Detecting chirps based on dynamic filtering for the analysis of social interactions in weakly electric fish

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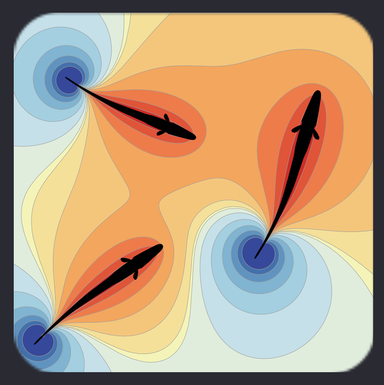
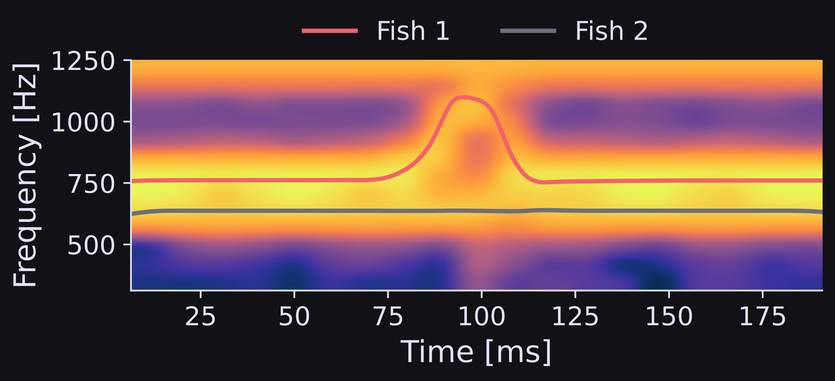
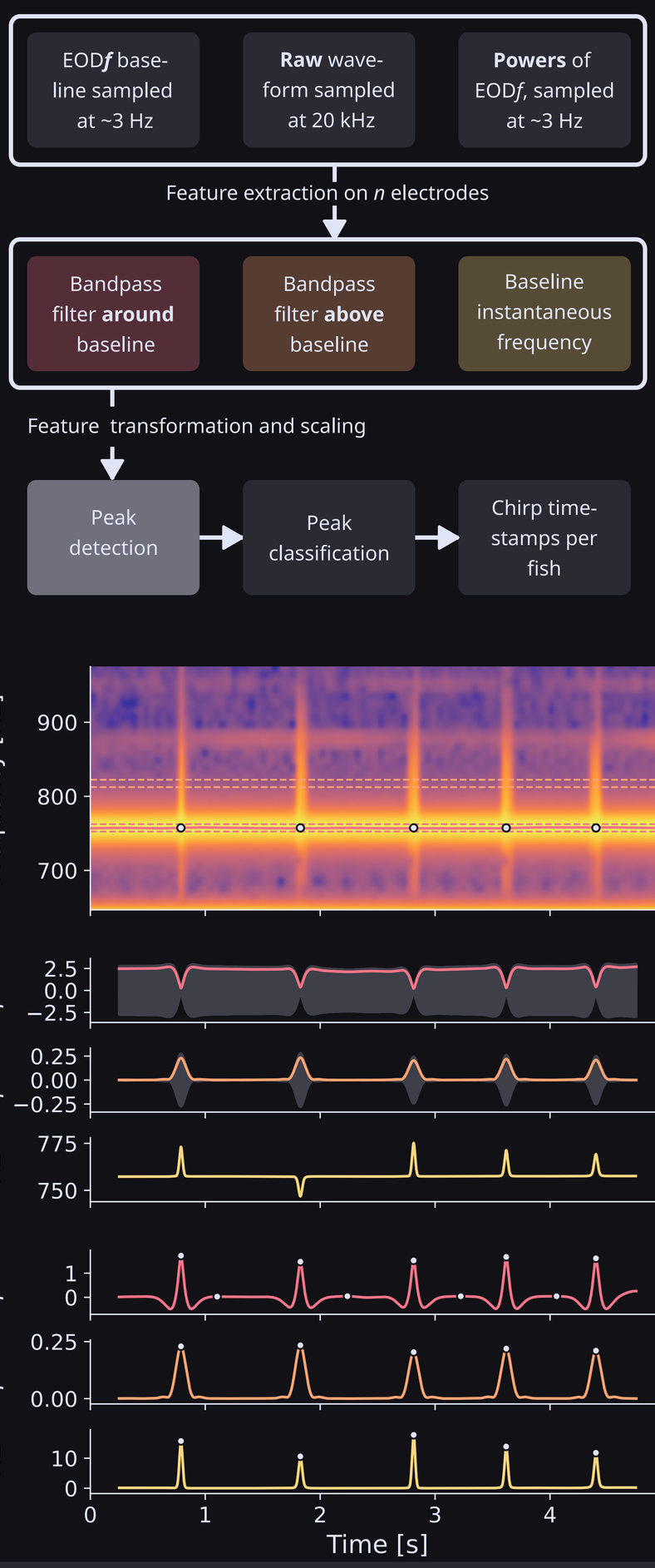


Introduction

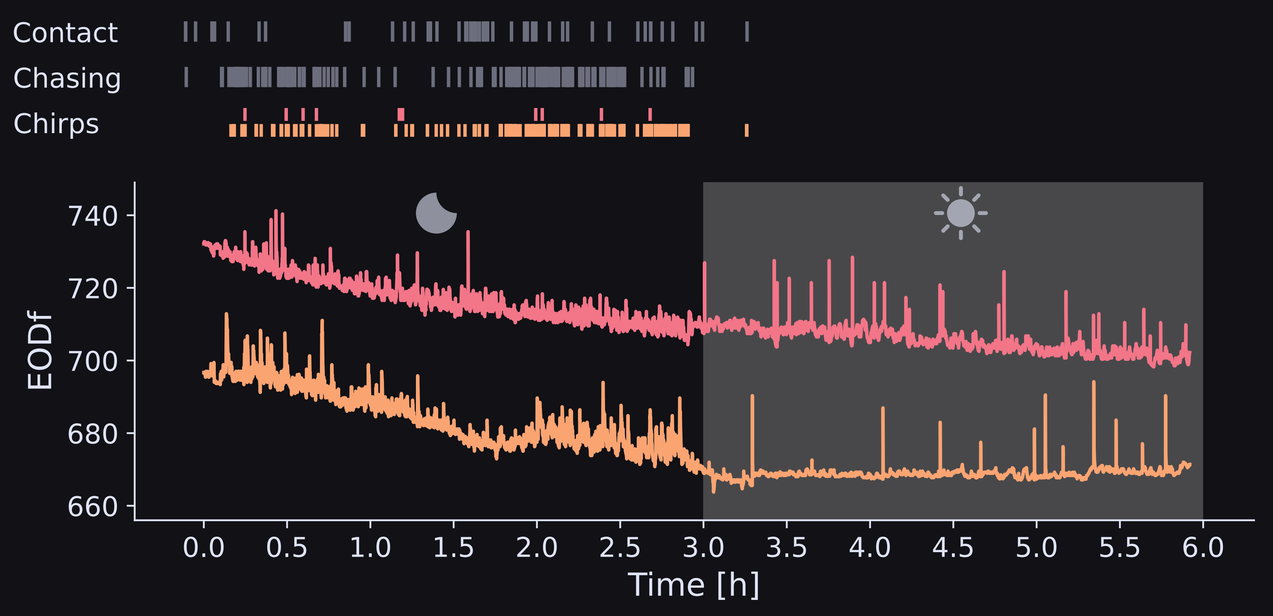
Chirps are one type of communication signals in weakly electric fish. They are characterized by **short frequency excursions** and are emitted during various social contexts. The time-frequency uncertainty of the Fourier transform makes it nearly impossible to reliably **detect and assign** chirps in freely interacting fish based on spectral methods. To overcome these limits, we developed a method based on **dynamic filtering** and subsequent **feature detection**.



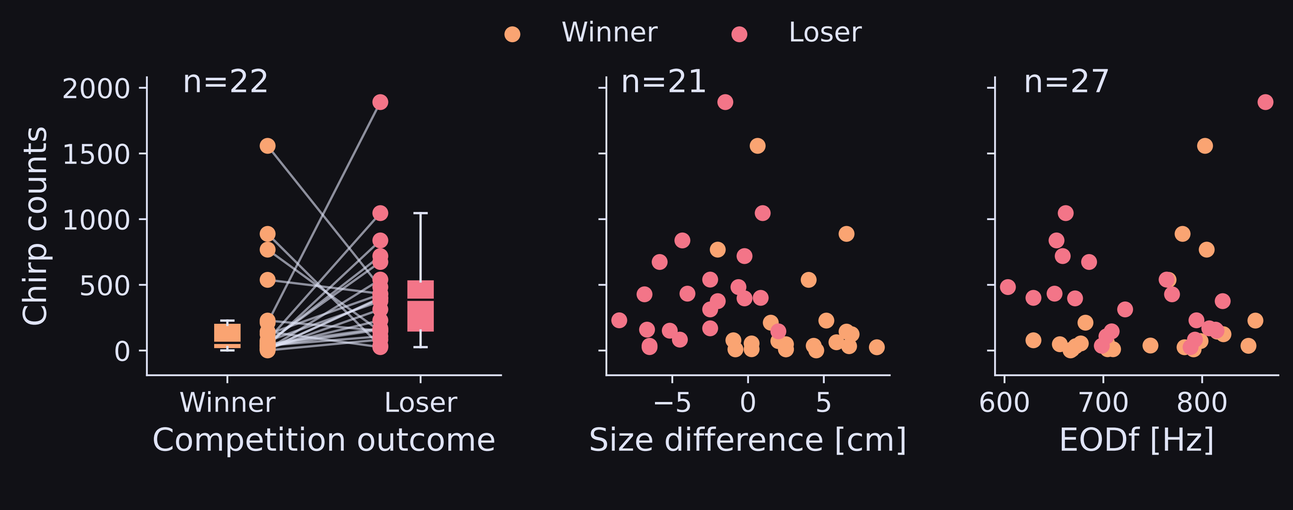
Chirp detection algorithm



Chirps in dyadic competitions (Data by Till Raab, 2020)

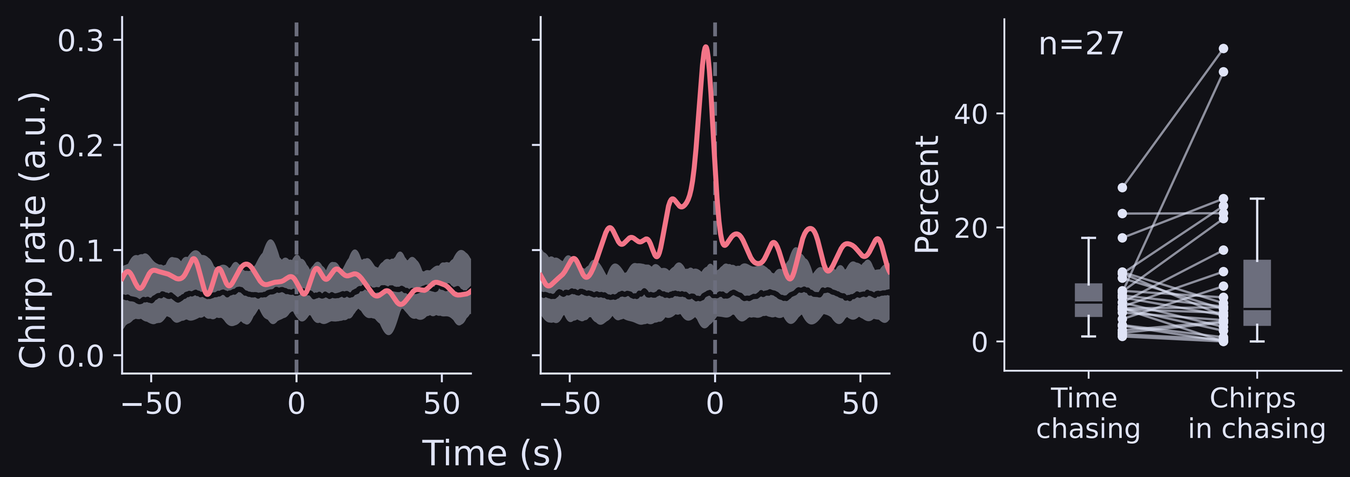


- The electric behavior of two fish competing for one shelter were recorded in a light and dark condition.
- Using video recordings, behavior was classified as chasings or physical contacts.



- Losers tend to chirp more.
- Larger fish usually win. The smaller the size difference the more chirps are emitted.
- EOD frequency has no effect on the competition outcome and the chirp rate.

Chirps emitted by loser fish might stop chasing events



- In most cases there is no correlation between chirping and chasing- or physical contact events.
- The chirp rate during chasings only increases for some dyads.

Conclusion

- First tests indicate that our algorithm is able to detect chirps in recordings of multiple fish.
- In some cases the chirp rate drastically increases before chasing stops.
- Behavioral analysis needs to consider more variables, such as sex, size, and interindividual differences in chirping behavior.

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