

Optimization of nearest neighbour selection using ROC for a KNN based classifier

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In cluster analysis, input data are grouped based on some inherent similarity measures. This is basically known as unsupervised learning. In the context of speech emotion recognition, many data clustering techniques have been introduced in previous studies. This study proposes a binary hierarchical classifier based on Fisher Linear Discriminant Analysis (FLDA) and K Nearest Neighbour search (KNN search). At each stage of the hierarchy, the training speech signal was mapped into a feature space and the clustering patterns were observed. Then, the test speech was categorized into an emotional cluster considering the maximum likelihood of nearest neighbours belonging to that cluster. At this point, the number of neighbours varied from stage to stage of the hierarchy, as some acoustic features are common to several emotions.

The selection of the optimum number of allowable nearest neighbours was done using Receiver Operating Characteristics (ROC) curve. As indicated in previous studies, a fixed number of allowable nearest neighbours have been used at each stage of the hierarchical method.

The optimum allowable number of neighbours differs from application to application according to the True Positive Rate (TPR) and the False Positive Rate (FPR) of the recognition. For example, in an emotion recognition system, where the proposed classifier has been applied, getting a higher false positive rate is problematic for surveillance and call center applications whereas in automatic translation systems, a bit higher FPR will not generate an adverse effect. Hence, the allowable number of neighbours will depend on the applications where the KNN classifier is used.

The ROC curve was used to justify the selection of the optimum number of allowable nearest neighbours.