Chapter 11
Hybrid Non-Dominated Sorting Genetic Algorithm: II–Neural Network Approach

Sankhadeep Chatterjee
University of Calcutta, India

Sarbartha Sarkar
Indian Institute of Technology Dhanbad, India

Nilanjan Dey
Techno India College of Technology, India

Amira S. Ashour
Tanta University, Egypt

Soumya Sen
University of Calcutta, India

ABSTRACT

Water pollution due to industrial and domestic reasons is highly affecting the water quality. In undeveloped and developed countries, it has become a major reason behind a number of water borne diseases. Poor public health is putting an extra economic liability in order to deploy precautionary measures against these diseases. Recent research works have been directed toward more sustainable solutions to this problem. It has been revealed that good quality of water supply can not only improve the public health, it also accelerates economic growth of a geographical location as well. Water quality prediction using machine learning methods is still at its primitive stage. Besides, most of the studies did not follow any national or international standard for water quality prediction. In the current work, both the problems have been addressed. First, advanced machine learning methods, namely Artificial Neural Networks (ANNs) supported by a well-known multi-objective

INTRODUCTION

Water quality monitoring is a domineering process for maintaining safe and reliable water source. It is considered one of the serious problems that affect the individual’s health. The furthermost death cause in Asia and Africa is the contaminated drinking water (Vasudevan, & Oturan, 2014). Deteriorated water quality originated widespread management labors in several countries to resolve and to predict water quality issue. Typically, several factors can affect the water quality, including i) the calcium level that exists in the natural water, and ii) the industrial wastes, rocks, sewage, which are another calcium source leading to lower water quality. Furthermore, the hard water is liable for the heart disease and many other serious and chronic diseases. Water contaminators are subsequently reached the ground water sources. Ultimately, water quality prediction techniques become urgent to evaluate and to test the water quality for addressing the specific water supply’s problems. This ensures the water sources protection from prospective contamination toward achieving good quality water that preserves the overall public health (Edition, 2011). Water sources contamination is considered the major reason behind water pollution due to physical, chemical, and radioactive elements. In the urban areas, the municipal tap water is one of the main water sources for the domestic uses. Accordingly, in order to ensure the water supply quality, water quality analysis becomes obligatory.

Water quality prediction can efficiently achieved by using machine learning techniques, such as the NN that has been employed for water quality prediction process. In order to study the industrial waste effect on the water quality prediction, data is to be collected from a water treatment plant in terms of the water quality optimization algorithm called the Non-dominated Sorting Genetic Algorithm-II (NSGA-II) has been used to classify the water samples into two different classes. Secondly, Indian national standard for water quality (IS 10500:2012) has been utilized for this classification task. The hybrid NN-NSGA-II model is compared with another two well-known meta-heuristic supported ANN classifiers, namely ANN trained by Genetic Algorithm (NN-GA) and by Particle Swarm Optimization (NN-PSO). Apart from that, the support vector machine (SVM) has also been included in the comparative study. Besides analysing the performance based on several performance measuring methods, the statistical significance of the results obtained by NN-NSGA-II has been judged by performing Wilcoxon rank sum test with 5% confidence level. Results have indicated the ingenuity of the proposed NN-NSGA-II model over the other classifiers under current study.
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