Signal Processing Project (Monsoon 2024)

Part 1: Bird recognition

Introduction: Bird sounds can allow us to uniquely identify the bird species. Their time and frequency characteristics can be studied and used for bird recognition.

Signals: The folder 'Reference' contains audio files of sounds made by three distinct bird species. The folder 'Task' contains multiple audio files corresponding to the sounds made by the same three bird species.

Objective: Analyse the audio files in the 'Reference' folder and identify some features/properties which can be used to distinguish the bird species. Use learning from the course to design these features. Apply your analysis to identify the bird species for each of the audio file in the 'Task' folder.

Part 2: Heart rate estimation

Introduction: Electrocardiogram (ECG) signals are heart signals (electrical activity of the heart) routinely used to monitor heart health. Heart rate (HR) is an important parameter used for health assessment. The ECG is a quasi-periodic signal, and the HR typically varies over time based on the activity involved. Often, these signals get corrupted during the measurement process.

Signals: You are given various ECG signal samples. Signal E1 is a noise free ECG signal. Signals E2 and E3 are noisy ECG signals. The sampling rate is 128 samples/second.

Objective:

Task 1 – For E1, find and plot the HR as function of time. Perform the estimation per minute.

Task 2 – For E2 and E3, perform appropriate noise removal and then find the HR per minute.

Part 3: Loudness segmentation

Introduction: Speech is a natural mode of communication to convey the feelings and intentions. These intentions will be passed by changing loudness of the words spoken in one's speech. Often, the words in speech have strong perceptual boundaries however similar strong indications can't be observed in the speech signal.

Signals: You are given different speech samples and text files. The text files contain information of spoken words, its start and end time and markings indicate louder (1) or not (0) for each speech sample.

Objective:

Task 1 – For given speech samples, find the louder words using its respective start and end times.

Task 2 – For given speech samples, find the louder words without using start and end time information.