

# Iman Nematollahi

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Autonomous Intelligent Systems  
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## Technical Expertise

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- Robot Learning
- Reinforcement Learning
- Robot Skills
- Self-Supervised/Unsupervised Learning
- Learning Intuitive Physics
- Video Prediction

## Education

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### Ph.D. Candidate in Computer Science

UNIVERSITY OF FREIBURG

- Advisor: Prof. Dr. Wolfram Burgard

Freiburg, Germany

Jan. 2019

### MSc in Embedded Systems Engineering

UNIVERSITY OF FREIBURG - GRADE: 1.3 (EXCELENT)

- Thesis: Augmenting Action Model Learning by Non-Geometric Features
- Advisor: Prof. Dr. Wolfram Burgard

Freiburg, Germany

Oct. 2015 - Nov. 2018

### BSc in Electrical Engineering (Electronics)

SHAHID BEHESHTI UNIVERSITY

- Thesis: Wireless Vehicle Controlling using Sensor Fusion of Android OS

Tehran, Iran

Sep. 2010 - May 2015

## Work Experience

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### Doctoral Researcher

UNIVERSITY OF FREIBURG, DEPARTMENT OF COMPUTER SCIENCE, AUTONOMOUS INTELLIGENT SYSTEMS LAB

- My research focuses on robot manipulation and deep learning to enable robots to develop an intuitive understanding of physics from past unlabeled interaction experiences. This intuitive physics model allows robots to comprehend the 3D dynamics of the surrounding world in order to predict plausible future outcomes and learn a diverse repertoire of adaptive and generalizable skills.

Freiburg, Germany

Jan. 2019 - current

### Student Research Assistant

UNIVERSITY OF FREIBURG, DEPARTMENT OF COMPUTER SCIENCE, AUTONOMOUS INTELLIGENT SYSTEMS LAB

- Implementation of Dynamic Obstacle Avoidance for KUKA OmniRob

Freiburg, Germany

Aug. 2017 - Oct. 2017

### Student Research Assistant

IMTEK, LABORATORY FOR THE DESIGN OF MICROSYSTEMS

- Low power hardware implementation of an Early Seizure Detection Convolutional Neural Network algorithm on FPGA
- Continuous and simultaneous readout of ADC channels using SPI and USB protocols via FPGA

Freiburg, Germany

Nov. 2016 - Oct. 2018

### Electrical Engineer

MAHYA INTELLIGENT TRANSPORTATION SYSTEMS

- Design, implementation and maintenance of software and hardware requirements of Tehran traffic control devices

Tehran, Iran

Sep. 2012 - Sep. 2014

### Student Research Assistant

SHAHID BEHESHTI UNIVERSITY, MICROPROCESSORS LAB

- Design and implementation of a novel Class Attendance System using AVR Microcontrollers and RFID Modules (used in the 22nd Iranian Conference on Electrical Engineering)

Tehran, Iran

Mar. 2014 - Jun. 2014

## Teaching

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### Deep Learning Laboratory

UNIVERSITY OF FREIBURG

- Introduction to Deep Learning, optimization, projects on robot learning

Freiburg, Germany

SS 2020, SS 2021, SS 2022

### Introduction to Mobile Robotics

UNIVERSITY OF FREIBURG

- Introduction to basic concepts and techniques for autonomous intelligent systems

Freiburg, Germany

SS 2019

- Introduction to several microprocessor and microcomputer architectures and their programming

## Supervision

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2023	<b>Kirill Yankov</b> , Transfer Robot Skills in Reinforcement Learning by Learning Keypoints	Master Thesis
2022	<b>Seyed Mahdi B. Azad</b> , Task-Agnostic State Value for Visual Planning in 3D World Models	Master Thesis
2021	<b>Jens Rahmfeld</b> , Action-Conditioned Video Prediction with 3D Images	Bachelor Thesis
2021	<b>Leonhard Sommer</b> , Towards Unsupervised Scene Decomposition	Master Project
2021	<b>Erick Rosete-Beas</b> , Deep Reinforcement Learning for Adapting Dynamical Systems	Master Project
2020	<b>Alexander Goltz, Jens Rahmfeld, Julian Weidhase</b> , Virtual-Reality Data Collection	Bachelor Project

## Publications

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### PEER-REVIEWED CONFERENCE PUBLICATIONS

- **Robot Skill Generalization Keypoint Integrated via Soft Actor-Critic Gaussian Mixture Models**  
**Iman Nematollahi**, Kirill Yankov, Wolfram Burgard, Tim Welschehold  
*Proceedings of the International Symposium on Experimental Robotics (ISER), 2023, Chiang Mai, Thailand*
- **T3VIP: Transformation-based 3D Video Prediction**  
**Iman Nematollahi**, Erick Rosete-Beas, Seyed Mahdi B. Azad, Raghu Rajan, Frank Hutter, Wolfram Burgard  
*Proceedings of the International Conference on Intelligent Robots and Systems (IROS), 2022, Kyoto, Japan*
- **Robot Skill Adaptation via Soft Actor-Critic Gaussian Mixture Models**  
**Iman Nematollahi**, Erick Rosete-Beas, Adrian Röfer, Tim Welschehold, Abhinav Valada, Wolfram Burgard  
*Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2022, Philadelphia, USA*
- **Hindsight for Foresight: Unsupervised Structured Dynamics Models from Physical Interaction**  
**Iman Nematollahi**, Oier Mees, Lukas Hermann, Wolfram Burgard  
*Proceedings of the International Conference on Intelligent Robots and Systems (IROS), 2020, Las Vegas, USA*
- **Augmenting Action Model Learning by Non-Geometric Features**  
**Iman Nematollahi**, Daniel Kuhner, Tim Welschehold, Wolfram Burgard  
*Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2019, Montreal, Canada*
- **Hardware Implementation of a Performance and Energy-optimized Convolutional Neural Network for Seizure Detection**  
Simon Heller, Maria Hügler, **Iman Nematollahi**, Farrokh Manzouri, Matthias Dümpelmann, Andreas Schulze, Joschka Boedecker, Peter Woias  
*Proceedings of the 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2018, Honolulu, Hawaii*
- **Three Channel High Dynamic Current Measurement System for Low Power Systems**  
Simon Heller, **Iman Nematollahi**, Soeren Koeble, Peter Woias  
*In Journal of Physics: Conference Series, vol. 1052, no. 1, p. 012059. IOP Publishing, 2018*
- **Assistive Medication Management System for Users with Visual Impairment**  
Kiana Farhadyar, Reza Safdari, Ahmad Behpajoo, **Iman Nematollahi**  
*Studies in health technology and informatics, 249, 53-60, 2018*

### PEER-REVIEWED WORKSHOP PAPERS

- **Robot Skill Adaptation via Soft Actor-Critic Gaussian Mixture Models**  
**Iman Nematollahi**, Erick Rosete-Beas, Adrian Röfer, Tim Welschehold, Abhinav Valada, Wolfram Burgard  
*Workshop on Implicit Representations for Robotic Manipulation at Robotics: Science and Systems (RSS), 2022*
- **T3VIP: Transformation-based 3D Video Prediction**  
**Iman Nematollahi**, Erick Rosete-Beas, Seyed Mahdi B. Azad, Raghu Rajan, Frank Hutter, Wolfram Burgard  
*Workshop on Scaling Robot Learning at International Conference on Robotics and Automation (ICRA), 2022*
- **Hindsight for Foresight: Unsupervised Structured Dynamics Models from Physical Interaction**  
**Iman Nematollahi**, Oier Mees, Lukas Hermann, Wolfram Burgard  
*Workshop on Machine Learning in Planning and Control of Robot Motion at International Conference on Robotics and Automation (ICRA), 2020*
- **Hindsight for Foresight: Unsupervised Structured Dynamics Models from Physical Interaction**  
**Iman Nematollahi**, Oier Mees, Lukas Hermann, Wolfram Burgard  
*Workshop on Structured Approaches to Robot Learning for Improved Generalization at Robotics: Science and Systems (RSS), 2020*

## Software & Datasets

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### Robot Skill Generalization via KIS-GMMs

<http://kis-gmm.cs.uni-freiburg.de>

- Keypoint Integrated Soft Actor-Critic Gaussian Mixture Models that learn to adapt robot skills and generalize them to unseen environments.

### T3VIP: Transformation-based 3D Video Prediction

<http://t3vip.cs.uni-freiburg.de>

- State-of-the-art T3VIP models that learn a 3D world model from unlabeled physical interaction and predict RGB-D videos of future.
- DexHand Dataset - over 10K RGB-D videos of a synthetic Shadow Hand robot manipulating a cube towards arbitrary goal configurations.

### Robot Skill Adaptation via SAC-GMMs

<http://sac-gmm.cs.uni-freiburg.de>

- Soft Actor-Critic Gaussian Mixture Models that learn and refine robot skills in trajectory distribution space through interactions.

### Learning of Intuitive Physics from Interaction

<http://hind4sight.cs.uni-freiburg.de>

- State-of-the-art Hind4Sight models that learn dynamics of the real-world from unlabeled physical interaction.
- Freiburg Poking Dataset - over 40K poke interactions with a KUKA LBR iiwa manipulator and over 30 objects.

## Skills

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- Daily Use** Python, Pytorch, PyBullet, NumPy, Bash, Git, LaTeX
- Familiarity** C/C++, Robot Operating System (ROS), VHDL, MATLAB, Android
- Languages** English, Deutsch, Farsi