

# Aditya Milind Deshpande

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## Education

### University of Cincinnati

PH.D. IN MECHANICAL ENGINEERING, GPA: 4.0

- Research Focus: Embodied Intelligence in robots

Cincinnati, Ohio, USA

Aug. 2017 - Present

### University of Cincinnati

M.S. IN MECHANICAL ENGINEERING, GPA: 3.9

- Thesis: Robot Swarm Based On Ant Foraging Hypothesis With Adaptive Lévy Flights. (Electronic Thesis).

Cincinnati, Ohio, USA

Aug. 2015 - Jul. 2017

### Maharashtra Institute of Technology

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

- Senior Design Project: Design Optimization of Heat Exchanger

Pune, India

Aug. 2010 - Jul. 2014

## Experience

### UC Simulation Center

RESEARCH ASSISTANT

- Project in collaboration with Procter & Gamble for developing indoor robots and smart product technologies.

Cincinnati, Ohio, USA

Jan. 2021 - Present

### Procter & Gamble

ROBOTICS RESEARCH INTERN

- Implemented target driven navigation in indoor robots using computer vision and deep reinforcement learning.
- Developed localization and SLAM algorithms for indoor-robots (flying and ground robots) using RGB cameras, depth cameras and LiDAR.

Cincinnati, Ohio, USA

May 2020 - Dec. 2020

### Cooperative Distributed Systems Lab, University of Cincinnati (Prof. Manish Kumar)

GRADUATE RESEARCHER

- Current research is focused on framework development to expedite embodied learning in modular robots using deep reinforcement learning and evolutionary approaches.
- 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.
- Led the software development and delivered the non-invasive Computer Vision Toolkit (CVT) to enable digitization of legacy machines; used Python and OpenCV; software deployed in Faurecia and Raytheon.
- Created software for vision-based road traffic monitoring with quadcopters using TensorFlow-based fine-tuned Faster-RCNN model and OpenCV.
- Implemented image captioning model based on Natural Language Processing (VGG-net+LSTM-net) using COCO-dataset in PyTorch.
- Designed PyTorch-based one-shot recognition deep-learning module to identify manufacturing defects on steel surfaces using computer vision.

Cincinnati, Ohio, USA

May. 2017 - Present

### CEAS, University of Cincinnati

INSTRUCTOR

- 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 using Arduino Uno and ROS.

Cincinnati, Ohio, USA

Jan. 2019 - Apr. 2019

### Viaanix, Inc.

ENGINEERING INTERN

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

Wichita, Kansas, USA

Jun. 2016 - Jul. 2016

### Dassault Systèmes (SIMULIA)

SOFTWARE ENGINEER

- 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.

Pune, Maharashtra, India

Jul. 2014 - Jul. 2015

## Skills

**Software** Python, MATLAB, PyBullet, MuJoCo, OpenCV, Robot Operating System (ROS), Gazebo Sim, Julia, LaTeX, Git, MySQL

**Deep Learning** Pytorch, Keras, TensorFlow

**Hardware** PixHawk Autopilot, NVIDIA Jetson (TX2, Nano), Arduino Uno, Raspberry Pi

## 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

- **Deshpande, A. M.**, Ramakrishnan, S., Kumar, M. "Adaptive Switching between Brownian and Lévy Foraging Strategies for Improved Area Coverage by a Biologically Inspired Robot Swarm." Submitted to Swarm Intelligence (Under review).

### 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-Present	<b>American Society of Mechanical Engineers (ASME), Student Member</b>
2021	<b>European Control Conference, Reviewer</b>
2020-21	<b>The Visual Computer: Springer Nature, Reviewer</b>
2020-21	<b>ISA Transactions: Elsevier, Reviewer</b>
2020	<b>IEEE Conference on Decision and Control (CDC), Reviewer</b>
2020	<b>IEEE Conference on Decision and Control (CDC), Reviewer</b>
2020	<b>International Conference on Unmanned Aircraft Systems (ICUAS), Reviewer</b>
2020	<b>International Conference on Ubiquitous Robots (UR), Reviewer</b>
2019	<b>IEEE International Conference on Robotics and Automation (ICRA), Reviewer</b>
2017-20	<b>Dynamic Systems and Control Conference (DSCC), Reviewer</b>
2017-21	<b>American Control Conference (ACC), Reviewer</b>

## Honors & Awards

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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>