Mohammad Nikbakht

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Education

Georgia Institute of Technology | Atlanta, GA *August 2019 – Present*
Ph.D. in Electrical & Computer Engineering (Major), Business (Minor), GPA 4.0 Expected Graduation: Dec 2023
M.S. in Electrical & Computer Engineering, GPA 4.0 Graduated in May 2022

University of Tehran | Tehran, Iran *August 2015 – August 2019*
Bachelor of Science in Electrical & Computer Engineering, GPA 3.97

Skills

Programming Languages: Python, MATLAB, C, C#, React JS, React Native
Tools: PyTorch, TensorFlow, Keras, PySpark, Hugging Face, Wandb, Scikit-learn, ONNX, Flask, Jupyter, AWS SageMaker Studio, Google Cloud, Google Colab, Linux, Git, GPU, CUDA, Embedded Systems, Wearable Sensors, Biomedical Sensing
Machine Learning: Deep Learning, Natural Language Processing (NLP), Digital Signal Processing, Sequence Modeling, Transformer Neural Network, Autoencoders, Variational Autoencoders, U-Net, ResNet, Random Forest, SVM, KNN
Other skills: Data Analysis, Visualization, Rapid Prototyping, Validation, Problem Solving, Collaboration, Design, Strategy

Professional Experiences

Generative Pretraining for Cardiovascular Signals (Based on GPT-II) *Summer 2023-Present*
Inan Research Lab | Georgia Tech, Atlanta, GA

- Pioneering the investigation and implementation of generative pre-trained transformer (GPT) architectures for cardiovascular signal generation, leveraging their proven success in language, image, and media learning. Spearheading a groundbreaking effort with the potential to revolutionize risk prediction and preventive care, enabling accurate forecasting of patient conditions.

Sequence Modeling Tools for Marketing Data to Boost Business Intelligence *Fall 2023*
Cisco (Data Scientist PhD Intern) | San Jose, CA

- Lead cutting-edge research and perform in-depth analysis on product and marketing data sourced from Cisco ET&I. Through the application of advanced data analytics techniques, I will develop and refine machine learning models aimed at accurately predicting customers' likelihood to purchase products. This pivotal work will drive strategic insights and inform data-driven decision-making, leading to enhanced customer targeting and maximizing business growth.

Cardio-mechanical Signal Denoising Without Clean Labels (Based on U-Net) *Spring 2023-Summer 2023*
Inan Research Lab | Georgia Tech, Atlanta, GA

- Transformed vital sign monitoring with a deep learning model based on the U-Net architecture, successfully combating motion noise effects on Seismocardiogram signals without the need for clean ground truth data during training.
- Demonstrated exceptional results, achieving an astounding 87% accuracy improvement for heart rate estimation from 5-second SCG windows, and an impressive 85%, and 61% accuracy enhancement in beat-by-beat PEP, and LVET estimation respectively during walking, satisfying FDA regulatory standards.
- Accepted paper for publication in Biomedical & Health Informatics (BHI) conference proceedings. Submitting journal manuscript to Journal of the American Medical Informatics Association (JAMIA).

Noninvasive Cardiac Shunt Monitoring in Infants with Congenital Heart Disease (Based on VAE) *Spring 2022-Fall 2022*
Children's Healthcare of Atlanta and Inan Research Lab | Georgia Tech, Atlanta, GA

- Transformed cardiac shunt evaluation procedures by successfully implementing a variational autoencoder (VAE) to help classify the auditory characteristics of blood flow through shunts. This groundbreaking technology now allows for frequent evaluations using a digital stethoscope, ensuring the sustained functionality and prolonged lifespan of the shunts.
- Successfully demonstrated AUCs surpassing 0.71 accurately classifying flow states under ECMO, and cyanosis, and surpassing 0.85 classifying flow states during elevated pulmonary artery pressure, and after pulmonary artery angioplasty.
- Presented findings at Emory University, garnering recognition for the valuable contributions. Submitted a manuscript to the Journal of Biomedical Health Informatics (JBHI).

Social Determinants of Health Extraction from EHR Clinical Text (NLP, Based on BERT) *Summer 2022*
OMNY Health (Data Science Intern) | Atlanta, GA

- Spearheaded extensive feasibility analyses on the OMNY Health data platform, encompassing data from 540,000 patients. Transformed the OMNY Health data platform by successfully implementing and rigorously validating a state-of-the-art Natural Language Processing (NLP) product (ONNX) for Social Determinants of Health (SDoH) labeling of clinical notes. This transformative addition enhanced the feature set of the OMNY Health data platform, bolstering its capabilities and impact.
- Led the domain adaptation of BERT using clinical notes from the OMNY Health data platform, expertly fine-tuning the model for a challenging multilabel SDoH classification downstream task achieving 91% macro-F1 score on test data.
- Successfully presented the work at ISPOR conference 2022, showcasing noteworthy research findings to a global audience of experts in health economics and outcomes. Additionally, submitted a comprehensive journal paper to JMIR.

Synthetic Cardio-mechanical Signal Generation (Based on Transformer Neural Networks) *Fall 2021-Spring 2022*
Inan Research Lab | Georgia Tech, Atlanta, GA

- Pioneered the successful development of a transformer-based neural network, enabling the generation of synthetic, human-like Seismocardiogram (SCG) beats while exerting precise control over clinically relevant features. By harnessing the transformative capabilities of transformer neural networks in sequence modeling, this achievement marks a significant revolution in cardiovascular signal processing. The innovative model leads to applications such as dataset augmentation, online learning, and uncertainty quantification, ushering in a new era of cardiac diagnostics and predictive modeling.
- Published in the esteemed Journal of the American Medical Informatics Association (JAMIA) in 2023. Additionally, filed a nonprovisional patent application.

Activity Classification Using Domestic Sounds (Based on CNN) *Summer 2021*
SensorsCall (Data Science Intern) | Atlanta, GA

- Led the successful implementation and validation of a state-of-the-art deep learning model based on Convolutional Neural Networks (CNN) for activity detection through domestic sound classification. Successfully deployed the deep learning model to an IoT device, employing the lightweight TensorFlow Lite framework for efficient processing on the edge. This cutting-edge solution is now actively utilized by individuals and caregivers to detect activities and monitor the well-being of seniors living independently.

Publications

[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., Lin, D. J., & Inan, O. T. Learning Seismocardiogram Beat Denoising Without Clean Data. Accepted at 2023 IEEE BHI Conference
[4] 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
[5] Nikbakht, M., Lin, D. J., Gazi, A. H., & Inan, O. T. (2022, October). A Synthetic Seismocardiogram and Electrocardiogram Generator Phantom. In 2022 IEEE Sensors
[6] Nikbakht, M., Chan, M., Lin, D.J., and Inan, O.T.. End-to-end Seismocardiogram Denoising During Walking to Enable Continuous Cardiac Health Monitoring. in preparation
[7] 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. under review

Patents

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