

Mohammad Nikbakht

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INTERESTS	Deep Learning, Self-Supervised Learning, Human Computer Interaction (HCI), Health AI, NLP, LLM, Foundation Models, Digital Signal Processing, Biomedical Sensing, Software Engineering
EDUCATION	<p>Georgia Institute of Technology, Atlanta, Georgia, USA</p> <ul style="list-style-type: none">PhD in Electrical and Computer Engineering Aug 2019 - Dec 2023 (Expected)<ul style="list-style-type: none">Adviser: Prof. Omer InanFocus: Deep Learning, Transformer Neural Networks, Health AI, Biomedical Sensing.Cumulative GPA: 4.00 / 4.00MSc in Electrical and Computer Engineering Aug 2019 - May 2022<ul style="list-style-type: none">Adviser: Prof. Omer InanFocus: Deep Learning, Transformer Neural Networks, Health AI, Biomedical Sensing.Cumulative GPA: 4.00 / 4.00Minor in Strategy and Technology Innovation Jan 2022 - May 2023<ul style="list-style-type: none">Focus: Market Analysis, Technology Analysis, Financial Analysis, Business Model Design.Cumulative GPA: 4.00 / 4.00 <p>University of Tehran, Tehran, Iran</p> <ul style="list-style-type: none">BSc in Electrical and Computer Engineering Aug 2015 - Aug 2019<ul style="list-style-type: none">Graduated with College Honors.Cumulative GPA: 18.91/20.00
SKILLS	<p>Programming Languages</p> <ul style="list-style-type: none">Python, MATLAB, C, C#, React JS, React Native <p>Related Knowledge,</p> <ul style="list-style-type: none">Deep Learning: Unsupervised Learning, Self-Supervised Learning, Sequence Modeling, Data Visualization, LLM, NLP, Distributed Computing, 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, PandasAlgorithms 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	<p>Data Scientist intern at OMNY Health, Atlanta, GA, USA</p> <ul style="list-style-type: none">Social Determinants of Health Extraction from EHR Clinical Notes (NLP) May 2022 - Aug 2022<ul style="list-style-type: none">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 <p>Data Scientist intern at SensorsCall, Atlanta, GA, USA May 2021 - Aug 2021</p> <ul style="list-style-type: none">Activity Classification Using Domestic Sounds (Based on CNN)<ul style="list-style-type: none">Designed a hardware-aware model based on CNN 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 ICU Cardiac Signals (Based on GPT-II)** Jul 2023 - Dec 2023
 - Pioneering the design of generative pre-trained transformer (GPT) architectures for cardiac signal generation.
 - Leading the use of LLM architectures in health AI for cardiac signals.
 - **Aim:** To revolutionize risk prediction, patient condition forecasting, and preventive care in ICUs.
 - **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 Residual U-Net Neural Network 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)
- ACM Transactions on Computing for Healthcare (ACM Health)

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
- 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