Reproducible Anisotropic EEG Phantom with Multiple Sources

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Summary

- **Reproducible simple low-cost printable head phantom mimicking the electromagnetic properties of the human head**
- **Useful for testing new EEG recording systems, dry biopotential electrodes, and EEG processing algorithms**
- **Controllable anisotropic conductivity of the skull**
- **Plurality of current sources**
- **Printable meshes are available from the corresponding author**

Fabrication

- Low conductivity and anisotropy of the skull were emulated by 3D printing an anisotropic texture and filling it with a warm conductive Agar gel followed by its cooling and solidification
- Both the anisotropy ratio and the conductivity were controlled by the porosity of the texture

Figure 1: Phantom with connected EEG cap and signal sources and the breakdown of the constituent 3D printed parts. Recorded signals show emulated interference and motion artifacts.

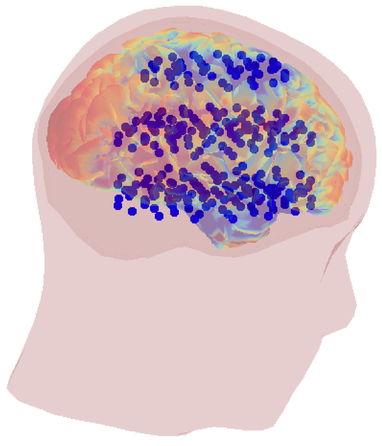

Figure 2: The RMS error for each cortical dipolar source gain vector interpolated by the monopolar sources gain vectors.

Monopolar current sources

Monopolar current sources (sources with a single distant sink) allow the interpolation of the full gain matrix (relating source currents to the scalp electrode potentials) from any dipolar current source position and orientation within the head

Results

- Keysight U2331A unit served both as a recording and signal generating unit
- Connected to an EasyCap EEG cap and to an analog multiplexer
- Phantom was tested in a realistic environment successfully simulating plausible signals from neural activations situated at various depth within the brain as well as motion artifacts and interference noise

References

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[2] Yu Mike Chi, Tzyy-Ping Jung, and Gert Cauwenberghs. Dry-contact and noncontact biopotential electrodes: Methodological review. IEEE reviews in biomedical engineering, 3:106-119, 2010

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