

## Ali Marjaninejad

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## Education

**Ph.D., Biomedical Engineering**  
GPA: **3.95/4.0**  
**M.Sc., Electrical Engineering** (Data science)  
GPA: **3.88/4.0**  
**M.Sc., Biomedical Engineering** (Bioelectronics)  
GPA: **4.0/4.0**  
**B.Sc., Electrical Engineering** (Bioelectronics)  
GPA: **3.83/4.0** (Junior/Senior: **3.96/4.0**)

**University of Southern California (USC)**  
Fall 2021  
**University of Southern California (USC)**  
Fall 2017  
**Amirkabir University of Technology (AUT)**  
Spring 2015  
**Sahand University of Technology (SUT)**  
Spring 2012

## Honors & Awards

- Being featured on the cover of the march 2019 issue of the *nature machine intelligence* and one of the only two research articles being featured on its *one year anniversary special collection*
- Appeared on more than 80 news outlets including the Wired magazine, PCMag, and VoA for research contributions
- USC Stevens center for innovation's "Best Commercial Potential" award for the work done on bio-inspired autonomous robots (2019)
- USC Provost's fellowship; the most prestigious fellowship at USC (2015 – 2019)
- USC Grad. School's Research Advancement fellowship recipient; The most competitive project award at USC (2018 – 2019)
- Society for Brain Mapping & Therapeutics (SBMT) and Brain Mapping Foundation Student Outstanding Leadership and Service Award (2019)
- USC Viterbi BME Best Research Assistant award (2021)
- USC Viterbi BME Jenny Wang Excellence in Teaching Awards (2021)
- USC Grad. Student Government's International Student Recognition Award (2018)
- Finalist in Maseeh Entrepreneurship Prize Competition, USC Stevens Innovation Awards, and the Creating Reality Hackathon (Won the Sponsor award)
- Featured on USC news for instructing MATLAB classes for students in the SHINE program (2016)
- Honor student privilege package award (Iran ministry of science and technology 2012)
- Awarded the Certificate of Appreciation from the Deputy Minister of Science for my active role in the "Bioelectric" journal (awarded as the best national student journal of the year – Iran, 2009)

## Publications

### Refereed full-length Articles

1. "insideOut: A Bio-Inspired Machine Learning Approach to Estimating Posture in Robots Driven by Compliant Tendons" | Daniel A Hagen, Ali Marjaninejad, Gerald Eli Loeb, Francisco J Valero-Cuevas | *Frontiers in Neurobotics*, 2021
2. "Data-Efficient Causal Decoding of Spiking Neural Activity Using Weighted Voting" | Ali Marjaninejad, Christian Klaes, Francisco Valero-Cuevas | *43th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE EMBC)*, 2021
3. "Estimating Center of Pressure of a Bipedal Mechanism Using a Proprioceptive Artificial Skin around its Ankles" | Darío Urbina-Meléndez, Jiaoran Wang, Daniel Wang, Ali Marjaninejad, Francisco Valero-Cuevas | *43th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE EMBC)*, 2021
4. "Autonomous functional movements in a tendon-driven limb via limited experience" | A. Marjaninejad, D. Urbina-Meléndez, B. A. Cohn, and F. J. Valero-Cuevas | *Nature Machine Intelligence*, vol. 1, no. 3, pp. 144–154, 2019.
5. "A Bio-Inspired Framework for Joint Angle Estimation from Non-Collocated Sensors in Tendon-driven Systems" | Hagen DA, Marjaninejad A, Valero-Cuevas FJ | *IEEE International Conference on Intelligent Robots and Systems (IEEE IROS)*, 2020
6. "Autonomous Control of a Tendon-driven Robotic Limb with Elastic Elements Reveals that Added Elasticity can Enhance Learning" | Marjaninejad A, Tan J, Valero-Cuevas FJ | *42th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE EMBC)*, 2020
7. "Simple Kinematic Feedback Enhances Autonomous Learning in Bio-Inspired Tendon-Driven Systems" | Marjaninejad A, Urbina-Meléndez D, Valero-Cuevas FJ | *42th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE EMBC)*, 2020
8. "Blood Glucose Regulation Using Adaptive Fuzzy Sliding Mode Control in Type I Diabetic Patients" | M Khazaei, A Geramipour, S Sadat-Hosseini, A Marjaninejad | *International Journal of Mechatronics, Electrical and Computer Technology (IJMEC)*, 2018
9. "Model-Free Control of Movement in a Tendon-Driven Limb via a Modified Genetic Algorithm" | A Marjaninejad, R Annigeri, FJ Valero-Cuevas | *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, (IEEE EMBC)*, 2018
10. "An Analytical Approach to Posture-Dependent Muscle Force and Muscle Activation Patterns" | A Marjaninejad, J Berry, FJ Valero-Cuevas | *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, (IEEE EMBC)*, 2018
11. "Finger movements are mainly represented by a linear transformation of energy in band-specific ECoG signals" | A Marjaninejad, B Taherian, FJ Valero-Cuevas | *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, (IEEE EMBC)*, 2017.

12. "A Radial Basis Function Neural Network approximator with fast terminal sliding mode-based learning algorithm and its application in control systems" | M Khazaei, H Sadat-Hosseini, A Marjaninejad, S Daneshvar | *Iranian Conference on Electrical Engineering (IEEE ICEE)*, 2017
13. "A model-based exploration of the role of pattern generating circuits during locomotor adaptation" | A. Marjaninejad and J. M. Finley | *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, (IEEE EMBC)*, 2016.
14. "Online signal to noise ratio improvement of ECG signal based on EEMD of synchronized ECG beats" | A Marjaninejad, F Almasganj, AJ Sheikhzadeh | *Iranian Conference on Biomedical Engineering (IEEE ICBME)*, 2014
15. "A low-cost real-time wheelchair navigation system using electrooculography" | A Marjaninejad, S Daneshvar | *Iranian Conference on Electrical Engineering (IEEE ICEE)*, 2014
16. "Design of FPGA-based Digital PID controller using Xilinx SysGen® for regulating blood glucose level of type-i diabetic patients" | A Geramipour, M Khazaei, A Marjaninejad, M Khazaei | *International Journal of Mechatronics, Electrical and Computer Technology (IJMEC)*, 3 (7), 56-69, 2013

## Refereed Book Chapters

1. "Should Anthropomorphic Systems be 'Redundant,?'" | A Marjaninejad, FJ Valero-Cuevas | *Biomechanics of Anthropomorphic Systems, Springer Tracts in Advanced Robotics (STAR) series, Springer, 2019*

## Under-review (full-length papers)

1. Biological Underpinnings for Lifelong Learning Machines | Dhireesha Kudithipudi et. al. | *Nature Machine Intelligence*, 2021

## Non-refereed full-length publications

1. "Quantifying and attenuating pathologic tremor in virtual reality." | Cohn, Brian A., Dilan D. Shah, Ali Marjaninejad, Martin Shapiro, Serhan Ulkumen, Christopher M. Laine, Francisco J. Valero-Cuevas, Kenneth H. Hayashida, and Sarah Ingersoll | *ArXiv preprint ID arXiv:1809.05970 (2018)*
2. "The utility of tactile force to autonomous learning of in-hand manipulation is task-dependent" | Mir, Romina, A Marjaninejad, FJ Valero-Cuevas | *ArXiv Preprint ID arXiv:2002.02418, 2020*

## Refereed Conference/Workshop abstracts

1. The ability of musculotendons to undergo eccentric contractions is a critical enabler of learning for the control of movement | Ali Marjaninejad, D Urbina-Meléndez, BA Cohn, FJ Valero-Cuevas | The Society for the Neural Control of Movement (NCM) conference 2021
2. Active sensing in a bioinspired hand as an enabler of implicit curriculum learning for manipulation | R Mir, P Ojaghi, A Marjaninejad, M Wehner, F J Valero-Cuevas | International Symposium on Adaptive Motion of Animals and Machines 2021
3. Autonomous Functional Movements in a tendon-driven leg via limited experience | Ali Marjaninejad, Urbina-Meléndez D, Cohn BA, Valero-Cuevas FJ | *Dynamical Walking, Canmore, Canada, 2019*.
4. "Autonomous Functional Locomotor Movements in a Tendon-Driven Limb via Limited Experience" | Marjaninejad A, Urbina-Meléndez D, Cohn BA, Valero-Cuevas FJ | *The 9th International Symposium on Adaptive Motion of Animals and Machines EPFL, Lausanne, 2019*.
5. *Few-shot learning of autonomous behavior in a bio-plausible hardware-software setting* | Ali Marjaninejad | *15th Annual World Congress of Society for Brain Mapping and therapeutics (SBMT), Los Angeles, CA, 2019*.
6. "Simple and Two-Element Hill-Type Muscle Models Cannot Replicate Realistic Muscle Stiffness" | Ali Marjaninejad, Babak Taherian, Kian Jalaaliddini, and Francisco J Valero-Cuevas | *The 41<sup>st</sup> American Society of Biomechanics (ASB) Conference, Boulder, CO, 2017*.

## Non-refereed Conference/Workshop abstracts

1. "Bioinspired few-shot learning in robotic systems" | Ali Marjaninejad, Urbina-Meléndez D, Cohn BA, Valero-Cuevas FJ | *Society for Neuroscience (SfN) Conference, Chicago, IL, 2019*.
2. "New generation of bio-inspired robots that learn and adapt using limited experience" | Ali Marjaninejad | *23<sup>th</sup> Grodins Research Symposium, Los Angeles, CA, 2019*.
3. "Autonomous Functional Movements in a Tendon-Driven Limb via Limited Experience" | Ali Marjaninejad | *USC Biomedical Graduate Talk Series, Los Angeles, CA, 2019*.
4. "Using Genetic Algorithm to Control a Tendon-Driven limb" | Ali Marjaninejad, F.J. Valero-Cuevas | *22<sup>th</sup> Grodins Research Symposium, Los Angeles, CA, 2018*.
5. "Using genetic algorithm to control tendon-driven systems with unknown structure" | Ali Marjaninejad, R. Annigeri, F.J. Valero-Cuevas | *Society for Neuroscience (SfN) Conference, San Diego, CA, 2018*.
6. *Evaluating the learnability-dimensionality relationship in a tendon-driven finger* | Brian A. Cohn, A. Marjaninejad, F. J. Valero-Cuevas | *Society for Neuroscience (SfN) Conference, San Diego, CA, 2018*.
7. "A NeuRoBotic experimental system to study muscle function" | D. Urbina-Meléndez, A. Marjaninejad, B.A. Cohn, J.A. Berry, H. Zhao, F.J. Valero-Cuevas | *Society for Neuroscience (SfN) Conference, San Diego, CA, 2018*.
8. *Simple and Two-Element Hill-Type Muscle Models Cannot Replicate Realistic Muscle Stiffness* | Ali Marjaninejad and Francisco J Valero-Cuevas | *21<sup>th</sup> Grodins Research Symposium, Los Angeles, CA, 2017*.
9. "A Model-based Exploration of the Role of Pattern Generating Circuits during Locomotor Adaptation." | Ali Marjaninejad, James M. Finley | *Society for Neuroscience (SfN) Conference, San Diego, CA, 2016*.

10. "An Exploration of the Role of Pattern Generating Oscillators during Locomotor Adaptation" | Ali Marjaninejad, James M. Finley | *The 20<sup>th</sup> Grodins Research Symposium, Los Angeles, CA, 2016.*

## Technical Articles

1. "Toward A New Generation of Robots: A Bio-Inspired Tendon-Driven Robot That Teaches Itself How To Walk" | Ali Marjaninejad | *wevolver.com, 2020*
2. "Creating a Tendon-Driven Robot That Teaches Itself to Walk with Reinforcement Learning" | Ali Marjaninejad | *Mathworks Technical Articles and Newsletters, 2020*
3. "Toward A New Generation of Robots: A Bio-Inspired Tendon-Driven Robot That Teaches Itself How to Walk" | *wevolver.com, 2020*

## Invited Talks

1. On the New Generation of Bio-inspired Robots – MATLAB EXPO 2019, San Jose, Ca. 2019
2. Bio-plausible Mechanics, Learning, and Control for Robots – Google Brain / Robotics, Mountain View, Ca. 2019
3. Learning without forgetting in real-time with limited experience: A bio-inspired approach. | Ali Marjaninejad, S.C. Raja, F.J. Valero-Cuevas | DARPA Electronics Resurgence Initiative (ERI) Summit. Detroit, MI, July 15-17, 2019.
4. Learning and Control in Bio-inspired Robots – Kanso Bioinspired Motion Lab, University of Southern California, Los Angeles, Ca. 2019
5. Experience-driven, Autonomous Learning for Robots – ICAROS Lab, University of Southern California, Los Angeles, Ca. 2019.
6. Principles and the future of Biomedical Signal Processing (BSP) – Amirkabir University of Technology, 2014.

## Professional Experiences

- Postdoctoral Research Fellow at University of Southern California (2021 – Current)
  - Developing Autonomous Robotic Systems and Embodied Intelligence
- Research Assistant at ValeroLab: Exploring the neuromechanics of the hand and its representation in human cortex (2016 – present)
  - Finding sensory motor representations on human brain in EEG, ECoG, and Single Unit Activity (SUA) signals
  - Showed that a linear mapping can efficiently describe the relationship between finger positions (joint angles) and signal power in different frequency bands of ECoG recordings
  - Used Genetic Algorithm (GA) to find optimal tendon excursion values in a tendon-driven robotic limb (with unknown parameters) to follow a desired trajectory and ML to control the over- and under-determined robotic systems
  - Addressed the long-standing problem of redundancy in the anthropomorphic neuromechanics using optimization and dimensional reduction approaches
  - Developed the Neuromechanics toolbox in MATLAB environment as a complementary toolbox for the book: Fundamentals of Neuromechanics
  - Led two groups of interns in hardware and software development projects; resulted in peer-reviewed publications and raising research grant funding
- A.I. Residency offer from Google X (2019)
- Internship as a Data Scientist at Neural Analytics (Summer 2018)
  - i. Worked on algorithms to improve the search speed and efficiency of the robotic brain scanner
  - ii. Designed machine learning protocols to enable robotic system to make data driven clinical decisions
- Trained in Computational Sensory Motor Neuroscience (CoSMo) and Health Data Exploration (HDE) summer schools (2017, 2018)
  - Received competitive, merit-based fellowships to attend each program
  - Trained to work with bigdata, neural data, and health related data by the most famous leaders of the field
- Research Assistant at Intelligent Signal and Data Processing Lab: Biological and Array Signal Processing (2012 – 2015)
  - Used SVM and Neural Network regressors to predict the direction of arrival of a sound wave to a microphone array system
  - Collected a database of microphone array recordings using Persian vocabulary and implemented a MATLAB toolbox that increased speech recognition ratio using beamforming; the project was later integrated successfully in industry
- Internship at the MRI section of the exclusive service provider for the General Electric Healthcare in Iran (Pishrafteh Co., 2011)
  - Contributed to both hardware and software Installation, repair, and maintenance
  - Mastered the general principles of physics of imaging modalities especially the MRI

## Teaching Experiences

- Course Instructor
  - *Electronics I Laboratory (at AUT)*
  - *Electrical Circuits Laboratory (at AUT)*
  - *Microprocessors Laboratory (at AUT)*
- Teaching Assistantships
  - *BME/BKN 504 - Neuromuscular Systems (at USC) | Supervisor: Dr. Francisco J. Valero-Cuevas*



