

A NEW KERNEL MSE ALGORITHM FOR CONSTRUCTING EFFICIENT CLASSIFICATION PROCEDURE

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ABSTRACT. *The kernel minimum square error (KMSE) algorithm has been widely used in classification problems. However, this algorithm has the following drawback: the classification efficiency is inversely proportional to the size of the training sample set. Therefore, to improve KMSE algorithm for obtaining efficient classification is significant. In this paper we analyze the disadvantages of the OLS algorithm, an improvement of KMSE algorithm, and propose to construct an improved KMSE (IKMSE) algorithm using the variable selection technique. We first select a small number of samples from the training sample set and call the selected samples elements. Then we use the elements to construct IKMSE algorithm, which has several advantages over other improved KMSE algorithms such as the OLS algorithm. Experiments show that IKMSE algorithm produces elements fewer than the total number of training samples. Consequently, the IKMSE-based classification procedure is much more efficient than the KMSE-based classification procedure. Experiments also show that the IIKMSE-based classification procedure is also more efficient and accurate than both SVM-based and the OLS-based procedures.*

Keywords: Kernel minimum square error algorithm, Classification efficiency, Variable selection, Pattern recognition

1. Introduction. The minimum square error (MSE) algorithm, which has received much attention in recent years [1,2], is theoretically related to Fisher discriminant analysis (FDA) [3,4,5]. A recent development of MSE algorithm is kernel minimum square error (KMSE) algorithm, which has been applied to a number of classification problems such as face recognition and spiral problems [6,2]. KMSE algorithm implicitly transforms the input space into a high-dimensional space (feature space) by using the so-called kernel trick. Mathematically, KMSE algorithm is more tractable than other nonlinear methods [2], but it still has the drawback that its classification efficiency decreases as the size of the training sample set increases. Indeed, other kernel algorithms [9-14] also have the drawback. This is because KMSE algorithm bases the classification procedure of one test sample on all kernel functions between the test sample and all training samples. As a result, the classification efficiency of the KMSE-based classification procedure is inversely proportional to the number of training samples. Therefore, when KMSE algorithm is applied to a classification problem that has a large number of training samples, the implementation of the corresponding classification procedure may be time-consuming and even unfeasible.

A number of attempts have been made to improve KMSE algorithm for more efficient classification. For example, one very simple scheme [8] was proposed to assess the contributions of different training samples to the KMSE-based classification procedure.