Aortic Valve Stenosis

DATA:

- Videos in .avi (recommend VLC media player)
- Consisting of several frames. A frame is an image. In this case, they are 8-bit greyscale images. This means that a frame is only a matrix with values between 0 (black) and 255 (white).

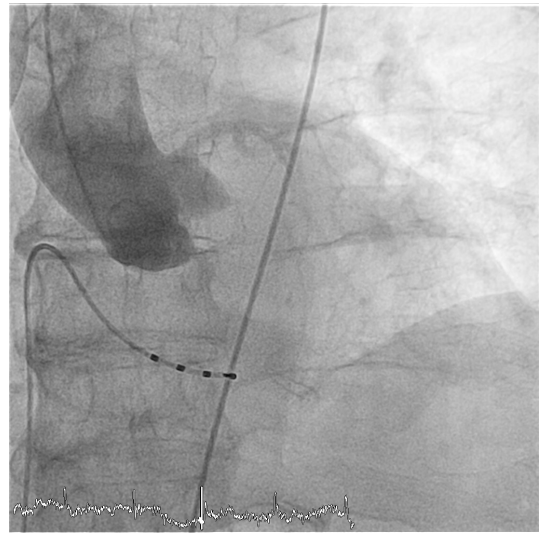
PROBLEM STATEMENT:

- The valves we are studying here are the valves between the aorta and the heart. They are meant to prevent the blood that has been pumped out of the heart from flowing back into the heart.
- In this disease, however, the valves are hardened and stiff. This prevents the flow of blood out of the heart.
- This stiffening is detected by injecting a contrast medium in front of the valve on the side of the aorta. If the valve is functioning intact, we see that the opening valves push the contrast medium to the side and the contrast-free blood then colours the area normally.

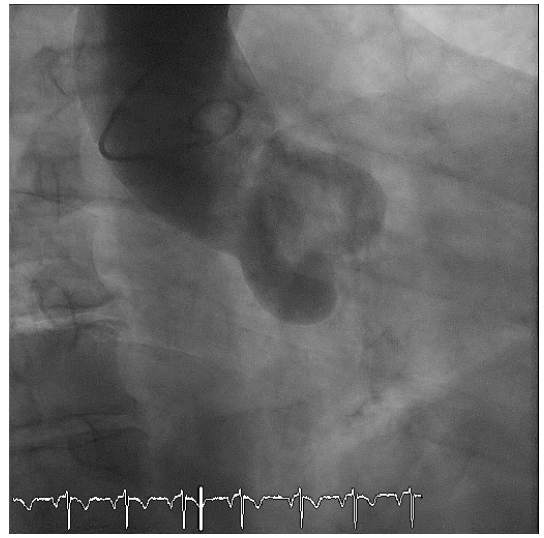
GOAL:

- To be able to distinguish between aortic valve stenosis and no aortic valve stenosis.
- Be able to indicate the severity of aortic valve stenosis

Case



Control



Preprocessing

- Automatic **cutting** to the area of interest on all three dimensions
  - Selecting of the interesting frames:
    - A few (maybe 5) frames after the contrast medium was injected.
    - Looking for the frame in which the contrast medium was injected and from this one selecting a few more (fixed amount) of frames
    - The frame in which the contrast medium was injected is the first frame in which a high change appears -> subtracting consecutive frames and calculate the squared 2-norm to get one value for the pair of frames:
      $$\|t_i - t_{i+1}\|_2^2 \text{ for } i \text{ in } \#\text{frames-}1,$$
      where t_i is the i-th frame.
    - The list of values that results should have quite the same low numbers at the beginning, and then jump from the point in time we are looking for. Between these two frames k and $k+1$, there is a greater difference than between the frames before. The injection has therefore occurred in frame $k+1$.
  - Selecting the interesting pixels in the frames (rectangular area)
- **Resizing** to the same size for all cropped images
- **Normalising** of the images to make the grey-values between the images more comparable
  - Comparing Histogramms before and after apply standardisation or another normalisation method.