Proposal of \(k\)-principal points for Binary Data by Introducing a Dendrogram

Sunhee Kwon  
Graduate School of Business Administration  
Meiji University  
Tokyo, Japan  
sunnyktd3@yahoo.co.jp

Takaaki Kawanaka  
Institute for Innovation in International Engineering Education, Graduate School of Engineering  
The University of Tokyo  
7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan  
kawanaka@cce.t.u-tokyo.ac.jp

Hiroshi Yamashita  
Department of Commerce, Meiji University  
1-1 Kanda-Surugadai, Chiyoda-ku, Tokyo, Japan  
hyamas@meiji.ac.jp

Abstract

In recent years, many studies on principal points, which was proposed by Flury (1990), have been developed in the field of statistical analysis. When a probability density function is divided into several regions for the data for which the probability distribution is assumed, the points representing the respective regions are called the principal points.

On the other hand, there are numerous data, including selection type questionnaire data and personal profile data, which can return binary (0 or 1) values that assume the distributions of multivariate binary data. In regard to this, Haruka Yamashita and Suzuki (2010) proposed principal points for the distribution of binary data based on the framework of the conventional principal points scheme.

In this research, we propose a new search method by introducing a dendrogram for binary (0 or 1) type \(k\)-principal points (Haruka Yamashita and Hideo Suzuki; 2010). In this search method, we aggregate \(n\) samples into \(k\) groups using dendrograms obtained from a cluster analysis. Then, the minimum binary type vector is obtained for each group by finding the sum of the squares of the distances from each sample, and we set them as the principal points.

Furthermore, we classified various “line superiority organizations” using binary data and separating their characteristics into a few (\(k\)) typical types (principal points) whose characteristics are similar, as an example of an application of the proposed method. A “line superiority organization” is an organization scheme with members who have high levels of expertise and authority, who actually carry out duties as lines (Junichi Nagakura and Hiroshi Yamashita; 2002). For example, universities, hospitals, airlines, auditing corporations, think tanks, and others are can be considered as line superiority organizations.

Through this research, we describe the various characteristics of the “line superiority organizations” in a concise form, and we examine the validity and effectiveness of the proposed method from these results.

Keywords  
Diversity, Binary Data, Cluster Analysis, Line Superiority Organizations
Biographies

Sunhee Kwon is currently an assistant lecturer in Graduate School of Business Administration, Meiji University, Japan. She earned Bachelor Degree of Commerce in School of Commerce from Meiji University, Japan and Master Degree of Commerce in Master course Graduate School of Commerce from Meiji University and Doctor Degree of Information and Communication in Doctor course Graduate school of Information and Communication from Meiji University. Her research interests are mainly focused on Consumer Behavior and Statistical Methodology. She is member of Japan Association for Management Systems, Japan Association for Communication, Information and Society, Association of Behavioral Economics and Finance and Japan Society of Business Ethics.

Takaaki Kawanaka is currently a lecturer in Institute for Innovation in International Engineering Education, Graduate School of Engineering, the University of Tokyo, Japan. He earned Bachelor Degree of Engineering in Faculty of Science and Engineering from Waseda University, Japan, Master Degree of Engineering in Master course Graduate school of Science and Engineering from Waseda University and Doctor Degree of Engineering in Doctor course Graduate school of Engineering from the University of Tokyo, Japan. His research interests are mainly focused on Industrial Engineering, Management Modeling and Information Security Management. He is member of Japan Association for Management Systems, Japan Industrial Management Association, Japan Society of Security Management and Information Processing Society of Japan.

Hiroshi Yamashita is currently Professor in Department of Commerce, Meiji University, Japan. He earned Bachelor Degree of Engineering in Faculty of Science and Engineering from Waseda University, Japan, Master Degree of Engineering in Master course Graduate school of Science and Engineering from Waseda University, Doctor Degree of Engineering in Doctor course Graduate school of Science and Engineering from Waseda University and Doctor of Commerce from Meiji University. His research interests are mainly focused on Human Resource Management, Management Quality Science and Management Modeling. He is member of Japan Association for Management Systems, Japan Association for Communication, Information and Society, Association for the Study of Industrial Management (Japan), Japan Society of Human Resource Management, Japan Logistics Society, Japan Society of Business Ethics, Japan Industrial Management Association, and Japan Academy of Management.