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Spoken character classification using abductive network

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Abstract In this paper, we address the problem of learning a classifier for the classification of spoken character. We present a solution based on Group Method of Data Handling (GMDH) learning paradigm for the development of a robust abductive network classifier. We improve the reliability of the classification process by introducing the concept of multiple abductive network classifier system. We evaluate the performance of the proposed classifier using three different speech datasets including spoken Arabic digit, spoken English letter, and spoken Pashto digit. The performance of the proposed classifier surpasses that reported in the literature for other classification techniques on the same speech datasets.

Keywords Abductive network · Spokem digit classification · Spoken letter classification

1 Introduction

Accurate classification of spoken characters (digits and letters) is crucial for many applications, including automated telephone-based services such as voice dialing and speech-to-text services such as text dictation (Sarma and Sarma 2015; Wiqas and Navdeep 2012). An accurate classifier is important for classification of spoken character because a classifier with a high classification error can cause, for example, the partial or complete distortion of texts in a text dictation application.Thus a high accuracy of the spoken characters is needed in order for the application to be useful.

The development of a classifier for the classification of spoken characters involves acquiring a training set in the form of labeled feature attributes that are representative of the spoken character to be classified. Then the training set is used as input to a machine learning algorithm in order to build the classification model (Padmanabhan and Premkumar 2015). The machine learning algorithms commonly used include, K-Nearest-Neighbor (KNN) and Support Vector Machines (SVMs). KNN build a classifier by computing the similarity among the samples in the training set and then creating a local neighborhood map of all the samples (Lanjewar et al. 2015). During classification, a new sample (spoken character) is assigned to the class of its closest neighbor (Lanjewar et al. 2015). KNN suffer from a number of limitations including the need for a large training set in order to build a good classifier and its high computational cost, due to the need to compute the similarity between a given sample to all the samples in the training set before reaching classification decision. SVM, on the other hand, builds a classifier by using a non-linear function to map the training set from the input space into a high dimensional feature space and then constructs separating hyperplanes that separate the mapped samples into different classes. These hyperplanes are defined by a small subset of the training set known as the *support vectors* (Ananthi and Dhanalakshmi 2015). Although SVM has been shown to build a reliable classifier even with small training set (Ananthi and Dhanalakshmi 2015), its training process is tedious and less appealing because of the many choices to be made in determining the critical hyperparameters for the SVM such as the regularization constant and kernel hyperparameter. Moreover, the wrong selection of these hyperparameters can lead to the realization of an SVM characterized with poor performance.

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