

# Amirhossein Kazerouni

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## Education

### University of Toronto (U of T)

PHD IN COMPUTER SCIENCE

Toronto, Canada

Jan. 2024 - present

- **Courses:** Probabilistic Machine Learning, Mathematical Foundations of Algorithmic Fairness

### Iran University of Science and Technology (IUST)

B.S. IN ELECTRICAL ENGINEERING

Tehran, Iran

Sep. 2017 - Feb. 2022

- **GPA:** 17.95/20 (3.85/4)
- **Thesis topic:** Design, Simulation, and Construction of an Autonomous Vehicle with Environment Perception, Planning, and Control Capabilities. (Thesis Grade: 20/20) — **Supervisor:** Dr. Saeed Shamaghdari, Associate Professor at IUST

## Publications

### Conference Papers

1. **FuseNet: Self-Supervised Dual-Path Network for Medical Image Segmentation**  
*Amirhossein Kazerouni, Sanaz Karimijafarbigloo, Reza Azad, Yury Velichko, Ulas Bagci, Dorit Merhof*  
Published in **ISBI 2024** ([Paper](#), [GitHub](#))
2. **INCODE: Implicit Neural Conditioning with Prior Knowledge Embeddings**  
*Amirhossein Kazerouni, Reza Azad, Alireza Hosseini, Dorit Merhof, Ulas Bagci*  
Published in **IEEE/CVF WACV 2024** ([Paper](#), [GitHub](#), [Project Page](#))
3. **Beyond Self-Attention: Deformable Large Kernel Attention for Medical Image Segmentation**  
*Reza Azad, Leon Niggemeier, Michael Huttemann, Amirhossein Kazerouni, Ehsan K. Aghdam, Yury Velichko, Ulas Bagci, Dorit Merhof*  
Published in **IEEE/CVF WACV 2024** ([Paper](#), [GitHub](#))
4. **Laplacian-former: Overcoming the limitations of vision transformers in local texture detection**  
*Reza Azad, Amirhossein Kazerouni, Babak Azad, Ehsan Khodapanah Aghdam, Yury Velichko, Ulas Bagci, Dorit Merhof*  
Published in **MICCAI 2023 (top 14%)** ([Paper](#), [GitHub](#))
5. **Unlocking Fine-Grained Details with Wavelet-Based High-Frequency Enhancement in Transformers**  
*Reza Azad, Amirhossein Kazerouni, Alaa Sulaiman, Afshin Bozorgpour, Ehsan Khodapanah Aghdam, Abin Jose, Dorit Merhof*  
Published in **MLMI @ MICCAI 2023** ([Paper](#), [GitHub](#))
6. **DermoSegDiff: A Boundary-Aware Segmentation Diffusion Model for Skin Lesion Delineation**  
*Afshin Bozorgpour\*, Yousef Sadegheih\*, Amirhossein Kazerouni\*, Reza Azad, Dorit Merhof*  
Published in **PRIME @ MICCAI 2023** ([Paper](#), [GitHub](#))
7. **Self-supervised Semantic Segmentation: Consistency over Transformation**  
*Sanaz Karimijafarbigloo, Reza Azad, Amirhossein Kazerouni, Yury Velichko, Ulas Bagci, Dorit Merhof*  
Published in **CVAMD @ IEEE/CVF ICCV 2023** ([Paper](#), [GitHub](#))
8. **Implicit Neural Representation in Medical Imaging: A Comparative Survey**  
*Amirali Molaei, Amirhossein Aminimehr, Armin Tavakoli, Amirhossein Kazerouni, Bobby Azad, Reza Azad, Dorit Merhof*  
Published in **CVAMD @ IEEE/CVF ICCV 2023** ([Paper](#), [GitHub](#))
9. **HiFormer: Hierarchical Multi-scale Representations Using Transformers for Medical Image Segmentation**  
*Moein Heidari\*, Amirhossein Kazerouni\*, Milad Soltany\*, Reza Azad, Ehsan Khodapanah Aghdam, Julien Cohen-Adad, Dorit Merhof*  
Published in **IEEE/CVF WACV 2023** ([Paper](#), [GitHub](#))
10. **Reducing Uncertainty in 3D Medical Image Segmentation under Limited Annotations through Contrastive Learning**  
*Sanaz Karimijafarbigloo, Reza Azad, Amirhossein Kazerouni, Dorit Merhof*  
Published in **MIDL 2024** ([Paper](#), [GitHub](#))
11. **MMCFormer: Missing Modality Compensation Transformer for Brain Tumor Segmentation**  
*Sanaz Karimijafarbigloo, Reza Azad, Amirhossein Kazerouni, Dorit Merhof*  
Published in **MIDL 2023 (Oral presentation)** ([Paper](#), [GitHub](#))
12. **MS-Former: Multi-scale Self-guided Transformer for Medical Image Segmentation**  
*Sanaz Karimijafarbigloo, Reza Azad, Amirhossein Kazerouni, Dorit Merhof*  
Published in **MIDL 2023 (Oral presentation)** ([Paper](#), [GitHub](#))
13. **An Intelligent Modular Real-Time Vision-Based System for Environment Perception**  
*Amirhossein Kazerouni, Amirhossein Heydarian, Milad Soltany, Aida Mohammadshahi, Abbas Omid, Saeed Ebadollahi*  
Published in **ML4AD @ NeurIPS 2022** ([Paper](#), [GitHub](#), [Workshop Page](#))

Journal Papers

1. **Diffusion models in medical imaging: A comprehensive survey**  
*Amirhossein Kazerooni*, Ehsan K. Aghdam, Moein Heidari, Reza Azad, Mohsen Fayyaz, Ilker Hacihaliloglu, Dorit Merhof  
Published in **Medical Image Analysis Journal** (2023) ([Paper](#), [GitHub](#))
2. **Advances in Medical Image Analysis with Vision Transformers: A Comprehensive Review**  
*Reza Azad*, *Amirhossein Kazerooni*, Moein Heidari, Ehsan Khodapanah Aghdam, Amirali Molaei, Yiwei Jia, Abin Jose, Rijo Roy, Dorit Merhof  
Published in **Medical Image Analysis Journal** (2023) ([Paper](#), [GitHub](#))

Pre-print Papers

1. **SUM: Saliency Unification through Mamba for Visual Attention Modeling**  
*Alireza Hosseini\**, *Amirhossein Kazerooni\**, Saeed Akhavan, Michael Brudno, Babak Taati  
Published on arXiv preprint arXiv:2406.17815 (2024) ([Paper](#), [GitHub](#))
2. **Enhancing Efficiency in Vision Transformer Networks: Design Techniques and Insights**  
*Moein Heidari*, *Reza Azad*, Sina Ghorbani Kolahi, René Arimond, Leon Niggemeier, Alaa Sulaiman, Afshin Bozorgpour, Ehsan Khodapanah Aghdam, *Amirhossein Kazerooni*, Ilker Hacihaliloglu, Dorit Merhof  
Published on arXiv preprint arXiv:2403.19882 (2024) ([Paper](#), [GitHub](#))
3. **Foundational Models in Medical Imaging: A Comprehensive Survey and Future Vision**  
*Bobby Azad*, *Reza Azad*, Sania Eskandari, Afshin Bozorgpour, *Amirhossein Kazerooni*, Islem Rekik, Dorit Merhof  
Published on arXiv preprint arXiv:2310.18689 (2023) ([Paper](#), [GitHub](#))
4. **Ensemble Neural Representation Networks**  
*Milad Soltany Kadaravish\**, Hesam Mojtahedi\*, Hossein Entezari Zarch\*, *Amirhossein Kazerooni\**, Alireza Morsali, Azra Abtahi, Farokh Marvasti  
Published on arXiv preprint arXiv:2110.04124 (2021) ([Paper](#), [GitHub](#))

Research Interests

- Computer Vision
  - Medical Image Analysis
- Deep Learning
  - Diffusion Models
- Machine Learning
  - Transformers
- Computer Graphics
  - Neural Representations

Honors & Awards

2022	<b>Ranked 3rd</b> among 41 students who chose Control as a subfield	<i>IUST, Iran</i>
2022	<b>Ranked 4th</b> among 127 Electrical Engineering students	<i>IUST, Iran</i>
2021	<b>Ranked 1st</b> team in the national Rahneshan competitions for autonomous vehicles	<i>INEF, Iran</i>
2021	<b>Ranked 2nd</b> team in FIRA World Cup Competitions in Autonomous Cars League	<i>FIRA, Iran</i>
2015	<b>Ranked 1st</b> team in the A-lympiad National Mathematical Competition	<i>Iran</i>
2016	<b>Hold a diploma</b> from the A-lympiad World Mathematical Competition	<i>Utrecht University, Netherlands</i>
2017	<b>Ranked within the top 1%</b> among approximately 148,000 participants in the National University Entrance Exam	<i>Iran</i>

Skills

<b>Programming</b>	Python, MATLAB, C/C++, Latex, Familiar with HTML, CSS, PHP
<b>AI Tools/ Libraries</b>	PyTorch, TensorFlow, OpenCV, NPM (NumPy - Pandas - Matplotlib), etc.
<b>Tools</b>	Linux, Git

Research Experience

<b>Remote Research Assistant</b>	<i>Aachen, Germany</i>
RWTH AACHEN UNIVERSITY — SUPERVISOR: PROF. DORIT MERHOF AND REZA AZAD	
2022 - 2024	
• Worked on Transformers, Diffusion models, and Implicit Neural Representations.	
<b>Remote Machine Learning and Computer Vision Researcher</b>	<i>Montreal, Canada</i>
DGSCULPTOR	
2021 - 2023	
• Worked on the “Ensemble Neural Representation Networks” paper and proposed a novel suboptimal ensemble architecture for Implicit Neural Representations (INRs).	
• Worked on using Transformers for the image super-resolution task.	
<b>AI Researcher</b>	<i>IUST, Iran</i>
AI AND CONTROL LAB — SUPERVISOR: PROF. SAEED SHAMAGHDARI	
2019 - 2021	
• Worked on “Fusion-Based 3D Shape Analysis in a Noisy Environment” project.	

## Computer vision Researcher

UNIVERSITY OF TEHRAN— SUPERVISOR: PROF. MOHAMMAD ALI AKHAEI, ASSOCIATE PROFESSOR AT THE UNIVERSITY OF TEHRAN

Tehran, Iran

2019 - 2020

- Worked on “Statistical and Semantic Analysis of Football Game” project.

## Teaching Experience

### CSC148 (Introduction to Computer Science)

UofT, Canada

Winter 2024

### CSC420 (Introduction to Image Understanding)

UofT, Canada

Summer 2024

### Principles of Mechatronics

IUST, Iran

Spring 2021

## Working Experience

### CEO and Co-founder

IUST, Iran

AIR (ARTIFICIAL INTELLIGENCE AND ROBOTICS) CENTER

2020 - 2022

- Teaching and mentoring Deep Learning, Machine Learning, and Python courses.

## Professional Services

**MICCAI** Conference Reviewer for MICCAI 2024

**Media** Journal Reviewer for Medical Image Analysis Journal

**EAAI** Journal Reviewer for Engineering Applications of Artificial Intelligence

## Major Projects

### Automatic Parallel Parking ([Link](#), [GitHub](#))

INEF, Iran

NATIONAL RAHNESHAN COMPETITIONS

2021

- Implemented a parallel parking system that includes path planning, path tracking, and parallel parking.

### Statistical and Semantic Analysis of Football Game ([GitHub](#), [Website](#))

Tehran, Iran

SUPERVISOR: PROF. MOHAMMAD ALI AKHAEI

2019 - 2020

- Created the bird's eye view of the soccer field by predicting the homography matrix using GANs.
- Created a Telegram bot with PHP to collect voice data to create a voice spotting dataset.

### Fusion-Based 3D Shape Analysis in a Noisy Environment Using Stereo Camera

IUST, Iran

SUPERVISOR: PROF. SAEED SHAMAGHDARI

2019 - 2021

- Proposed a fusion-based multi-stage approach that performs 3D shape analysis on vehicles to measure the amount of load protrusion.

### Design, Simulation, and Construction of an Autonomous Vehicle with Environment Perception, Planning, and Control Capabilities

IUST, Iran

SUPERVISOR: PROF. SAEED SHAMAGHDARI

Sep. 2021

- Designed and built a toy self-driving car from scratch.

### Autonomous Car Simulation Based on AVIS Engine ([GitHub](#))

FIRA, Iran

FIRA WORLD CUP COMPETITIONS

Summer 2021

- Developed an autonomous car having control and environment perception capabilities.

## Languages

**English** IELTS (Academic): 7, C1 Proficiency

**Persian** Native