Dmitrii **Altukhov**

PhD in computer science · Research Fellow (neuroscience)

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Profile

I specialize in functional brain connectivity estimation from electrophysiological data (EEG/MEG). This involves using **DSP**, **statistics**, and **machine learning**. For my daily job, I use **Python**, **MATLAB**, **Latex**, and **Bash** with occasional usage of **C/C++** and **Java**.

Education

Ph.D. in computer science

Moscow, Russia

Higher School of Economics, Faculty of Computer Science — *Jan. 2016 – Nov. 2021*

- Thesis: "Optimal methods for functional connectivity estimation in magnetoencephalography."
- Published a paper in a leading neuroscientific journal (see Ossadtchi et al. [2018]) by proposing a method for signal leakage suppression when measuring brain areas interaction from EEG/MEG data. Programmed the algorithm and validation scripts in **MATLAB**

Ph.D. in Computational Fluid Dynamics *(unfinished, transferred to CS program)*

Moscow, Russia

Lomonosov Moscow State University, Department of Mechanics and Mathematics — *Sep. 2013 – Jan. 2016*

- Thesis: "Numerical simulations of reactive gas flows."

Specialist degree in Mechanics *(Masters equivalent)*

Moscow, Russia

Lomonosov Moscow State University, Department of Mechanics and Mathematics — *Sep. 2008 – Jun. 2013*

- Thesis: "Enhancement and validation of LOGOS software for simulations of the reactive fluid flows."

Experience

Artificial Intelligence Research Institute (AIRI)

Moscow, Russia

Research fellow — *Feb. 2022 – Present*

- Developing real-time EEG neurofeedback pipeline in Python
- Building machine learning model to predict speech from MEG data

Higher School of Economics, Faculty of Computer Science

Moscow, Russia

Senior lecturer — *Aug. 2019 – Dec. 2021*

- Developed and taught a course "**MATLAB** for data analysis" to undergraduate psychology students

Higher School of Economics, Centre for Cognition and Decision Making

Moscow, Russia

Junior research fellow — *Feb. 2017 – Dec. 2021*

- Curated and published MEG dataset for metacognition research using BIDS and OpenNeuro. Developed an analysis pipeline in **Python**, ("metacognition" on github), supervised 2 students on using it. Manuscript is submitted to Neuron.
- Led 4-people group developing software for real-time feature extraction and 3D visualization of brain activity from EEG in **Python**
- Sped up by a factor of 10 the beamformer inverse solver in MNE-python by modifying the algorithm for vectorized computations
- Administered a laboratory GPU cluster running **Linux**

University of Montreal, CERNEC lab.

Montreal, Canada

Visiting researcher, temporary position — *Oct. – Dec. 2015, May 2016 – Dec. 2016*

- Preprocessed MEG dataset of 90 subjects for classification using **Python** scripts
- Built a classifier for ASD patients vs. Controls with 75% accuracy using classical ML and information geometry in **Python**
- Co-developed an open-source **Python** package for heavy neuroimaging data processing, Neuropycon, Meunier et al. [2020]

Moscow State University for Pedagogics and Education, MEG Center

Moscow, Russia

Junior research fellow — *Feb 2015 – Dec 2018*

- Published two papers in international collaboration with the University of Montreal, see Alamian et al. [2017a,b]

Scientific Research Institute of System Analysis

Moscow, Russia

Research assistant, promoted to junior research fellow — *Jun. 2011 – Jan. 2015*

- Validated commercial software for simulations of flow in jet engines by comparing simulated vs. theoretical shock wave parameters

Honors & Awards

- Selected together with other 178 people across the university for *2-year Higher School of Economics Academic Scholarship* for publishing a paper in a high-impact journal — *Moscow, Russia* *2019*
- Selected 1-st out of 5 teams together with 2 teammates in *IEEE Brain Data Bank Challenge* for building a competitive 2-players drinking game based on brain-computer interface — *St. Petersburg, Russia* *2017*

Conference contributions

Poster presentations

Biomag 2018 — *Philadelphia, USA*

Oblique projection for phase shift invariant imaging of coherent sources — *2018*

Biomag 2018 — *Philadelphia, USA*

NeuroPycon: A python package for efficient multi-modal brain network analysis — *2018*

5th Workshop on Optically-Pumped Magnetometers — *Freiburg, Switzerland*

OPM vs. SQUID arrays in MEG Functional Connectivity Estimation — *2017*

Biomag 2016 — *Seoul, South Korea*

Power and shift invariant imaging of coherent sources by MEG data — *2016*

Brain Connectivity Workshop 2015 — *San Diego, USA*

Globally-Optimized Power and Shift Invariant Imaging of Coherent Sources — *2015*

Talks

International conference "Brain-Computer Interface: Science and Practice" — *Samara, Russia*

Cognigraph: a real-time EEG-based source imaging software — *2019*

Comprehensive training "MEG at McGill" — *Montreal, Canada*

MEG resting-state in autism. Approach to analysis. — *2015*

Int. scientific school "Problems of functional synchronization assessment based on MEG/EEG data" — *Moscow, Russia*

Globally-optimized power and shift invariant imaging of coherent sources (GO-PSIICOS) — *2015*

Publications

1. D. Meunier, A. Pascarella, D. Altukhov, M. Jas, E. Combrisson, T. Lajnef, D. Bertrand-Dubois, V. Hadid, G. Alamian, J. Alves, F. Barlaam, A.L. Saive, A. Dehgan, and K. Jerbi. NeuroPycon: An open-source python toolbox for fast multi-modal and reproducible brain connectivity pipelines. *NeuroImage*, 219, 2020

2. E. Combrisson, R. Vallat, C. O'Reilly, M. Jas, A. Pascarella, A.L. Saive, T. Thiery, D. Meunier, D. Altukhov, T. Lajnef, P. Ruby, Aymeric G., and K. Jerbi. Visbrain: A multi-purpose GPU-accelerated open-source suite for multimodal brain data visualization. *Frontiers in Neuroinformatics*, 13:14, 2019

3. A. Ossadtchi, D. Altukhov, and K. Jerbi. Phase shift invariant imaging of coherent sources (PSIICOS) from MEG data. *NeuroImage*, 183, 2018

4. Z. Yaple, M. Martinez-Saito, N. Novikov, D. Altukhov, A. Shestakova, and V. Klucharev. Power of feedback-induced beta oscillations reflect omission of rewards: evidence from an EEG gambling study. *Frontiers in Neuroscience*, 12, 2018

5. G. Alamian, A.S. Hincapié, E. Combrisson, T. Thiery, V. Martel, D. Althukov, and K. Jerbi. Alterations of Intrinsic Brain Connectivity Patterns in Depression and Bipolar Disorders: A Critical Assessment of Magnetoencephalography-Based Evidence. *Frontiers in Psychiatry*, 8(March):1–17, 2017a

6. G. Alamian, A.S. Hincapié, A. Pascarella, T. Thiery, E. Combrisson, A. L. Saive, V. Martel, D. Althukov, F. Haesebaert, and K. Jerbi. Measuring alterations in oscillatory brain networks in schizophrenia with resting-state MEG: State-of-the-art and methodological challenges. *Clinical Neurophysiology*, 128(9):1719–1736, 2017b

7. N.N. Smirnov, V.B. Betelin, V.F. Nikitin, L.I. Stamov, and D.I. Altukhov. Supercomputer simulations of detonation of hydrogen-air mixtures. *International Journal of Hydrogen Energy*, pages 11059–11074, 2015a

8. N.N. Smirnov, V.B. Betelin, V.F. Nikitin, L.I. Stamov, and D.I. Altukhov. Accumulation of errors in numerical simulations of chemically reacting gas dynamics. *Acta Astronautica*, pages 338–355, 2015b

9. V.B. Betelin, V.F. Nikitin, D.I. Altukhov, V.R. Dushin, and J. Koo. Supercomputer modeling of hydrogen combustion in rocket engines. *Acta Astronautica*, pages 46–59, 2012