ABSTRACT

Vulnerability assessments are effective solutions to reduce risk and losses of the impact of natural hazards. Many vulnerability assessments put more emphasis on the biophysical and physical vulnerability aspects leaving the social dimension of vulnerability poorly addressed. Social vulnerability was largely disregarded, mainly because it is difficult to quantify. Social Vulnerability Index (SoVI) is a popular method to assess social vulnerability. SoVI has some weaknesses such as in the accuracy and validity testing, containing subjectivity in the process of transformation, aggregation and weighting and cannot handle outlier problem. Model-based clustering method can be used to assess social vulnerability. This method is much preferred recently because it uses statistical principles, can determine number of clusters in the data and can solve outlier problem. Model-based clustering method which based on finite mixture models has an assumption that data are generated from several probability distributions, each representing a different cluster. This dissertation develops RMBC-MML method, a model-based clustering method which using Maximum Penalized Likelihood method for parameter estimation and Minimum Message Length criterion for model selection on mixtures of multivariate t distributions. The RMBC-MML method has proven to yield accurate parameter estimation descriptively and can overcome singularity problem on covariance matrix estimation. Application of the RMBC-MML algorithm identifies there are 3 clusters in the 2010 social vulnerability data. The majority of districts in Indonesia are in moderate level of social vulnerability and about 4.02 percent is in high level of social vulnerability. A typology map based on the formed clusters is created. When resources are limited, this typology map can be used to prioritize those districts with relative high of social vulnerability level.

Key words: Robust Model-Based Clustering, Finite Mixture Model, Multivariate t Distributions, Minimum Message Length, Social Vulnerability, Natural Hazards, Indonesia.