

Optimization of Fuzzy Tsukamoto Membership Function using Genetic Algorithm to Determine the River Water

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ABSTRACT

Some aquatic ecosystems in rivers depend on the river water, so it needs to be maintained by measuring and analyzing the river water quality. STORET is one of the methods used to measure the river water quality, but it takes a quite high of time and costs. Fuzzy Tsukamoto is an alternative method that works by grouping the river water data, but it is difficult to determine the membership function value. The solution offered in this study is the use of genetic algorithm to determine the membership function value of each criterion. Based on the test results, the optimization of fuzzy membership function using genetic algorithm provides higher accuracy value that is 95%, while the accuracy value without optimization process is 90%. The parameters used in genetic algorithm are as follows: population size is 80, generation number is 175, crossover rate (*cr*) is 0.6, and mutation rate (*mr*) is 0.4.

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1. INTRODUCTION

Water is one of the natural resources that is very important to human beings and other beings. The river is one of the place or container to hold the water resources flowing to the lowest point on the earth's surface. Rivers have a role as home to several aquatic ecosystems on earth that flows from upstream to downstream. The river is one of the nearest water sources for some residents in rural and urban areas in Indonesia. However, the river which an important part of human life sources have been polluted. It is mostly caused by human activity that occurred in the catchment area which became a river water supply and then flowed to residential areas. Increased industrial activity and household activity became one of the main causes of pollution that occurred in the watershed.

The disposal of industrial waste and household waste that does not do the screening process contributed to a decrease in the quality and quantity of the river water. Therefore, it needs an effort to maintain the quality, quantity, and continuity of the water so the ecosystems that exist therein remain balanced [1]. This is done by monitoring and controlling the water pollution regularly. An effort to monitor and control the water pollution is done by measuring and analyzing the water quality so that the factors affecting the pollution can be known, as stipulated in the Indonesian Government Regulation No. 82 of 2001. Based on the Ministry of the Living Environment of Indonesia No. 115 of Article 2 of 2003, the guidelines used to determine the status of the water quality is using the STORET method or Pollution Index Method. Determination of the water quality using STORET method still done manually so it took quite a long time and needs a laboratory cost which is quite expensive. The development of existing technologies can provide solutions to assist in the calculation and determination of the water quality to reduce the time and cost required.