

restingIAF: A RELIABLE, AUTOMATED METHOD FOR QUANTIFYING INDIVIDUAL ALPHA FREQUENCY

Andrew W Corcoran^{a,b} Phillip M Alday^{c,b} Matthias Schlesewsky^b Ina Bornkessel-Schlesewsky^b

INTRODUCTION

IAF is a fundamental property of brain processing relating to individual differences across various domains:

- perception^[1,2]
- memory^[3] & attention^[4]
- language^[5]
- general intelligence^[6]

IAF might also help improve the precision of frequency band analysis.^[7]

THE PROBLEM

IAF is typically indexed by a dominant (peak) frequency elicited during eyes-closed resting-state M/EEG. However, a subset of individuals do not demonstrate a clear alpha peak. Further, visual identification of peak frequency from channel spectra is time-consuming and prone to bias. Automated strategies may solve these problems, but also introduce new sources of error.

KEY FINDINGS

CONCLUSIONS

- S-G filtering aids accurate, automated extraction of target alpha components.
- Empirical data show similar characteristics to previous large n studies.
- *restingIAF* may help improve reliability and rigour of future IAF research.

FUTURE WORK

- ☐ **SOON:**
 - GitHub release
 - Assess performance in children
- ☐ **LATER:**
 - Develop GUI for EEGLAB
 - Automate parameter settings

THE IDEA

We devised an automated routine that estimates **peak alpha frequency (PAF)** from the 1st derivative of Savitzky-Golay filtered spectra. S-G filtering smoothes noisy fluctuations while preserving peak characteristics.^[8] We also extended this approach to derive **centre of gravity (CoG)** estimates of IAF.

METHOD

ALGORITHM

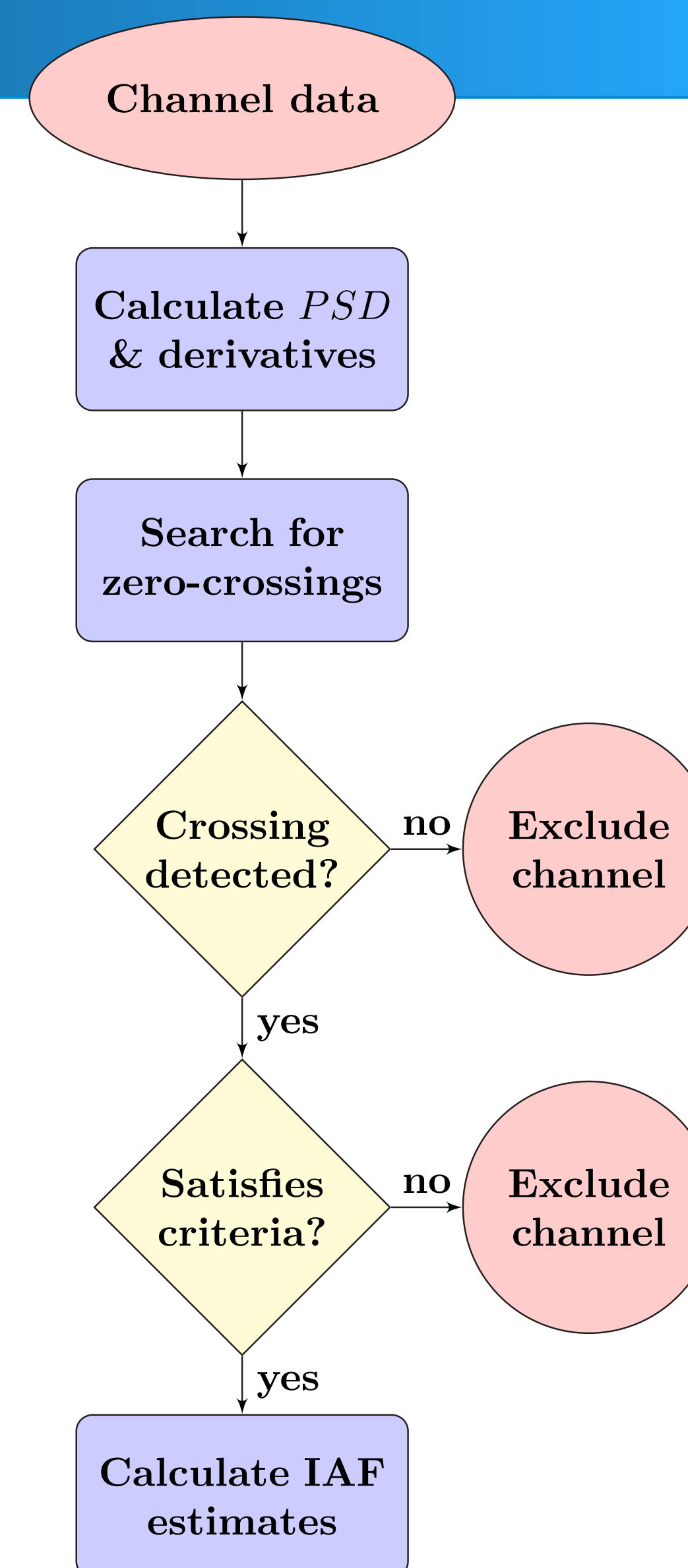
The routine is summarised in the flow diagram (right). To register as a PAF, peaks must exceed a background spectral noise threshold and a secondary peak threshold. Number of estimates for averaging can also be thresholded. *restingIAF* has EEGLAB and Python implementations.

EMPIRICAL DATA

63 healthy adults (42 females; age range: 18-74 yrs). 2 min eyes-closed resting-state EEG recorded pre/post 90 min experimental session.

SIMULATION DATA

Single and complex (Gaussian-distributed) alpha component signals were randomly synthesised and embedded within pink noise. Signal-to-noise ratio (SNR) and component dispersal (α) were parametrically varied.



AFFILIATIONS & REFERENCES

^aCognition & Philosophy Laboratory, Monash University. ^bCognitive Neuroscience Laboratory, University of South Australia. ^cMax Planck Institute for Psycholinguistics, Nijmegen. **CONTACT:** andrew.corcoran1@monash.edu

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