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An Efficient LDA Algorithm for Face Recognition

Automatic face recognition has been in research and a lot of techniques and approaches based on PCA using Eigen faces has played an important role in the dimensionality reduction. But LDA encode the discriminatory information in a linear separable space. The standard LDA algorithm has difficulty processing the high dimensional image data. PCA is often used to project data into lower dimension space and then LDA is performed. But the relevant information could be lost in the first step, so they propose an unified LDA/PCA algorithm. The basic idea of LDA is to find a linear transformation such that the cluster features are separable. This could be achieved by scatter matrix analysis. The average scatter of the sample vectors of different classes around their mean vector Mu. The class separability can be measured by a certain criterion. The solution to this is to compute inverse of Sw and solve eigen problem for Sw-1Sb. But this is unstable as it has inversion of high dimension matrix. The solution to this problem is to perform PCA first and then LDA. The PCA would remove null spaces from Sw and Sb. This step would lose some information when the projection of Sb is not zero in that direction. The new LDA algorithm assumes that the null space has some information and could be useful if the projection of Sb is not zero in that direction. Remove the null space from Sb and diagonalize it. Sort the eigen vectors in decreasing order. Diagonalize Sw and get the smallest eigen values of Dw. Use LDA transformation. Even though LDA has good performance, traditional LDA algorithms have problem handling a degenerated Sw. The full rank requirement of Sw can be transferred to Sb.The new algorithm is an unified algorithm with fisher’s criterion where St=Sb+Sw which is a total scatter matrix. The first step is PCA and then LDA giving a unified PCA+LDA algorithm. Without any preprocessing step the best recognition rate for the new algorithm was 95%. Facial region is the start of facial recognition and the quality of extraction effects face recognition directly. For a face extraction purpose, the system focuses on eyes and use particular distance between eyes to establish bounding box. This is a platform to allow many techniques to be plugged in and run. The model has input and output from recognition algorithms. It starts off by loading images and then used for training the various recognition methods. Running recognition on a live image data comes from atracking model. The LDA algorithm for face recognition by full rank requirement from Sw to Sb has avoided losing the most discriminant dimension. The fusion of PCA and LDA has provided platform for developing the new algorithms.

**Critique analysis:** I feel that PCA and LDA when combined together works better than either using PCA or LDA alone. The beauty of reduction of dimension through PCA and then applying LDA on top of it is a wise choice of picking of algorithms.