A COMPARISON OF PARTIAL LEAST SQUARES REGRESSION WITH OTHER PREDICTION METHODS

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Received 25.06.2002

Abstract

The aim of this study is to compare popular regression methods with the partial least squares method. The paper presents a theoretical point of view, as well as an application on a real data set. It is found that partial least squares regression yields somewhat better results in terms of the predictive ability of models obtained when compared to the other prediction methods.

Key Words: Ordinary least squares, Ridge regression, Principal component regression, Partial least squares.

1. Introduction

In several linear regression and prediction problems, the independent variables may be many and highly collinear. This phenomenon is called multicollinearity and it is known that in this case the ordinary least squares (OLS) estimator for the regression coefficients or predictor based on these estimates may give very poor results [4]. Even for finite or moderate samples, collinearity problem may still exist. Plenty of methods have been developed to overcome this problem, such as principal component regression (PCR), ridge regression (RR) and partial least squares (PLS).

Two of the most used methods, namely PCR and RR, require a large amount of computation when the number of variables is large [5]. PCR handles the collinearity problem with few factors. However, PLS may even overcome the collinearity problem with fewer factors than PCR. Meanwhile simulations tend to show that PLS reaches its minimal mean square error (MSE) with a smaller number of factors than PCR. Hence, PLS gives a unique way of choosing factors, contrary to PCR, and it requires less computations than both PCR and RR. In the following sections theoretical aspects of those methods have been presented. Then, the methods mentioned above have been compared using real data and the results obtained have been discussed to stress the advantage of PLS.

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