Ali Özgür Argunşah, Ph.D.

Neuroscientist · Engineer · Data Analyst

Schaffhauserstrasse 514, 8052 Zürich - SWITZERLAND

+41784011868 | aliozgur.argunsah@gmail.com | argunsah | Publications

Summary

I studied biomedical engineering with a focus on biomedical instrumentation. Afterwards I transitioned to developing machine learning algorithms for EEG-based brain machine interfaces. For my Ph.D., I shifted to synaptic neurobiology and studied the effects of naturalistic activity patterns on individual dendritic spines. Currently, as a senior research scientist, I am working in the field of developmental systems neuroscience, exploring the biological foundations of neuronal circuit formation.

Research and Work Experience

Brain Research Institute (HiFo), University of Zürich — *Zürich, Switzerland*

Senior Research Scientist — *Sep. 2024 - Current*

Brain Research Institute (HiFo), University of Zürich — *Zürich, Switzerland*

Oberassistent — *Sep. 2022 - Aug. 2024*

Department of Molecular Biology and Genetics, Kadir Has University — *Istanbul, Turkey*

Visiting Scholar — *Jan. 2023 - Jan. 2024*

Brain Research Institute (HiFo), University of Zürich — *Zürich, Switzerland*

Postdoc — *Sep. 2016 - Aug. 2022*

Neuroscience Statistics Research Laboratory, Massachusetts General Hospital — *Massachusetts, USA*

Visiting Researcher — *Aug. 2007 - Feb. 2008*

Education

Champalimaud Neuroscience Programme — *Lisbon, Portugal*

Ph.D. in Biology | Neuroscience — *Sep. 2009 - Jul. 2016*

- **Thesis Title:** Activity Dynamics Lead to Diverse Structural Plasticity at Single Dendritic Spines.
- **Thesis Summary:** I worked on inducing synaptic plasticity at single dendritic spines using two-photon glutamate uncaging and imaging and quantified spatio-temporal structural changes utilizing computer vision techniques to understand plasticity at CA1 hippocampal neurons.
- **PhD Advisor:** Dr. Inbal Israely, Neuronal Structure and Function Lab.

Riken Brain Science Institute — *Wako, Saitama, Japan.*

Riken Summer School — *July. 2012 - Aug. 2012*

- **Project:**I performed in-vivo ephys recordings using self-made tetrodes from freely moving mice and analyzed complex ephys datasets using various signal processing techniques.
- **Supervisor:** Dr. Thomas J. McHugh, Circuit and Behavioral Physiology Lab.

Sabancı University — *Istanbul, Turkey*

M.S. in Electronics Engineering and Computer Science — *Jan. 2006 - Aug. 2009*

- **Thesis Title:** An HMM-PCA Approach for EEG-Based Brain-Computer Interfaces.
- **Thesis Summary:** Developed machine learning algorithms for the classification of EEG data for brain-computer interface applications.
- **MS Advisor:** Dr. Mujdat Cetin, Computer Vision and Pattern Analysis Lab.

University of São Paulo — *Ribeirão Preto, SP, Brazil*

Latin American School on Computational Neuroscience — *June. 2008 - Aug. 2008*

- Studied biophysically detailed single neuron models; simplified neuron models; neural network models; synaptic plasticity and memory models; and biochemical modeling.

Başkent University — *Ankara, Turkey*

B.S. Biomedical Engineering — *Sep. 1999 - Jun. 2004*

- **Senior Project:** Design and Implementation of a Mobile EEG Acquisition System.
- **Project Summary:** Designed a mobile two-channel EEG amplifier coupled with a data recording and visualisation interface using Palm PDA.

Grants, Scholarships & Awards

Individual Grants

2010-2013	**Hippocampal Synaptic Plasticity Induced by Natural Spike Trains**, FCT, Portugal	*44K Euro (59K USD)*

Co-Authored Grants

2014-2017	**Probabilistic and Machine Learning-based Methods for Automatic Dendritic Spine Segmentation, Classification, and Tracking in Two-Photon Microscopy Images**, TÜBITAK, Turkey	*345K TRY (165K USD)*
2007-2010	**Development of Electroencephalography (EEG) Signal Analysis Techniques for Brain Computer Interface (BCI) Systems**, TÜBITAK, Turkey	*360K TRY (250K USD)*

Scholarships & Awards

2023	**Best Presentation**, Turkish Neuroscience Conference, Bolu, Turkey	-
2014-2016	**Ph.D. Fellowship**, Champalimaud Foundation, Portugal	*Salary*
2012	**Travel Grant**, RIKEN BSI Summer School, Japan	*Flight+Acc.*
2006	**BAD-Wyeth Travel and Education Scholarship**, Brain Research Society, Turkey	*3500 TRY (2500 USD)*
2004	**One of Best 50 Graduation Projects of the Year**, Interpro Weekly Information Systems Journal, Turkey	-
2004	**Best Poster Award**, National Biophysics Congress, Turkey	-

Teaching Experience

Professor

Kadir Has Un., Istanbul, Turkey.

Department of Molecular Biology and Genetics — *2023-2024*

- Biopython (30% In-Person, 70% Online), Fall 2023.
- Neuroscience (30% In-Person, 70% Online), Fall 2023.
- Behavioral Biology (30% In-Person, 70% Online), Spring 2023.

Teaching Assistant

Sabanci University, Istanbul, Turkey.

Faculty of Engineering and Natural Sciences — *2006-2009*

- Undergradute: Calculus I and II, Discreet Math., Linear Algebra, Probability and Statistics
- Graduate: Multivariate Data Analysis, Computer Vision and Pattern Analysis

Scientific Activities

- **Review Editor**, Frontiers in Neuroinformatics. -
- **Reviewer**, Neuron, eLife, Communications Biology, PloS One, PloS Computational Biology, IEEE Transactions on Medical Imaging, Computer Methods in Biomechanics and Biomedical Engineering -

Extracurricular Activity

Member of Working Group on Flight Emissions

University of Zurich

Faculty of Medicine — *2018*

- UZH is trying to reduce thr carbon emission caused through flights by university staff and aiming to have it decreased of 3% until 2030.

Neuronal Circuit Assembly Lab., Brain Research Institute

University of Zurich

Deputy study director of animal experimentation. — *Jan. 2022 - Jan. 2026*

- Coordination of Experimental Procedures

Member of Faculty Hiring Committee

University of Zurich and ETH Zurich

Institute of Neuroinformatics — *2018*

- Postdoctoral Representative of Hiring Committee

Co-Organizer

Sesimbra/Lisbon, Portugal

European Neuroscience Conference by Doctoral Students — *2015*

- One of the three organizers of the second edition of the ENCODS, hosted 80 students and 8 faculty, supported by Google, Boehringer Ingelheim, Gatsby Foundation, FENS, IBRO, Roche

Journal Papers

2024 **Developmental Cajal-Retzius cell death contributes to the maturation of cortical inhibition and somatosensory processing**,
Damilou, A., Cai, L., **Argunsah, A.Ö.**,..., Karayannis T.,
Nature Communications, 15(1), p.6501.

2024 **A nasal chemosensation-dependent critical window for somatosensory development**,
Cai, L., **Argunsah, A.Ö.**, Damilou, A., Karayannis T.
Science, 384(6696), pp.652-660.

2024 **Progressive engagement of SST+ interneurons via Elfn1 regulates the barrel-septa response deviation**,
Argunsah, A.Ö.,Stachniak T.J.E., Yang J.W.,...,Karayannis T.
Biorxiv, 2024.01.23.576792; DOI: 10.1101/2024.01.23.576792

2023 **Presynaptic kainate receptors onto somatostatin interneurons are recruited by activity throughout development and contribute to cortical sensory adaptation**,
Stachniak T.J.E., **Argunsah, A.Ö.**, Yang J.W., Cai L., Karayannis T.,
Journal of Neuroscience 14 September 2023, JN-RM-1461-22; DOI: 10.1523/JNEUROSCI.1461-22.2023

2023 **Homosynaptic plasticity induction causes heterosynaptic changes at the unstimulated neighbors in an induction pattern and location-specific manner**,
Argunsah, A.Ö., Israely, I.
Frontiers in Cellular Neuroscience, Volume 17, 2023, ISSN 1662-5102; DOI=10.3389/fncel.2023.1253446

2023 **The temporal pattern of synaptic activation determines the longevity of structural plasticity at dendritic spines**,
Argunsah, A.Ö., Israely, I.,
iScience, Volume 26, Issue 6, 2023, 106835, ISSN 2589-0042; https://doi.org/10.1016/j.isci.2023.106835

2022 **Sparse postnatal labeling and quantification of superficial cortical cell synapses in the mouse neocortex.**,
Gesuita L.*, **Argunsah, A.Ö.***, Karayannis T.,
STAR Protocols, 3(4), p.101837.

2022 **An interactive time series analysis software for dendritic spines**,
Argunsah, A.Ö.*, Erdil E.*, Ghani M.U., Ramiro-Cortes Y., Hobbiss A., Karayannis T., Cetin, M., Israely I., Unay D.,
Scientific Reports 12, 12405 (2022); https://doi.org/10.1038/s41598-022-16137-y

2022 **Microglia contribute to the postnatal development of cortical SST+ inhibitory cells and to whisker-evoked cortical activity**,
Gesuita, L., Cavaccini, A., **Argunsah, A.Ö.**, Favuzzi, A.E., Ibrahim, L.A., Stachniak, T., ..., Karayannis, T.,
Cell reports, 40(7), p.111209.

2021 **Post-mitotic Prox1 expression controls the final specification of cortical VIP interneuron subtypes**,
Stachniak T.J.*, Kaestli R.*, Hanley O., **Argunsah, A.Ö.**, Karayannis, T.,
Journal of Neuroscience 11 August 2021, JN-RM-1021-21; DOI: 10.1523/JNEUROSCI.1021-21.2021

2020 **Developmental Divergence of Sensory Stimulus Representation in Cortical Interneurons**,
Argunsah, A.Ö.*, vd Bourg, A.*, Kaestli, R.*, Vighagen, R.*, ..., Aguzzi, A., Helmchen, F., Karayannis, T.,
Nature Communications 11, no. 1 (2020): 1-14.

2018 **Tracking-assisted Detection of Dendritic Spines in Time-Lapse Microscopic Images**,
Rada L., Kilic, B., Erdil, E., Ramiro-Cortés, Y., Israely I., Unay D., Cetin, M., **Argunsah, A.Ö.**.,
Neuroscience, 394, 189-205.

2017 **Nonparametric joint shape and feature priors for image segmentation**,
Erdil E., Ghani M.U., Rada, L., **Argunsah, A.Ö.**, Unay D., Tasdizen T., Cetin, M.,
IEEE Transactions on Image Processing, 26 (11), 5312-5323.

2017 **Dendritic Spine Classification using Shape and Appearance Features based on Two-Photon Microscopy**,
Ghani M.U., Mesadi F., Kanik S.D., **Argunsah, A.Ö.**, Hobbiss A.F., Israely I., Unay D., Tasdizen T., Cetin, M.,
Journal of Neuroscience Methods, Volume 279, Pages 13-21, doi.org/10.1016/j.jneumeth.2016.12.006.

Selected Conference Proceedings (Peer Reviewed)

2022 **Enhancing Two-Photon Images for Anatomical Visualisation using Super-Resolution**,
Aydeniz B., Metin S.C., Unay D., Karayannis, T., Turkan M., **Argunsah, A.Ö.**,
Medical Technologies Congress (TIPTEKNO), pp. 1-4, doi: 10.1109/TIPTEKNO56568.2022.9960191.

2019 **Combining nonparametric spatial context priors with nonparametric shape priors for dendritic spine segmentation in 2-photon microscopy images**,
Erdil E., **Argunsah, A.Ö.**, Tasdizen T., Unay D., Cetin, M.,
IEEE 16th International Symposium on Biomedical Imaging (ISBI), pp. 204-207, doi: 10.1109/ISBI.2019.8759273.

2016 **Dendritic Spine Shape Analysis: A Clustering Perspective**,
Ghani M.U., Erdil E., Kanik S.D., **Argunsah, A.Ö.**, Hobbiss A.F., Israely I., Unay D., Tasdizen T., Cetin, M.,
Lecture Notes in Computer Science, vol 9913. Springer, Cham.

2016 **Nonparametric joint shape and feature priors for segmentation of dendritic spines**,
Erdil E., Rada L., **Argunsah, A.Ö.**, Israely, I., Unay D., Tasdizen T., Cetin, M.,
IEEE 13th International Symposium on Biomedical Imaging (ISBI), pp. 343-346, doi: 10.1109/ISBI.2016.7493279.

2016 **On comparison of manifold learning techniques for dendritic spine classification**,
Ghani M.U., **Argunsah, A.Ö.**, Israely I., Unay D., Tasdizen T., Cetin, M.,
IEEE 13th International Symposium on Biomedical Imaging (ISBI), pp. 339-342, doi: 10.1109/ISBI.2016.7493278.

2015 **A joint classification and segmentation approach for dendritic spine segmentation in 2-photon microscopy images**,
Erdil E., **Argunsah, A.O.**, Tasdizen T., Unay D., Cetin, M.,
IEEE 12th International Symposium on Biomedical Imaging (ISBI), pp. 797-800, doi: 10.1109/ISBI.2015.7163992.

2014 **Automatic dendritic spine detection using multiscale dot enhancement filters and sift features**,
Rada L., Erdil E., **Argunsah, A.Ö.**, Unay D., Cetin, M.,
Image Processing (ICIP), IEEE International Conference on Image Processing (ICIP), Paris, France, pp. 26-30, doi: 10.1109/ICIP.2014.7025004

2012 **A tool for automatic dendritic spine detection and analysis. Part I: Dendritic spine detection using multi-level region-based segmentation**,
Erdil, E., Yagci A.M., **Argunsah, A.Ö.**, Ramiro-Cortes Y., Hobbiss A.F., Israely, I., Unay, D.,
International Conference on Image Processing Theory, Tools and Applications (IPTA), Istanbul, Turkey, pp. 167-171, doi: 10.1109/IPTA.2012.6469558

2010 **AR-PCA-HMM approach for sensorimotor task classification in EEG-based brain-computer interfaces**,
Argunsah, A.Ö., Cetin, M., **20th International Conference on Pattern Recognition**, Istanbul, Turkey, pp. 113-116, doi: 10.1109/ICPR.2010.36.

2007 **Comparison of Different Feature Extraction Methods on Classification of Gene Expression Data**,
Argunsah, A.Ö. , Akan, B., Ercil, A., Sezerman, U.,
IEEE 15th Signal Processing and Communications Applications, Eskisehir, Turkey, pp. 1-4, doi: 10.1109/SIU.2007.4298706

2007 **A human-computer interface (HCI) based on electrooculogram (EOG) for handicapped**,
Akan B., **Argunsah, A.Ö.**, **IEEE 15th Signal Processing and Communications Applications**, Eskisehir, Turkey, 2007, pp. 1-3, doi: 10.1109/SIU.2007.4298649

2004 **A Portable EEG Data Recording System**,
Argunsah, A.Ö., Yagcioglu S., Erogul O., Duman F., **Proceedings of XVI. National Biophysics Congress**, Poster 42, page 73, 19-21 Sep. 2004, Ankara, Turkey, https://www.turkbiyofizikdernegi.org/kongreler/16.pdf

Dataset and Code

2023 **“argunsah/SpineS: v1”. Zenodo. doi: 10.5281/zenodo.7871556.**, **Argunsah, A.Ö.**, **Zenodo**

2023 **“argunsah/NaturalisticStimulationPatternGenerator: iScience”. Zenodo. doi: 10.5281/zenodo.7871541.**, **Argunsah, A.Ö.**, **Zenodo**

2022 **“Dendritic Spine Datasets”, Scientific Reports. Zenodo. doi: 10.5281/zenodo.6985022.**, **Argunsah, A.Ö.**, **Zenodo**

2022 **“argunsah/punctaDensity: v1.1”. Zenodo. doi: 10.5281/zenodo.6980507.**, **Argunsah, A.Ö.**, **Zenodo**

2022 **“argunsah/colocAnalysis: Microglia-SST colocalization code for Gesuita et al., 2022, Cell Reports.”. Zenodo. doi: 10.5281/zenodo.6862093.**, **Argunsah, A.Ö.**, **Zenodo**