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Towards speech recognition using palato-lingual contact patterns for voice restoration.

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Abstract

The loss of speech following a laryngectomy presents substantial challenges, and a number of devices have been developed to assist these patients. These devices range from the electrolarynx to tracheoesophageal speech. However, all of these devices and techniques have concentrated on producing sound from the patient's vocal tract.

Research into a new type of artificial larynx is presented. This new device utilizes the measurement of dynamic tongue-palate contact patterns to infer intended speech. The dynamic tongue measurement is achieved with the use of an existing palatometer and pseudopalate. These signals are then converted to 2-D Space-Time plots and feature extraction methods (such as Principal Component Analysis, Fourier Descriptors and Generic Fourier Descriptors) are used to extract suitable features for use as input to neural network systems. Two types of neural network (Multi-layer Perceptrons and Support Vector Machines) are investigated and a voting system is formed. The final system can correctly identify fifty common English words 94.14% of the time with a rejection rate of 17.74%.

Voice morphing is investigated as a technique to match the artificially synthesized voice to the laryngectomy patient's original voice. It is successfully implemented thus creating a transfer function that can change one person's voice to sound like another's. Once the voting system has correctly identified the word said by the patient the word is then synthesized in the patient's pre-laryngectomy voice.

The final artificial larynx system solves a number of the problems inherent in previous artificial larynx designs (such as poor voice quality and invasiveness). This new artificial larynx uses current technology in a new way to produce a viable solution for alaryngeal patients.