ABSTRACT

THE ANALYSIS OF MATRIX DECOMPOSITION IN NULL SPACE-BASED ON LINEAR DISCRIMINANT ANALYSIS ALGORITHM

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The small sample size problem is common in pattern recognition. Almost all machine learning algorithms experience performance degradation when dealing with small sample size data. This problem can lead to singularity in the scatter matrix, which is a main problem in the Linear Discriminant Analysis (LDA) method. A null space-based LDA (NLDA) has been conceived to address the singularity issue. The NLDA method works by projecting the within-class scatter matrix onto the null space and then maximizing the between-class scatter matrix in that space. In early research, the NLDA algorithm involved the computation of eigenvalue decomposition and singular value decomposition (SVD). This research led to several new implementations of NLDA method using other matrix decompositions. The new implementations include NLDA using Cholesky decomposition and NLDA using QR decomposition. This thesis compares the performance of three NLDA methods using different matrix decompositions, namely SVD, Cholesky decomposition, and QR decomposition. Three datasets were used in the experiments that applied three different NLDA algorithms. To determine the performance of the NLDA methods, the classification accuracy was measured using the Confusion Matrix. The results show that the NLDA method using SVD has the best performance when compared by the other two methods. It achieved 77.8% accuracy for the Colon dataset, 98.8% accuracy for the TKI-resistance dataset, and 90,32% accuracy for the batik dataset.

Keywords: linear discriminant analysis, small sample size, null space, singular value decomposition (SVD), Cholesky decomposition, QR decomposition.