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SELECTED PAPERS FROM
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ICOM'08

Editors

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Educational Project on a Simple Voice Identification using Mel-Frequency Cepstrum Coefficients and Vector Quantization

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ABSTRACT

Voice identification is a task of identifying a person based on the content of information in one's voice signal which distinguishes his/hers from voices of other people. This paper presents an educational project on a simple voice identification system, which uses two parameters of voice features: the fundamental frequency or pitch and the vocal tract information represented by Mel-Frequency Cepstrum Coefficients (MFCC). The estimation fundamental frequency is performed with Harmonic Product Spectrum (HPS) algorithm, whilst MFCC is calculated using Discrete Cosine Transform, then, is modeled with Vector Quantization to compress the size of data to be processed and to assist identification.

1. INTRODUCTION

Human auditory system enables a person to receive information through voice communication with other persons. Human voice is rich in information that it can contain messages in form of sequences of words that have meaning and information on language used, emotional or health state of the speaker, gender and the identity of the speaker. This paper proposes a system which identifies a person based on the information extracted from his/her voice signal.

Features of voice signal are unique for each person that they allow us to differentiate voices of our parents, siblings, friends or colleagues. Voice identification attempts to mimic the behaviors of the auditory system in terms of determining the speaker of voice signal from an unknown source.

Voice identification can be applied to many mechatronics systems, such as in robots, manufacturing systems and in security systems, whereby the activation of certain processes can be initiated through voice identification/recognition.

A voice identification system requires a robust acoustic feature extraction technique, where specific information contents in the signal are captured, and an efficient scheme to model the extracted features [2]. The method proposed in this paper is identification using a combination of pitch and MFCC, and utilizing vector quantization for modeling. The method results in voice identification, which is based on simple algorithm (in MATLAB and Signal Processing toolbox), and developed using a simple system includes a MIC and a personal computer (PC), yet the accuracy achieved is considerably good (80-90%).

The content of this paper is divided into five main sections. To assist understanding in the origin of the two voice features, MFCC and pitch, a brief background on anatomy and production of human voice is explained in Section 2. Section 3 discusses the architecture of the proposed voice identification system. Then, details of the process involved in the system: pre-processing, enrollment and identification are discussed in Section 4, 5 and 6, respectively. The testing results of the system are presented in Section 7 to validate the performance of the proposed voice identification system.

2. PRODUCTION OF VOICE FEATURES

Figure 1 shows a model of human vocal tract. Human voice is a product of air molecules, which travel from lungs to the lips or nose, and experience compression and rarefactions by the movements