Mohammad Nikbakht

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INTERESTS

Deep Learning, Self-Supervised Learning, Human Computer Interaction (HCI), NLP, LLM, Digital Signal Processing, Health AI, Biomedical Sensing, Software Engineering

EDUCATION

Georgia Institute of Technology, Atlanta, Georgia, USA

- PhD in Electrical and Computer Engineering — Aug 2019 - Dec 2023 (Expected)
  - Adviser: Prof. Omer Inan
  - Focus: Deep Learning, Transformer Neural Networks, Health AI, Biomedical Sensing.
  - Cumulative GPA: 4.00 / 4.00
- MSc in Electrical and Computer Engineering — Aug 2019 - May 2022
  - Adviser: Prof. Omer Inan
  - Focus: Deep Learning, Transformer Neural Networks, Health AI, Biomedical Sensing.
  - Cumulative GPA: 4.00 / 4.00
- PhD Minor in Strategy and Technology Innovation — Jan 2022 - May 2023
  - Focus: Market Analysis, Technology Analysis, Financial Analysis, Business Model Design.
  - Cumulative GPA: 4.00 / 4.00

University of Tehran, Tehran, Iran

- BSc in Electrical and Computer Engineering — Aug 2015 - Aug 2019
  - Graduated with College Honors.
  - Cumulative GPA: 18.91/20.00

SKILLS

Programming Languages

- Python, MATLAB, C, C#, React JS, React Native

Related Knowledge,

- ***Deep Learning:*** Unsupervised Learning, Self-Supervised Learning, Sequence Modeling, LLM, NLP, Distributed Training, Network Architecture Development including Transformer Neural Networks, Autoencoders, VAEs, RNN, CNN, U-Net, ResNet.
- ***Deep Learning Libraries and Frameworks:*** PyTorch, TensorFlow, Keras, Spark, Hugging Face Transformers, WandB, Scikit-learn, ONNX.
- ***Development Tools/Frameworks/Libraries***: Jupyter, AWS SageMaker Studio, Google Cloud, Google Colab, Linux, Git, GPU, CUDA, OpenCV, Flask, Numpy, SciPy, Pandas
- ***Algorithms and CS Knowledge:*** Big-O Analysis, Data Structures, Sorting, Trees, Graphs, Hashing, Heaps, Dynamic Programming, Recursion, BFS, DFS.
- ***Biomedical Sensing:*** Wearable Sensors, Multi-Modal Sensing, Sensor Fusion, Signal Processing, Biomedical Instrumentation, Human Study Design, Embedded Systems.

PROFESSIONAL EXPERIENCE

Data Scientist intern at **OMNY Health**, Atlanta, GA, USA

- Social Determinants of Health Extraction from EHR Clinical Notes (NLP) — May 2022 - Aug 2022
  - Performed feasibility analyses on the OMNY Health data platform, encompassing data from 540,000 patients.
  - Transformed the OMNY Health data platform by implementing a Natural Language Processing (NLP) product for SDoH labeling of unstructured clinical notes. Deployed for inference with ONNX format.
  - Led the domain adaptation of BERT using clinical notes and fine-tuning for a multilabel SDoH classification task.
  - Presented the work at ISPOR conference 2022. Submitted a journal paper to JMIR.
  - ***Focus:*** deep learning, self-supervised learning, big data, natural language processing, text classification, large language models

Data Scientist intern at **SensorsCall**, Atlanta, GA, USA — May 2021 - Aug 2021

- Activity Classification Using Domestic Sounds (Based on CNN)
  - Designed a Convolutional Neural Networks (CNN) based architecture for activity detection using domestic sounds.
  - Deployed the model to an IoT device, employing the lightweight TensorFlow Lite framework, for edge computing.
  - This solution is actively utilized by individuals and caregivers to monitor the well-being of seniors living independently.
  - ***Focus:*** deep learning, audio processing, audio classification, activity recognition

RESEARCH EXPERIENCE

Inan Research Lab (IRL), Georgia Institute of Technology, Atlanta, GA, USA

- Generative Pretraining for Cardiovascular Signals (Based on GPT-II) Jul 2023 - Nov 2023
  - Pioneering the design of generative pre-trained transformer (GPT) architectures for cardiovascular signal generation.
  - Leading the use of LLM architectures in the healthcare domain for cardiovascular signals.
  - ***Aim:*** To revolutionize risk prediction, patient condition forecasting, and preventive care.
  - ***Focus:*** deep learning, self-supervised learning, large language models, generative AI, signal processing
- Cardiac Signal Denoising Without Clean Labels (Based on U-Net) Dec 2022 - Jul 2023
  - Designed a U-Net architecture trained without clean labels to mitigate motion noise from cardiac signals.
  - Improved health parameter (HR, PEP, LVET) estimation accuracy during activities to meet FDA standards, enabling precise health parameter monitoring during daily activities.
  - Accepted paper at BHI conference. Submitted journal manuscript to JAMIA.
  - ***Focus:*** deep learning, image reconstruction, blind denoising, signal processing, computer vision
  - ***GitHub:*** https://github.com/mohnikbakht/SCG_Walking_Denoising
- Noninvasive Cardiac Shunt Monitoring in Infants with CHD (Based on VAE) Jan 2022 - Dec 2022
  - Implemented a variational autoencoder (VAE) for classifying auditory characteristics of blood flow through shunts.
  - Introduced a novel approach enabling frequent noninvasive shunt health evaluations using a digital stethoscope.
  - Successful flow state classification under ECMO, elevated pulmonary artery pressure, after angioplasty and cyanosis.
  - Presented findings at Emory University. Submitted a journal manuscript to JBHI.
  - ***Focus:*** deep learning, unsupervised learning, autoencoders, audio processing, audio classification
  - ***GitHub:*** https://github.com/mohnikbakht/PCG_Shunt_Demo
- Synthetic Cardio-mechanical Signal Generation (Based on Transformers) Aug 2021 - Jan 2022
  - Designed a transformer-based neural network for generation of synthetic, human-like SCG beats while exerting precise control over clinically relevant features.
  - Enabled applications such as dataset augmentation, online learning, and uncertainty quantification, ushering in a new era of cardiac diagnostics and predictive modeling.
  - Published in JAMIA (2023). Additionally, filed a nonprovisional patent application.
  - ***Focus:*** deep learning, self-supervised learning, generative AI, transformers, signal processing, large language models
  - ***Paper*** https://academic.oup.com/jamia/article-abstract/30/7/1266/7117772

PUBLICATIONS

JOURNALS

[1] **Nikbakht, M.**, Gazi, A. H., Zia, J., An, S., Lin, D. J., Inan, O. T., & Kamaleswaran, R. (2023). Synthetic seismocardiogram generation using a transformer-based neural network. Journal of the American Medical Informatics Association, ocad067.

[2] **Nikbakht, M.**, Kumar, V., Gazi, A. H., & Rasouliyan, L., Extracting Social Determinants of Health from Unstructured Clinical Notes Using Transformer Based Natural Language Processing Models, under review at JMIR.

[3] **Nikbakht, M.**, Sanchez-Perez, J. A., Aljiffry, A., Maher, K., Inan, O. T., & Rodriguez, S., Application of Acoustic Signals in Systemic to Pulmonary Shunts in Ductal Dependent Infants using Deep Learning. under review at IEEE JBHI.

[4] **Nikbakht, M.**, Chan, M., Lin, D.J., Gazi, A.H., and Inan, O.T.. A U-Net-Based Approach for Seismocardiogram Denoising: Improved Cardiomechanical Health Monitoring During Walking. under review at JAMIA.

[5] **Nikbakht, M.**, Pakbin, B. and Nikbakht Brujeni, G., 2019. Evaluation of a new lymphocyte proliferation assay based on cyclic voltammetry; an alternative method. Scientific Reports, 9(1), p.4503.

[6] Lin, D.J., Gazi, A.H., Kimball, J., **Nikbakht, M.** and Inan, O.T., 2023. Real-Time Seismocardiogram Feature Extraction Using Adaptive Gaussian Mixture Models. IEEE Journal of Biomedical and Health Informatics.

[7] Bhattacharya, S., **Nikbakht, M.**, Alden, A., Tan, P., Wang, J., Alhalimi, T.A., Kim, S., Wang, P., Tanaka, H., Tandon, A. and Coyle, E.F., 2023. A Chest Conformable, Wireless Electro Mechanical E Tattoo for Measuring Multiple Cardiac Time Intervals. Advanced Electronic Materials, p.2201284.

CONFERENCES

[1] **Nikbakht, M.**, Lin, D. J., & Inan, O. T. Learning Seismocardiogram Beat Denoising Without Clean Data. Accepted at 2023 IEEE BHI Conference

[2] **Nikbakht, M.**, Lin, D. J., Gazi, A. H., Inan, O. T. (2022, October). A Synthetic Seismocardiogram and Electrocardiogram Generator Phantom. In 2022 IEEE Sensors.

[3] **Nikbakht, M.**, Chan, M., Lin, D.J., Nicholson, C.J., Bibidakis, M., Soliman, M., and Inan, O.T.. SeismoNet: A Multi-Node Wireless Wearable Platform for Enhanced Physiological Sensing. Accepted at 2023 IEEE BSN Conference

[4] **Nikbakht, M.**, Goossens, Q., Ozmen, G.C., Bibidakis, M., Lin, D.J., and Inan, O.T.. KneeMS: A Low-Cost Wireless Wearable System to Monitor Knee Acoustic Emissions. Accepted at 2023 IEEE BSN Conference

[5] Chan, M., Gazi, A.H., Soliman, M., Richardson, K.L., Abdallah, C.A., Ozmen, G.C., **Nikbakht, M.** and Inan, O.T., 2022, October. Estimating Heart Rate from Seismocardiogram Signal using a Novel Deep Dominant Frequency Regressor and Domain Adversarial Training. In 2022 IEEE Biomedical Circuits and Systems Conference (BioCAS) (pp. 158-162). IEEE.

[6] Gazi, A.H., Sanchez-Perez, J. A., Natarajan, S., Chan, M., **Nikbakht M.**, Lin, D.J., Bremner, D., Hahn, J., Inan, O. T., and Rozell, C. J. Leveraging Physiological Markers to Quantify the Transient Effects of Traumatic Stress and Non-Invasive Neuromodulation. Accepted In 2023 IEEE Engineering in Medicine and Biology Society Conference (EMBC)

PATENTS

[1] **Nikbakht, M.**, Inan, O. T., Kamaleswaran, R., Biophysical Waveform and Actuation Synthesis Using Phantom Hardware Systems and Methods, US63/385874 (nonprovisional pending)

PROFESSIONAL SERVICES

Reviewer

- Journal of the American Medical Informatics Association (JAMIA)
- Journal of Medical Internet Research (JMIR)
- Journal of Biomedical and Health Informatics (JBHI)

HONORS & AWARDS

- Blended and Online Learning Design (BOLD) Fellowship — 2022
- N. Walter Cox Memorial Fellowship — Aug 2019
- Faculty of Engineers (FOE) Award of University of Tehran School of Engineering — Apr 2019

HOBBIES

Swimming, Basketball, Hiking, Cooking

REFERENCES

- **Omer, Inan (PhD Advisor)**, Professor at Georgia Institute of Technology, Department of ECE, omer.inan@ece.gatech.edu • +1 (404) 385-1724
- **Rishi, Kamaleswaran**, Professor at Emory University, Department of CS, rkamaleswaran@emory.edu • +1 (404) 727-9015