Auditory Efficient Coding for Bat Vocalisations

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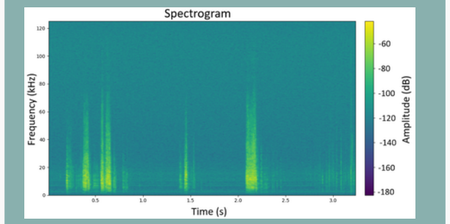
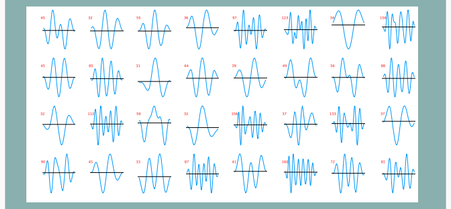
Background

- Efficient Auditory Coding Hypothesis
- May extend beyond humans
  - to Bats
    - social mammals with developed auditory systems
- What influences these calls?
  - Context?

Bat social call



Auditory kernel for bats



Does the context of the vocalisation influence the encoding?

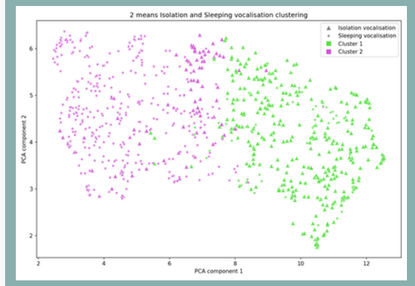
Does the context of the vocalisation influence the kernel usage in the encoding?

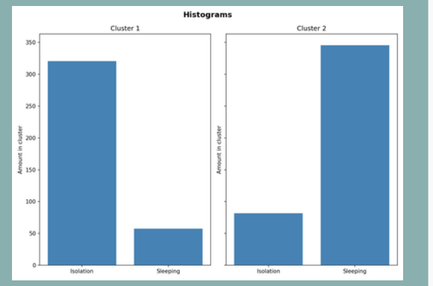
How to solve

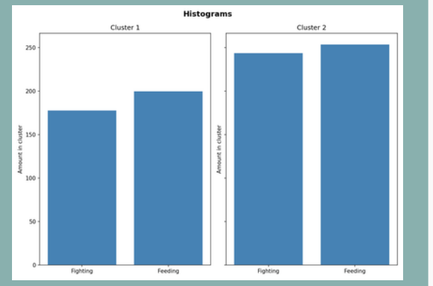
Choose contexts
- Fighting
- Feeding
- Sleeping
- Isolation

Calculate Encodings
- 400-450 per context

Group them
- Kmeans clustering
  - fixed feature length
- Visualise with UMAP







Does the context of the vocalisation influence the structure of the encoding?

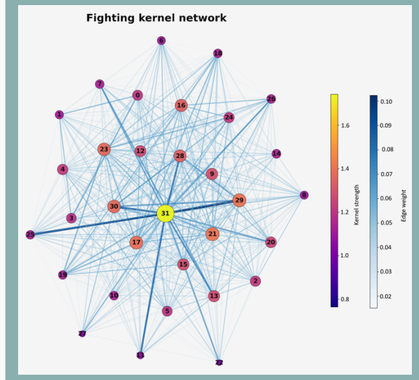
How to solve

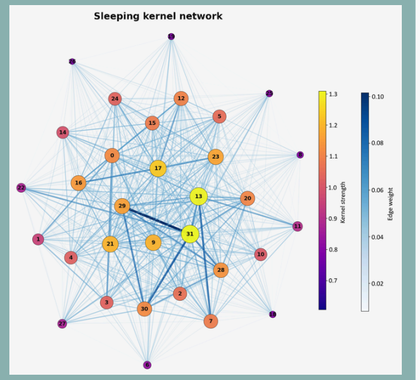
Choose contexts
- Fighting
- Sleeping

Calculate Encodings
- 1150 per context

Evaluate structure
- Markov transition matrix
  - make discrete steps
- Visualise a reduced matrix

- The matrix is reduced to a 32x32 matrix, leaving out the amplitude and delta t options
- The node size and color correspond to the degree of the node in the graph
- The edge thickness and color represent the chance/weight of the edge





Conclusion

- Yes context influences kernel usage in the encodings
  - Function > context
- Yes context influences structure of in the encoding
  - for fighting and sleeping

Discussion

- Fighting, Feeding
  - same kernel usage
  - different context
  - same function
- Sleeping, Isolation
  - Different kernel usage
  - More research needed for reason
    - Only speculations
    - Isolation need more information
    - Sleeping can be al sorts of context under 1 umbrella
- Graphs
  - Difference in how spread out
  - Different degree and edge relation
  - 29, 30, 31 in both graphs important