Chapter 5

Experiments

Last chapter was dedicated to describe the informative vector machines, its problems and our proposed methods for application into face recognition. This chapter summarizes details of experiment designs we carried out to evaluate the performance of our proposed methods for face recognition. Detail discussion about the results and evaluations will be discussed in the next chapter.

5.1 Face Databases

As in other pattern recognition experiments face recognition can also be carried out with standard databases. Use of standard databases makes the experimental results more comparable with other results in the literature. Many standard face databases have been developed for face recognition and a listing of many of them are available at [9].

In our experiments we restrict to holistic and frontal face recognition and do not take much facial feature as expressions or illumination.

5.1.1 ORL Database

For our experiments we use ORL face database. ORL face database [7] was developed by AT&T Laboratories, Cambridge and it is one of the most popular face databases used in face recognition. ORL database has been employed in many experiments to evaluate various algorithms proposed by researchers. This has made it a very reliable database and an easier one to benchmark new algorithms. Above features and the convenience of comparing our results with others found in literature made us choose ORL database for our research.

ORL consists of frontal face images of 40 subjects, 10 from each totaling 400 images. These subjects differ in age and gender and in most cases images are taken with slight face rotation, varying lighting condition, facial expressions (smiling, eyes closed) like and facial details (glasses). All images come in PGM format with 256 gray levels per pixel and size is 92x112. Figure 5.1 shows a sample of face images of ORL database.
5.2 Experimental Design

In our research work we have conducted two face recognition experiments using ORL databases. The main objective of these experiments is to evaluate performance of informative vector machines. But we have conducted the same experiment with support vector machines for comparisons. All these experiments were conducted as binary classifications. In our experiments we restrict to holistic and frontal face recognition and do not take much facial feature as expressions or illumination.

5.2.1 Experimental Setup

All programs are written using MatLab version 7 and experiments were conducted using Intel Pentium IV PC’s with 2.9 GHz processors. We have modified the IVM code developed by Neil Lawrence [16] to suit our experiments with faces. In the case of ARD kernels we have modified the IVM according to the optimization method proposed in algorithm 3 that was described in the last chapter. We call this modified version IVM* for convenience. For other normal kernels we use the original IVM algorithm. In IVM* we can use a threshold to reduce dimension of face images. We used kernel adatron [2] (Appendix B) as our SVM.

5.2.2 Preprocessing of Images

In our experiments we did not apply any preprocessing since faces in the ORL database didn’t have a considerable amount of noise or illumination. Reasons for this were that ORL images did

Figure 5.1 A sample of faces of ORL database.
not contain a great deal of illumination or noise problems and limited amount of these conditions were allowed since it would help to measure the ability of classification algorithms to perform under these varying conditions. For both experiments below we took the images of the faces as it’s available in the database. Input data was normalized by dividing by 512.

5.3 Experiment 1

For our first experiment five images from each subject were chosen to formulate the training set and the remaining five images were used for testing. Images were selected one after the other from their natural ordering for each set. All algorithms applied in this experiment used binary classification with five from each subject as positive and other 195 as negative sets. Experiments were repeated for all 40 subjects.

As our evaluating algorithm, IVM with RBF, linear and MLP kernels and IVM* with their ARD versions were included. For comparisons SVM was used with RBF kernel with width 10 and second degree polynomial kernels.

5.4 Experiment 2

In the second experiment a larger training set compared to the first experiment was created by taking nine face images of each subject. This made the training set contain 360 images. For each subject nine positive images were taken as positive examples and 351 negative examples form others. Contrary to the first experiment for testing we have taken all 400 images.

Similar the first experiment we included IVM with RBF, linear and MLP kernels and IVM* with their ARD versions and SVM with RBF kernel with width 10 and second degree polynomial kernels.

5.5 Summary

Any new algorithm for face recognition needs to be evaluated and compared with existing methods. In this chapter we justify our preference in ORL face database for our experiments described features of it. Next we described the experimental we were planning to conduct. Two experiments are proposed which takes two different numbers of samples to formulate training and test sets. Both experiments contain informative vector machines and support vector machines algorithms with different kernels for evaluation purposes. Next chapter discusses results and gives an analysis of these experiments.