
One of the problems in computer science is the gap between natural languages for human beings and programming languages for digital computers, since the former are much more complex than the latter. This is due to the fact that natural languages are fuzzy in nature but programming languages are precise. For example, when we say that a certain university is a good university, fuzziness arises since there is no sharp boundary between a good university and an average one. A university may be good from one person’s point of view, but may be considered as just an average one in another person’s opinion. To solve a problem by a computer, a great deal of time and energy would be saved if the computer could understand either natural languages themselves or something close to them. In other words, computers would become more powerful if they could accept fuzzy concepts similar to the capability of a human brain.

The first step in this direction was made by Zadeh, who introduced fuzzy sets [1] and characterized them by a membership function which assigns to each object a grade of membership ranging from full membership (grade = 1) to nonmembership (grade = 0). The assignment of membership grades essentially maps (transforms) a fuzzy set to a nonfuzzy set for computer processing. Additional theoretical work on fuzzy sets has been reported [2]–[13].

This paper presents a technique for analysis and synthesis of fuzzy logic functions with their implementation in terms of logic gates. Examples of fuzziness in English language are given at the beginning of the paper, followed by some background on fuzzy sets. The word “grade membership” is replaced by the word “fuzzy variables” for ease of relating them to fuzzy functions. Since fuzzy variables can take on infinitely many values between 0 and 1, map or topological methods which are convenient in 2-valued logic cannot be used. Instead, analytical techniques are presented for the simplification of fuzzy functions.

Analysis and synthesis of fuzzy functions of sum-of-product and product-of-sum forms are presented in a simple and straightforward way. The logic diagrams for realizing fuzzy functions with AND, OR, NOT, and threshold gates are also given. At the end of the paper, the author gives some suggestions for possible applications of fuzzy logic in both analog and digital fields. In the analog field, quality control, industrial processes, and component testing are suggested. Pattern recognition and classification [13] are suggested as possible applications in the digital field.

To the reviewer’s knowledge, this is the first paper which gives the logic implementation of fuzzy functions. The material has been clearly presented except on the implementation of the compliment of a fuzzy variable. The reviewer believes that this paper may be of interest to people in the area of computer engineering as well as related fields.

The complement of a fuzzy variable \( x_i \) is defined as \( 1 - x_i \). The author uses a transistor inverter to realize \( x_i \) (Fig. 1) and says, “When \( V_n = 0 \), \( V_o = V_n - x_i \) which is equivalent to \( x' = 1 - x \).” But this is only a special case since \( x \) can assume any value between 0 and 1. The circuit analysis of the inverter should be given with the aid of the equivalent circuit for the active region of the transistor to show how the relation \( x' = 1 - x \) is obtained.

Some possible applications of fuzzy logic are suggested but not in detail. It would be of interest if some actual applications of fuzzy logic were found and described in future papers in more detail.

Handwritten character recognition by computers is one of the important subjects in computer science. Since everybody’s handwriting is different, the reviewer feels that the concept of fuzzy logic and fuzzy sets may be useful for solving this problem.

Another possible application of fuzzy logic is in the area of information retrieval. For example, to determine whether a book belongs to a certain subject (such as computer systems, computer theory, etc.) is often a fuzzy matter. However, if a membership grade is assigned to each book according to the relevance of that book to a certain subject, then it will be much easier to retrieve the names of books which the user is interested in. Furthermore, by providing a list of books with membership grades to the user, a guidance is provided to him about the degree of importance of each book to his subject of interest. This is especially useful to a person who is not familiar with the subject he is studying.

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This work is a solution to the generalization of the by now classical problem of Minsky, namely, the firing squad problem.

The original problem was to arrange for an array of an arbitrary length of sequential machines, that communicated with immediate neighbors only, to go into a final state simultaneously. The command signal is given from one end of the array. In the generalized problem, the command can be given anywhere along the array.

Moore and Langdon’s solution is very elegant, and is surprising in its economy in terms of added complexity to each machine in the array.

The paper is self-contained and well written. Unfortunately, this solution, as well as the solution to the original problem, are still among the isolated results in modeling of replication and self-reproduction, where a general theory is yet to emerge.

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