Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 115 (2017) 572–579

Procedia Computer Science

www.elsevier.com/locate/procedia

7th International Conference on Advances in Computing & Communications, ICACC-2017, 22-24 August 2017, Cochin, India

Multi-label Classification: Problem Transformation methods in Tamil Phoneme classification

M. Pushpa[a]*, S. Karpagavalli[b]*

[a]*Department of Computer Science, PSGR Krishnammal college for women, Coimbatore-641004, Tamilnadu, India*

Abstract

Most of the supervised learning task has been carried out using single label classification and solved as binary or multiclass classification problems. The hierarchical relationship among the classes leads to Multi- Label (ML) classification which is learning from a set of instances that are associated with a set of labels. In Tamil language, phonemes fall into different categories according to place and manner of articulation. This motivates the application of multi-label classification methods to classify Tamil phonemes. Experiments are carried out using Binary Relevance (BR) and Label Powerset (LP) and BR's improvement Classifier Chains (CC) methods with different base classifiers and the results are analysed.

Peer-review under responsibility of the scientific committee of the 7th International Conference on Advances in Computing & Communications.

Keywords: Supervised learning; Multi-label classification; Speech recognition; Phoneme classification.

1. Introduction

Classification is a commonly used data mining task. Single label (SL) classification where each instance is associated with a class has been used in several distinct domains. In certain domains such as text categorization, annotation of image, audio and video, bioinformatics, emotion recognition systems where instances may belong to one or more classes. The set of techniques that can handle instances having multiple labels has been developed and are called multi-label (ML) classification [1].

Several different methods have been developed and reported to perform multi-label learning task. Two broad

* Corresponding author. Tel.: 9787525777, 9842105105; fax: +0-000-000-0000 .
E-mail address: ranjthapushpa92@gmail.com, karpagavalli@psgrkc.ac.in

1877-0509 © 2017 The Authors. Published by Elsevier B.V.
Peer-review under responsibility of the scientific committee of the 7th International Conference on Advances in Computing & Communications
10.1016/j.procs.2017.09.116

categories used to perform multi-label learning are the problem transformation methods and the algorithm adaptation methods. The problem transformation approach involves transformation of an input instance into a representation suitable for traditional single-label classifier. In this approach, the multi-label data representation is transformed into a single-label data representation which is acceptable by traditional SL classification methods [2]. There are various algorithms which come under this approach are BR, LP, CC, RPC, CLR, etc. The algorithm adaptation approach involves modification of an existing SL classifier algorithm and making it suitable to handle multi-label instances. Many algorithms such as MLkNN, ML-BPNN, ML-DT uses this approach. Ensemble methods are also used for multi-label learning that combines outcomes from several classifiers based on either problem transformation or algorithm adaptation. Algorithms such as RAkEL, Ensembles of classifier chains (ECC), follow this approach.

Many application areas are present for multi-label classification like text categorization, scene classification, face recognition, drug discovery, music recommendation. This work employs multi-label classification approach in Tamil language phoneme classification task.

2. Phonemes in Tamil Language

Phoneme is the most commonly used sub-word unit in speech recognition application. Design and development of efficient phoneme recognition will lead to high accuracy speech recognition applications. The phonetic units of a Tamil language can be grouped into different categories such as vowels, plosives, fricatives, etc. According to the place and manner of articulation, phonemes can be organized in hierarchical fashion [3].

Tamil phonemes are majorly classified into obstruent and sonorant categories. Obstruent is a consonant sound such as that is formed by obstructing airflow, causing a strong gradient of air pressure in the vocal tract. Sonorant is a speech sound that is produced with continuous, non-turbulent airflow in the vocal tract. The hierarchy of phonemes in Tamil language is shown in figure 1. Stop consonants also known as plosives, are consonant in which the vocal tract is blocked so that all airflow ceases. Fricatives are consonants produced by forcing air through a narrow channel made by placing two articulators close together. This turbulent air flow is called frication. Affricates are combination of stops and fricatives, i.e., begins as a stop and release as a fricative with the same place of articulation. All these stops, fricatives and affricates fall in the group of obstruents. Nasals are allowing the air to escape freely through the nose but not through the mouth, as it is blocked by the lips or tongue. In terms of acoustics, nasals are sonorants, meaning that they do not significantly restrict the escape of air. In addition to vowels, phonetic categorizations of sounds that are considered sonorant include approximants, taps and trills [4][5].

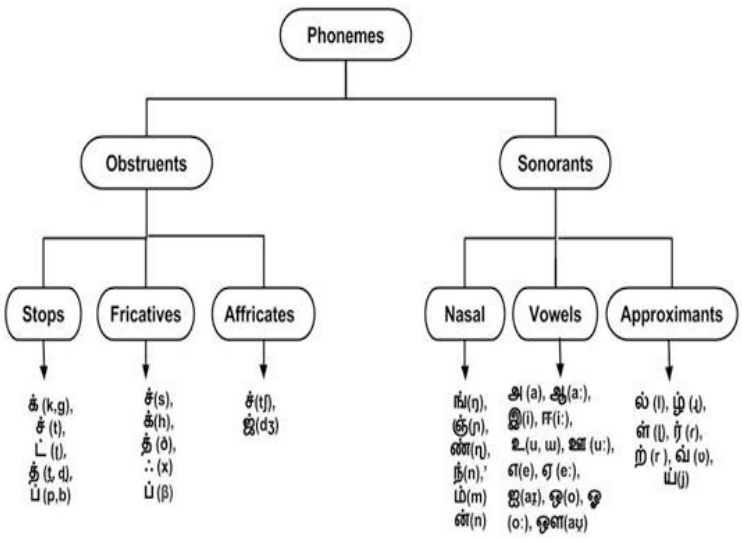

Fig. 1. The hierarchical relationship of Tamil Phonemes