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The Application of Clustering Technique to Water Quality of Surabaya River

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Abstract

Surabaya river is the source of the raw water used people in Surabaya to satisfy their daily needs. Surabaya river flow starts from Mlirip (Mojokerto) as upstream past the Sidoarjo, Gresik, and until the downstream that is Jagir Wonokromo (Surabaya). The background research studies because the water surface in Surabaya decreased perceived water quality is constantly increasing as a result most of the liquid industrial waste discharged from human activities into the channel that empties in Surabaya either directly or indirectly. Water pollutant components Surabaya river is known biological oxygen demand known as BOD, chemical oxygen demand known as COD, total suspend solid known as TSS, and dissolved oxygen known as DO. Even for biological oxygen demand components at some point status monitor heavy polluted with concentrations exceeding waterquality class sub-cleanness. K-means is one of a method for clustering objects based on their characteristics. Object of study in this research is a point source the disposal of industrial wastewater empties in Surabaya river in 2013. The first step of this research study is the normalization of water quality data biological oxygen demand, chemical oxygen demand, total suspend solid and dissolved oxygen in Surabaya river. The results of this step is the concentration of data which are in the range of 0 and 1. Concentrations were normalized value applied to K-means resulting in a model that desceibes the shape of the distibution of pollutants proximity region gruop. From the result obtained K-means suitability of water quality of each region along the Surabaya river is formed of similarity and attribute similarity. Davies Bouldin Index is an internal evaluation scheme, for cluster validation of K-means. From the results of the cluster validation, Davies Bouldin Index values obtained for 53.742. DBI value obtained is minimal DBI to the number of 672 iterations. This paper not only theoretically situation, the water quality of Surabaya river by clustering technique, but also get a conclusion of pollutant with five cluster becomes the best value Davies Bouldin Index.

Keywords: K-means clustering, Water quality, Surabaya river

1. Introduction

Progressive industrial development has also increasing use of rivers forwaste disposal activities. The pollution from these and the others sources, such as use agricultural pesticides, has led to the increasing need for rigorous assessment of river quality. Water pollution caused serious harm on human's lives, production activities and health (Nurul et al., 2012).

Determination of the water quality is traditionally based on cllassification by considering physical, chemical, bilogical factors, and heavy metals (Su et al., 2012) according to the purpose of water usage (Ay and Kisi, 2012).

Because modelling of the water parameters is an impportant and complex issue, different Artificial Intelligence (AI) techniques are performed in modelling for various water resources areas (Irawan et al., 2013). In this context, there are several parameters to assess water quality according to the national and international criteria standards. These parameters include biological oxygen demand, chemical oxygen demand, dissolved oxygen, and total suspend solids. According to the data report from Perum Jasa Tirta (PJT) of East Java province, for the last five years from 2009 to 2013 (Rahmawati et al., 2014a).

For instance, the AI techniques have been studied by several research in modelling rainfall, evaporation, discharge, BOD, COD and DO concentration, depth integrated DO and sediment over the last three decades. Based on this knowledge, these techniques have also been succesfully used in estimation and forcesting (Zeleňáková et al., 2012) of water resources. For instance, Artificial Neural Network (ANNs) were identified, tested and validation for the computation DO (Ay and Kisi, 2012) and BOD (Singh et al., 2009). When using ANN method to comprehensively assess air quality using RBF network by classifiying pollutants in assessment grades from air component, RBF network was an effective assessment to judge the combined effects of pollutants on air (Jie et al., 2014).