

A statistical technique for identifying articulatory roles in speech production

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Abstract

In describing speech production in the articulatory domain, many researchers have used distinctive features associated with phones through which coarticulatory effects are specified by phonological rules. Others have introduced coarticulation resistance and degree of articulatory constraint as a means of prioritising articulatory movements involved in speech gestures. On similar lines, the roles played by an articulator during an utterance can be termed critical, dependent or redundant at any time. We propose a statistical approach for identifying such roles from annotated articulatory data. The critical articulators for each phone are identified based on the strength of Kullback-Leibler divergence between phone-specific distributions and the global distributions. The effect of the critical articulators' configuration on dependent articulators is estimated using significant articulatory correlations. Two versions of the algorithm are considered, 1D and 2D, which either treat x and y coordinates of the articulatory data independently or incorporate covariation within the motion of an articulator in the mid-sagittal plane. The 2D case uses canonical correlation analysis. The performance of the critical articulator identification approach is evaluated by comparing the results obtained with our algorithm to the distinctive phonetic features. Such a model which captures the phonetic invariance in a statistical way from articulatory measurements has the potential to quantify cross-language differences in the realisation of the phonetic inventory, and provide a compact representation of critical articulatory events in speech production.