Introduction

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Neck Laser data is a biomedical data set. This data set contains the human pulse vibrations over the neck artery collected by a laser Doppler vibrometer. Each single set of data is collected for a person from multiple Left and Right-side scans and saved in .mat format. Each .mat file is the 1D signal values in the time spectrum like waves, electricity, mechanical vibrations etc.

We have total of 154 files mat files of 26 persons for now (more data will be available later). each file data is the 60 seconds with sampling rate 44,100 Hz.

We want to distinguish useful vs. useless, and normal and abnormal person from the data set. As we know a normal person heartbeat is 50~150. For the original signals, we will use Fourier transform and signal processing procedures to find the plausible heartbeat rates for each person, and other signals that could point to abnormal features. If person's heartbeat is in desired rate.

After formulating more data signatures, we will use machine learning model to learn from data to classify people of different age groups, gender and/or health conditions.

Planned to Work

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Data in each file in time spectrum of 60 seconds. Each person has multiple left side and right-side scans. we can work with each file and pick one of the files that has good signal value, or we can take average of each left side and right-side files and work on average files. We will go for two of this way and pick which one is worked best for our purpose.

As our data is in time domain. One of the first task of this data to transform in frequency domain. in order to that we will use one of the well know approach if Fast Fourier transform (FFT). We will apply FFT on both each individual files and average files. As We know a person normal heartbeat rate is 50~150. We will start with this range and retriev a person’s heartbeat is normal.

When our leveling of data is done. we will find/learn more features in the time and frequency domains and then use machine learning to classify data for different identification purposes.

Progress

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We learned how to use Fourier transform in Digital signal processing.

Each person's Left scans files and right scans file are averaged to left and right averaged file

Applied FFT on both Left and right scan file and visualized to 10Hz

Applied FFT on average left and right average files and visualized to 10Hz

Found out Our reason of interest lie on 0.8Hz~2.5Hz

Next

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develop a robust procedure to identify the heartbeat frequency from the same data set to retrieve information from the noisy data: for each data set we identify several local maximal Fourier magnitudes, after a voting procedure, the one with the most votes or the average of several close ones will be the heartbeat frequency. The precise voting policy will be determined later dictated by the data.