

# Aditya Deshpande

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## Skills

<b>Robotics and Computer Vision</b>	Robot Operating System (ROS), Pybullet, MuJoCo, OpenCV
<b>Artificial Intelligence</b>	Pytorch, TensorFlow
<b>Embedded systems</b>	STM32, NVIDIA Jetson TX2/Nano, Arduino, Raspberry Pi, PixHawk Autopilot
<b>Software</b>	Python, C++, Embedded C, Julia, MATLAB, SolidWorks, NetworkX, Git

## Experience

### Procter & Gamble

#### RESEARCH SCIENTIST

Cincinnati, Ohio, USA

Nov. 2021 - Present

- Robotics and Artificial Intelligence research and development for application in consumer products.

### University of Cincinnati - Simulation Center

#### GRADUATE RESEARCH ASSISTANT

Cincinnati, Ohio, USA

Jan. 2021 - Oct. 2021

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

### Procter & Gamble

#### ROBOTICS RESEARCH INTERN

Cincinnati, Ohio, USA

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.

### University of Cincinnati - Cooperative Distributed Systems Lab

#### GRADUATE RESEARCHER

Cincinnati, Ohio, USA

May. 2017 - Oct. 2021

- Robotics**
  - Researched 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 computer vision algorithms for drone assisted road traffic monitoring 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.

### University of Cincinnati - CEAS

#### INSTRUCTOR

Cincinnati, Ohio, USA

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.

### Viaan, Inc.

#### ENGINEERING INTERN

Wichita, Kansas, USA

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)

#### SOFTWARE ENGINEER

Pune, Maharashtra, India

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

#### PH.D. IN MECHANICAL ENGINEERING

Cincinnati, Ohio, USA

Aug. 2017 - Oct. 2021

- Dissertation: Developmental Learning of Control in Modular Robotic Systems with Increasing Complexification [\[Link\]](#);  
Advisors: Prof. Manish Kumar and Prof. Ali A. Minai

- Thesis: Robot Swarm Based On Ant Foraging Hypothesis With Adaptive Lévy Flights [Link]; Advisor: Prof. Manish Kumar.

**Maharashtra Institute of Technology**

- Senior Design Projects: (1) Design Optimization of Heat Exchanger; (2) Development of Remote Controlled Fixed-wing Drone.

**Publications and Presentations****Publications**

- **Deshpande, A. M.**, Minai, A. A. "Robust Deep Reinforcement Learning for Quadcopter Control". IFAC-PapersOnLine 54.20 (2021): 90-95, doi:10.1016/j.ifacol.2021.11.158.
- Majid, F., **Deshpande, A. M.**, Ramakrishnan, S., Ehrlich, S. and Kumar, M. "Analysis of epidemic spread dynamics using a PDE model and COVID-19 data from Hamilton County OH USA". Ifac-papersonline, 54.20 (2021): 322-327.
- 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].
- **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.

**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 and Presentations**

- **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.
- Kumat, 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.
- **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.

## Honors, Awards & Professional Activities

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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
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”.
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”.
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
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.
2018	<b>Media Coverage: “UC researchers team up with ODOT to study traffic with drones”</b> [ <a href="#">link</a> ], WCPO-TV, Channel 9 Cincinnati, July 10, 2018
2018	<b>University Research Council (URC) Award, \$5000</b> , Principal Investigator (PI) for the research on “Deep Intelligence for Complex Learning in Robots”
2017-21	<b>Reviewer</b> , Various conferences and journals including <b>ICRA, ACC, DSCC, CDC, ICUAS, ISA Transactions, The Visual Computers</b>