem includes identification of correct sowing period, crop variety selection; land preparation, sowing method, fertilizer and pest selection according to variety. It also includes lack of experts to support the agricultural growers, and the heavy dependence upon the experiences of these experts. Thus, there is need of expert system approach, which is more flexible, and gives the end user wide choices for farming methods. Expert system in agriculture is not a new idea. It is being used in agriculture since the early 1980s. Agriculture Expert systems (AES) are being developed by various Agricultural Research Institutes and researchers

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