Short Term Forecasting based on Hybrid Least Squares Support Vector Machines

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Flood is one of the common natural disasters that have caused universal damage throughout the world. Due to that matter, reliable flood forecasting is crucial for the purpose of preventing loss of life and minimizing property damage. In this study, hybrid Least Squares Support Vector Machines (LSSVM) with four meta-heuristic algorithms viz. Grey Wolf Optimizer (GWO-LSSVM), Cuckoo Search (CS-LSSVM), Genetic Algorithm (GA-LSSVM) and Differential Evolution (DE-LSSVM) are presented for a week ahead water level forecasting. The employed meta-heuristic algorithms are individually served as an optimization tool for LSSVM and later, the forecasting is proceeded by LSSVM. This study assesses the performance of each hybrid algorithms based on three statistical indices viz. Mean Square Error (MSE), Root Mean Square Percentage Error (RMSPE) and Theil’s U which is realized on raw and normalized data set. Later, the performance of each identified hybrid algorithm is analyzed and discussed. From the simulations, it is demonstrated that all the identified algorithms are able to produce better forecasting result by using normalized time series data.

Keywords: Computational Intelligence, Flood forecasting, Least Squares Support Vector Machines, Meta-heuristic algorithm, Optimization.

1. INTRODUCTION

Flood is one of the common and widely distributed natural disasters that have caused significant losses in terms of economic, human and social tragedies as well1,2. In December 2014, Malaysia, particularly in the east coast area has experienced with major flooding. This unexpected situation has caused more than 90,000 flood victims from Terengganu, Pahang, Kelantan, Perak and Perlis had to be relocated to evacuation centers for a quite long time. Due to slow water recedes and damage of physical buildings, the school session for several schools also had to be delayed3. Early losses are estimated around RM1 billion impact of the destruction of infrastructure and property caused by severe flooding in several states. Nonetheless, the figure is doubled when extensive calculations are performed4.

In the history of Malaysia itself, the major flooding is not a new phenomenon. In fact, in previous years, history has witnessed several states have been hit by flood. However, a major flood in Kelantan in December 2014 was recorded as among the worst in the country’s history. Concerning that matter, there is a critical needs for flood control measures.

Alleviating the effects of floods can be practiced by using three measures namely structural, non-structural or by a combination of both. For structural measures, it consist of engineering works which includes channelization or flood reservoirs. This activity will cause