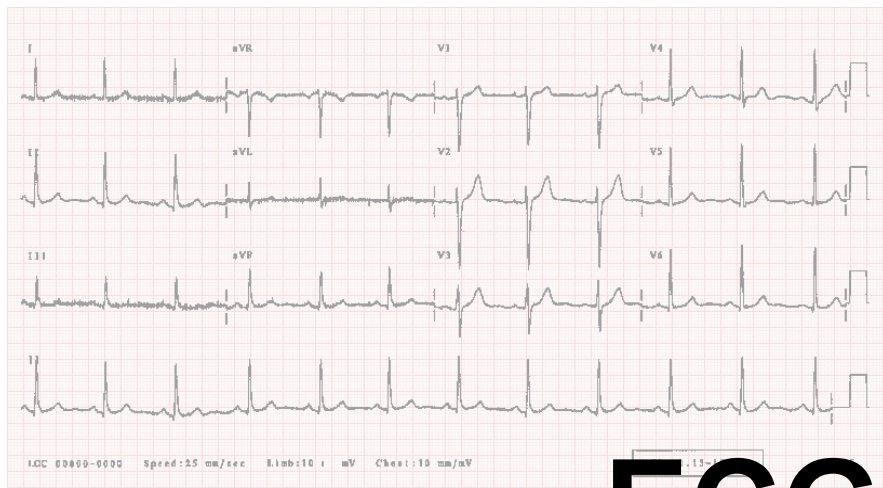


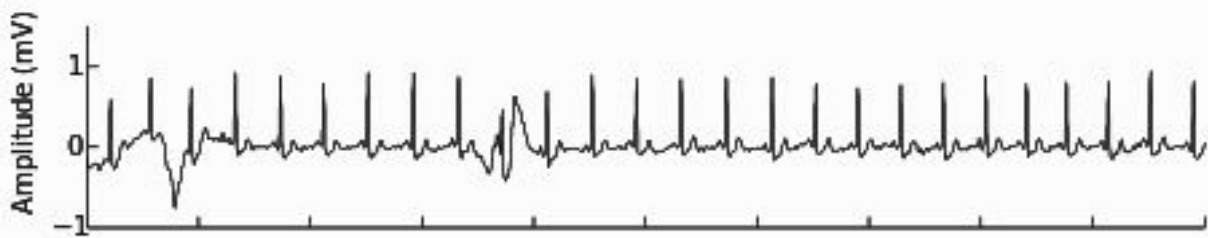
Project 3: time-series classification

Alina Dubatovka

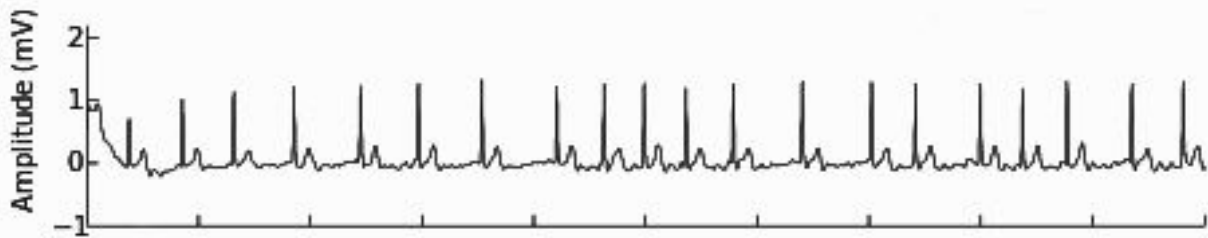
November 11 - 13
Advanced Machine Learning, Autumn 2020



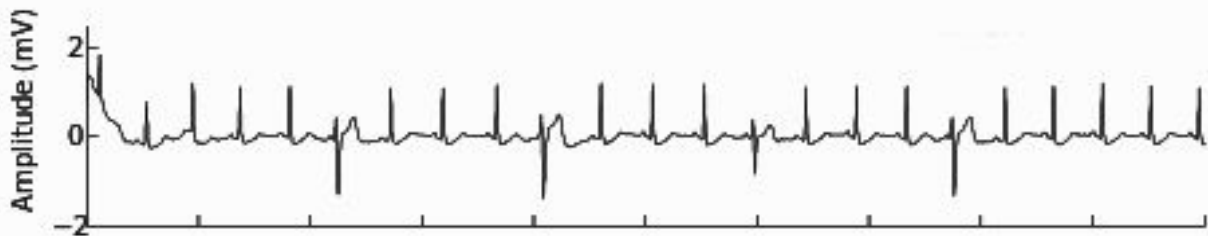
ECG signal



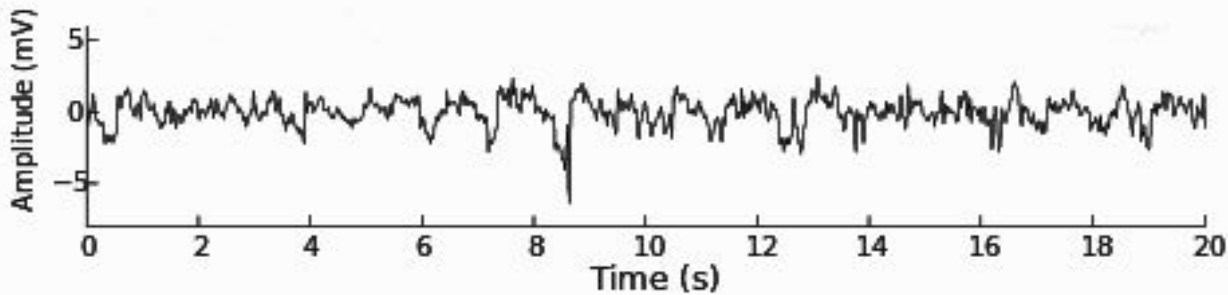
Class 0



Class 1



Class 2



Class 3

Data profile

Label	Number of recordings	Time length (s)				
		Mean	SD	Max	Median	Min
Class 0	3030	30.5	9.5	59.8	28.6	8.4
Class 1	443	30.2	11.8	59.9	28.5	9.3
Class 2	1474	32.7	11.3	59.9	28.7	8.7
Class 3	170	22.7	9.2	57.7	27.3	9.2
Total	5117	30.9	10.4	59.9	28.6	8.4

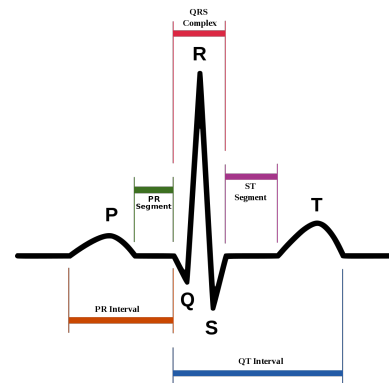
ECG is a sequence...



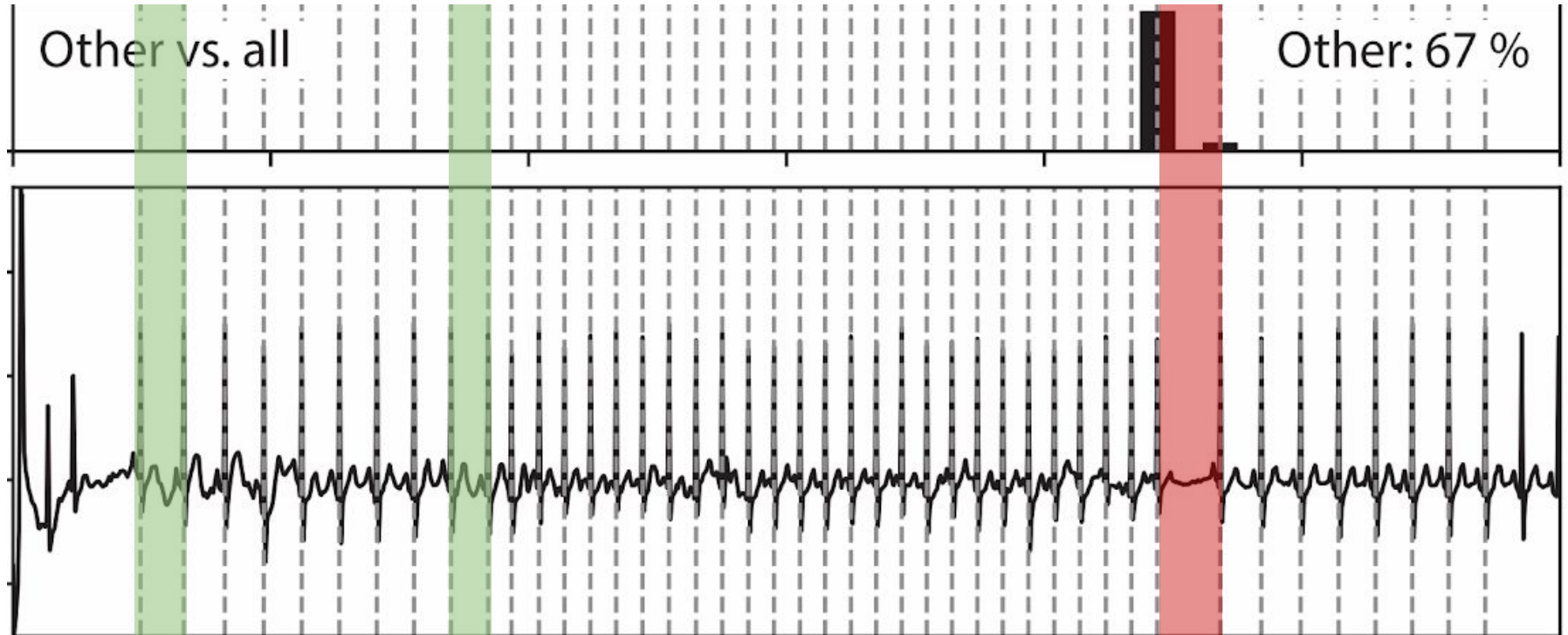
... of Data points



... of Heartbeats

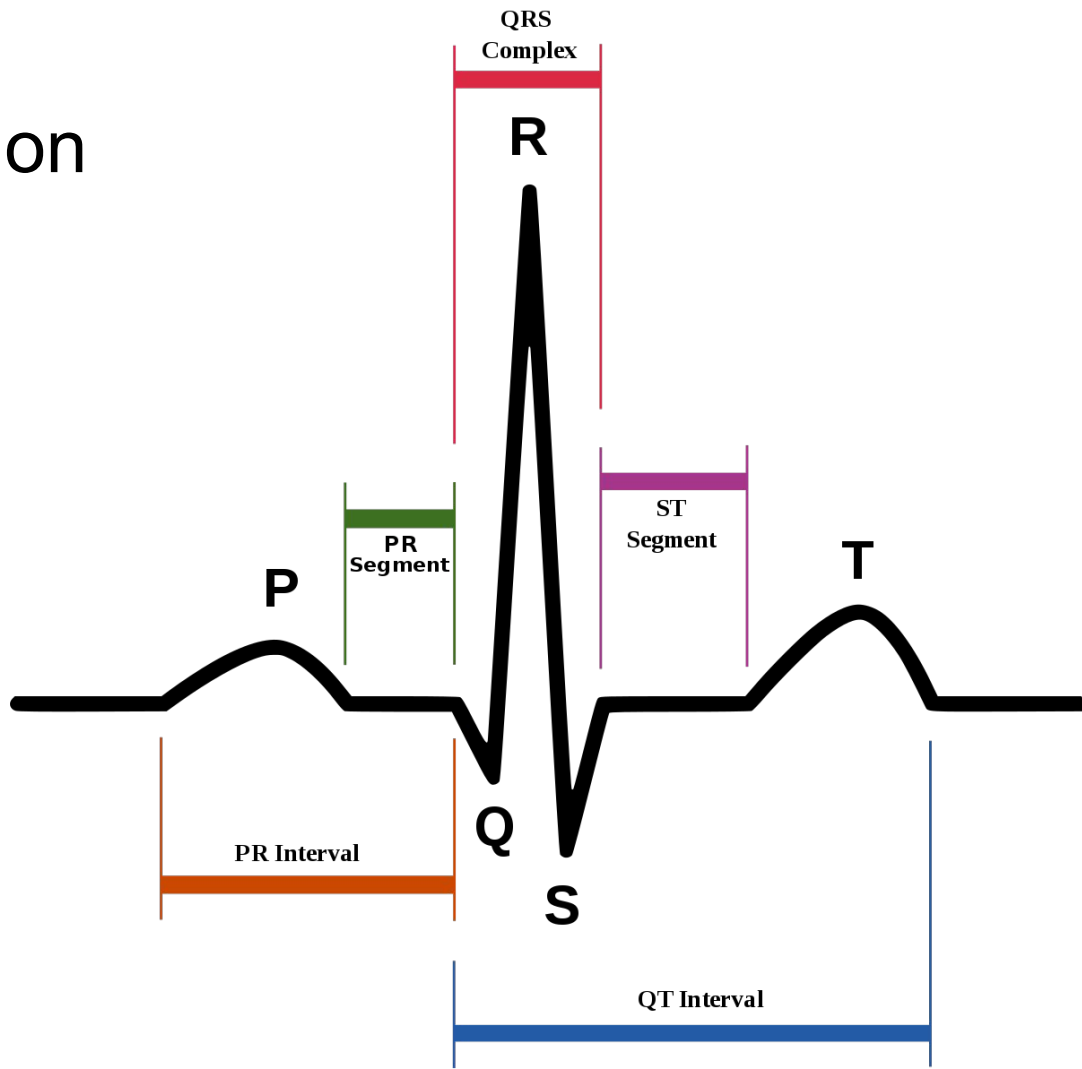


Splitting into Heartbeats

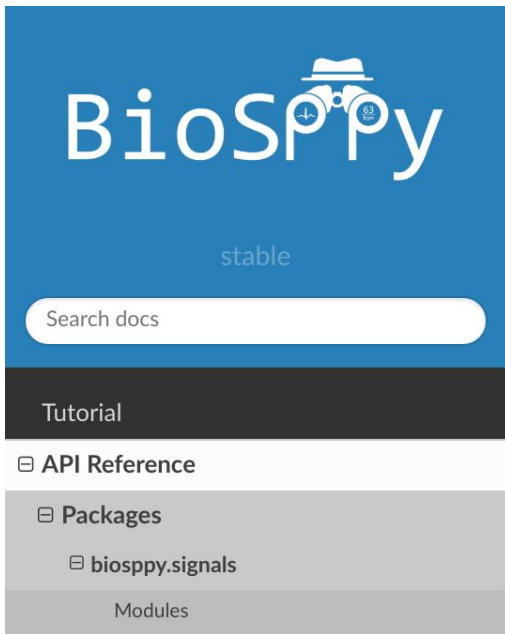


Manual feature extraction

- RR interval
- R amplitude
- Q amplitude
- QRS duration
- Heart rate variability
- Frequency domain



import biosppy.signals.ecg as ecg



```
biosppy.signals.ecg.extract_heartbeats(signal=None, rpeaks=None, sampling_rate=1000.0, before=0.2, after=0.4)
```

Extract heartbeat templates from an ECG signal, given a list of R-peak locations.

Parameters:

- **signal** (*array*) – Input ECG signal.
- **rpeaks** (*array*) – R-peak location indices.
- **sampling_rate** (*int, float, optional*) – Sampling frequency (Hz).
- **before** (*float, optional*) – Window size to include before the R peak (seconds).
- **after** (*int, optional*) – Window size to include after the R peak (seconds).

Returns:

- **templates** (*array*) – Extracted heartbeat templates.
- **rpeaks** (*array*) – Corresponding R-peak location indices of the extracted heartbeat templates.

https://biosppy.readthedocs.io/en/stable/biosppy.signals.html#biosppy.signals.ecg.extract_heartbeats

Some other Python libraries: neurokit, pyhrv, hrv, heartpy, etc...

Wave extraction: ecg-kit (Matlab/Octave), ecgpuwave (Fortran, partially ported to Matlab/Octave)

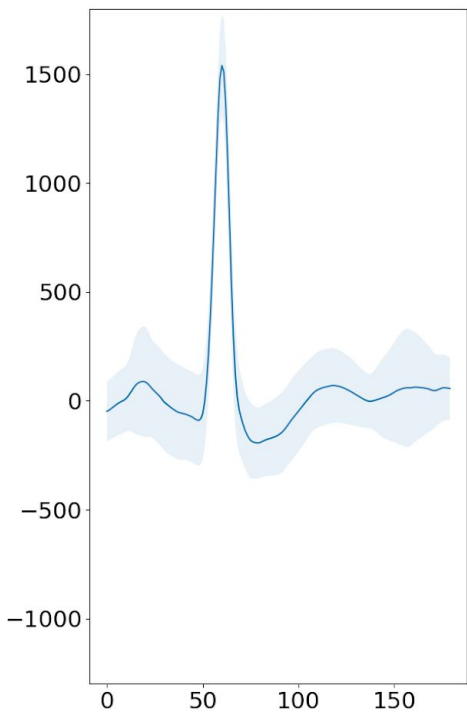
DOs and DON'Ts

- Use suggested libraries
- Think (!) which features might be helpful to extract
- Document what and how was extracted in the hand-in description
- Usage of external data
- Transfer learning
- Apply external pre-trained models
- Borrow third party models / code
- AutoML
- Send such submissions to the system “just for fun/out of curiosity”

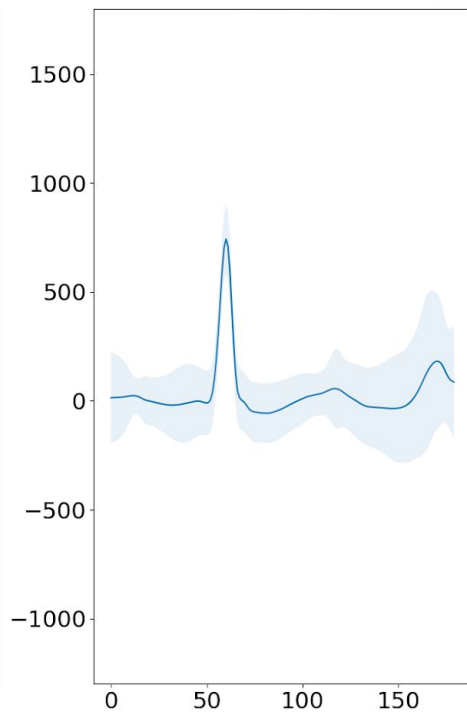
Reason: not only neural networks should learn something!

Mean heartbeat with variance

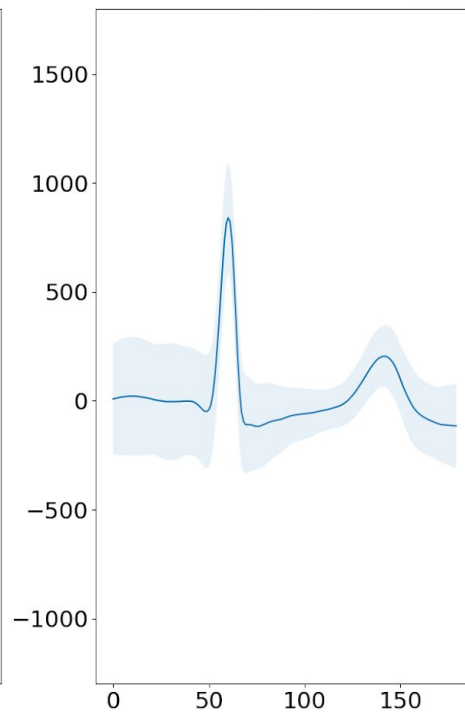
Class 0



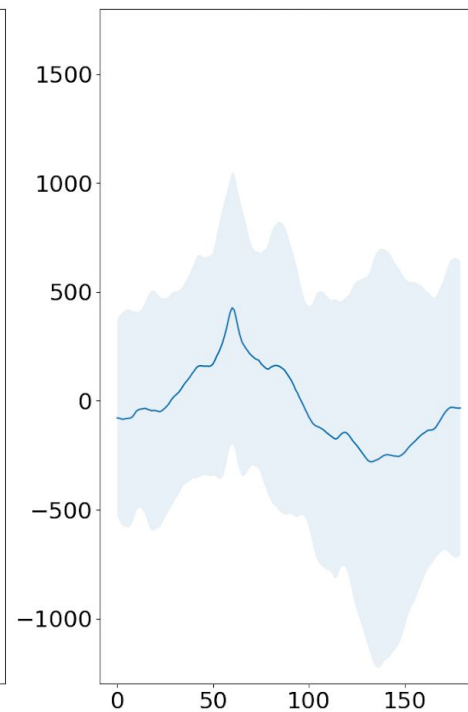
Class 1



Class 2

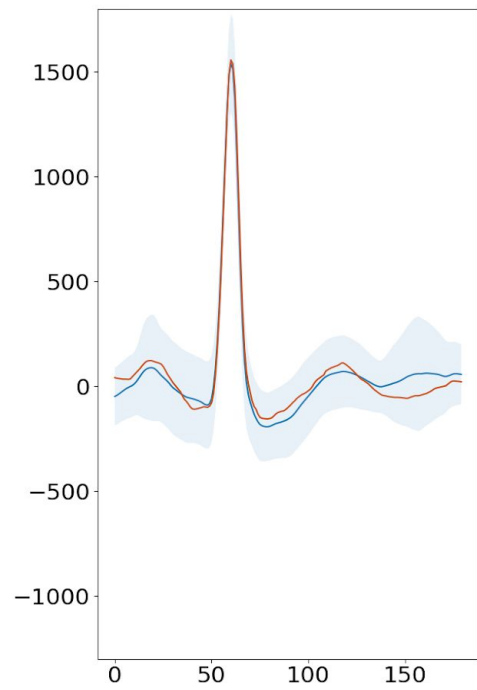


Class 3

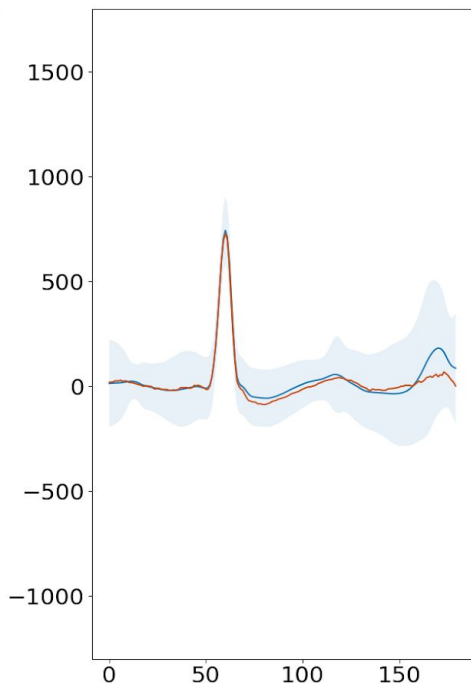


Mean heartbeat with variance and median

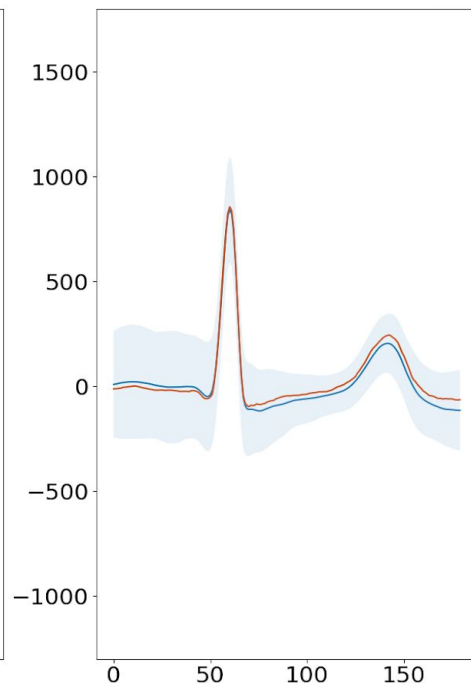
Class 0



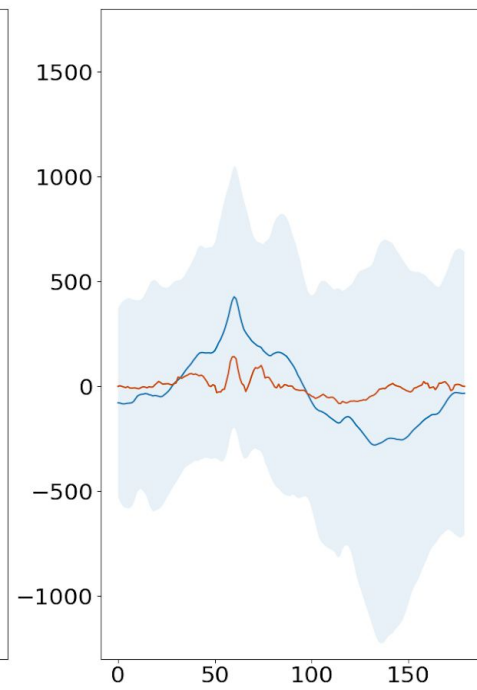
Class 1



Class 2



Class 3



Questions?