MELINA BAGHER

Tehran-Iran Last Update: October 1, 2024

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EDUCATION

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING Sep. 2019 – Sep. 2022
Sharif University of Technology *Tehran, Iran*

- **Thesis:** "Comparative Analysis of Haplotype Assembly Algorithms to Identify Optimal Methods"
- **Advisor:** Prof. Babak Hosseini Khalaj, Prof. Mehran Jahed
- **GPA: 19.19/20 ➔ 4/4 (Ranked)**

BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING Sep. 2014 – Sep. 2018
Islamic Azad University, Science and Research Branch *Tehran, Iran*

- **Thesis:** "Extraction of Fractal Dimension of Malignant and Benign Skin Lesions in Dermoscopic Images"
- **Advisor:** Prof. S. Rashidi
- **GPA: 19.10/20 ➔ 4/4 (Ranked)**

PUBLICATIONS

JOURNAL PAPERS

❍ **Bagher M.**, Karimzadeh R. , khalaj B.H., Jahed M; *A rapid heuristic algorithm to solve the single individual Haplotype assembly problem* ; AUT Journal of Electrical Engineering 55 (2), 191-206, 2023.

CONFERENCE PAPERS

❍ **Bagher M.**, Karimzadeh R. , khalaj B.H., Jahed M; *QuickHap: a Quick heuristic algorithm for the single individual Haplotype reconstruction problem* ; 29th National and 7th International Iranian conference on Biomedical Engineering 2022 (ICBME).

❍ Karimzadeh R., **Bagher M.**,Khodabakhsh A., Arabi H., Zaidi H; *Generative Adversarial-based Framework for Classification using Imbalance Data: Application to Pneumonia Detection in Chest Radiographs*; IEEE NSS and Medical Imaging Conference 2022.

SELECTED EXTRACURRICULAR COURSES

☆ **Supervised Machine Learning; Regression and Classification**
DeepLearning.AI, Stanford University via Coursera, Jan. 2024
Instructor:Andrew Ng

☆ **Advanced Learning Algorithms**
DeepLearning.AI, Stanford University via Coursera, Jan. 2024
Instructor:Andrew Ng

☆ Introduction to Machine Learning and DeepLearning

Rayan.AI, Sharif Univercity of Technology, Sep. 2024

Instructor:Mohammad Hossein Rohban, Rayan.AI Group

☆ Trustworthiness in DeepLearning

Rayan.AI, Sharif Univercity of Technology, Sep. 2024

Instructor:Mohammad Hossein Rohban, Rayan.AI Group

SELECTED ACADEMIC PROJECTS

Artificial Intelligence and Deep Learning Projects/Tasks

☆ Credit Card Fraud Detection using Machine Learning

Developed a machine learning pipeline for fraud detection in an imbalanced dataset. Preprocessed data through cleaning, outlier detection, and feature engineering. Employed SMOTE for resampling and implemented models like logistic regression, SVM, and random forest.

✎ *Part of the "Introduction to Machine Learning" course, Rayan International AI Contest*

☆ Image classification using Convolutional Neural Network

Developed a Convolutional Neural Network using Pytorch to classify ImageNet dataset. Preprocessing included various data transformations for augmentation and Normalization. Trained and Implemented the model and some other pre-trained models, such as Alex-Net, and evaluated their performances.

✎ *Part of the "Introduction to Machine Learning" course, Rayan International AI Contest*

☆ Image Generation using Stable Diffusion and VAE

Developed an image generation system utilizing Stable Diffusion, combining noise tensors and text prompts into embeddings processed by a U-Net model and finalized with a Variational Autoencoder (VAE). Enhanced my understanding of generative models and their applications.

✎ *Part of a personal project exploring AI-driven creative tools.*

☆ Enhancing Adversarial Robustness in Convolutional Neural Networks

Developed a convolutional neural network using PyTorch to evaluate and improve robustness against adversarial attacks. Applied Projected Gradient Descent (PGD) and Fast Gradient Sign Method (FGSM) for generating adversarial examples and optimized the model for both robust and clean accuracy.

✎ *Part of the "Trustworthiness in DeepLearning" course, Rayan International AI Contest*

☆ CycleGAN for Image-to-Image Translation

Developed a CycleGAN model using PyTorch for unsupervised image-to-image translation between two distinct domains, training two generators and two discriminators. Optimized the model's performance to ensure high-quality image transformations.

✎ *Pursued out of personal interest in generative models.*

☆ Semi-Supervised GAN for Pneumonia Detection

Developed a semi-supervised GAN model using PyTorch to classify pneumonia in chest X-ray images. The model enhanced classification accuracy by generating synthetic features and integrating both GAN and classification loss, improving performance on imbalanced datasets.

✎ *Voluntarily pursued due to personal interest, resulting in a publication listed earlier in my resume.*

Medical Image Processing Projects/Tasks

☆ Development of Registration Pipeline for Spinal Cord CT Images

Developed a pipeline using Coherent Point Drift (CPD) and Iterative Closest Point (ICP) algorithms in MATLAB for accurate registration of spinal cord CT images. Evaluated the results using Hausdorff Distance (HD), Dice Score (DS), and Average Surface Distance (ASD).

✎ *Medical Image Processing and Analysis Course Project*

☆ Segmentation of Brain Tumors and Tissues in MRI Images Using Clustering and Segmentation Techniques

Implemented various clustering techniques including FCM, K-Means, and GMM, as well as segmentation algorithms such as Chan-Vese, GVF (Gradient Vector Flow), and basic snake using MATLAB to achieve accurate brain MRI image segmentation.

✎ *Medical Image Processing and Analysis Course Project*

☆ Preprocessing, Artifact Elimination, and Skin Lesion Segmentation of Dermoscopy Images

Utilized MATLAB to remove noise, hair, and air bubbles from dermoscopy images through various filtering and morphological techniques. Subsequently, skin lesions were segmented using multiple methods to enhance diagnostic accuracy.

✎ *In line with my BSc project*

Computational Genomics and Bioinformatics Projects/Tasks

☆ A convolutional neural network for Single Individual Haplotype Reconstruction

Designed a single-layer convolutional neural network using PyTorch to address the haplotype assembly problem. Developed a novel cost function to enhance accuracy and improve the overall performance of the model.

✎ *In line with my final project*

☆ NGS (Next Generation Sequencing) data simulation and variant calling

Utilized tools such as PBsim and NanoSim to simulate sequencing data in Fastq format. Implemented a variant calling pipeline using BWA-MEM, GATK, Samtools, and BCFtools to prepare for subsequent analyses.

✎ *In line with my final project*

Other Projects, Tasks and Simulations

☆ Simulation and Comparison of SFP and MFP Transducers

Designed and simulated Single-Focal Point (SFP) and Multi-Focal Point (MFP) transducers in MATLAB, comparing Lateral Resolution and Depth of Field (DOP) across frequencies to identify the optimal structure for ultrasound applications.

✎ *Medical Ultrasound Course Project*

☆ Simulation of Acoustic Wave Propagation and Ultrasound Image Reconstruction

Utilized the K-wave toolbox in MATLAB to simulate acoustic wave propagation in various materials, calculating transmission and reflection coefficients at different angles for ultrasound image reconstruction.

✎ *Medical Ultrasound Course Project*

☆ Simulation of main neural dynamics models

Simulated various 4D, 2D, and 1D neural dynamic models in MATLAB, evaluating results through phase plots and time-domain analysis.

✎ *System Biology Course Project*

WORKING EXPERIENCE

Medical Equipments unit of Parsian Hospital Summer 2018

ENGINEERING INTERNSHIP

- Becoming familiar with Repair and maintenance of health monitoring equipments ...

Educational counsellor 2019 - 2021

Mahan Institude of Higher Education

- Consulting to Master and Ph.D Konkoor Candidates.

TEACHING EXPERIENCE

- **TEACHING ASSISTANT** | Medical Images Analysis and Processing | Supervisor: Prof. Emad Fatemizadeh
  Department of Electrical Engineering, Sharif University of Technology *Fall 2021*
- **TEACHING ASSISTANT** | System Biology | Supervisor: Prof. Babak Hossein Khalaj
  Department of Electrical Engineering, Sharif University of Technology *spring 2020*
- **TEACHING ASSISTANT** | Electronics 2 | Supervisor: Prof. Keyvan Maghouli
  Department of Biomedical Engineering, Islamic Azad University, Science and Research Branch *Fall 2019*
- **TUTOR** | Engineering Mathematics, Differential Equations, Signals and Systems,
  Mahan Institude of Higher Education *Summer 2019*

LANGUAGES

English *(Professional Working Proficiency)*

Persian/Farsi *(Native)*

TECHNICAL SKILLS

Programming Languages:	Python, R, C/C++, Bash
Python Selected Libraries:	Pytorch, TensorFlow, Scikit-learn, Matplotlib, Numpy, Scipy
Software Simulators:	Matlab, Simulink
Hardware Simulator:	Pspice, Proteus
Typesetting:	TEX, Prezi, Microsoft Office(Word, Powerpoint, Excel)
Operating Systems:	Windows,Ubuntu
NGS Tools and Simulators:	GATK Toolkit, BWA, Samtools, BCFtools, PBSIM, NanoSim, ART

HONORS & AWARDS

- Ranked 1st among approximately 500 participants in the nationwide Ph.D. entrance exam for Biomedical Engineering (Bioelectric)

- Ranked 39th among approximately 40,000 participants in the nationwide M.Sc. entrance exam for Electrical Engineering
- Member of National Elite Foundation
- Distinguished student in master's degree
- Distinguished student in B.Sc degree

RESEARCH INTERESTS

- Machine learning, Deep Learning
- Medical Image Processing, Computer Vision
- Computational Genomics, NGS data analysis
- Medical Signal Processing

HOBBIES

SPORTS: Volleyball, Badminton, Ping-pong, Foosball, Karting

ART: Piano Player (Advanced), Guitar Player (Intermidiate)

REFERENCES

Asst. Prof. Saeed. Rashidi, *Department of Biomedical Engineering, Islamic Azad University, Science and Research Branch*
Email: rashidi@srbiau.ac.ir

Prof. Babak Hosseini Khalaj, *Department of Electrical Engineering, Sharif University of Technology*
Email: khalaj@sharif.edu

Asst. Prof. Mehran Jahed, *Department of Electrical Engineering, Sharif University of Technology*
Email: Jahed@sharif.edu

Asst. Prof. Emad Fatemizadeh, *Department of Electrical Engineering, Sharif University of Technology*
Email: fatemizadeh@sharif.edu