Curriculum Vitae

HEDIYEH TOUFANY

Researcher ● Engineer ● Entrepreneur

Isfahan University of Medical Sciences, Iran

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SUMMARY

- Solid research background
- Clinical experience
- Team working
- Leadership capacities
- Problem solving experience
- Deep learning
- Neuroimaging
- Computer vision
- Image processing
- Multi-lingual (Farsi, English, Arabic, Turkish)

EDUCATION

Isfahan University of Medical Sciences **Isfahan, Iran**

Master of Biomedical Engineering (2017-2021)

- National Entrance Exam Score: 32
- GPA: 4.0/4.0 [US Equivalent]
- Relevant courses: “Digital Image Processing” = A+, “Clinical Engineering Lab” = A+, “Biosignal Processing” = A+, “Modeling of Biological Systems” = A.
- Thesis: “Differentiation between Advanced MS and NMO Patients: Considering Spinal Cord Volume in Magnetic Resonance Images, Using Deep Learning Methods”
- Supervisor: Dr. Alireza Vard.
- Advisor: Dr. Iman Adibi

Isfahan University of Medical Sciences **Isfahan, Iran**

Bachelor of Biomedical Engineering (2010-2017)

- Bachelor in Biomedical Engineering
- University of Isfahan, Isfahan, Iran
- Thesis: “Wireless Transmission of Body Motions to Computer Software”
- Supervisor: Dr. Javad Rasti.

RESEARCH EXPERIENCE

Isfahan University of Medical Sciences **Isfahan, Iran**

Project: Python-based quantification of spinal cord atrophy utilizing deep learning networks (2021)
Results: Presentation of novel, robust pipeline to accurately quantify spinal cord atrophy of MRI images. Offering an affordable computer-aided tool for diagnostic purposes. 3D rendering of spinal cord volume. Published academic paper.

Project: Comparison of the performances of two state-of-the-art Deep Learning Networks U-Net and Mask R-CNN for the spinal cord cross-sectional area segmentation task in Python (2020)
Results: Mask R-CNN showed better performance than U-Net in terms of overlapping and distance evaluation metrics. Acquired a fully-automated and robust technique for the purpose of segmenting the spinal cord cross-sectional area of MRI images.

Project: Investigation of human central nervous system disease signs on MRI images (2020)
Results: Highly accurate recognition differentiation of spinal cord atrophy patterns in Multiple sclerosis (MS) and Neuromyelitis optica spectrum disorder (NMOSD)

Project: MATLAB-based implementation of "A comprehensive approach to the segmentation of multichannel three-dimensional MR brain images in multiple sclerosis" (2018)
Results: Verified accuracy claimed in paper using externally-collected datasets.

Project: Transmitting human hand motions to computer software (2014)
Results: Operation of accelerometer model MMA7361 and designing printed circuit board with Altium Designer software. Data transmission of sensor from microcontroller AVR to computer via Bluetooth chipset. Combination of two programming languages C++ to run Microcontroller AVR with C# in Visual Studio to receive and process data.

RESEARCH INTERESTS

Medical Image Processing

- Brain image processing (fMRI, MRI)
- Image analysis in neurodegenerative diseases (Multiple Sclerosis, Neuromyelitis optica)

Image Processing

- Computer Vision
- Image segmentation and classification

Machine learning

- Deep Learning

PAPER PUBLICATION

Toufani, H., Vard, A., & Adibi, I. (2021). A pipeline to quantify spinal cord atrophy with deep learning: Application to differentiation of MS and NMOSD patients. *Physica Medica*, 89, 51-62. https://doi.org/10.1016/j.ejmp.2021.07.030.

TEACHING EXPERIENCE

Isfahan University of Medical Sciences **Isfahan, Iran**

Teaching Assistant (2018-2019)

Lectured Digital Signal Processing to 7 graduate biomedical students. Taught linear systems, convolution, the discrete Fourier transform, Fourier transform properties, continuous signal processing, introduction to digital filters, moving average filters, windowed-sinc filters, custom filters, FFT convolution, recursive filters, and filter comparison.

Key Achievements:

- Led group activities to promote students' knowledge depth.
- Offered problem-solving techniques to facilitate learning.

Vasei Hospital **Sabzevar, Iran**

Medical and Hospital Equipment Trainer (2014-2015)

Trained nurses and device operators to properly run, maintain, and follow safety protocols of the medical equipment.

Key Achievements:

- Dramatically reduced operational human error by 50%.
- Increased service life of costly clinical devices.
- Reduced repair costs of clinical equipment by 29%.

WORK EXPERIENCE

Arshian Fanavari Pars **Sabzevar, Iran**

CEO (2014-2016)

Registered under No.: 3785 and National Code: 14005670389. Established company to achieve research and operational objectives. Sold, maintained, and repaired medical and clinical equipment.

Key Achievements:

- Stimulated vocational opportunities for 12 job seekers.
- Fully covered needs of local physicians and surgeons.

Vasei Hospital **Sabzevar, Iran**

Medical Engineer (2014-2015)

Managed repair and maintenance of medical equipment in maternity, neonatal, ICU, CCU, internal wards. Provided purchase consultancy and produced invoices. Coordinated among technical and medical engineers of other city hospitals to provide better service and align efforts to utilize medical tools.

Key Achievements:

- Selected as most efficient center.
- Trained nurses and operators of high-risk equipment.
- Trained intern medical engineers for medical challenges and crises.
- Saved approximately 5.000.000.000 IR for repairing and maintaining medical equipment.
- Reshaped optimized structure for purchase plans with outlook to future.

WORKSHOPS

Tehran University of Medical Sciences **Tehran, Iran**

fMRI Imaging and Data Analysis (2021)

Key Achievements:

Clinical and research applications of fMRI, data acquisition and task design, functional neuro-anatomy of the brain, the necessary mathematics and statistics, fMRI preprocessing, single subject fMRI data analysis, group level fMRI data analysis, resting-state fMRI data analysis, and functional connectivity estimation in fMRI.

Medical Image and Signal Processing Research Center **Isfahan, Iran**

Introduction to Machine Learning with Python Programming (2020)

Key Achievements:

Supervised learning, unsupervised learning, feature engineering, model evaluation and improvement, pattern recognition, and linear and non-linear regression.

Isfahan University of Medical Sciences **Isfahan, Iran**

MedLean Health Entrepreneurship (2018)

Key Achievements:

Formulation of a business idea, networking principles, teamworking laws, leadership skills, and problem-solving strategies.

Isfahan University of Medical Sciences **Isfahan, Iran**

LaTex Workshop (2018)

Key Achievements:
Creation of a document by LaTex, combining third-party graphic software, producing cross-references, inserting mathematical formula, and arranging bibliography.

Hakim Sabzevari University **Sabzevar, Iran**

Business Model Canvas Workshop (2017)

Key Achievements:
Business modeling, market study, making action plans, and risk assessment.

COMPUTER & CODING SKILLS

- C++
- C#
- MATLAB
- Python
- Deep learning essentials like tensorflow, keras
- Visual Studio
- HTML
- Microcontroller ARM
- Microcontroller AVR
- Altium Designer
- Adobe Photoshop
- Microsoft Office Suite (ICDL)

LANGUAGE SKILLS

- Farsi/Persian – native
- English – upper-intermediate
- Turkish – elementary
- Arabic – elementary

PERSONAL INTERESTS

- Volleyball
- Piano
- Travelling
- Chess
- Drawing
- Photography

VOLUNTERRY & CHARITY WORK

- Anonymously sponsored educational costs of a unparented girl.
- Taught mathematics and physics in underprivileged secondary schools of Isfahan.