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Normal Multivariate Based Clustering of Regencies in East Java Province-Indonesia

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Abstract. One of the adverse effects of development in Indonesia is the incline of welfare inequality. Particularly in East Java Province, we can identify this condition among regencies and cities. In this thesis I intend to make clusters among the regencies with regards to their welfare indicators. This may help the government in giving development priority program among the regencies for reducing welfare inequality. I used the model-based clustering method to overcome over-lapping problem found in the welfare data. Based on the Bayesian Information Criterion, the most fitted cluster model is a three-cluster model with diagonal distributions, variable volumes, equal shapes, and coordinate axes orientations. The first cluster, the low welfare cluster, consists of twelve regencies. The second one is the middle welfare cluster consisting fifteen regencies. The third class, the high welfare cluster, has twelve regencies too. Accordingly, I suggest that the government gives priorities on the twelve low welfare regencies, particularly in clean water accessibility, literacy, child delivery helping by medical doctors, poverty elevation, sanitation, and year of schooling.

Keywords: Welfare Indicators, Model Based Clustering, Expectation Maximization, Bayesian Information Criterion.

INTRODUCTION

The East Java Province of Indonesia consists of thirty-eight regencies. It lays between 111,0-114,4 east longitude and 7,12-8,48 latitude with a total land area of 47.157,72 Km^2. It has 229 islands that consist of 162 named and 67 unnamed islands. It is the widest territorial among six provinces in Java Island and the second biggest population. Its large number of regencies contributes to the difficulty in achieving equity. We can indicate this condition from the Williamson index (see Figure 1). In 2009-2013 period, the index tends to increase and it's always higher than the national average. Williamson (1986) argued that spatial equity will have a negative effect on economic growth and income distribution. Accordingly, the government should reduce the equity among the regions. Particularly, the government should put more efforts to regions with a lower welfare level.