Skin bioelectronics and the autonomic nervous system

2020-02/Area: neuroscience/bioengineering

Background

Autonomic nervous system (ANS) activity (and dysfunction) is often inferred from signals recorded at the body surface, such as electrodermal activity [1]. While skin conductance is widely used as indicator of sweat gland activity, additional information on the underlying processes can be gleaned from other data sources [2, 3], such as skin potential and skin susceptance.

With a partner lab at University of Oslo, we collected a substantial data set of simultaneous skin conductance, skin susceptance, and skin potential measurements under various ANS activation protocols.

You will (1) analyse these data in a model-free way to relate the different biosignals to ANS stimulation, (2) test LTI models of skin conductance and skin susceptance, and (3) relate the data to an existing approximate non-linear bioelectrical model, in order to suggest extensions of the model.

What you can learn

- Background knowledge on model-based analysis of biophysical signals with the Matlab-based software PsPM (bachlab.org/pspm)
- Background knowledge in skin bioelectronics and bioengineering
- Biophysical modelling skills
- Data analysis skills (Matlab, R or Python)

Your profile

(1) You have a background in electrical engineering, physics, or related fields, and a strong interest in biosystems.

(2) Your background is in neuroscience, biology, or related fields, and you have first experience with bioelectronics and mathematical modelling of biological (or physical) systems.

In either case, an ability to conduct data analyses (e.g. in Python, R, or MATLAB) is required.

Supervision

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Partner lab

https://www.mn.uio.no/fysikk/english/research/projects/bioimpedance/index.html

Literature

1. Bach, D.R.*, et al.* Psychophysiological modeling: Current state and future directions. *Psychophysiology*, e13214 (2018).
2. Tronstad, C., Kalvoy, H., Grimnes, S. & Martinsen, O.G. Waveform difference between skin conductance and skin potential responses in relation to electrical and evaporative properties of skin. *Psychophysiology* **50**, 1070-1078 (2013).
3. Pabst, O., Tronstad, C. & Martinsen, O.G. Instrumentation, electrode choice and challenges in human skin memristor measurement. *Conf Proc IEEE Eng Med Biol Soc* **2017**, 1844-1848 (2017).