# ALI AKBARI

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## Research Interests

**Precision Medicine**

**Remote and Connected Health Monitoring**

- Digital and mobile health
- Bioinformatics
- Machine learning/Deep learning
- Multi-omics data analysis
- Algorithm design
- Biomedical signal processing
- Wearable sensing and computing, embedded systems design
- Cyber-physical systems and Internet of Things (IoT)

## Education

**Postdoctoral Scholar**
**December 2021 – Present**
Stanford University, CA, USA
Department of Genetics, Snyder Lab
Advisor: Michael Snyder

**Ph.D. in Biomedical Engineering**
**August 2016 – September 2021**
Texas A&M University, TX, USA
Department of Biomedical Engineering
Advisor: Dr. Roozbeh Jafari
Dissertation: Wearable Sensors for Precision Medicine through Personalized, Holistic, and Context-Aware Analytics

**M.S. in Biomedical Engineering-Bioelectric**
**August 2013 – January 2016**
Sharif University of Technology, Tehran, Iran
Department of Electrical Engineering
Advisor: Dr. Mohammad Parnianpour, Dr. Bijan Vosoughi
Thesis: Wearable System for Human Joint Angle Estimation through Inertial and Textile Sensor Fusion

**B.S. in Electrical Engineering**
**August 2009 – May 2013**
Sharif University of Technology, Tehran, Iran
Department of Electrical Engineering

## Research Experience

**Graduate Research Assistant**
**September 2016 – October 2021**
Texas A&M University, TX, USA
Department of Biomedical Engineering
Embedded Signal Processing Lab (ESP Lab) under the supervision of Dr. Roozbeh Jafari

**Selected Projects:**

- Worked on a large-scale collaborative project on COVID-19 detection and prediction using commercial off-the-shelf wearable sensors. I led a team of five grad students focusing on data analytics for COVID-19 detection. I built a personalized and context-aware machine learning model running on the cloud (Amazon Sagemaker) for big data analysis to detect pre-symptoms of COVID-19. We achieved ROC AUC of 0.86 regarding predicting COVID-19 up to 2 days prior to the medical test.
- Built infrastructure for data collection from commercial off-the-shelf wearable devices. I worked with various AWS tools including AWS Lambda, Amazon API Gateway, AWS Amplify, S3, and DynamoDB, to create an online dashboard containing cloud-to-cloud integration with wearables vendors' APIs for seamless and effortless user experience.
- Conducted research on deep transfer learning (using generative autoencoders), uncertainty quantification (in deep neural networks), personalization (through a novel active learning technique), and context identification (using IoT) algorithms for the specific application of human activity recognition with wearable motions sensors. I published several papers in top journals and conferences in this area.
- Developed interpretable algorithms for extracting actionable information from physiological signals to obtain blood pressure from Bio-impedance signals.

- Designed an efficient context-aware change point detection algorithm and developed an Android-based app for smartwatches that facilitate data annotation for activity recognition to reduce users' burden.
- Mentored over ten undergrad and three grad students and published several papers.
- Contributed to writing over five grant proposals.

**Lab Manager and Research Assistant**
**August 2009 – July 2016**

Sharif University of Technology, Tehran, Iran
Laboratory of wearable technologies and NeuroMusculoSkeletal researches (Lowner Lab) under supervision of Dr. Mohammad Parnianpour

**Selected Projects:**

- Built a hybrid system including inertial MEMS sensors (IMU) and textile sensors and developed algorithms for data fusion using of Kalman filters for measuring joint angle. The system that I built achieved low error (< 5 degree) compared to the state-of-the-art motion cameras.
- Designed and implemented a gimbal system for calibrating IMUs. This system could rotate in 3D space and has three rotatory encoders to measure the actual angle in each direction.
- Organized all the lab activities including hosting bioinstrumentation and applied electronics courses.

## Teaching Experience

**Teaching Assistant**
**Texas A&M University**
**Fall 17, 18, 19**

*Embedded Systems for Medical Application*
- Instructor: Dr. Roozbeh Jafari
- Head TA of four sections
- Tutored the lab section of the course and mentored more than 100 students in the lab, designed and prepared homework assignments, lab assignments, lectures, and final projects, assisted in designing and grading exams. I also gave lecture in the class for multiple sessions.

**Teaching Assistant**
**Sharif University of Technology**
**Fall 13, 14**

*Applied Electronics and Advanced Applied Electronics*
- Instructor: Roya Narimani
- Mentored students in the lab and graded homework

*Bioinstrumentation*
- Instructor: Roya Narimani
- Mentored students in the lab and designed and graded the final project on measuring human join orientation with motion sensors. Two groups published papers in national conferences after finishing the project.

**Instructor**
**Fall 2013**

*Electronic Basics Lab*
- University of Applied Science and Technology (UAST), Tehran, Iran

## Professional Experience and External Service

**Review Panel and Study Section for Funding Agencies**

- Panel Member, National Science Foundation's Small Business Innovation Research/Small Business Technology Transfer (NSF SBIR/STTR), 2021

**Conference and Workshop Leadership**

Track Co-Chair, IEEE International Conference on Acoustics, Speech, & Signal Processing (ICASSP) 2022

**Reviewer**

- IEEE Transaction on Biomedical Engineering (TBME)
- IEEE Internet of Things Journal (IoT-J)
- IEEE Journal of Biomedical and Health Informatics (JBHI)
- IEEE Sensors Journal
- Neurocomputing journal
- Journal of the International Measurement Confederation
- Pervasive and Mobile Computing Journal
- PLOS One

**Membership**

IEEE since 2016

## Invited Talks

- "Context-aware Few-shot Learning of Human Activities of Daily Living", Invited Speaker and Panelist, BSN 2021, Special session on "Toward Artificial General Intelligence for Wearable Systems", July 30, 2021.

## Publications

### Book Chapter

BC1. **Ali Akbari,** Parastoo Alinia, Hassan Ghasemzadeh, Roozbeh Jafari, Transfer learning for wearable computers, Edited by Edward Sazonov, In Wearable Sensors: Fundamentals, Implementation and Applications (Second Edition), Elsevier, 2020, ISBN 9780128192467.

### Journal Publications

J8. **Ali Akbari,** Kaan Sel, Jonathan Martinez, Zanbo Zhu, Surya Gandikota, Niels Olson, Anne G. Rizzo, Roderic I. Pettigrew, Roozbeh Jafari, Detecting Pre-symptoms of COVID-19 with Off-the-shelf Wearable Devices through Personalized and Context-aware Data Analysis, Ready for Submission.

J7. **Ali Akbari**, Jonathan Martinez, Roozbeh Jafari, A Meta-Learning Approach for Fast Personalization of Modality Translation Models in Wearable Physiological Sensing, IEEE Journal of Biomedical and Health Informatics (J-BHI), in press.

J6. **Ali Akbari**, Jonathan Martinez, Roozbeh Jafari, Facilitating Human Activity Data Annotation via Context-Aware Change Detection on Smartwatches, ACM Transactions on Embedded Computing Systems (TECS), vol. 20, issue 2, pp. 15:1-15:23, March 2021.

J5. **Ali Akbari**, Roozbeh Jafari, Transition-Aware Detection of Modes of Locomotion and Transportation through Hierarchical Segmentation, IEEE Sensors Journal (SENSORS), vol. 21, issue 3, pp. 3301-3313, February 2021.

J4. **Ali Akbari**, Reese Grimsley, Roozbeh Jafari, Data-Driven Context Detection Leveraging Passively-Sensed Nearables for Recognizing Complex Activities of Daily Living, ACM Transactions on Computing for Healthcare (HEALTH), vol. 2, issue 2, pp. 12:1-12:22, January 2021.

J3. **Ali Akbari**, Roger Solis, Roozbeh Jafari, Bobak Mortazavi, Using Intelligent Personal Annotations to Improve Human Activity Recognition for Movements in Natural Environments, IEEE Journal of Biomedical and Health Informatics (JBHI), vol. 24, issue 9, pp. 2639-2650, September 2020. (September Feature Article)

J2. **Ali Akbari**, Roozbeh Jafari, Personalizing Activity Recognition Models with Quantifying Different Types of Uncertainty Using Wearable Sensors, IEEE Transactions on Biomedical Engineering (TBME), vol. 67, issue 9, pp. 2530-2541, September 2020.

J1. Mohammad Iman Mokhlespour Esfahani, **Ali Akbari**, Omid Zobeiri, Ehsan Rashedi, Mohamad Parnianpour, Sharif-Human Movement Instrumentation System (SHARIF-HMIS): Development and Validation, Medical Engineering Physics, vol. 61, pp. 87-94, November 2018.

### Refereed Conference Publications

C13. Luffina C. Huang, **Ali Akbari**, Roozbeh Jafari, A Graph-based Method for Interbeat Interval and Heart Rate Variability Estimation Featuring Multi-channel PPG Signals During Intensive Activity, IEEE Sensors, October 31-November 4, 2021, Virtual Meeting, in press.

C12. Jonathan Martinez, **Ali Akbari**, Kan Sel, Roozbeh Jafari, Strategic Attention Learning for Modality Translation, IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), May 4-8, 2020, Barcelona, Spain.

C11. **Ali Akbari**, Roozbeh Jafari, A Deep Learning Assisted Method for Measuring Uncertainty in Activity Recognition with Wearable Sensors, IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI), May 19-22, 2019, Chicago, IL, USA. Acceptance rate: 31%

C10. **Ali Akbari**, Roozbeh Jafari, An Autoencoder-based Approach for Recognizing Null Class in Activities of Daily Living In-the-wild via Wearable Motion Sensors, IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), May 12-17, 2019, Brighton, UK. Acceptance rate: 46%

C9. **Ali Akbari**, Roozbeh Jafari, Transferring Activity Recognition Models for New Wearable Sensors with Deep Generative Domain Adaptation, ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN), April 16-18, 2019, Montreal, Canada. Acceptance rate: 25%

C8. Roger Solis, Arash Pakbin, **Ali Akbari**, Bobak J. Mortazavi, Roozbeh Jafari, A Human-centered Wearable Sensing Platform with Intelligent Automated Data Annotation Capabilities, ACM/IEEE International Conference on Internet of Things Design and Implementation (IoTDI), April 16-18, 2019, Montreal, Canada. Acceptance rate:28%

C7. **Ali Akbari**, Peiming Liu, Bobak J. Mortazavi, Roozbeh Jafari, Tagging Wearable Accelerometers in Camera Frames through Information Translation between Vision Sensors and Accelerometers, ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS), April 16-18, 2019, Montreal, Canada. Acceptance rate: 23%

C6. Jian Wu, **Ali Akbari**, Reese Grimsley, Roozbeh Jafari, A Decision Level Fusion and Signal Analysis Technique for Activity Segmentation and Recognition on Smart Phones, ACM SHL Recognition Challenge in sixth International Workshop on Human Activity Sensing Corpus and Applications, in conjunction with UbiComp, October 12, 2018, Suntec City, Singapore.

C5. **Ali Akbari**, Jian Wu, Reese Grimsley, Roozbeh Jafari, Hierarchical Signal Segmentation and Classification for Accurate Activity Recognition, ACM SHL Recognition Challenge in sixth International Workshop on Human Activity Sensing Corpus and Applications, in conjunction with UbiComp, October 12, 2018, Suntec City, Singapore.

C4. Bassem Ibrahim, **Ali Akbari**, Roozbeh Jafari, A Novel Method for Pulse Transit Time Estimation Using Wrist Bio-Impedance Sensing Based on a Regression Model, IEEE Biomedical Circuits and Systems Conference (BioCAS), October 19-21, 2017, Turin, Italy.

C3. **Ali Akbari**, Richard B. Dewey, Roozbeh Jafari, Validation of a New Model-Free Signal Processing Method for Gait Feature Extraction Using Inertial Measurement Units to Diagnose and Quantify the Severity of Parkinson Disease, International Conference on Computer Communication and Networks (ICCCN), July 31 -August 3, 2017, Vancouver, Canada.

C2. **Ali Akbari**, Xien Thomas, Roozbeh Jafari, Automatic Noise Estimation and Context-Enhanced Data Fusion of IMU and Kinect for Human Motion Measurement, IEEE International Conference on Wearable and Implantable Body Sensor Networks (BSN), May 9-12, 2017, Eindhoven, The Netherlands.

C1. Mohammad Iman Mokhlespour Esfahani, Omid Zobeiri, **Ali Akbari**, Yahya Milani, Roya Narimani, Behzad Moshiri, Mohammad Parnianpour, Sharif-human Movement Instrumentation System (SHARIF-HMIS) for Daily Activities, 19th Iranian Conference of Biomedical Engineering (ICBME), Dec, 20-21, 2012, Tehran, Iran.

## Grant Proposals

Pr5. **AWARE: Accessible data from WeARable Sensors**
*Principal Investigator*: Dr. Roozbeh Jafari
National Institutes of Health (NIH)
Under review, submitted in August 2021
Bridge2AI program, included six modules each of which was a separate full-length proposal
Wrote the whole proposal for data acquisition module, contributed in several sections of other five proposals (modules)

Pr4. **Rapid Analysis of Threat Exposure (RATE) Operationalization**
*Principal Investigator*: Dr. Roozbeh Jafari (Prime: Philips North America)
Defense Threat Reduction Agency
Funded for $15M (TAMU's Portion: $12,259,071), Duration: 4/20-3/21
Contributed to several sections

Pr3. **Persistent Readiness through Early Prediction (PREP)**
*Principal Investigator*: Dr. Roozbeh Jafari
Defense Threat Reduction Agency
Funded for $12M (TAMU's Portion: $7,467,295), Duration: 2/21-1/23
Contributed to one section

Pr2. **Micro-Electro-Mechanical Neural Integrated Sensing and Computing Units for Wearable Device Applications**
*Principal Investigator*: Dr. F. Alsaleem, *co-PI*: Dr. Roozbeh Jafari
National Science Foundation
Funded for $391,000 (TAMU's Portion: $148,776), Duration: 9/19-8/22
Contributed to one Section

Pr1. **HealthSense: An Integrated Context-Aware Wearable Sensing Platform Leveraging Personalized Deep Learning for Objective Identification of Fatigue**
*Principal Investigator*: Dr. Roozbeh Jafari
The National Aeronautics and Space Administration (NASA)
Under review
Contributed to one section

## Honors and Awards

- Won 3rd prize poster presentation award at EnMed Lasker Lecture and Biomedical Imaging Symposium, Methodist, Houston, Texas, April 2018.
- 6-year Fellowship of National Elites Foundation in Iran, 2009-2015.
- Ranked 61th in the Electrical engineering entrance exam for master level, among more than 20,000 participants, 2013.
- Ranked 68th in the Iranian university entrance exam, among more than 300,000 participants, 2009.

## Technical Skills and Courses

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|---|---|
| **Software** | Python, TensorFlow, Keras, C++, R, MATLAB, JavaScript, SQL, AWS |
| **Hardware** | Code Composer Studio, Verilog, Assembly, Altium Designer |

**Courses**

- Data Mining
- Artificial Neural Networks
- Deep Learning
- Analysis of Algorithms
- Applied Bayes Methods
- Digital & Biomedical Signal Processing
- Adaptive Filters
- Microcontrollers & Advanced Microcontrollers
- ASIC and FPGA Design
- Motion Biomechanics
- Pathophysiology of Systemic Diseases and Implantable Devices
- Physiology and Anatomy