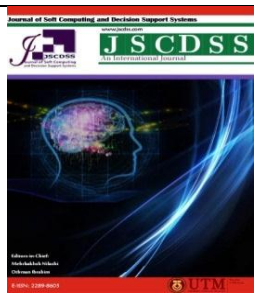
An International Journal
JSCDSS
http://www.jscdss.com
Vol.2 No.1 February 2015: 8-17
Article history:
Accepted 24 November 2014
Published online 3 January 2015

Journal of Soft Computing and Decision Support Systems



E-ISSN: 2289-8603

A Comparative Study of CCR-(ε-SVR) and CCR-(ν-SVR) Models for Efficiency Prediction of Large Decision Making Units

Mohammadreza Farahmand [a,c,*], Mohammad Ishak Desa [b], Mehrbakhsh Nilashi [a]
[a] Faculty of Computing, Universiti Teknologi Malaysia, Johor, Malaysia
[b] Advanced Informatics School, Universiti Teknologi Malaysia, Jalan Semarak, 54100 Kuala Lumpur, Malaysia
[c] Department of Science, Abarkouh Branch, Islamic Azad University, Abarkouh, Iran

[*] **Corresponding author email address**: mmreza_farahmand@yahoo.com

Abstract

In this paper, we develop CCR-(ε-SVR) and CCR-(ν-SVR) models based on modified parameters for efficiency prediction of large DMUs to improve the accuracy and reduce the computation time using three normalization functions. CCR-(ε-SVR) and CCR-(ν-SVR) are evaluated using large datasets over the three normalization functions. The experimental results of comparisons between CCR-(ε-SVR) and CCR-(ν-SVR) demonstrate that the proposed models can significantly improve the accuracy and reduce the computation time in predicting the efficiency of large DMUs.

Keywords: Data Envelopment Analysis (DEA), Support Vector Regression (SVR), Large DMUs, Normalization function

1. Introduction

Data Envelopment Analysis (DEA) is an effective method for obtaining the efficiency of Decision Making Units (DMUs) (Charnes et al., 1978; Chen and van Dalen, 2010; Emrouznejad and Shale, 2009). DMUs have been generated based on production function, cost function and measuring efficiency for evaluation and selection (Koopmans, 1951; Debreu, 1951; Farrell, 1957). Conventional DEA methods such as Charnes, Cooper and Rhodes (CCR) and Banker, Charnes and Cooper (BCC) models have been proposed by (Charnes et al., 1978; Banker, et al., 1984). Methods such as Additive DEA model (ADD), Enhanced Russell Measure (ERM) and Slack Based Measure (SBM) have been proposed to classify the DMUs into efficient and inefficient units which are not able to complete ranking for DMUs (Charnes et al., 1985; Färe and Knox, 1978; Pastor et al., 1999). In the most of these DEA models, the best DMUs have an efficiency score of unity, and, the experience is shown that there are usually plural DMUs which have this efficient status.

The dimensions of the original DEA linear programs formulated by Charnes et al. (1987) are essentially the dimensions of the *n* by *m* matrix defined by the data. Since each data point needs to be processed once, the original DEA procedure of Charnes et al. (1987) requires the application of *n* Linear Programs (LPs).

To overcome the computation time in DEA, several researchers tackled the problem in large data sets with using different DMUs (Ali, 1990, 1993, 1994; Ali and Seiford, 1993; Barr et al., 2002; Dulá, 2008).

Although LPs can be solved in polynomial time, the repeated solution of LPs becomes computationally intensive and time consuming, especially when large data sets are involved. In the other hand, for a massive data set with high dimensions of inputs and outputs for DMUs, DEA needs huge computer resources in terms of memory and CPU time (Emrouznejad and Shale, 2009).

The main problems with DEA based methods for large DMUs raking are time consuming and insufficient accuracy. The proposed combination of DEA and SVR (DEA-SVR) method for large DMU's efficiency evaluation was presented by Farahmand et al. (2014). They presented a combination of two conventionally methods, namely CCR and BCC with SVR (CCR/BCC-(ν-SVR)) for measuring of efficiency large DMUs ranking. The data used for training the SVR includes input, output and efficiency of DEA. This method was proposed for efficiency evaluation of large DMUs to solve some