

# **Robust Simultaneous Confidence Interval Estimation of Principal Component Loadings**

By

**Martin Augustine B. Borlongan**

A thesis submitted in partial fulfillment  
Of the requirements for the degree of

**Master of Science in Statistics**

School of Statistics  
University of the Philippines  
Diliman, Quezon City

September 2015

## **Abstract**

In principal components analysis, outlying observations cause perturbations in the eigenvectors that consequently influence the principal components (PCs). Estimation of PC loadings are sensitive to outliers and hence, subsequent inference are not optimal. We propose a method that integrates bootstrap into a fully-automated forward search in the construction of robust confidence intervals for the elements of the eigenvectors of the correlation matrix in the presence of outliers. The coverage probability of the proposed bootstrap simultaneous confidence intervals was compared to the coverage probabilities of regular asymptotic confidence region and asymptotic confidence region via Minimum Covariance Determinant (MCD) approach through a simulation study. The proposed method generally yielded more stable coverage probabilities for datasets with or without outliers across several sample sizes compared to approaches based on asymptotic results.

*Keywords:* principal components analysis, bootstrap, forward search algorithm, outliers