

# Prishita Ray

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## Education

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### Cornell University

*Ithaca, New York, USA*

#### MASTER OF ENGINEERING- COMPUTER SCIENCE, GPA: 3.75/4.0

*Jan 2022 - Dec 2022*

- Master of Engineering Project I: ShadowSense (Advised by Prof. Guy Hoffman)
- Master of Engineering Project II: RL Testbed for Autonomous Robot Navigation (Advised by Prof. Mark Campbell)

Relevant Coursework: Mathematical Foundations of ML, Introduction to Computer Vision, Foundations of Robotics, Principles of Large-Scale ML Systems, Digital Systems Design using Microcontrollers, Grad. Special Topics in Statistics (Graphical Models and Causal Discovery)

### Vellore Institute of Technology

*Vellore, Tamil Nadu, India*

#### BACHELOR OF TECHNOLOGY- COMPUTER SCIENCE AND ENGINEERING, GPA: 9.1/10.0

*Jul 2017 - Jun 2021*

- Merit Scholarship Awardee 2017-18 (GPA: 9.6/10)
- Undergraduate Capstone Project: Efficient Renewable Energy Powered Automatic Water Dam Control System (Advised by Prof. Geraldine Bessie Amali D.)
- Extracurricular Activities: IEEE Computer Society VIT, VIT Music Club

Relevant Coursework: Data Structures and Algorithms, Natural Language Processing, Compilers, Databases, Machine Learning, Data Mining, Networks, Operating Systems, Statistics, Computer Architecture, Digital Logic and Design, Theory of Computation, Microprocessors, Neural Networks

## Research Experience

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### Human Robot Collaboration and Companionship Lab, Cornell University

*Ithaca, NY*

#### ADVISOR: PROF. GUY HOFFMAN

*Feb 2022 - Present*

- Worked on a human-robot interaction project called ShadowSense to deploy a real-time Reachy robot for tracking motion of human subjects from fuzzy live captures and interacting with them in privacy-preserved home environments.
- Transfer Learning was used to retrain an EfficientNet-v2 model on YOLO generated ground truth annotations of a custom recorded blurry image dataset collected using the robot.
- The trained model was then deployed in the robot to predict the bounding boxes of the detected subjects which were then tracked in real-time using concepts in Computer Vision such as stereo matching (of the two eye cameras) and coordinate transformations.
- mIoU scores averaging from 0.6-0.75 and accuracy scores averaging from 0.9-1.0 were obtained across multiple distance-angle combinations of subjects from the robot, new subjects that were not used during training as well as challenging situations when subject foreground and background color are similar.
- Research draft and demos currently under preparation

### Autonomous Systems Lab, Cornell University

*Ithaca, NY*

#### ADVISOR: PROF. MARK CAMPBELL

*Sept 2022 - Present*

- Developed two different Curriculum Learning approaches to train Reinforcement Learning agents that are more robust to adversarial environments for the purpose of Autonomous Racing.
- The Proximal Policy Optimization on-policy RL algorithm was used to train the agents in the Default OpenAI Gym CarRacing Environment and an obstacles variant environment of the same.
- In the first approach, the curriculum was designed to learn a CNN policy for the RL agents, by expressing the agent final reward as a function of 3 epoch-based turnpoints that successively generated more adversarial environments during training, and more-robust curricula were chosen through Bayesian Optimization over the function.
- In the second approach, the curriculum was automatically designed on-the-fly to learn a Multi-Input policy for the RL agents using adversarial environment generation (that used VAE based policy and value networks). The VAE gradient incurred at individual epochs was used to control the adversarial environment difficulty at the immediately following epochs during training.
- Results for the first approach are published at the IROS LRSA 2023 workshop and are under preparation for the second approach.

## **School of Computer Science and Engineering, Vellore Institute of Technology**

Vellore, India

ADVISOR: PROF. GERALDINE BESSIE AMALI D.

Jan 2021- Jun 2021

- Created the prototype of a Real Time Dam Control System using a Raspberry Pi 4B microcontroller that makes use of an intelligent RL scheduler to manage flooding based on real-time sensor readings.
- Experimented with 3 algorithms: Soft Actor Critic with Emphasized Recent Experience and Prioritized Experience Replay (SAC+ERE+PER), Proximal Policy Optimization (PPO) and Natural Evolution Strategies (NES) to choose the best scheduler on a software simulation of the system and deploy on the actual prototype.
- Ensured maximum usage of available renewable resources with lesser pollution while controlling flooding optimally.
- Results published at the IEEE ICAIGE 2023 conference.

## **Indian Space Research Organization (ISRO)- in collaboration with VIT Vellore**

Bangalore, India

ADVISOR: PROF. SANTHI V.

Dec 2020- Jan 2021

- Removed speckle (multiplicative) noise in Synthetic Aperture Radar (SAR) sentinel images using Neuro-fuzzy and Wavelet Transform techniques
- Evaluated the proposed model using the four metrics: Speckle Suppression Index (SSI), Equivalent Number of Looks (ENL), Speckle Mean Preservation Index (SMPI), and Peak Signal to Noise Ratio (PSNR).

## **FrameNet Brasil (as part of Google Summer of Code 2020 project)**

Online

ADVISORS: PROF. TIAGO TIMPONI TORRENT, PROF. ELY EDISON MATOS

Jun 2020- Aug 2020

- Designed an automated annotation framework using identified objects and textual data from multimodal corpora, with the core and non-core frame elements present in the FrameNet database. Results published in the LAW-XVI Workshop, LREC 2022.

## **School of Computer Science and Engineering, Vellore Institute of Technology**

Vellore, India

ADVISOR: PROF. KAKELLI ANIL KUMAR

Dec 2019- Mar 2020

- Performed multiclass classification of network intrusion malwares by extracting relevant features from log files of running processes in the web server system using variants of autoencoders and the FSFC Clustering algorithm.
- Used those features to classify each malware using limited labeled examples for training through Ladder Networks.
- The combined RAELN classifier using L2-Regularized Autoencoders and semi-supervised Ladder Networks obtained 81% overall classification accuracy and better per-class accuracies over 10 malware classes of the UNSW-NB15 Malware Dataset compared to baseline fully supervised Ladder Networks and SOTA classifiers such as Random Forest and Naive Bayes, and 74% overall classification accuracy over 4 malware classes of the NSL-KDD Malware Dataset
- Results published at the ICIIC 2021 conference.

## **Computer Science and Automation Department, Indian Institute of Science**

Bangalore, India

ADVISOR: PROF. SHALABH BHATNAGAR

May 2019- Jul 2019

- Proposed a Multi-Agent Reinforcement Learning solution for demand and supply management in Microgrids using the RapSim simulator, using two DQN networks for scheduling of jobs (ADL Network) and trading energy (ET network) through a Dynamic Pricing scheme.
- The Dynamic Pricing model returned higher average rewards than the Constant Pricing model for most microgrids each of which had different energy-generating capabilities.
- Microgrids quoted suitable selling prices for energy exchange based on various factors, to maximize overall profits and engaged in energy trading with other microgrids
- Impending ADL demands were scheduled judiciously in order to shift the load from peak demand time slots and minimize incurred penalty.
- Results published at the ISGT Europe 2020 conference.

## **Publications**

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### **CONFERENCE PROCEEDINGS- PEER REVIEWED**

**Ray, P.,** Bessie Amali D., G. 2023. An Intelligent RL-based Scheduler to Control Flooding in a Renewable Energy powered Automatic Water Dam control system. IEEE International Conference on Artificial Intelligence and Green Energy 2023.

**Ray, P.,** Nandan, T., Anne, L., Anil Kumar, K. 2021. A New Combined Model with Reduced Label Dependency for Malware Classification. 3rd International Conference on Integrated Intelligent Computing Communication & Security (ICIIC 2021).

**Ray, P.,** Kaluri, R., Reddy, T., Lakshmana, K. 2021. Contemporary Developments and Technologies in Deep Learning-Based IoT. Deep Learning for Internet of Things Infrastructure, Taylor and Francis, 61-82, 2021.

Nayak, S., Ajit Ekbote, C., Pratap Singh Chauhan, A., Bharadwaj Diddigi, R., **Ray, P.,** Sikdar, A., Koti Reddy Danda, S., Bhatnagar, S. 2020. Stochastic Game Frameworks for Efficient Energy Management in Microgrid Networks. 2020 IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), 116-120

## WORKSHOPS

**Ray, P.\***, Banerjee, R.\*, Campbell, M. 2023. Improving Environment Robustness of Deep Reinforcement Learning Approaches for Autonomous Racing Using Bayesian Optimization-based Curriculum Learning. Learning Robot Super Autonomy Workshop at International Conference on Intelligent Robots and Systems (IROS) 2023.

Belcavello, F., Viridiano, M., Edison Matos, E., Timponi Torrent, T. 2022. Charon: a FrameNet Annotation Tool for Multimodal Corpora. Proceedings of the 16th Linguistic Annotation Workshop (LAW-XVI) @LREC 2022.  
Acknowledged for GSoC 2020 Contribution.

## IN REVIEW AND PREPARATION

**Ray, P.\***, Hu, Y.\*, Hoffman, G. ShadowSense: Vision-Based Privacy-Preserving Human-Robot Interaction. (Under Preparation)

**Ray, P.\***, Banerjee, R.\*, Campbell, M. Dynamic Curriculum Design of Robust Deep Reinforcement Learning Approaches for Autonomous Racing from Latent Representations. (Under Preparation)

Google Scholar Link: <https://scholar.google.com/citations?user=kapU0vUAAAAJ&hl=en>

Link to publications: [https://drive.google.com/drive/folders/1\\_Lc83JIB78u00w9NZXAkEWPWFHoSc2Ta](https://drive.google.com/drive/folders/1_Lc83JIB78u00w9NZXAkEWPWFHoSc2Ta)

## Honors, Awards & Fellowships

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- 2022 **Academic Excellence Recognition- Spring 2022 (GPA: 3.9/4.0)**, Computing and Information Sciences Department, Cornell University
- 2021 **Best Paper Award**, 3rd International Conference on Integrated Intelligent Computing Communication & Security (ICIIC)
- 2020 **Google Summer of Code (GSoC)**, Google
- 2019 **Summer Research Fellowship (SRFP)**, Indian Academy of Sciences
- 2018 **VIT Academic Merit Scholarship (Branch Rank 4, GPA: 9.6/10.0)**, Vellore Institute of Technology
- 2015 **National Talent Search Examination (NTSE) Scholarship**, Department of State Education and Training (DSERT), Karnataka

Link to certificates: [https://drive.google.com/file/d/18fFbE\\_ypz-dlJuK7udW18Yo6J4lBpLyd/view?usp=sharing](https://drive.google.com/file/d/18fFbE_ypz-dlJuK7udW18Yo6J4lBpLyd/view?usp=sharing)

## Service

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**NES Division Lead: BrainGenix, Carboncopies Foundation (2022)** Serving as the lead of the Neuron Emulation System division at BrainGenix.

**Peer Reviewer: Journal of Network and Systems Management (2020)** Served as a reviewer in their special issue for Cybersecurity management in the era of AI.

## Skills

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### Deep Learning

Frameworks: PyTorch, TensorFlow, Keras, ROS3, StableBaselines3

Domains: Reinforcement Learning, Robotics, Computer Vision

**Microcontrollers and Microprocessors:** Raspberry Pi, Arduino Uno, Intel 8086, Keil MicroVision, PIL

**Programming:** Python, C, C++, Java, Matlab, R

**Languages:** English, French, Hindi, Bengali