

# **Incorporated Fuzzy Robust Principal Component Analysis with Context-Dependent Data Envelopment Analysis for an Advanced Decision Making Process**

**Fu-Hsiang Chen**

Department of Accounting, Chinese Culture University, Taipei, Taiwan, R.O.C.  
chenfuhsiang1@gmail.com

**Te-Min Chang**

Department of Information Management, National Sun Yat-sen University, Kaohsiung,  
Taiwan, R.O.C.  
temin@cm.nsysu.edu.tw

**Hsueh-Li Huang**

English Program of Global Business, Chinese Culture University, Taipei, Taiwan, R.O.C.  
shirleyhuang60@gmail.com

**Sin-Jin Lin\***

Department of Accounting, Chinese Culture University, Taipei, Taiwan, R.O.C.  
annman1204@gmail.com (Corresponding author: S.-J. Lin)

**Ming-Fu Hsu**

Department of Business Management, National United University, Miaoli, Taiwan, R.O.C.  
hsumf0222@gmail.com

**Yu-Lin Huang**

English Program of Global Business, Chinese Culture University, Taipei, Taiwan, R.O.C.  
huangyulin18@gmail.com

## **Abstract**

One of the critical challenges of traditional data envelopment analysis (DEA) is a lack of discriminant ability, particularly if there is a relatively large amount of variables with respect to observations. To overcome this problem and uncover some essential messages behind successful business operations, this research introduces an advanced decision making scheme that combines fuzzy robust principal component analysis (FRPCA) and context-dependent data envelopment analysis (CD-DEA) to handle the performance measurement task. FRPCA condenses a large amount of information into some essential and manageable elements, while CD-DEA derives the learning path of each observation to reach an assessable benchmark. The introduced scheme not only yields a precise performance evaluation outcome, but also equips it with forecasting capability via artificial intelligence (AI) adoption. The introduced scheme, examined by real cases, is a promising alternative for performance forecasting and evaluation.

## **Keywords**

Decision making, context-dependent data envelopment analysis, performance evaluation, forecasting

### **Biographies**

**Dr. Fu-Hsiang Chen** is a full professor in the Department of Accounting at Chinese Culture University, Taipei, Taiwan. His research interests include financial accounting, computer auditing and decision making.

**Dr. Te-Min Chang** is a full professor in the Department of Information Management, at National Sun Yat-sen University, Kaohsiung, Taiwan. His research interests include text/data mining, decision making and recommendation system.

**Dr. Hsueh-Li Huang** was educated in Southern California, receiving her doctorate degree from La Verne University with an emphasis on organizational leadership and a master's degree in management from Pepperdine University with a minor in finance. Previously, she worked in finance at a Fortune 500 company for about 35 years. Her expertise in the finance and banking industries is extensive. Her academic accomplishments have been recognized through her books, publications, and a number of speeches and presentations. She is also an assistant professor in the English Program of Global Business at Chinese Culture University.

**Dr. Sin-Jin Lin\*** is a full professor in the Department of Accounting at Chinese Culture University, Taipei, Taiwan. Her research interests include financial accounting and decision making.

**Dr. Ming-Fu Hsu** is an assistant professor in the Department of Business Management at National United University, Miaoli, Taiwan. His research interests include business analytics and risk management.

**Mr. Yu-Lin Huang** is an undergraduate student in the English Program of Global Business at Chinese Culture University, Taipei, Taiwan.