

# Jamal Saeedi



## Contact Information

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## Summary

He is a skilled and experienced engineer with a Ph.D. in Electronic Engineering from Tehran Polytechnic. His career highlights expertise in a broad range of technologies, including signal and image processing, computer vision, machine learning, and deep learning. He has applied his expertise to solve challenging problems in diverse fields such as road traffic monitoring, automated quality control and visual inspection (anomaly detection), time series forecasting for finance, 3D computer vision, remote sensing (synthetic aperture radar imaging), and object detection and tracking in video sequences.

## Experiences

### Work

- ⌘ **Postdoctoral researcher** at Istituto Dalle Molle di Studi sull'Intelligenza Artificiale (IDSIA), Lugano, Switzerland, (Jan 2019 – Present).
  - ✧ Participated in the design and implementation of multiple automated visual inspection and quality control projects for steel, electromechanical, and textile products, as well as other computer vision and data science projects utilizing deep learning, signal and image processing, and computer vision techniques.
- ⌘ **Signal and image processing engineer** at Towzin Electric Company (TEC), Tehran, Iran, (June 2016 – November 2018).
  - ✧ Contributed to the design and construction of the first Iranian High-Speed Weigh in Motion system at Towzin Electric Company (TEC), Tehran, Iran, (September 2016).
  - ✧ Involved in the design and implementation of real-time license plate recognition software, (March 2017).
- ⌘ **Research associate** at Information and Communication Technology Research Center (ICTRC), Tehran, Iran, (March 2016 – June 2016).
- ⌘ **Signal processing engineer** at Pardis Electronic Development Co., Tehran, Iran, (September 2011 – January 2015).
  - ✧ Played a role in the design and construction of the first Iranian Synthetic Aperture Radar (IRSAR/N-1) at Pardis Electronic Development Co., Tehran, Iran, (July 2013).
  - ✧ Contributed to technology transfer for a pulsed mode SAR system manufactured by Russia, at Pardis Electronic Development Co., Tehran, Iran, (2012-2013).
- ⌘ **Research assistant** at Machine Vision Research Lab. (MVRL) under the supervision of Prof. Karim Faez, Electrical Engineering Department, Amirkabir University of Technology, (September 2007- September 2015).
  - ✧ Obtained M.Sc. and Ph.D. degrees in electrical engineering in 2010 and 2015, respectively.
  - ✧ Published ten ISI journal papers and seven conference papers in various research areas.

### Volunteering

- ⌘ **Reviewer** for IEEE, Elsevier, Springer, IET, Taylor & Francis, and World Scientific journals on signal and image processing, computer vision, and remote sensing (2012 – Present).
- ⌘ **Evaluator** of knowledge-based companies at Presidential Deputy for Science and Technology, Tehran, Iran (February 2017 – December 2019).

## Education

### Academic Degrees

#### Doctor of Philosophy (Ph.D.) in Electrical Engineering

September 2015

- ✎ Amirkabir University of Technology (*Tehran Polytechnic*), Tehran, Iran. Total GPA: 3.67/4.
- ✎ Thesis Title: "Synthetic Aperture Radar Signal Processing Using Nonlinear Frequency Modulation and Phase Error Compensation," Score: 19.50/20. [[pdf](#)]

#### Master of Science (M.Sc.) in Electrical Engineering

January 2010

- ✎ Amirkabir University of Technology (*Tehran Polytechnic*), Tehran, Iran. Total GPA: 3.34/4.
- ✎ Thesis Title: "Image Fusion in the Multi-Scale Transforms Domain Using Fuzzy Logic and Particle Swarm Optimization," Score: 20/20. [[pdf](#)]

**Bachelor of Science (B.Sc.) in Biomedical Engineering**

September 2007

☞ Sahand University of Technology, Tabriz, Iran.

☞ Thesis Title: "Adaptive Control Using NARMA-L2 Model for Nonlinear Systems," Score: 19/20. [\[pdf\]](#)

**Relevant Courses**

☞ Signals and Systems	☞ Statistical Signal Processing	☞ Artificial Neural Network
☞ Digital Image Processing	☞ Speech Processing	☞ Statistical Pattern Recognition
☞ Fuzzy Systems	☞ Machine Learning	☞ Computer Vision
☞ Wavelets and Its Applications in Image Processing	☞ 3D Computer Vision	☞ Radar Signal Processing
☞ Digital Signal Processing	☞ Biomedical Signal Processing	☞ Deep Learning
	☞ Robust Speech Processing	

**Research Interests**

☞ Applied Machine Learning	☞ Self-supervised Learning	☞ Non-Stationary Time Series Forecasting
☞ Anomaly Detection	☞ Remote Sensing	
☞ Normalizing Flows	☞ Object Detection and Tracking	☞ 3D Computer Vision

**Skills, Language, and Awards****Skills****☞ Programming Languages:**

- Python (proficient), C/C++ (intermediate), MATLAB (proficient)

**☞ Development Environments (IDEs/Editors):**

- Experienced with PyCharm, Visual Studio Code, Qt, Visual Studio, Eclipse, MATLAB/Simulink, Weka, and Maple.

**☞ Machine Learning and Deep Learning:**

- Excellent knowledge of Supervised methods (Classification, Regression), Unsupervised methods (Clustering, Feature Selection, Dimensionality Reduction) and Self-supervised learning.
- Proficient in designing and implementing CNNs for image and video analysis, including tasks like classification, object detection, and semantic segmentation. Skilled in Autoencoder development for tasks such as anomaly detection, image denoising, and feature learning, and expert at applying deep learning to solve complex problems with expertise in model architecture, hyperparameter tuning, image augmentation and transfer learning. Familiar with time-series forecasting using deep learning techniques.
- Skilled in using Scikit-learn, Pyod, SciPy, TensorFlow, Keras, TensorBoard, PyTorch, PyTorch Lightning, Albumentations, Imgaug and MLflow for building and deploying machine learning and deep learning models.

**☞ Computer Vision and Image Processing:**

- Expertise in various computer vision tasks, including Image reconstruction, 3D surface matching, depth estimation, SLAM, multi-sensor image fusion, object detection (instance segmentation) and tracking, semantic segmentation, visual inspection, image registration, template matching, and image enhancement.
- Proficient in utilizing OpenCV, Scikit-image, and Kornia for image and video analysis.
- Competent in using Open3D and Point Cloud Library (PCL) for point cloud data processing.

**☞ Signal Processing:**

- Proficient in Synthetic Aperture Radar (SAR) signal processing, biomedical signal analysis (ECG, EEG), speech signal processing, and dynamic load-cell signal processing for vehicle weight estimation.
- Skilled in using a comprehensive set of signal processing libraries, including NumPy, SciPy, matplotlib, scikit-signal, PyWavelets, SoundFile, FilterPy, and Wavelets, covering a wide range of signal processing tasks.

**☞ Optimization Algorithms:**

- Proficient in particle swarm optimization (PSO) and Genetic algorithms for solving complex optimization problems. Experienced in utilizing Python libraries such as DEAP, PySwarm, and PyGMO for implementing and solving optimization tasks.

**☞ Technologies and Frameworks:**

- Operating Systems: Familiar with Linux for development and deployment and Microsoft windows (WSL2).
- Version Control: Proficient in using GitHub for collaborative coding and using pytest with GitHub Actions.
- Web Development: Proficient in Flask and FastAPI for building APIs with Python.
- Data Analysis: Skilled in data manipulation and analysis using Pandas, and Numpy.
- Parallel Programming: Proficient in multithreading and multiprocessing for optimizing program performance.
- GPU Computing: Experience with CUDA Processing for parallel computing on GPUs.

✂ **Other relevant skills:** Problem-solving, teamwork, communication.

### Language

✂ Persian (native)

✂ English (full professional proficiency)

- TOEFL iBT: total 100 (Reading 23/30, Listening 29/30, Speaking 24/30, Writing 24/30)

✂ Italian (B1)

### Honors and Awards

✂ Member at Iran's National Elites Foundation (BMN), (April 2016 – Present).

✂ Scholarships for PhD and Master Educations, granted for top students in entrance exam, granter: Iranian government, (Sep 2010 and Sep 2007).

## Selected Projects and Academic Works

### Istituto Dalle Molle di Studi sull'Intelligenza Artificiale (IDSIA), Lugano, Switzerland

- ✂ Design and implementation of anomaly detection and localization for textile products using self-supervised learning based on defect augmentation. July 2022 - Present
  - Utilized a self-supervised deep learning framework to train a two-class classifier for anomaly detection in textile products.
  - Implemented a novel approach employing self-supervised deep segmentation using the UNET architecture to localize defects, surpassing the results obtained with the Grad-CAM algorithm and the trained classifier.
- ✂ Depth estimation and 3D surface matching using multiple focal images. June 2023
  - Developed a system capable of recognizing and locating objects with a predefined shape and accurately estimating their positions for robotic gripping.
- ✂ Design and implementation of microwave image reconstruction using deep Learning approach. April 2022
  - Proposed an architecture to address the electromagnetic inverse scattering problem, training it on data collected by receivers on the measurement surface.
- ✂ Design and implementation of anomaly detection for zipper cursors and electromechanical components inspection based on convolutional autoencoder. March 2021
  - Implemented various semi-supervised deep learning approaches, including autoencoder, variational autoencoder, generative adversarial network, and deep feature-based one-class classification, for anomaly detection.
  - Incorporated a rigid image registration technique based on correlation maximization for image alignment purposes.
  - Results led to one conference paper and one journal paper.
- ✂ Design and implementation of a time-series forecasting approach for mid-term ranking and recommendation of financial assets using deep learning architecture. July 2020
- ✂ Design and implementation of visual inspection and measurement for different steel types for an industrial inspection project. June 2019
  - Developed a convolutional neural network for estimating surface roughness and detecting defects in electrical discharge machining steel.
  - Achieved a mean absolute percentage error rate of 7.32% in the regression task for roughness estimation and an accuracy of 97.26% in the classification task for defect detection, with an area under the curve of 99.09%.
  - Resulted in one journal paper.

### Towzin Electric Company (TEC), Tehran, Iran.

- ✂ Designed and implemented a real-time license plate recognition and vehicle dimension estimation system for a road monitoring project. August 2017
  - The system achieves a high accuracy rate of 98% for optical character recognition, 99% for speed estimation, and 99% for vehicle counting.
- ✂ Developed and implemented real-time signal processing algorithms for a high-speed weigh-in-motion project. The algorithms encompass vehicle velocity estimation, axle detection, calibration, weight estimation, and vehicle class determination. July 2016

- The system ensures a maximum margin of error of 3% for gross weight estimation, along with 97% accuracy for vehicle classification, 98% accuracy for speed estimation, and 99% accuracy for vehicle counting.

#### **Pardis Electronic Development Co., Tehran, Iran**

- ⌘ Designed and implemented signal processing algorithms for image formation, motion compensation, and autofocus in a stretch-based pulsed mode synthetic aperture radar. May 2015
  - This work led to the production of three technical reports and one journal paper.
- ⌘ Conducted research on synthetic aperture radar signal processing and design considerations. Sept. 2013
  - Explored design considerations for synthetic aperture radar imaging on various platforms such as UAV (FMCW mode), airborne (FMCW and Pulsed modes), space-borne (Pulsed mode), and missile-borne (Pulsed mode). -
  - Simulated raw data for different synthetic aperture radar scenarios, including point targets and distributed targets. Jan. 2015
  - Implemented various time and frequency domain signal processing algorithms, such as Omega-k, Range Doppler, Frequency Scaling, Time Domain Correlation, and Back projection. These algorithms were simulated for both continuous wave (used in UAV SAR) and pulsed modes (used in airborne, space-borne, and missile-borne SARs).
  - Processed real SAR data from different platforms, including UAV, airborne, and space-borne (ERS1-2, RADARSAT, and COSMO-SkyMed).
  - Implemented motion compensation techniques for phase error correction using GPS data for both time and frequency domain algorithms.
  - Implemented phase gradient autofocus algorithm for spotlight data and phase curvature autofocus algorithm for stripmap SAR data.
  - Achieved real-time implementation of various signal processing algorithms using Graphics Processing Unit (GPU).
  - Designed Synthetic Aperture Radar Simulators for testing hardware components in both FMCW and Pulsed modes.
  - This extensive research resulted in eight technical reports and two journal papers.

#### **Machine Vision Research Lab. (MVRL), Amirkabir University of Technology, Tehran, Iran**

- ⌘ Proposed a new method for deceptive jamming of synthetic aperture radar, resulting in one technical report and one journal paper. Sept. 2014
- ⌘ Proposed a new method for motion compensation of synthetic aperture radar signal imaging as part of a Ph.D. thesis at Amirkabir University of Technology, resulting in two journal papers. Nov. 2013
- ⌘ Proposed a new method for synthetic aperture radar signal processing using nonlinear frequency modulation chirp as part of a Ph.D. thesis at Amirkabir University of Technology, resulting in one conference paper and one journal paper. October 2013
- ⌘ Estimated power spectrum of a signal impinging on an array of M sensors using MVDR, MMSE, and MUSIC beamformer as a project for the Statistical Signal Processing course at Amirkabir University of Technology, resulting in one technical report. August 2011
- ⌘ Proposed a new method for EEG signal compression and implemented a journal paper titled "Iterative function system and genetic algorithm-based EEG compression" as part of a project for the Biomedical Signal Processing course at Amirkabir University of Technology, resulting in one technical report and one journal paper. July 2011
- ⌘ Proposed a new method for voice activity detection as a project for the Machine Learning course at Amirkabir University of Technology, resulting in one technical report and one journal paper. June 2011
- ⌘ Implemented a 3D reconstruction algorithm from multiple calibrated images, object tracking in video sequences using particle filter, and stitching photo mosaics to produce panorama pictures as projects for the 3D Computer Vision course at Sharif University, resulting in three technical reports. May 2011
- ⌘ Introduced a neural network for speech enhancement and implemented a journal paper titled "Wavelet speech enhancement based on time-scale adaptation" as part of a project for the Robust Speech Processing course at Amirkabir University of Technology, resulting in one technical report. February 2011

- ⌘ Implemented speech signal compression using wavelet and speech recognition using HMM classifier as a project for the Speech Processing course at Amirkabir University of Technology. January 2011
- ⌘ Proposed a new method for infrared and visible image fusion as part of an M.Sc. thesis at Amirkabir University of Technology, resulting in one IEEE conference paper and one Elsevier journal paper. Nov. 2010
- ⌘ Proposed a new method for multi-focus image fusion as part of an M.Sc. thesis at Amirkabir University of Technology, resulting in two conference papers and one Springer journal paper. July 2010
- ⌘ Proposed a new method for remote sensing image fusion as part of an M.Sc. thesis at Amirkabir University of Technology, resulting in one Elsevier journal paper. February 2010
- ⌘ Proposed a new method for document image segmentation and implemented a journal paper titled "Text Extraction and Document Image Segmentation Using Matched Wavelets and MRF Model" as part of a project for the Computer Vision course at Amirkabir University of Technology, resulting in one IEEE conference paper. October 2009
- ⌘ Introduced fuzzy logic for image enhancement and implemented two journal papers titled "A fuzzy noise reduction method for color images" and "A New Fuzzy-based Wavelet Shrinkage Image Denoising Technique" as part of a project for the Wavelet course at Amirkabir University of Technology, resulting in two conference papers and one Elsevier journal paper. March 2009
- ⌘ Implemented generalized fuzzy Hough transform, fuzzy edge detection, and fuzzy-neural system as a project for the Fuzzy Systems course at Amirkabir University of Technology, resulting in three technical reports. July 2008

#### Sahand University of Technology, Tabriz, Iran

- ⌘ Designed an adaptive control for a nonlinear system and implemented a journal paper titled "Adaptive Control Using Neural Networks and Approximate Models" as part of a B.Sc. thesis at Sahand University of Technology, resulting in one technical report. Sept. 2007

#### Publications h-index: 11 (source: Google Scholar)

1. J. Saeedi, A. Giusti, "Bezier curve empowered self-supervised anomaly localization using deep segmentation framework," 2023, (under preparation)
2. J. Saeedi, A. Giusti, "Semi-supervised visual anomaly detection based on convolutional autoencoder and transfer learning," *Machine Learning with Applications*, 11, 2023 [[pdf](#)]
3. J. Saeedi, A. Giusti, "Anomaly detection for industrial inspection using convolutional autoencoder and deep feature-based one class classification," *International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications*, pp. 85-96, 2022 [[pdf](#)] [[ppt](#)]
4. J. Saeedi, M. Dotta, A. Galli, A. Nasciuti, U. Maradia, M. Boccadoro, L. M. Gambardella, A. Giusti, "Measurement and inspection of electrical discharge machined steel surfaces using deep neural networks," *Machine Vision and Applications*, pp. 1-15, November 2020 [[pdf](#)]
5. J. Saeedi, "Improved Phase Curvature Autofocus for Stripmap Synthetic Aperture Radar Imaging," *IET Signal Processing*, pp. 1-10, February 2021 [[pdf](#)]
6. J. Saeedi, "A new hybrid method for synthetic aperture radar deceptive jamming," *International Journal of Microwave Engineering*, 4 (1), pp. 1-14, January 2019 [[pdf](#)]
7. J. Saeedi, "Feasibility study and conceptual design of missile-borne synthetic aperture radar," *IEEE Transactions on Systems, Man, and Cybernetics: Systems* PP (99), pp.1-12, July 2017 [[pdf](#)]
8. J. Saeedi, K. Faez, "Synthetic Aperture Radar Imaging Using Nonlinear Frequency Modulation Signal," *IEEE Transactions on Aerospace and Electronic Systems*, 52 (1), pp. 99-110, February 2016. [[pdf](#)]

9. J. Saeedi, and S.M. Alavi, "Improved navigation-based motion compensation for LFM-CW synthetic aperture radar," *Signal Image and Video Processing*, 10 (2), pp. 405-412, February 2016. [[pdf](#)]
10. J. Saeedi, K. Faez, "A back-projection autofocus algorithm based on flight trajectory optimization for synthetic aperture radar imaging," *Multidimensional Systems and Signal Processing*, 27 (2), pp. 411-431, 2016. [[pdf](#)]
11. J. Saeedi, S.M. Ahadi, and K. Faez, "Robust Voice Activity Detection Directed by Noise Classification," *Springer Signal, Image and Video Processing Journal*, 9 (3), pp. 561-572, 2015. [[pdf](#)] [[code](#)] [[dataset-speech](#)] [[dataset-noise](#)]
12. J. Saeedi, K. Faez, and M.H. Moradi "Hybrid Fractal-Wavelet Method for Multi-Channel EEG Signal Compression," *Circuits, Systems & Signal Processing*, (33), pp. 2583-2604, March 2014. [[pdf](#)]
13. J. Saeedi, K. Faez, "A classification and fuzzy-based approach for digital multi-focus image fusion," *Pattern Analysis and Application Journal* 16 (3), pp. 365-379, July 2013. [[pdf](#)] [[dataset](#)]
14. J. Saeedi, K. Faez, "Infrared and visible image fusion using fuzzy logic and population-based optimization," *Elsevier Applied Soft Computing Journal* 12 (3), pp. 1041-1054, March 2012. [[pdf](#)] [[dataset](#)]
15. J. Saeedi, K. Faez, "A new pan-sharpening method using multiobjective particle swarm optimization and the shiftable contourlet transform," *Elsevier Photogrammetry & Remote Sensing Journal* 66, pp. 365-381, 2011. [[pdf](#)] [[dataset](#)]
16. J. Saeedi, M.H. Moradi, and K. Faez, "A New Wavelet-based Fuzzy Single and Multi-Channel Image Denoising," *Elsevier Image and Vision Computing Journal* 28, pp. 1611-1623, 2010. [[pdf](#)] [[dataset](#)]
17. J. Saeedi, K. Faez, "Non-linear Frequency Modulation Using Piecewise Linear Functions for Synthetic Aperture Radar Imaging," *10th European Conference on Synthetic Aperture Radar, Berlin, Germany*, pp. 1-4, 2014. [[pdf](#)]
18. J. Saeedi, M.H. Moradi, and Ali. Abedi, "Image Denoising Based on Fuzzy and Intra-Scale Dependency in Wavelet Transform Domain," *IEEE International Conference on Pattern Recognition ICPR*, pp. 2672-2675, 2010. [[pdf](#)]
19. J. Saeedi, A. Abedi, "Wavelet-Based Multi-Channel Image Denoising Using Fuzzy Logic," *ICISP 2010, LNCS 6134, Springer-Verlag Berlin Heidelberg*, pp. 44-53, 2010. [[pdf](#)]
20. J. Saeedi, K. Faez, and S. Mozaffari, "Multi-focus Image Fusion Based on Fuzzy and Wavelet Transform," *CIARP 2009, LNCS 5856, Springer-Verlag Berlin Heidelberg*, pp. 970-977, 2009. [[pdf](#)]
21. J. Saeedi, R. Safabakhsh, and S. Mozaffari, "Document Image Segmentation Using Fuzzy Classifier and the Dual-Tree DWT", *14th International CSI conference, Tehran, Iran*, pp. 385-390, 2009. [[pdf](#)] [[ppt](#)]
22. J. Saeedi, K. Faez, "Fisher Classifier and Fuzzy Logic Based Multi-Focus Image Fusion," *IEEE International Conference on Intelligent Computing and Systems Intelligent*, pp. 420-425, 2009. [[pdf](#)]
23. J. Saeedi, K. Faez, "The New Segmentation and Fuzzy Logic based Multi-Sensor Image Fusion," *24<sup>th</sup> IEEE International Conference Image and Vision Computing New Zealand*, pp. 328-333, 2009. [[pdf](#)] [[ppt](#)]