

# Deniz Kocanaogullari

kocanadeniz@gmail.com | (412) 304-6978 | Google Scholar | kocanadeniz.github.io

## Research Interests

Signal Processing, Machine Learning, Statistical and Computational Modeling, Brain-Computer Interfaces, Deep Learning, Shallow Neural Networks, Quantization and Pruning, Domain Adaptation

## Education

University of Pittsburgh – PhD in Electrical and Computer Engineering	Expected Aug 2024
University of Pittsburgh – MS in Electrical and Computer Engineering	Apr 2021
Istanbul Technical University – BS in Electronics and Communication Engineering	June 2019

## Experience

Research Assistant, University of Pittsburgh – Pittsburgh, PA	Aug 2019 – Present
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### *Augmented Reality EEG Project - Project Lead*

- Led a project on a human-in-the-loop system for rehabilitation of neglect in stroke patients using EEG data
- Collected data from stroke patients in both hospital and lab environments using the developed BCI device
- Created preprocessing pipeline using MATLAB and Python that reduced noise in EEG data and increased the accuracy of machine learning algorithms by 15%
- Established real-time analysis procedures and built shallow neural network models using PyTorch that reduces the number of parameters by 30% while keeping the system robust
- Worked with autoencoders for domain generalization to suppress person-specificity of EEG data

### *Hearing Aid EEG Project - Project Co-lead*

- Created a hybrid CNN-SNN structure using snnTorch with PyTorch for auditory attention detection, reducing the number of operations required by 50% while surpassing state-of-the-art algorithms by 15%
- Reduced the number of EEG channels by up to 87.5% while keeping the accuracy within a 5% bound
- Performed 8-bit quantization while keeping the overall accuracy within a 3% bound

Undergraduate Research Assistant, Istanbul Technical University – Istanbul, Turkey	Jan 2018 – June 2019
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- Studied state-of-the-art super-resolution and image reconstruction problems
- Built a CNN model using TensorFlow for MRI reconstruction that increased peak signal-to-noise ratio (PSNR) by 0.34 dB while keeping model complexity and training time similar to other state-of-the-art modalities
- Researched super-resolution techniques and implemented state-of-the-art algorithms for comparison and trained a cohort of students about CNNs and GANs in image denoising and reconstruction

Engineering Intern, ASELSAN – Ankara, Turkey	June 2018 - Aug 2018
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- Developed a cross-platform heart-rate sensor and GPS tracker application using Python
- Provided a prototype to the engineering design team, helped with field testing the application and devices
- Saved money by cutting outsourcing fees by developing a single application for both PC and mobile phones instead of developing two different apps for iOS and Android, as well as PC

Engineering Intern, EKTAM – Izmir, Turkey	June 2016 - Aug 2016
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- Designed the automation scheme of automatic bottling machines by PLC programming in C++
- Presented the machines and automation pipeline to auditors and buyers, helped with installation procedures

## Skills

**Languages:** Python, C, C++, R, MATLAB

**ML Tools:** TensorFlow, PyTorch, scikit-learn, OpenCV, pandas, NumPy, SciPy, Matplotlib, seaborn

**Tools:** Git, GNU/Linux, AWS (S3, EC2), GCP

## Patents

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- \* **Kocanaogullari, D.**, Akcakaya, M., Grattan, E., Wittenberg, G. F., Mak, J., Ostadabbas, S. & Huang, X. PCT International Application No. PCT/US2023/016885, 2023
- \* Gall, R., **Kocanaogullari, D.**, Akcakaya, M. & Kubendran, M. PCT International Application No. PCT/US2023/079463, 2023

## Publications

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- **Kocanaogullari, D.**, Gall, R., Akcakaya, M., Erdogmus, D. & Kubendran, R. "Corticomorphic Hybrid CNN-SNN Architecture for EEG-based Low-footprint Low-latency Auditory Attention Detection", IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI) (Submitted)
- Mak, J., **Kocanaogullari, D.**, Huang, X., Mullen, K., Grattan, E. S., Ostadabbas, S., Wittenberg, G. F., Akcakaya, M. "A Scalable EEG-Based Spatial Neglect Detection System in Augmented Reality for Stroke Patients", Neurorehabilitation & Neural Repair (Submitted)
- **Kocanaogullari, D.**, Soehner, A., Akcakaya, M., Bendixen, R., Hartman, A. G. "What goes on when the lights go off? Using machine learning techniques to characterize a child's settling down period", Biomedical Signal Processing and Control (Submitted)
- **Kocanaogullari, D.**, Mak, J., Huang, X., Kersey, J., Shih, M., Grattan, E., Skidmore, E., Wittenberg, G. F., Ostadabbas, S., Akcakaya, M. "Detection of Stroke-Induced Visual Neglect and Target Response Prediction Using Augmented Reality and Electroencephalography," In IEEE Transactions of Neural Systems and Rehabilitation Engineering, 2022
- **Kocanaogullari, D.**, Huang, X., Mak, J. Shih, M. Skidmore, E. Wittengerg, G. F., Ostadabbas, S., Akcakaya, M., "Fine-tuning and Personalization of EEG-based Neglect Detection in Stroke Patients," 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), 2021, pp. 1096-1099
- **Kocanaogullari, D.**, Mak, J., Kersey, J., Khalaf, A., Ostadabbas, S., Wittenberg, G., Skidmore, E., Akcakaya, M., "EEG-based Neglect Detection for Stroke Patients," 2020 IEEE 42nd Annual International Conferences of the IEEE Engineering in Medicine and Biology Society (EMBC 2020), Online, 2020
- **Kocanaogullari, D.**, Eksioğlu, E. M., "Deep Learning For MRI Reconstruction Using A Novel Projection Based Cascaded Network," 2019 IEEE 29th International Workshop on Machine Learning for Signal Processing (MLSP), Pittsburgh, PA, USA, 2019, (pp. 1-6)

## References

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Provided upon request.