Paint by seismic

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https://github.com/James-Beckwith/hackathon_ABZ_18

https://github.com/James-Beckwith/SOM

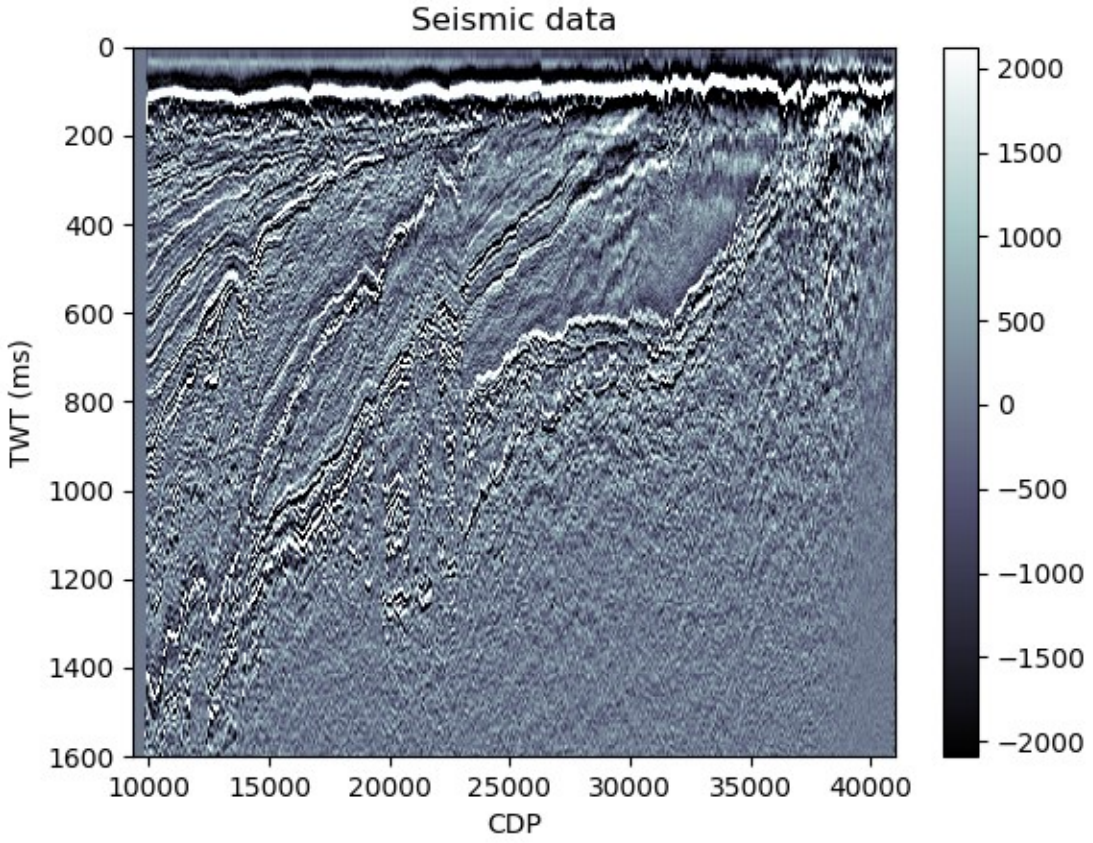
Motivation

- Do we need to use complex image classification to separate characteristics of seismic data?
- Can we use simple clustering algorithms to define changes in the seismic instead?
  - This approach doesn't require large amounts of training data ✓
  - Clustering and feature extraction needed on every application X

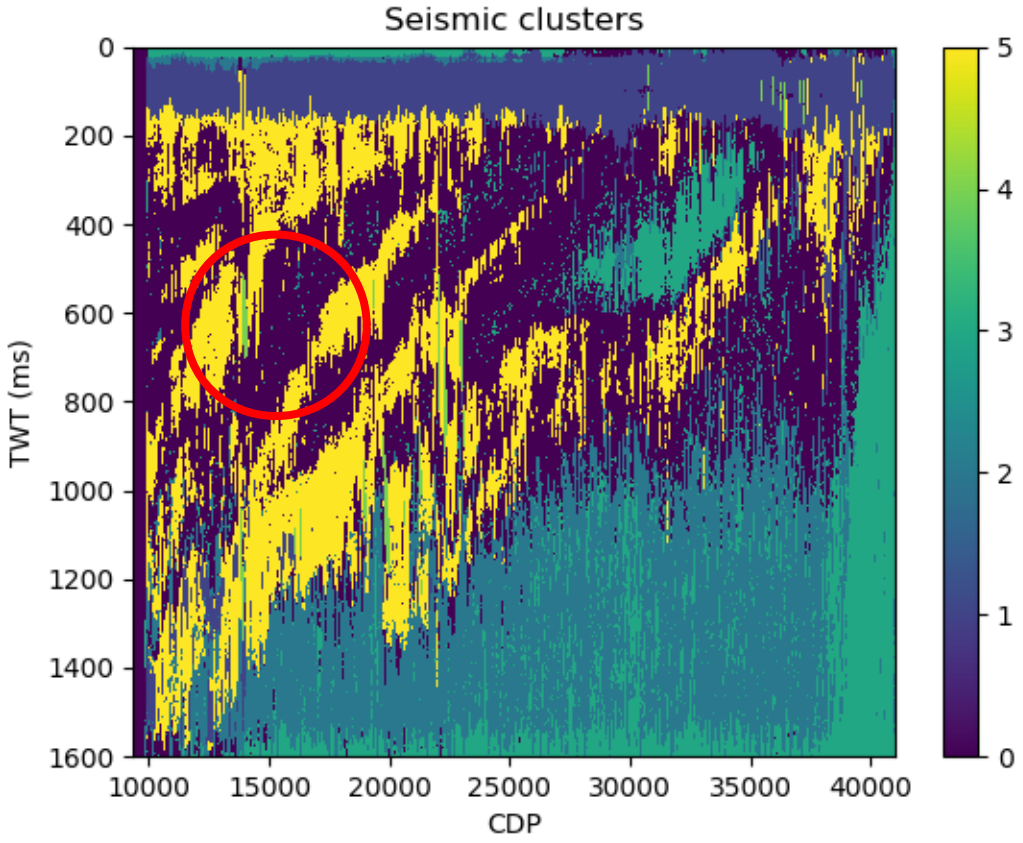
outline/workflow

- Feature extraction - Derive seismic attributes
- Feature scaling – try to create a normal distribution for features
  - Typical Box-Cox or log transforms
- Clustering – find what areas look similar
  - K-means
  - Self Organizing Maps (SOM)

seismic

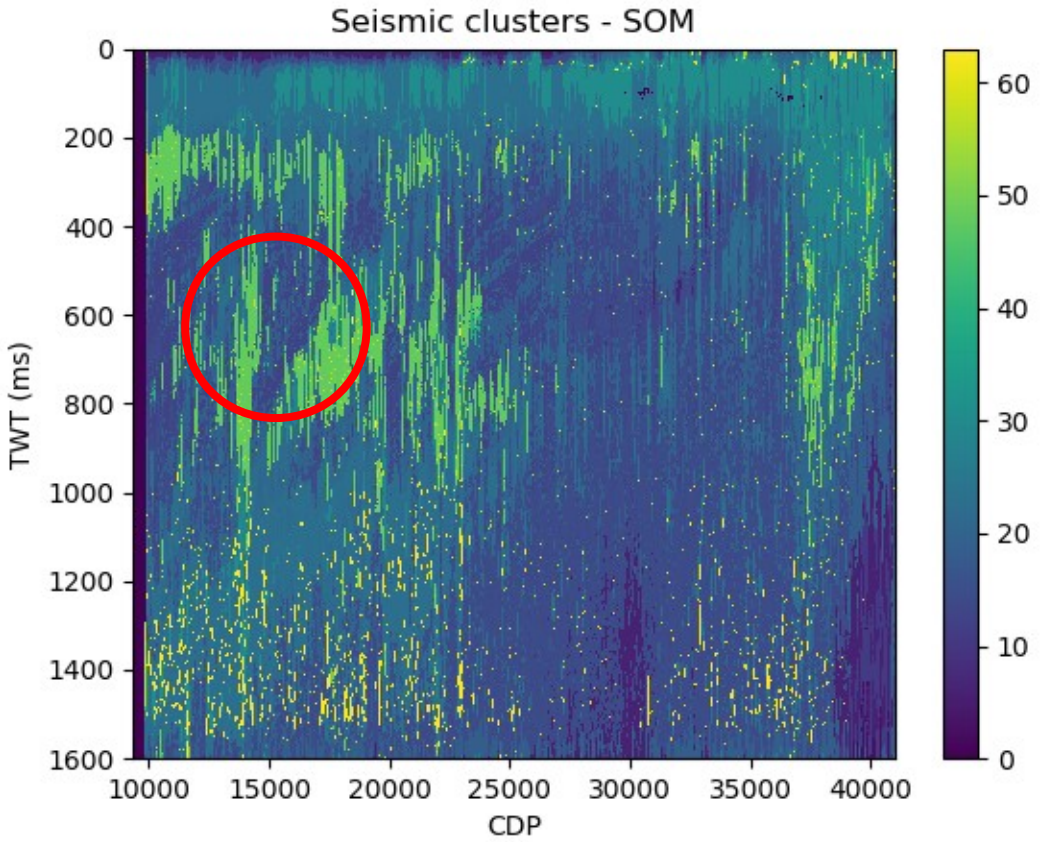

Seismic data
TWT (ms)
0
200
400
600
800
1000
1200
1400
1600
10000
15000
20000
25000
30000
35000
40000
CDP
2000
1500
1000
500
0
−500
−1000
−1500
−2000

k-means



Fault zone

SOM



Fault zone

Ideally this should be a 2D colourmap as a 2D SOM grid was used. The colours are not necessarily representative of different seismic similarities!!

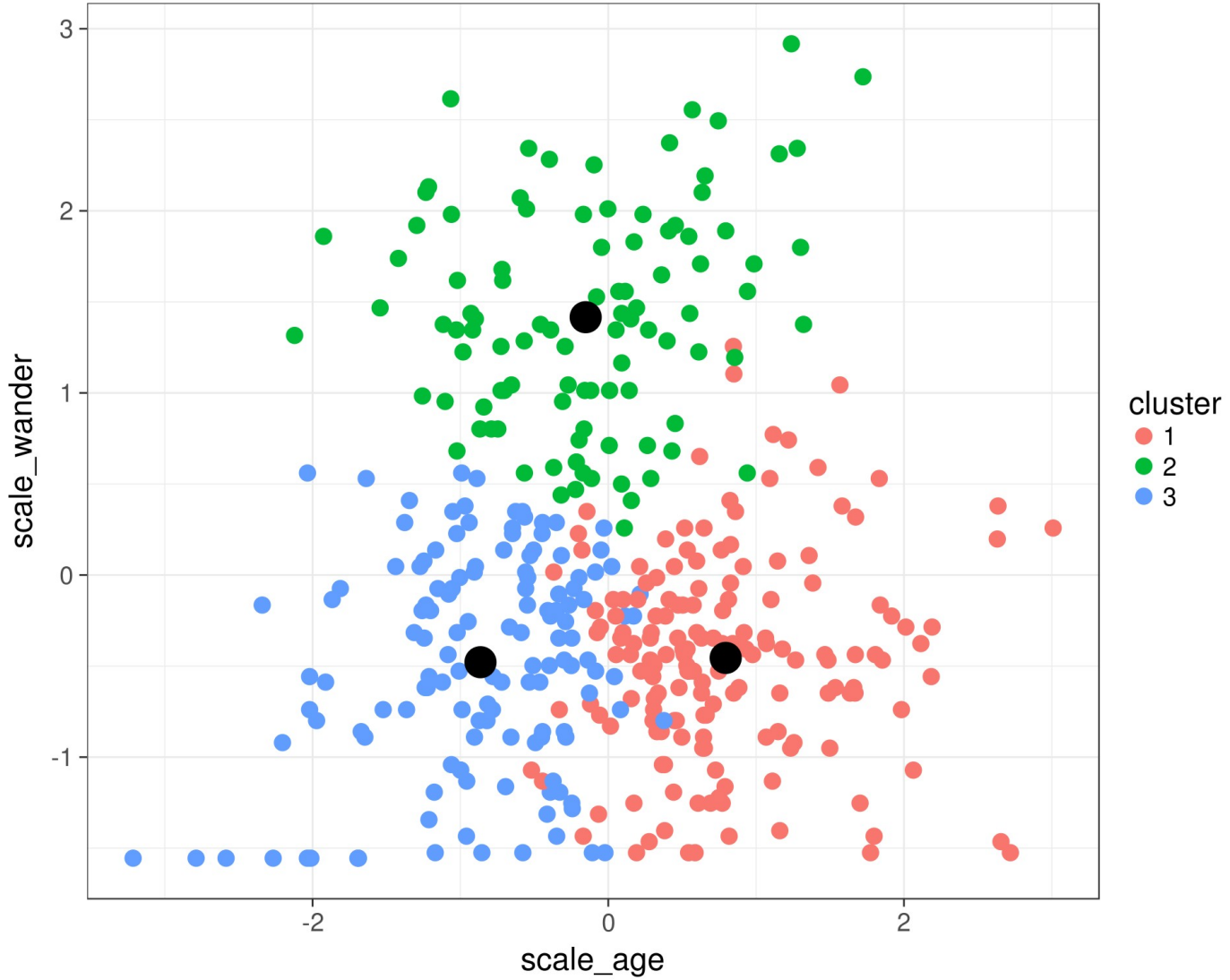
Conclusions

- Seismic data has been clustered
- Qualitatively similar points are clustered together ✓
- Some features cause correlations that are not interesting
  - Strong reflections being stored in similar clusters

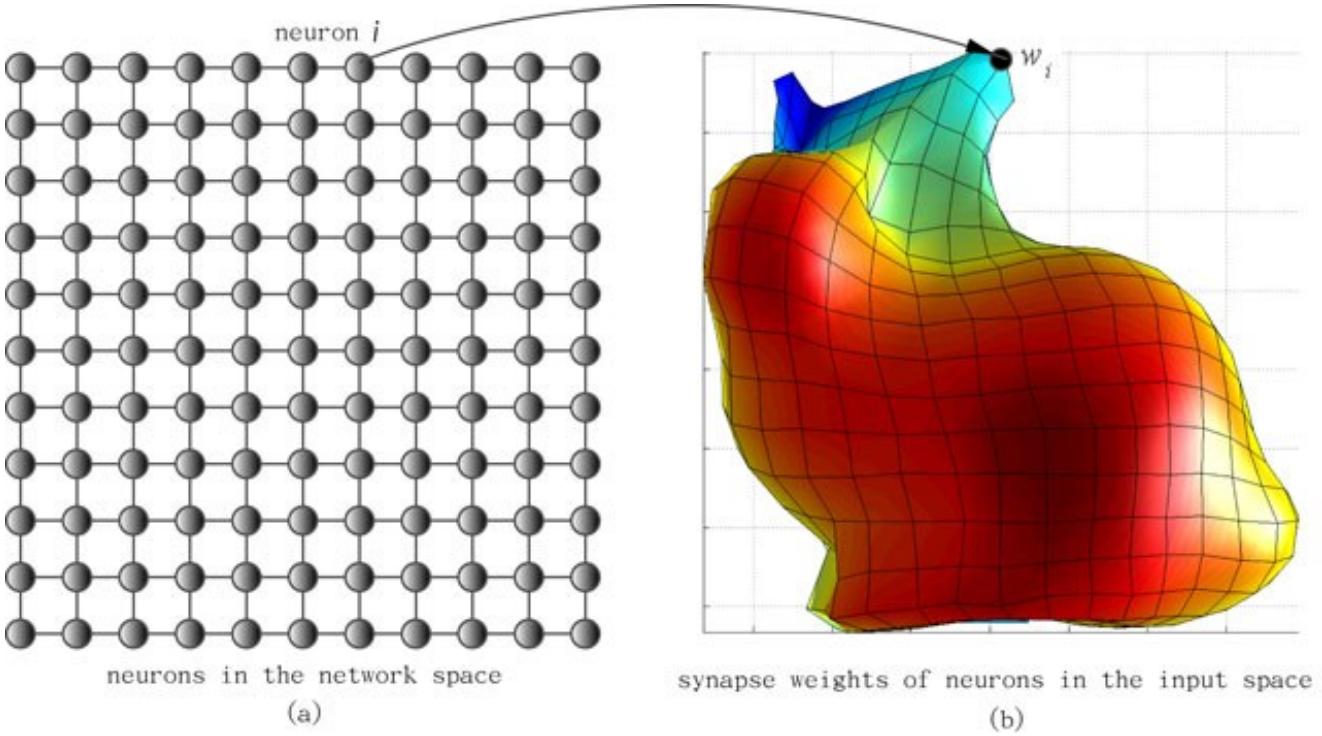
Way forward

- Different clustering? Better parameterization of current clustering algorithms?
- Application of cluster locations to new seismic to avoid need for re-clustering?
- Better/more feature extraction
  - What features should we be using

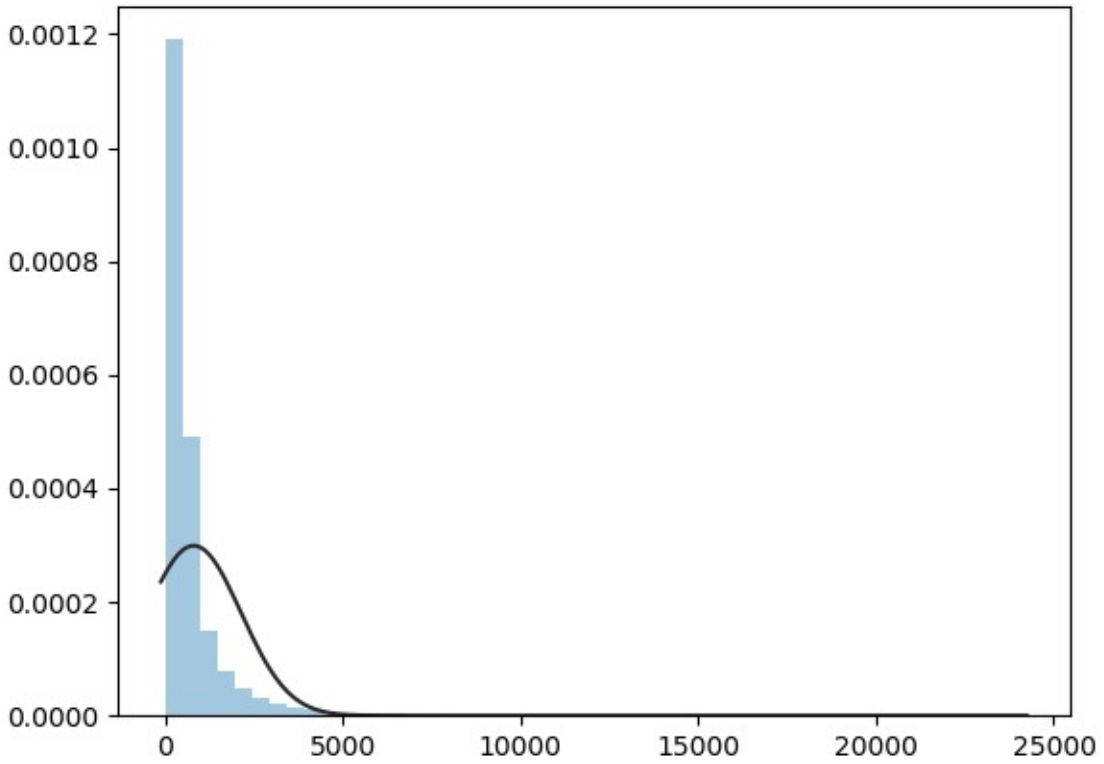
K-means clustering



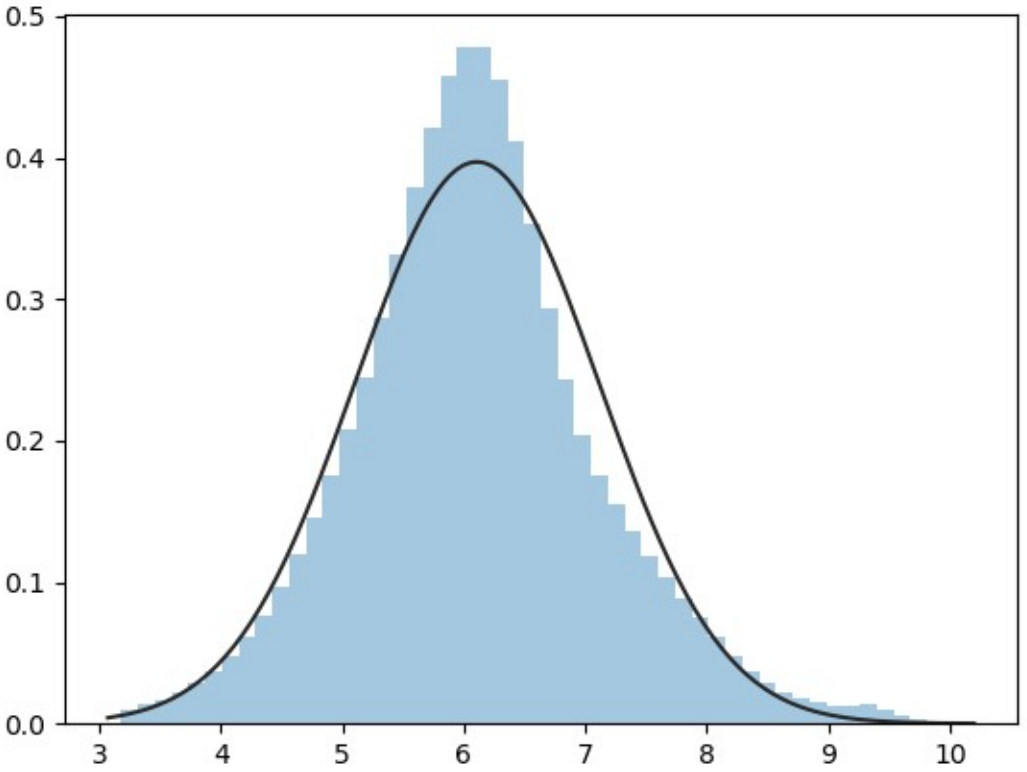
Self Organizing maps (SOM)



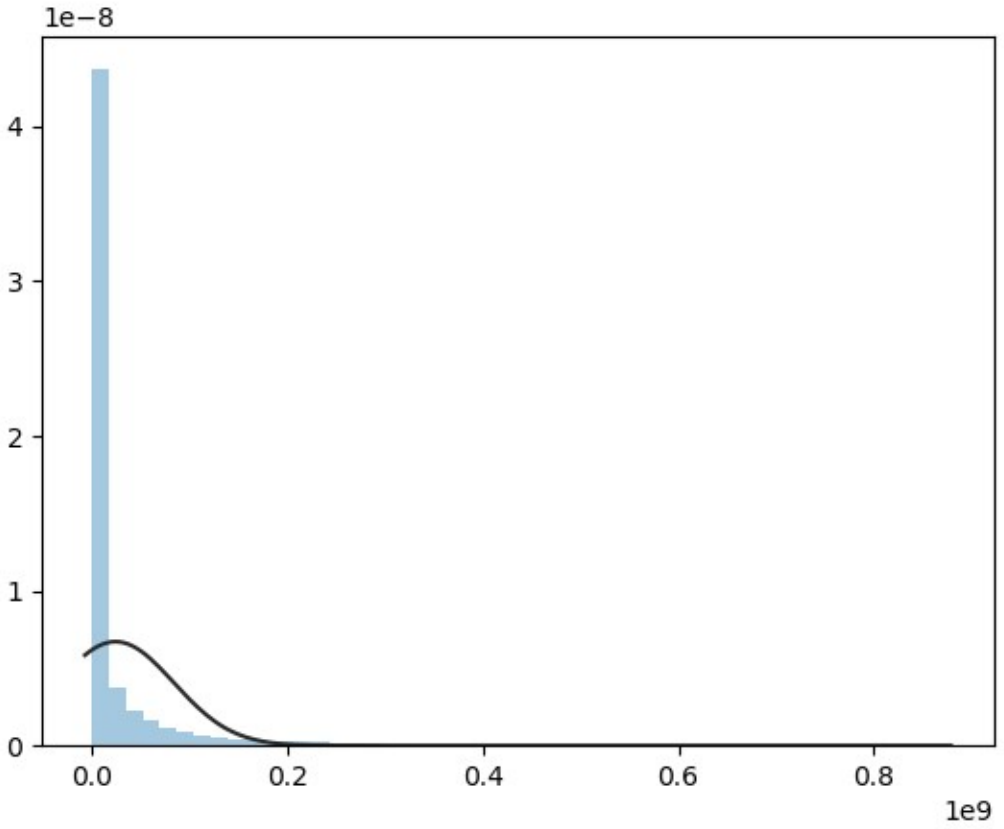
Distributions - envelope



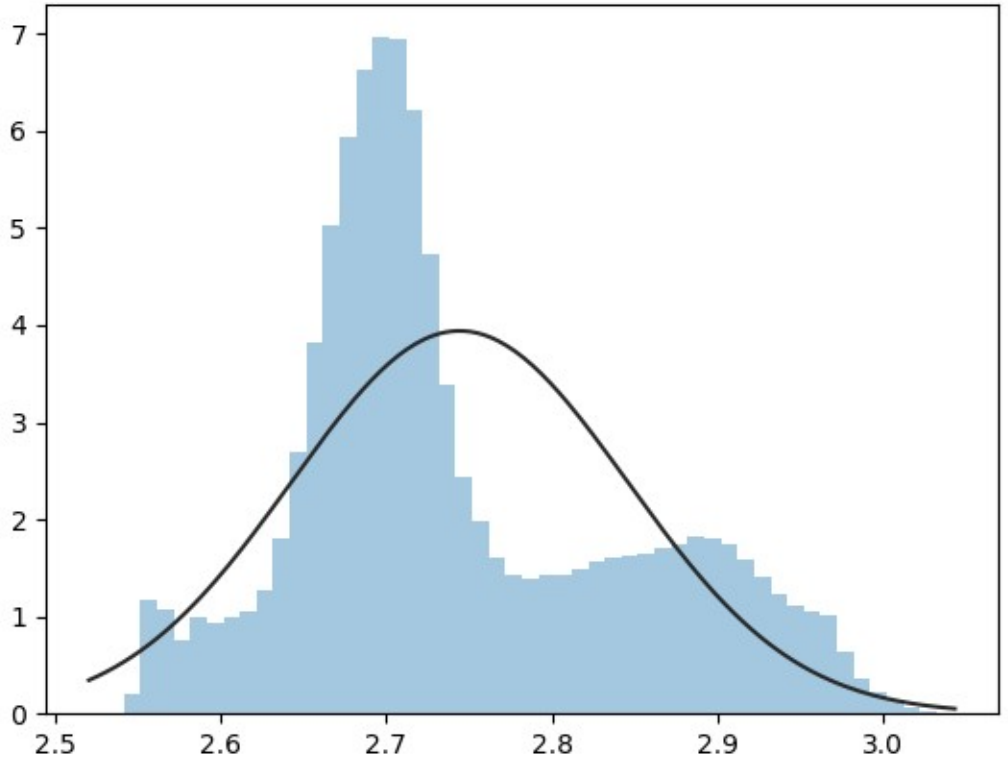
Distributions – envelope - transformed



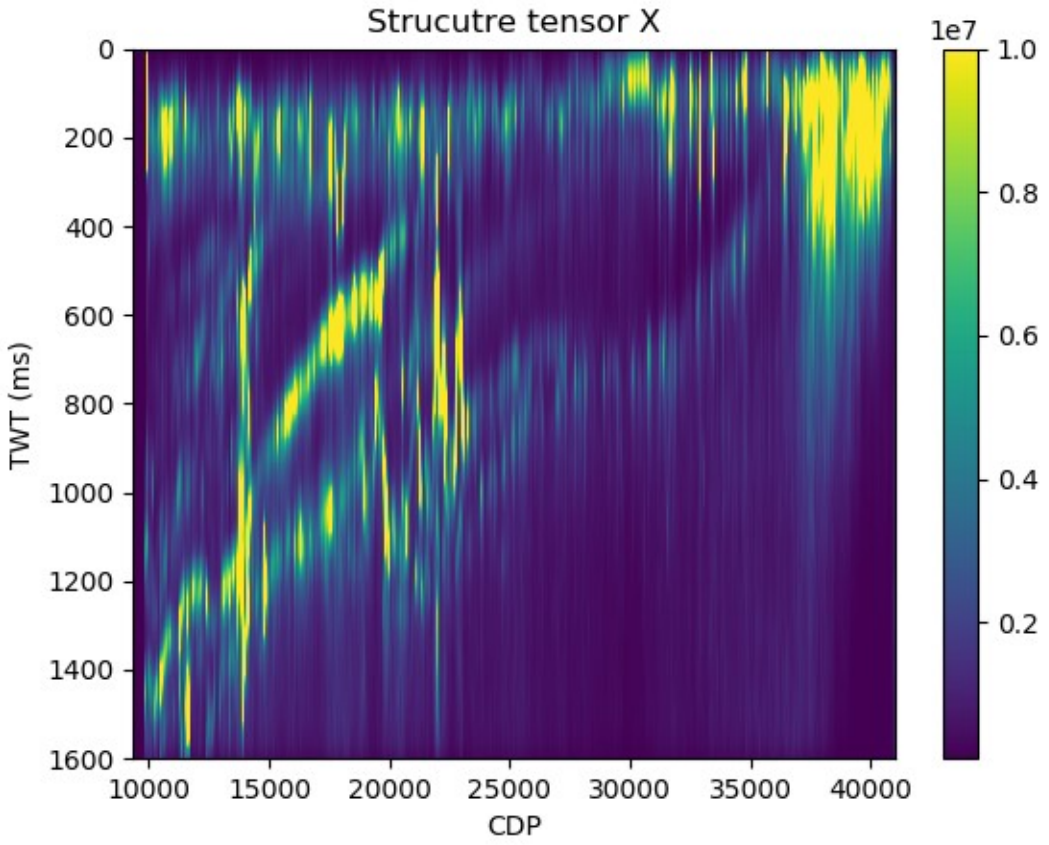
Distributions – structure tensor Z



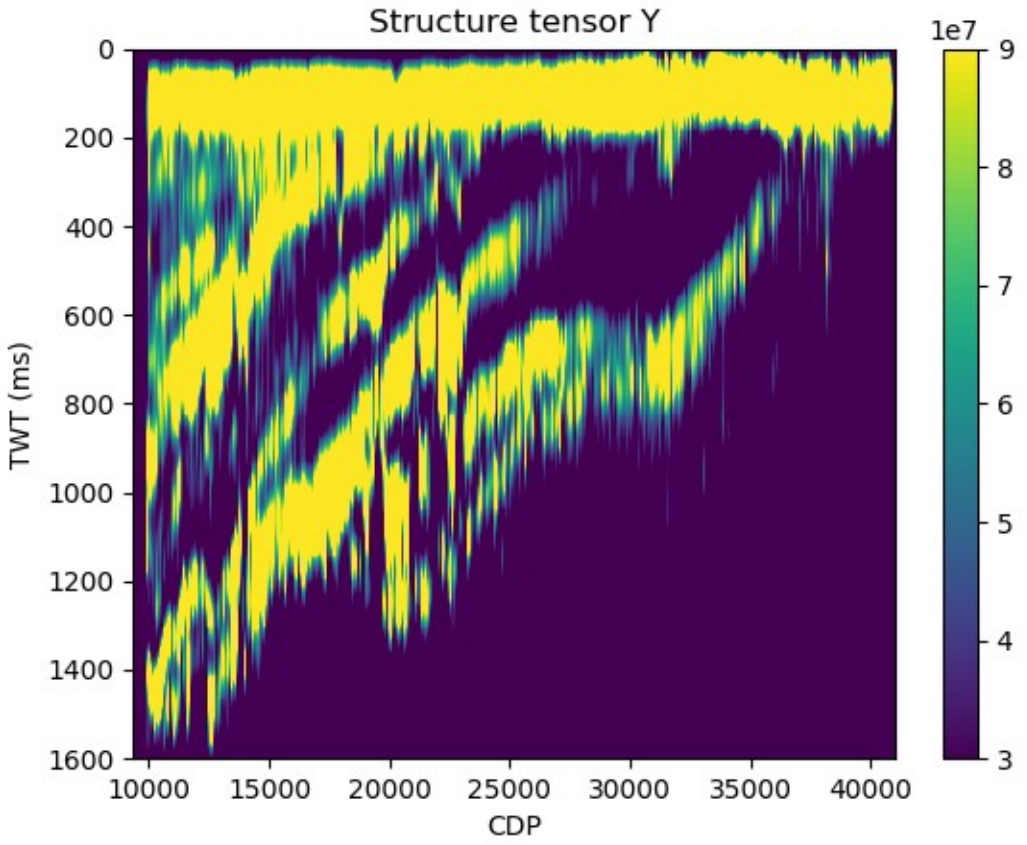
Distributions – structure tensor Z - transformed



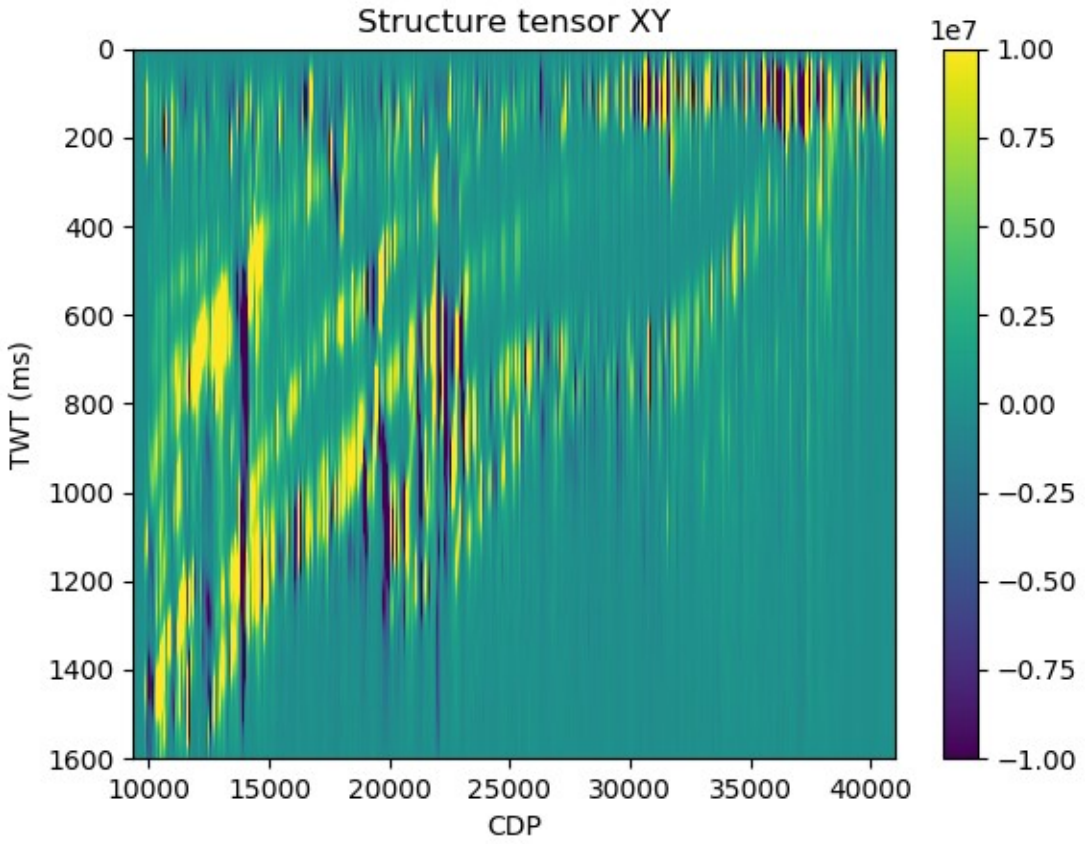
Structure tensor X



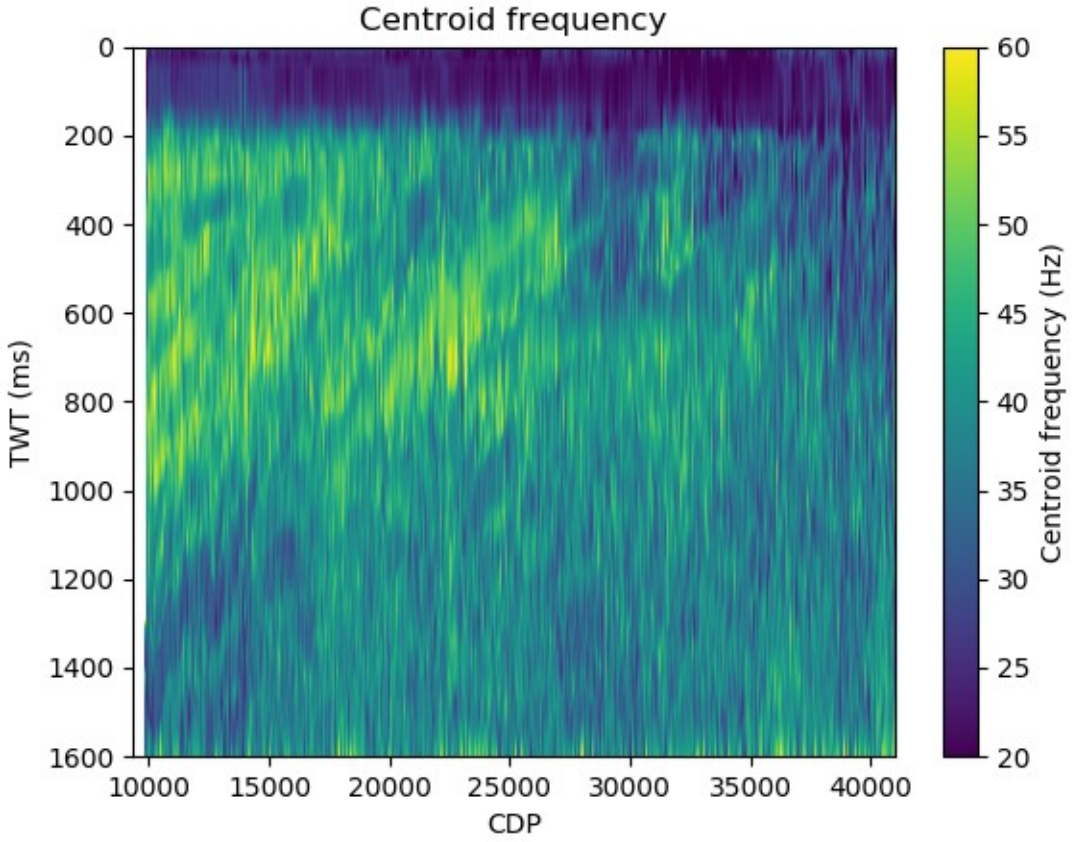
Structure tensor Y



Structure tensor XY



Centroid frequency



Centroid bandwidth