Cardiac Sound Separation and Analysis

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**Motivation**
Heart disease is the leading cause of death in the world. One percent of all newborns have some sort of heart dysfunction. The stethoscope is the most widely used frontline instrument to detect heart dysfunction.

**Problems**
Using the stethoscope requires extensive training. Interpretation of the phonocardiogram can be subjective. The phonocardiogram is a mixture of sounds with complexity that makes it difficult to analyze for diagnosis of heart dysfunctions.

**Goals**
Extract discrete heart sounds from the phonocardiogram and develop algorithms for real-time analysis. Non-invasive, easy to use and inexpensive apparatus. Automated support of diagnosis of the separated sounds to classify dysfunctions.

**Phonocardiogram Dissection**
- Apply blind source separation algorithms to isolate major delayed components of the heart sound.
- Utilize dynamics of the heart to detect and isolate major heart sounds.
- Extract clinically relevant features from isolated heart sounds to perform clinical diagnosis.

**Systolic Murmur Classification**
- Ejection
- Regurgitant
- Ejection or Regurgitant
- Normal

**Simplicity based detection of heart sounds.**
Top: Mitral stenosis murmur. Bottom: Simplicity of mitral stenosis murmur

**Simplicity based classification of systolic murmurs.**