

A Study on the Lower Bounding to the Dynamic Time Warping-Exampld by
Voice Recognition
羅琪, 張俊仁
Applied Statistics
Management
chilo@chu.edu.tw

Abstract

In recent years, classification and clustering of time series data have become one of the topic of great interest within the database/data mining community. Most method in classification and clustering are needed to calculate the distance measure between two series. Several popular measures of distance are Euclidean distance, squared Euclidean distance, city block distance and Minkowski distance. However, when two time series are similar but they are not aligned in the time axis, then the above distance measures are very sensitive to distortion in time axis. Although using Euclidean and other distance measures in classification and cluster analysis can make calculation efficient, we have to face the evidence of higher error rate.

The problem of distortion in the time axis can be solved by using Dynamic Time Warping (DTW) which is a method based on the dynamic programming. In this research, both Euclidean distance and DTW distances by various path constraints are used as the dissimilarity measures. Then the k th nearest neighbor classification rule is used to classify the speech pattern of several people speaking Chinese “open the door, sesame” and the apparent error rate is used to compare the classification results. Finally, a discussion will be made on the effect of lower bounding constraints to the error rate and computation speed. The results demonstrated that DTW greatly reduced the error rate but it was time-consuming. Local continuity constraints had no much influence on the error rate, but constraints I and III spent less time in calculation than constraints II, IV and V. Finally, if using lower bounding properly, it not only can reduce the time in calculation and classification, but also can reduce the error rate.

Keyword : dynamic time warping, speech recognition, path constraint, lower bound, time series, classification analysis, nearest neighbor classification rule