

Analysis of voice signals using non-linear techniques

Analysis of speech signals is important for the development of speech recognition and speech synthesis techniques. Conventional methods used for speech analysis such as Fourier spectra and linear predictive coding are based on linear techniques. However, speech production is a non-linear process and the speech signals have been found to contain non-linearities. Therefore it has been recently recognised that non-linear techniques are more suitable for the analysis of speech signals.

In this work, an analysis of vowel sounds of Sinhala language was carried out using non-linear techniques such as time delay embedding, singular value decomposition embedding and dimension analysis. Example state space embeddings obtained for two vowel sounds are shown in Figure 1.



Figure 1 – State space embeddings of the vowel sounds ආ and ඈ

Evidence was found for non-linear low dimensional behaviour of speech signals, in agreement with some of the published work. In addition, by comparing reconstructed phase portraits with frequency spectra, evidence was found for the existence of period doubling bifurcations in speech signals.