

# Vardhan Dongre

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## EDUCATION

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### University of Illinois Urbana-Champaign

Urbana, IL

Doctor of Philosophy in Computer Science; **GPA: 3.74 / 4.00**

Aug 2023 – May 2027

Master of Science in Computer Science; **GPA: 3.74 / 4.00**

Aug 2020 – May 2022

### National Institute of Technology, summa cum laude

Bhopal, India

Bachelors of Technology in Civil Engineering; **GPA: 8.92/10.00**

Jul 2013 – Apr 2017

## RESEARCH EXPERIENCE

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### Brunswick Corporation I-Jet Lab

Champaign, IL

Research Engineer Intern (Robotics | Computer Vision)

July 2022 – Aug 2023

- **Project 1:** Multi-modal Representation Learning for Scene understanding and robot planning
  - \* Developed a metric-semantic slam software using inputs of RGB-D camera and IMU sensors for marine perception [ [Demo 1](#) | [Demo 2](#) ]
  - \* Improving scene interpretation using natural language acoustic and visual messages from sensors.
- **Project 2:** Unsupervised computer vision for robot perception

### Center for Informatics Research in Science and Scholarship

Urbana-Champaign, IL

Visiting Research Student, Advisor: Dr. Bertram Ludäscher

May 2023 – Aug 2023

- Integrating scientific, structured knowledge in Large Language Models for scholarly applications

### University of Illinois

Urbana-Champaign, IL

Course Director, MCS-Data Science & Coursera

Aug 2021 – May 2023

- Created data curation framework & built ontologies for knowledge discovery through graphs in scientific datasets
- Designed programming modules on data anonymization and encryption frameworks for user privacy based on hashing strategies, differential privacy and GDPR standards

### Brunswick Corporation I-Jet Lab

Champaign, IL

Computer Vision & Deep Learning Engineer Intern

May 2021 – Aug 2021

- Performed data acquisition expedition to support object detection & segmentation tasks in marine environments
- Developed data labeling pipeline on azure ml to create bounding boxes & segmentation masks in coco format
- Configured GPU and FPGA based hardware accelerators for experimenting model performance on marine vessels
- Deployed object detection and semantic segmentation models to ARM based SBC edge devices for prototyping and experimentation

## AWARDS & ACHIEVEMENTS

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**Ashby Prize in Computational Science:** For accelerating atmospheric aerosol state estimation through reduced order ML models on petascale computers [ [Statement](#) ], [ [Announcement](#) ]

**NCSA-NVIDIA Hackathon:** 1st Prize for developing segmentation algorithm for NASA Terra-MODIS satellite imagery product [ [Statement](#) ], [ [Announcement](#) ]

**US DOE Build Challenge 2020:** Illinois Solar Decathlon, Adapthaus project among top 5, received \$130,000 fund for on-site development. [ [Project](#) ]

**Department Silver Medalist, National Institute of Technology:** Awarded silver medal for outstanding academic performance in the class of 2017 from Department of Civil Engineering.

## PROJECTS (SELECTED)

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### Capturing Event Dynamics using Knowledge Augmented Language Modeling

- Utilizing Dynamic Knowledge graphs and LLMs for reliable QA on fast evolving events.

### Deep Reinforcement Learning on Atari Games

- Implemented DDQN and A2C on Atari game breakout for comparative analysis
- Developed an off policy counter for on-policy approach of A2C

### Reduced Order ML emulator for estimating atmospheric aerosols mixing states

- Developed a bi-directional lstm emulator trained on features extracted from particle resolved model Part-MOSAIC
- Performed grid based and bayesian optimized hyperband search for hyperparameter tuning to boost model performance

### Deep Learning Assisted Camera Pose Estimation for Visual Odometry [ [github](#) ] [ [Demo](#) ] [ [video ppt](#) ]

- Implemented pose estimation module using classical geometry, SIFT and RANSAC algorithms
- Developed a self-supervised Encoder-Decoder model for simultaneous keypoint detection & description

### Attention based visual-inertial feature fusion for robust pose estimation [ [github](#) ]

- Developed a encoder – fusion – regressor framework with ResNet backbones for estimating camera pose
- Trained pose regression model on fused encodings obtained from image frames based on *MAE* and imu features from *RoNIN*

### Performance Predictors for Meta-Learning and AutoML

- Developed a seq2seq model for predicting model performance based on model architecture information and initialization statistics
- Model achieved 97%  $R^2$  score with no loss in performance metric on several other datasets

### ResNet CNN with Distributed SGD: Synchronous & Asynchronous training [ [github](#) ]

- Implemented the distributed stochastic gradient descent algorithm for training a Deep Residual Convolutional Neural Network model on the CIFAR-100 dataset

### Domain guided neural network for structural topology optimization [ [PPT1](#) ] [ [PPT2](#) ]

- Experimented with deep generative methods to obtain optimal space fillings by conditioning latent space representations of sub-optimal topologies
- Developed ML algorithm for predicting intermediate sensitivity values from local state features obtained from PDE solver

## PEER REVIEWED PAPERS AND TECHNICAL REPORTS

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- **Dongre V**, Hora G, Evaluating Uncertainty Quantification approaches for Neural PDEs in scientific application [ [AI4Science NeurIPS 2023 workshop](#) ] [ [Paper](#) ]
- **Dongre V**, Singh R, DeFilippo M, Sacarny M, MIT-Brunswick Open-Sea Dataset for Marine Perception and Scene Understanding [ [Manuscript in progress](#) ]
- **Dongre V**, Reddeddy N, Thimma A, Adaptive re-calibration of channel-wise features for Adversarial Audio Classification [ [ArXiv Paper](#) ] [ [github](#) ]
- **Dongre V**, Haldar R, DeepFake Video Detection by Exploiting Spatio-Temporal features [ [Report](#) ]
- **Dongre V**, Haldar R, Detecting Robust Adversarial Audio Signals that Evade Detectors [ [Report](#) ] [ [PPT](#) ]
- **Dongre V**, Núñez J, Attention based visual-inertial features fusion for robust pose estimation: [ [Report](#) ] [ [PPT](#) ]

## RESEARCH PRESENTATIONS

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- EfficientDet: Scalable and Efficient Object Detection: Efficient & Predictive Vision [ [PPT](#) ]
- Stochastic Scene-Aware Motion Prediction (SAMP): Efficient & Predictive Vision [ [PPT](#) ]
- Learning to segment rigid motions from two frames: Advanced Computer Vision [ [PPT](#) ]
- Representation learning from 3D Point Clouds: Advanced Computer Vision [ [PPT](#) ]
- Efficient task specific data valuation for nearest neighbor algorithms: Topics in adversarial machine learning [ [PPT](#) ]
- DeepXplore automated whitebox testing of deep learning systems: Special Topics on Machine Learning for Systems, Networks & Security [ [PPT](#) ]
- MagNet: a two-pronged defense against adversarial examples: Special Topics on Machine Learning for Systems, Networks & Security [ [PPT](#) ]
- Multi-modal Perception: Brunswick R&D [ [PPT](#) ]

## TEACHING EXPERIENCE

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### University of Illinois

Graduate Teaching Assistant

Urbana-Champaign, IL

Aug 2019 – Dec 2020

- CS 598 Data Curation:
  - \* Co-Instructed and Developed an advanced data science course on data curation and knowledge representation in scientific datasets, handling data bias and explainability of ML models for a class of **350** graduate students
  - \* Maintained general oversight of 7 TA's and 14 graders
- CEE 201 Systems Engineering: Developed instructional material on optimization methods and graph algorithms including Dijkstra, TSP and Bellman Ford algorithm

## STUDENT MENTORSHIP

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- Felix D. AP Comp Sci A Languages program: **Lightweight Diffusion Models for Anime Art** [Ongoing]
- Sanchay D. American High, California, **Investigating applications of Foundation models in visual-language navigation** [Ongoing]
- James Lin, The Harker School, California, USACO (Silver, 750 on recent US Open): **Fast Object Detection methods for real-time PPE gear at workplace** [Completed]

## COURSEWORK (SELECTED)

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- ABE 598: Autonomous Decision Making
- CS 445: Computational Photography
- CS 446: Machine Learning (Theory)
- CS 547: Deep Learning
- CS 598: Advanced Computer Vision
- CS 598: Efficient & Predictive Vision
- CS 545: Machine Learning for Signal Processing
- CS 565: HCI: Cognitive Engineering
- CS 598: Adversarial Machine Learning
- CS 598: ML for Systems, Networks & Privacy
- CEE 472: Structural Dynamics
- ECE 544: Pattern Recognition

## SKILLS

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**Programming:** C++, Python, MATLAB, R, PHP, OWL, Shell Scripting

**Technologies:** Git, CUDA, ROS, Simulink

**Libraries:** Opencv, NumPy, PyTorch, TensorFlow, Scikit-Learn

**Databases:** SQL, MongoDB, Neo4j

**Graphics:** Blender, Autocad, Revit, Unreal Engine

## REFERENCES

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- Dr. John F. Reid, Research Professor, Computer Science, UIUC [Profile](#) / [j-reid1@illinois.edu](mailto:j-reid1@illinois.edu)
- Dr. Bertram Ludäscher, Professor & Director, Center for Informatics Research, UIUC [Profile](#) / [ludaesch@illinois.edu](mailto:ludaesch@illinois.edu)
- Mr. Trevor George, Associate Director, Brunswick Corporation I-Jet Lab [Profile](#) / [trevor.george@brunswick.com](mailto:trevor.george@brunswick.com)
- Dr. Jason Arbuckle, Marine Autonomy Technology Lead, Brunswick Corporation [Profile](#) / [jason.arbuckle@brunswick.com](mailto:jason.arbuckle@brunswick.com)