

# Data Ventures: Practical 3

## Detecting Heart Abnormalities

Spring 2018

### 1 Description

The task is to produce a method that can classify real heart audio (also known as “beat classification”) into one of three categories:

- Normal
- Murmur
- Extrasystole

The audio files are of varying lengths, between 1 second and 30 seconds (some have been clipped to reduce excessive noise and provide the salient fragment of the sound). Most information in heart sounds is contained in the low frequency components, with noise in the higher frequencies. It is common to apply a low-pass filter at 195 Hz. Fast Fourier transforms are also likely to provide useful information about volume and frequency over time. More domain-specific knowledge about the difference between the categories of sounds is provided below.

#### Normal Category

In the Normal category there are normal, healthy heart sounds. These may contain noise in the final second of the recording as the device is removed from the body. They may contain a variety of background noises (from traffic to radios). They may also contain occasional random noise corresponding to breathing, or brushing the microphone against clothing or skin. A normal heart sound has a clear “lub dub, lub dub” pattern, with the time from “lub” to “dub” shorter than the time from “dub” to the next “lub” (when the heart rate is less than 140 beats per minute). Note the temporal description of “lub” and “dub” locations over time in the following illustration:

...lub.....dub..... lub.....dub.....

In medicine we call the lub sound “S1” and the dub sound “S2”. Most normal heart rates at rest will be between about 60 and 100 beats (‘lub dub’s) per minute. However, note that since the data may have been collected from children or adults in calm or excited states, the heart rates in the data may vary

from 40 to 140 beats or higher per minute.

### **Murmur Category**

Heart murmurs sound as though there is a “whooshing, roaring, rumbling, or turbulent fluid” noise in one of two temporal locations: (1) between “lub” and “dub”, or (2) between “dub” and “lub”. They can be a symptom of many heart disorders, some serious. There will still be a “lub” and a “dub”. One of the things that confuses non-medically trained people is that murmurs happen between lub and dub or between dub and lub; not on lub and not on dub.

### **Extrasystole Category**

Extrasystole sounds may appear occasionally and can be identified because there is a heart sound that is out of rhythm involving extra or skipped heartbeats, e.g. a “lub-lub dub” or a “lub dub-dub”. (This is not the same as an extra heart sound as the event is not regularly occurring.) An extrasystole may not be a sign of disease. It can happen normally in an adult and can be very common in children. However, in some situations extrasystoles can be caused by heart diseases.

## **2 Rules**

Outside packages are allowed, but outside data isn't! No pretrained models. As you make submissions, the leaderboard will be updated. The leaderboard is only an estimate of your true score. Half of the test data will be set aside for the final score calculations (to avoid overfitting on the testing set, and incentivizing a large number of submissions).

Scoring will be done based on average F1 Score (harmonic mean of precision and recall) over classes.

## **3 Submission**

The upload format is a CSV with a 2 columns (file name and predicted class).

Click here: <https://goo.gl/forms/PDGqATnB3obWboxR2>