Matin Barekatain

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Education

- **Ph.D. in Electrical & Computer Engineering** — August 2017 - Present
  University of Southern California — *Los Angeles, CA*
- **M.Sc. in Computer Science & Electrical Engineering (Double Major)** — August 2017 - Present
  University of Southern California — *Los Angeles, CA*
- **B.Sc. in Electrical Engineering** — August 2013 - July 2017
  Sharif University of Technology — *Tehran, Iran*

Work Experience

- **University of Southern California MEMS Group** — USC, Los Angeles, CA
  Graduate Researcher — *August 2017 - Present (4 years)*

  AI in Healthcare

  • Building low-power noise robust models for on-chip human lung sound classification to prevent asthma attacks (C Language, Gaussian NB, SVM, KNN, HMM).

  • Developing deep convolutional neural network models for cloud-based health monitoring (Python, Keras, CNN, DNN, TCN).

  Wearables & IoT

  • Developing a mm-scaled ultra-low power Bluetooth wearable stethoscope for continuous health monitoring based on system-on-chip.

  • Designing mm-scaled energy harvesters for IoT and zero-power applications.

  5G & RFID

  • Implementing multi-GHz RFID tags, RF filters, and antennas with applications in 5G networks and IC tampering detection in large scale microelectronics supply chains.

- **Kavoshcom Asia R&D Group** — Tehran, Iran
  Research Intern — *March 2016 - August 2017 (1.5 years)*

  Wearables & IoT

  • Developing a mm-scaled ultra-low power Bluetooth ECG sensor for continuous health monitoring based on system-on-chip.

- **Advanced Communications Research Institute (ASRI)** — Tehran, Iran
  Undergraduate Researcher — *May 2015 - September 2015 (4 months)*

  Optimization

  • Studied loss function optimization for rebuilding non-uniform sub-Nyquist rate samples of sparse signals.

Areas of Interest

• AI in Healthcare • Noise Robust Machine Learning • Natural Language Processing • Computer Vision • Binary Neural Networks • Smart Low-power Design • Immersive Audio Signal Processing

Honors & Awards

- **Ph.D. Fellowship Awards** — 2017
  Won Ph.D. Fellowship awards of the University of Pennsylvania and Rice University.
- **Graduate & Undergraduate Teaching Fellow** — 2014-Present
  Mentored more than 600 students in 12 different courses.
- **Admission to Graduate Program without Entrance Exam** — 2017
  $< 1\%$ *acceptance rate, Sharif University of Technology.*
- **Member and Fellowship Award Winner of the National Elite Foundation** — 2013-2017
  As an exceptional talented student based on Academic Success.
- **Ranked 3^{rd} in Terms of Cumulative GPA** — 2016
  Among B.Sc. Electrical Engineering students at Sharif University of Technology.
- **Ranked 91^{st} in B.Sc. Entrance Exam** — 2013
  Out of more than 350,000 undergraduate applicants in the B.Sc. Entrance Exam.

Skills

- **Languages**: Python, Matlab, C, HTML, MySQL, LaTeX.
- **Frameworks**: TensorFlow, PyTorch, Fastai, OpenCV, Keras, Librosa, Scikit, Pandas, Django.
- **Platforms**: Cypress BLE, TI BLE, Raspberry Pi, Arduino, GCP.
- **Tools**: Git, COMSOL, HFSS, AutoCAD, Adobe Photoshop & Illustrator.

Projects

House Prices - Advanced Regression Techniques (Machine Learning, Regression, Feature Engineering, Supervised Learning)
• Predicted sales prices of houses in Iowa. • Practiced feature engineering, random forests, and gradient boosting. • XGBoost, LightGBM, SVR, Lasso, and Ridge. • log RMSE: 0.11643. • Kaggle top 100 team.

Facial Key-Points Detection (Computer Vision, Deep Learning)
• Developing an AI model to recognize keypoints on face images (in progress). • Fastai, PyTorch, OpenCV, Scikit-learn.

Pytorch CNN from the Scratch for Image Classification (Computer Vision, CNN)
• CIFAR-10 dataset. • CIFAR-10 dataset. • Peak class Accuracy: $\sim$ %89. • Mean Accuracy: $\sim$ %70

Part-of-Speech Tagger for Italian, Japanese, and a Surprise Language (NLP, HMM)
• Implemented an HMM part-of-speech tagger. • Accuracy: $\sim$ %93. • Python (from the scratch).

Object Tracking through Homography with RANSAC (Computer Vision, Feature Extraction)
• Used SIFT to locate objects in images through Homography with RANSAC estimation • 5/6 objects detected.

Hotel Reviews Classification (NLP, Supervised Learning)
• Implemented Perceptron and Naive Bayes classifiers for customer reviews of Chicago hotels. • F1-score: $\sim$ 0.85.

Multi-Layer Feed-Forward Neural Network from the Scratch (Machine Learning, Deep Learning)
• Implemented in Python without ML libraries. • MNIST Mean Accuracy: $\sim$ %94.

Publications

• E. Hadizadeh, R. Rabbani, Z. Azizi, M. Barekatain, K. Hakhamaneshi, E. Khoram, A. Fotowat-Ahmady, "Ultra Low-Power System for Remote ECG Monitoring", Arxiv: 1903.08835.

• H. Liu, M. Barekatain, A. Roy, E. S. Kim, "Automatic Wheezing Detection of Human Lung Sound with Resonant-Microphone-Array-Based Wearable Stethoscope", in progress.

• A. Shkel, M. Barekatain, E. S. Kim, "FBAR-Based Sensor for Wireless RFID Authentication of Integrated Circuits", Technical Digest-Solid-State Sensor, Actuator, and Microsystems Workshop, June 2018.

• M. Barekatain, E. S. Kim, "Powerless Wireless Tamper Detection Sensor with LiNbO3-based Pyroelectric Energy Converter and HBAR RFID Tag", in progress.

Selected Graduate Course Work

• Machine Learning • Advanced Computer Vision (Ph.D. level) • Applied Natural Language Processing • Analysis of Algorithms • Foundations of Artificial Intelligence • Database Systems • Mixed-Signal Integrated Circuit Design