

# Aditya Milind Deshpande

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## Skills

<b>Robotics</b>	Robot Operating System (ROS), Gazebo Sim, Pybullet, MuJoCo
<b>Deep Learning</b>	Pytorch, TensorFlow
<b>Embedded systems</b>	NVIDIA Jetson TX2/Nano, Arduino, Raspberry Pi, PixHawk Autopilot
<b>Computer Vision</b>	OpenCV, VLFeat, Open3D
<b>Programming</b>	Python, C++, Julia, MATLAB
<b>Software</b>	SolidWorks, MySQL, NetworkX, Git

## Experience

### University of Cincinnati - Simulation Center

Cincinnati, Ohio, USA

GRADUATE RESEARCH ASSISTANT

Jan. 2021 - Present

- Collaborating with Procter & Gamble for developing indoor robotics and smart product technologies.
- Developing novel computer vision algorithms for consumer products at P&G.

### Procter & Gamble

Cincinnati, Ohio, USA

ROBOTICS RESEARCH INTERN

May 2020 - Dec. 2020

- Implemented target driven navigation in indoor robots using computer vision and deep reinforcement learning.
- Developed ROS-based SLAM algorithms for indoor-robots using RGB and RGB-Depth cameras, and LiDAR sensor.

### Cooperative Distributed Systems Lab, University of Cincinnati

Cincinnati, Ohio, USA

GRADUATE RESEARCHER

May. 2017 - Present

- **Robotics**
  - Researching approaches to expedite embodied learning in modular robots using deep reinforcement learning and evolutionary strategies.
  - Automated quadcopter for indoor and outdoor flights using PX4-firmware, C++ and Python to assist firefighters in search and rescue; Used YOLO object detection model to identify objects of interest in robot's field-of-view.
  - Created software for vision-based road traffic monitoring with drones using TensorFlow-based fine-tuned Faster-RCNN model and OpenCV.
- **Deep learning**
  - Led the development of the non-invasive Computer Vision Toolkit (CVT) to enable digitization of legacy machines; Used Python and OpenCV; Software deployed in Faurecia and Raytheon.
  - Implemented Natural Language Processing (NLP) based image captioning model (VGG-net+LSTM-net) trained on COCO-dataset in PyTorch.
  - Developed PyTorch-based one-shot recognition deep-learning module to identify manufacturing defects on steel surfaces using computer vision.

### CEAS, University of Cincinnati

Cincinnati, Ohio, USA

INSTRUCTOR

Jan. 2019 - Apr. 2019

- Taught the large enrollment (60 students) course of MECH6032/5132 Robot Control and Design as a primary instructor.
- Revamped the course material and incorporated open-source hardware and software projects in the curriculum.
- Supervised students in the development of autonomous mobile robots and robot arms as class projects; robots were built using Arduino Uno and ROS.

### Viaanix, Inc.

Wichita, Kansas, USA

ENGINEERING INTERN

Jun. 2016 - Jul. 2016

- Designed sensor fusion algorithm for wearable IMU sensors using MATLAB to enable human motion tracking in real-time.
- Presented wearable device design solution as per the customer/chiropractor requirements and budgets.
- Collaborated with design and firmware teams for hardware-software interface testing of wearable motion tracking device.

### Dassault Systèmes (SIMULIA)

Pune, Maharashtra, India

SOFTWARE ENGINEER

Jul. 2014 - Jul. 2015

- Collaborated with the front-end team to develop the graphical user interface for the SIMULIA products using Polymerjs and JavaScript
- Focused on website rendering time minimization and usability to improve the user experience of SIMULIA products.

## Education

### University of Cincinnati

Cincinnati, Ohio, USA

PH.D. IN MECHANICAL ENGINEERING, GPA:4.0

Aug. 2017 - Present

- Research Focus: Embodied Intelligence in robots; Advisors: Dr. Manish Kumar and Dr. Ali A. Minai

### University of Cincinnati

Cincinnati, Ohio, USA

M.S. IN MECHANICAL ENGINEERING, GPA: 3.9

Aug. 2015 - Jul. 2017

- Thesis: Robot Swarm Based On Ant Foraging Hypothesis With Adaptive Lévy Flights. (Link); Advisor: Dr. Manish Kumar

### Maharashtra Institute of Technology

Pune, India

B.E. IN MECHANICAL ENGINEERING, First Class with Distinction

Aug. 2010 - Jul. 2014

- Senior Design Project: Design Optimization of Heat Exchanger; Development of Remote Controlled Fixed-wing Drone

## Publications and Presentations

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### Conference Publications

- **Deshpande, A. M.**, Kumar, R., Minai, A. A., Kumar, M. (2020). Developmental Reinforcement Learning of Control Policy of a Quadcopter UAV With Thrust Vectoring Rotors. In ASME 2020 Dynamic Systems and Control Conference, doi:10.1115/DSCC2020-3319
- Kumar, R., **Deshpande, A. M.**, Wells, J. Z., Kumar, M. (2020). Flight Control of Sliding Arm Quadcopter with Dynamic Structural Parameters. 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Las Vegas, NV, USA, 2020, pp. 1358-1363, doi: 10.1109/IROS45743.2020.9340694.
- **Deshpande, A. M.**, Minai, Ali A., Kumar, M. "One-Shot Recognition of Manufacturing Defects in Steel Surfaces." In 48th SME North American Manufacturing Research Conference (2020).
- **Deshpande, A. M.**, Telikicherla, A. K., Jakkali, V., Wickelhaus, D., Kumar, M., Anand, S., "CV Toolkit: Computer Vision Toolkit for Non-invasive Monitoring of Factory Floor Artifacts." In 48th SME North American Manufacturing Research Conference (2020).
- Kumar, R., Bhargavapuri, M., **Deshpande, A. M.**, Sridhar, S., Cohen, K., Kumar, M. "Quaternion Feedback Based Autonomous Control of a Quadcopter UAV with Thrust Vectoring Rotors." In 2020 American Control Conference.
- **Deshpande, A. M.**, Kumar, R., Radmanesh, M., Veerabhadrapa, N., Kumar, M., Minai, A. A. (2018, June). "Self-Organized Circle Formation around an Unknown Target by a Multi-Robot Swarm using a Local Communication Strategy." In 2018 Annual American Control Conference (ACC) (pp. 4409-4413). IEEE.
- **Deshpande, A.**, Kumar, M., Ramakrishnan, S. (2017, October). "Robot swarm for efficient area coverage inspired by ant foraging: The case of adaptive switching between Brownian motion and Lévy flight." In ASME 2017 Dynamic Systems and Control Conference (pp. V002T14A009-V002T14A009). American Society of Mechanical Engineers.
- **Deshpande, A. M.**, Phatnani, G. M., Kulkarni, A. J. (2013, June). "Constraint handling in firefly algorithm." In 2013 IEEE international conference on cybernetics (CYBCO) (pp. 186-190). IEEE.

### Journal Publications

- Majid, F., Gray, M., **Deshpande, A. M.**, Ramakrishnan, S., Kumar, M., Ehrlich, S. (2021) "Non-Pharmaceutical Interventions as Controls to mitigate the spread of epidemics: An analysis using a spatiotemporal PDE model and COVID-19 data." ISA Transactions. [link]

### Book Chapter

- Kumar R., **Deshpande, A. M.**, Scott D., Wells J. Z., Kumar, M. "Special Transportation Modes." in "Disruptive Emerging Transportation Primer". American Society of Civil Engineers (ASCE) (Under review).

### Posters

- **Deshpande, A. M.**, Kumar, R., Kumar, M. "IoT based AI Application for Posture Recognition to Reduce Workplace Injuries." 20th Annual 2019 Pilot Research Project (PRP) Symposium, University of Cincinnati Education and Research Center, October 2019.
- Kumar, A., Omotuyi, O., **Deshpande, A. M.**, Calabrese, N., Kumar, M. "Autonomous Mobile Robot Localization and Navigation system using Camera and Inertial Measurement Unit (IMU) in indoor environment." 2019 AIAA Intelligent Systems Workshop, July 2019.
- Anand, S., Kumar, M., **Deshpande, A.**, Jakkali, V., Telikicherla, A. K. "Non-Invasive Computer Vision Toolkit (CVT) using MTConnect®." Future Factory Technology Showcase, UI Labs, Chicago, Illinois, Nov. 13, 2018.

### Presentations

- **Deshpande, A. M.**, Kumar, M., Minai A. A. "Teaching Quadruped Robot to Walk using Reinforcement Learning and Central Pattern Generators." 2019 AIAA Intelligent Systems Workshop. July 2019.
- Wells, J., **Deshpande, A. M.**, Kumar, R., Ssaxena, A., Brown, B., Vanderelst, D., and Kumar, M. "Autonomous Indoor Flight in GPS Denied, Degraded Environments." 44th Dayton-Cincinnati Aerospace Sciences Symposium. March 2019.
- Kumar, R., **Deshpande, A. M.**, Sridhar, S., Cohen, K., Kumar, M. "Quaternion Feedback Based Full Pose Control of a Quadcopter UAV with Thrust Vectoring Capabilities." 44th Dayton-Cincinnati Aerospace Sciences Symposium. March 2019.
- Omotuyi, O., Wells, J., **Deshpande, A. M.**, Kumar, R., Kumar, M. "Laser Based EKF Localization on TurtleBot3 Robot." 44th Dayton-Cincinnati Aerospace Sciences Symposium. March 2019.
- **Deshpande, A. M.**, Kumar, M., Ramakrishnan, S. "Robot Swarm inspired by Ant Colony for Augmented Search and Retrieval." 43rd Dayton-Cincinnati Aerospace Sciences Symposium. February 2018
- **Deshpande, A. M.**, Kumar, M., Minai, A. A. "Self-Organized Circle Formation around an Unknown Target by a Multi-Robot Swarm using a Local Communication Strategy." 43rd Dayton-Cincinnati Aerospace Sciences Symposium. February 2018.
- **Deshpande, A. M.**, Kumar, M., Ramakrishnan, S. "Area Coverage Based On Lévy Foraging Hypothesis Applied to Robot Swarm Emulating Ant Foraging Behavior." 42nd Dayton-Cincinnati Aerospace Sciences Symposium. March 2017.

## Affiliations and Professional Activities

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| 2017-21 | <b>Mentoring and Leadership</b> , Guiding Bachelors and Masters students in their research related to various robotics and automation projects. |
| 2017-21 | <b>Student member</b> , American Society of Mechanical Engineers (ASME)   |
| 2019    | <b>Student member</b> , American Association for the Advancement of Science (AAAS)  |
| 2017-21 | <b>Reviewer</b> , ICRA, ACC, DSCC, CDC, ICUAS, ISA Transactions, The Visual Computers, ECC  |

## Honors & Awards

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2021	<b>Media Coverage: “UC students make app that prints custom face masks”</b> <a href="#">[link-1]</a> <a href="#">[link-2]</a> , WLWT Channel 5, Cincinnati, March 2, 2021	<i>Cincinnati, Ohio</i>
Oct. 2020	<b>People’s Choice Best Presentation Award</b> , 21th Annual Pilot Research Project Symposium. “IoT based AI Application for Posture Recognition to reduce Workplace Injuries”.	<i>Cincinnati, Ohio</i>
Oct. 2019	<b>People’s Choice Best Poster Award</b> , 20th Annual Pilot Research Project Symposium. “IoT based AI Application for Posture Recognition to reduce Workplace Injuries”.	<i>Cincinnati, Ohio</i>
2019	<b>Pilot Research Project Award, \$7000</b> , IoT based AI Application for Posture Recognition to reduce Workplace Injuries. University of Cincinnati’s Education and Research Center	<i>Ohio</i>
2019	<b>Video in Science Award</b> , 44th Dayton-Cincinnati Aerospace Sciences Symposium, presented the implementation of Style transfer on the scenic video from quadcopter.	<i>Dayton, Ohio</i>
2018	<b>Media Coverage: “UC researchers team up with ODOT to study traffic with drones”</b> , WCPO-TV, Channel 9 Cincinnati, July 10, 2018	<i>Cincinnati, Ohio</i>
2018	<b>University Research Council (URC) Award, \$5000</b> , Principal Investigator (PI) for the research on “Deep Intelligence for Complex Learning in Robots”	<i>Cincinnati, Ohio</i>
2015-19	<b>University Graduate Scholarship</b> , University of Cincinnati	<i>Cincinnati, Ohio</i>
2012	<b>3rd Place</b> , Designer Pro (AutoCAD) Competition in “Axlerate” (Technical Festival, Maharashtra Institute of Technology)	<i>Pune, India</i>