UNIVERSITI TEKNOLOGI MARA

STREAMFLOW PREDICTION USING NON-PARAMETRIC REGRESSION METHODS AT PAHANG RIVER CATCHMENT

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ABSTRACT

Flood disaster cannot be stopped or avoided, but all stakeholders should learn how to face this problem with an aggressive approach and maximum efforts to minimize the losses in terms of fatalities and economic. One of the remaining ways to minimize the flood problem is to constantly seek new knowledge and alternatives to improve the flood forecasting system. An ongoing need to achieve the best accuracy of flood forecasting obviously has been stimulating many recent studies to give more attention in many advances technique of flood prediction. Therefore, the aim of this study is to investigate the potential of two non-parametric regression methods as a flood predicting tool, where the application is relatively new in the hydrologic problems. The approaches studied are K-Nearest Neighbours (KNN) and Multivariate Adaptive Regression Splines (MARS). Pahang River situated in Pahang, Malaysia has been selected as an area of interest of this study. 30 years of historical data set of daily rainfall and streamflow at upstream tributaries of Pahang River were used as input data to develop and evaluate the effectiveness of both approaches in one-year-ahead prediction of streamflow. The effect of different length of data sets to the performance of models was also examined. Simulation results showed that longer period data can provide significant improvement to the performance of both approaches. However, based on the comparison of performance between KNN model and MARS model, all the error values and efficiency percentage for KNN model (CC=0.7241 to 0.7601; MRSE=0.591 to 0.2503; MRAE=0.464 to 0.3361; CE=11.62 % to 31.72 %) at all predictive points are not as good as the error values and efficiency percentage for MARS model (CC=0.9898 to 0.9921; MRSE=0.0278 to 0.0184; MRAE=0.1098 to 0.0962; CE=97.97 % to 98.45 %). This clearly indicated that satisfactory result of streamflow prediction only appeared superior for MARS model. Overall, all findings that emerge from this study have gone some way towards enhance the understanding of the capability and limitation of KNN and MARS model in long term flood prediction.

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1.1 INTRODUCTION

From the current global perspective, flood disasters has become one of the most serious natural hazards in all over the world and now it accounts as one of the higher ranks among natural disasters by number and economic losses and also responsible for fatalities of human, animals, and others life (Knight and Shamseldin, 2006). Severity impact of flood is not only caused by natural phenomena but also increases due to the effect of mans' activities in rapid urban development by changing the landscape, land use, deforestation, pollution, thus the global warming effect.

Since flood is a natural disaster that cannot be stopped or avoided and uncontrollable urbanization has led to such a disastrous year with large scale devastation of lives and damage of properties, it is important to learn how to face this disaster with maximum efforts to minimize the losses in terms of fatalities and economic. In flood management, at the time when structural measures such as dam, detention pond, tunnel, embankments, canalization were not entirely successful in accommodating high flood discharge due to their limitation of capacity, flood forecasting is an environmentally and economically way to solve the flood problem. Chan et al. (2004) defined flood forecasting systems as one of the non-structural measures that does not require the construction of large artificial concrete structures which can damage the environment and natural ecosystem. It plays an important role in providing early flood warning to people and as a guide in development planning of a country to avoid major economic losses in the future.

Therefore, the decisions making regarding to flood management always depends on flood forecast. Nevertheless, flood forecasting is usually not perfect because future events involve certain uncertainties (Abraham and Ledolter, 2005), which requires constant reviews and upgrades from time to time by many researchers in hydrological field to form good flood forecast with minimum forecast. The continuous improvement of flood forecasting by using advanced technologies also has