CHAPTER 1

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1.1 Project Overview

Researchers have been using evolutionary computation as one of the significant methodology in problem solving. Self-adaptation, robustness and population-based collective learning process are few important key features offered by the evolutionary algorithms as compared to other global optimization technique. They often provide satisfactory solutions and are easy to implement too.

1.2 Statement of Problems

Earlier global optimization approach are always seen as a “black box” as in their inability to produce comprehensible decisions, and it is hard to trust the reliability of network addressing real-world problems.

Consider the prediction of a highly complex and non-linear ecological time-series data. They have issues on classifying or predicting noisy data using certain predictive rules without providing a proper representation to explain the prediction.

Some of the rules were exceptionally simple, such as grammar based programming approach proposed by Whigham and Recknagel (2001). It involves attributes that were related to constant parameters relatively to functions that linked between multiple attributes.

Moreover, the parameters were not generated simultaneously to meet the optimized output value instead they are randomly generated on the rules.

A self-adapting evolutionary algorithm was adopted to have these parameters modified but it does not work as the rules become more complex and the number of the parameters involved rises. (Bobbin and Recknagel, 2003)

In this research, hybrid evolutionary algorithms (HEA) were employed to evolve the structure of the rule set and to optimize the random parameters in the rule set by combining the application of genetic programming and general genetic algorithm. IF-THEN-ELSE structure in HEA let the embedding of complex functions synthesised from diverse predefined arithmetic operators. Complexity of rule sets were controlled by the maximum tree depth and rule set size.

1.3 Objectives

The purpose of this research is to accomplish few goals:

1. To provide rule sets that best represent the dynamics of ecological parameters of freshwater lakes under study.
2. To provide suitable representation to explain relationship between physical and chemical variables of the ecological parameters and biological data in those lakes.

1.4 Project Scope

The scopes of this research are ecological data collected at 2 freshwater lakes of different morphometry and eutrophication – Tasik Bera (Bera Lake) and Putrajaya Lake. Data involved for Putrajaya Lake were taken from year 2006 until 2009 whereas data for Bera Lake were taken from year 2005 until 2009.

1.5 Limitation and Constraint

The limitation of this research are in term of the measurement intervals or raw data collected which are very likely to be irregular for both lakes and sampling were done on different dates and time. Also this research does not take into account other factor that can cause some uncertainty in the dissolved oxygen prediction, such as the weather factor and others.