

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

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INTRODUCTION

IAF is a fundamental property of brain processing that predicts individual differences across various domains:

- perception
- memory & attention
- language
- general intelligence

IAF might also help improve the precision of frequency band analysis.

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.

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.

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.

