

Aziz Koçanaoğulları

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Last updated on April 19, 2025

SUMMARY

Algorithm researcher and developer with 10+ years of experience in signal processing, machine learning, sequential decision-making, and deep learning, applied to biomedical time series and computer vision. Strong foundation in Bayesian inference and statistical modeling. Designed and deployed scalable AI systems for transforming raw biomedical data into clinically actionable insights. Proven record of delivering production-grade software, validating models on real-world data, and collaborating across regulated medical environments. Authored 22 publications and co-inventor on 1 patent.

SKILLS

- **Languages:** Python (13 yrs), MATLAB (15 yrs), C++, C (6 yrs)
- **Machine Learning / Data Science:** scikit-learn, pandas, NumPy, PyTorch, TensorFlow, Keras, Chainer, OpenCV
- **Software Engineering:** Git, CI/CD, Docker, Bash, unit testing, code reviews, automated pipelines
- **Tools / Frameworks:** Jupyter, VS Code, Linux, Slurm, AWS EC2/S3
- **Development Practices:** Agile workflows, reproducible research, software documentation, model deployment

EDUCATION

Northeastern University

Ph.D. Electrical Engineering

Gordon Engineering Leadership Fellow (Ms. Equivalent)

Boston, MA, USA

December 19th 2020

August 8th 2019

Istanbul Technical University

MSc. Telecommunications Engineering [GPA:3.90/4.00]

BSc. Mathematical Engineering [GPA:3.71/4.00]

BSc. Electronics Engineering [GPA:3.82/4.00]

Istanbul, Turkey

June 24th 2016

June 29th 2015

July 4th 2014

INDUSTRY EXPERIENCE

Analog Devices Inc.

Xtech, Manager – Machine Learning

Feb 2025 – Present

- Led high-impact ML initiatives as a key individual contributor, while mentoring peers and driving algorithmic advancement.
- Expanded a cutting-edge algorithmic portfolio into other domains, scaling impact beyond healthcare.
- Directed collaborative efforts with academic institutions and industry stakeholders to translate research models into real-world applications.

Xtech, Lead Research Scientist

Aug 2023 – Feb 2025

- Designed and implemented full-stack software to transform raw sensor data into actionable diagnostics for rapid bacterial detection and classification (Python [PyTorch], C++).
- Built an ensemble deep learning model for early sepsis detection and identification of causal biomarkers.
- Achieved 99.6% sensitivity, 99% specificity, and 89% accuracy across 8 distinct etiologies over 1,000 samples.
- Partnered with clinicians to validate the approach in a blind clinical study at Massachusetts General Hospital, outperforming existing diagnostic solutions.

Analog Garage, Lead Research Scientist

Jan 2022 – Aug 2023

- Developed advanced computer vision algorithms for handheld devices, achieving sub-millimeter accuracy in dimensioning and object detection in indoor environments (C++).
- Achieved 10^3 of magnitude compression in biomedical sensor fusion minimizing information loss (Python).

Mitsubishi Electric Research Laboratories

Computer Vision, Research Intern

May 2018 – Aug 2018, May 2019 – Aug 2019

- Developed algorithmic improvements for simultaneous localization in indoor robotics (C++).
- Co-invented a patented deep feature extraction method using curriculum learning, enabling use of shallower architectures and lower-cost training (Python [TensorFlow]).

ACADEMIC EXPERIENCE

Boston Children's Hospital & Harvard Medical School, PostDoc

Jan 2021 – Jan 2022

- Developed a deep learning algorithm for MRI reconstruction, achieving accurate estimation of TK parameters.(Python)
- Led development of a GPU-accelerated dynamic MRI reconstruction, reducing runtime from 8 hours to 20 minutes.(Python)
- Implemented motion correction techniques for infant MRI, improving accuracy by 15%. (Python, Matlab)

- Lead machine learning development for non-invasive Brain Computer Interfaced typing system.
- Developed active querying algorithms that doubled typing speed in adversarial conditions.

- Developed an active few-shot learning algorithm for image classification with comparable performance using 20% less data.
- Contributed to the transfer of deep image classifiers by designing novel algorithms for few-shot learning.
- Proposed a sample selection strategy to improve training efficiency in deep neural networks.
- Conducted comprehensive analysis of active learning techniques in low-data regimes for image classification.

PUBLICATIONS

Journal Papers

1. Ariyurek, C., **Koçanaoğulları, A.**, Afacan, O., & Kurugol, S. (2024). Motion-compensated image reconstruction for improved kidney function assessment using dynamic contrast-enhanced MRI. *NMR in Biomedicine*, 37(6), e5116.
2. Marghi, Y. M., **Koçanaoğulları, A.**, Akçakaya, M., & Erdoğan, D. (2022). Active recursive Bayesian inference using Rényi information measures. *Pattern Recognition Letters*, 154, 90-98.
3. **Koçanaoğulları, A.**, Ariyurek, C., Afacan, O., & Kurugol, S. (2021). Learning the Regularization in DCE-MR Image Reconstruction for Functional Imaging of Kidneys. *IEEE Access*.
4. **Koçanaoğulları, A.**, Akçakaya, M., & Erdoğan, D. (2021). Stopping Criterion Design for Recursive Bayesian Classification: Analysis and Decision Geometry. *IEEE Transactions on Pattern Analysis and Machine Intelligence*.
5. **Koçanaoğulları, A.**, Smedemark-Margulies, N., Akçakaya, M., & Erdoğan, D. (2021). Geometric Analysis of Uncertainty Sampling for Dense Neural Network Layer. *IEEE Signal Processing Letters*, 28, 867-871.
6. Memmott, T., **Koçanaoğulları, A.**, Lawhead, M., Klee, D., Dudy, S., Fried-Oken, M., & Oken, B. (2021). BciPy: brain-computer interface software in Python. *Brain-Computer Interfaces*.
7. **Koçanaoğulları, A.**, Marghi, Y., Akçakaya, M., & Erdoğan, D. (2019). An active recursive state estimation framework for brain-interfaced typing systems. *Brain-Computer Interfaces*, 6(4), 149-161.
8. **Koçanaoğulları, A.**, Marghi, Y. M., Akçakaya, M. and Erdoğan, D. "Optimal Query Selection Using Multi-Armed Bandits." *IEEE Signal Processing Letters* 25.12 (2018): 1870-1874.
9. **Koçanaoğulları, A.** and Akçakaya, M. and Erdoğan, D. "On Analysis of Active Querying for Recursive State Estimation", *IEEE Signal Processing Letters* 25.6 (2018): 743.
10. Tunga, B., and **Koçanaoğulları, A.** "Digital image decomposition and contrast enhancement using high-dimensional model representation." *Signal, Image and Video Processing* 12.2 (2018): 299-306.

Patents

1. **Kocanaogullari, A.**, Cansizoglu, E., & Corcodel, R. I. (2020). U.S. Patent No. 10,810,468. Washington, DC: U.S. Patent and Trademark Office.

Conference Papers

1. Smedemark-Margulies, N., Celik, B., Imbiriba, T., **Kocanaogullari, A.**, & Erdoğan, D. (2023, June). Recursive Estimation of User Intent From Noninvasive Electroencephalography Using Discriminative Models. In *ICASSP 2023-2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 1-5). IEEE.
2. **Koçanaoğulları, A.**, Akçakaya, M., Oken, B., & Erdoğan, D. (2020, June). Optimal modality selection using information transfer rate for event related potential driven brain computer interfaces. In *Proceedings of the 13th ACM International Conference on Pervasive Technologies Related to Assistive Environments* (pp. 1-7).
3. **Koçanaoğulları, A.**, Marghi, Y. M., Akçakaya, M., and Erdoğan, D., "A History-based Stopping Criterion in Recursive Bayesian State Estimation." *ICASSP 2019-2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, 2019.
4. **Koçanaoğulları, A.** and Quivira, F. and Erdoğan, D. "Incorporating Temporal Dependency on ERP Based BCI", *Biomedical Imaging (ISBI 2018)*, 2018 IEEE 15th International Symposium on. IEEE, 2018.
5. **Koçanaoğulları, A.**, and Bayram, İ. A dereverberation formulation employing phase information. In *Signal Processing and Communication Application Conference (SIU 2016)*, 2016 24th (pp. 633-636). IEEE.
6. **Koçanaoğulları, A.**, and Bayram, İ. A dereverberation formulation based on sparsity. In *Signal Processing and Communications Applications Conference (SIU 2015)*, 2015 23th (pp. 1018-1021). IEEE.
7. Bayram, İ., and **Koçanaoğulları, A.** A Minimization Formulation for Source Separation with a Microphone Array. In *Signal Processing and Communications Applications Conference (SIU 2015)*, 2015 23th (pp. 1014-1017). IEEE.

Workshop Papers

1. Ariyurek, C., **Kocanaogullari, A.**, Sari, T. C., Vasylychko, S., Afacan, O., & Kurugol, S. (2023). PyGRASP: A standalone python image reconstruction library for DCE-MRI acquired with radial sampling. In *ISMRM* (p. 2404).
2. **Kocanaogullari, A.**, Ariyurek, C., Afacan, O., & Kurugol, S. (2022). Coil selective golden angle dce-mr image reconstruction using mutual dependence. In *Proceedings of the 30th annual meeting of ismrm, london ISMRM* (Vol. 2442).

3. Ariyurek, C., Wallace, T. E., Kober, T., **Koçanaoğulları, A.**, Warfield, S. K., Kurugol, S., & Afacan, O. (2021). Prospective motion correction in kidney MRI using free induction decay navigators. ISMRM poster session on motion detection and correction.
4. **Koçanaoğulları, A.** and Ataer-Cansızoglu, E. "Active Descriptor Learning for Feature Matching." European Conference on Computer Vision. Springer, Cham, 2018.
5. Memmott, T., **Kocanaogullari, A.**, Erdogmus, D., Bedrick, S., Peters, B., Fried-Oken, M., & Oken, B. (2018). BciPy: A python framework for brain-computer interface research. In Proc. 7th Int. BCI Meeting (pp. 183-184).