# ABHINAV AGRAWAL

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Probabilistic Machine Learning | Approximate Inference | Generative Modeling

## EDUCATION

| | | |
|---|---|---|
| University of Massachusetts Amherst<br>MS - Ph.D. | Computer Science | 2018 - Present |
| Indian Institute of Technology Kanpur<br>Bachelor of Technology | Electrical Engineering | 2014 - 18 |

## PUBLICATIONS

[1] **Abhinav Agrawal**, Justin Domke. Amortized Variational Inference for Hierarchical Distributions. In Proceedings of *35th Annual Conference on Neural Information Processing Systems, NeurIPS, 2021*.

Paper

[2] **Abhinav Agrawal**, Daniel Sheldon, Justin Domke. Advances in Black-Box VI: normalizing flows, importance weighting, and optimization. In Proceedings of *34th Annual Conference on Neural Information Processing Systems, NeurIPS, 2020*.

Paper | Package </> | Slides | Poster

[3] Edmond Cunningham, Renos Zabounidis, **Abhinav Agrawal**, Ina Fiterau, Daniel Sheldon. Normalizing Flows Across Dimensions. In *Second workshop on Invertible Neural Networks, Normalizing Flows, and Explicit Likelihood Models, ICML, 2020*.

Paper | Slides

## RESEARCH EXPERIENCE

### GRADUATE RESEARCH ASSISTANT

Advisor: Prof. Justin Domke, University of Massachusetts Amherst — May'20 - Present

- **Aim:** To scale variational inference to large hierarchical models
- Developed a scalable inference approach that is as accurate as full-rank Gaussians on large hierarchical models

### GRADUATE RESEARCH ASSISTANT

Advisor: Prof. Justin Domke, University of Massachusetts Amherst — May'19 - Jan'20

- **Aim:** To develop a robust black-box variational inference scheme
- Curated an approach that achieves state-of-the-art inference with minimal user-intervention
- Developed an open-source library–*vistan*–to allow for easy access to proposed approaches

Paper | Package </>

### GRADUATE RESEARCH ASSISTANT

Advisor: Prof. Justin Domke, University of Massachusetts Amherst — Jul'18 - Jan'19

- **Aim:** To develop a hierarchical graphical model to infer time evolving user preferences
- Answered critical data-requirements-queries using inferred user-utilities from the developed model

Poster

### UNDERGRADUATE RESEARCH ASSISTANT

Advisor: Prof. Vinay P. Namboodiri, IIT Kanpur — Dec'17 - May'18

- **Aim:** To leverage generative models for learning transferable representations across two domains
- Developed a novel architecture to learn task-independent transferable representations

Report | Slides

### UNDERGRADUATE INTERN

Advisor: Prof. Latifur Khan and Prof. Vincent Ng, UT Dallas — May'17 - Aug'17

- **Aim:** To develop a classification/annotation pipeline for text corpora with class imbalance
- Captured semantics with an improved annotation pipeline and bettered classification using data-augmentation

Slides

## INDUSTRY EXPERIENCE

### APPLIED SCIENTIST

Amazon, Personalization, Repeat Purchase Team — May'21 - Sep'21

Interned with the repeat purchase team to improve "Buy-it-again" recommendations for Amazon retail

## REVIEWER

- Neural Information Processing Systems, NeurIPS (2019*, 2020, 2021)
- International Conference on Machine Learning, ICML, (2020, 2021)
- International Conference on Learning Representations, ICLR, 2021

* among top 50% reviewers

## RELEVANT PROJECTWORK

### HUMAN PART SEGMENTATION THROUGH WEAK SUPERVISION
Instructor: Prof. Vinay P. Namboodiri, CSE, IIT Kanpur — Aug'17 - Dec'17

- **Aim:** To leverage human pose annotation as weak supervision for body-part segmentation
- Developed an end-to-end fully convolutional model to jointly estimate pose-points and predict part segmentation

Report | Poster

### IMPROVING INFERENCE IN VARIATIONAL AUTOENCODERS
Instructor: Prof. Piyush Rai, CSE , IIT Kanpur — Aug'17 - Dec'17

- **Aim:** To introduce more flexible and efficient proposal distributions for VAEs
- Augmented the standard VAE architecture with real non volume preserving(rNVP) coupling layers

Report | Slides

### SELECTIVE BLUR USING EXTREME POINT ANNOTATION
Instructor: Prof. Tanaya Guha, EE, IIT Kanpur — Aug'17 - Dec'17

- **Aim:** To develop a motion blur application for natural images, requiring minimal user annotation
- Extended boundary detection in an existing approach with adaptive Gaussian weighted edge maps

Report

## OTHER EXPERIENCE

### TEAM MEMBER
PhD Applicant Support Program, University of Massachusetts Amherst — Nov'20 - Present

Helped conduct the support program for PhD applicants from under-represented backgrounds.

### TEACHING ASSISTANT
Probabilistic Graphical Models, University of Massachusetts Amherst — Spring'19, '20, '21

Held regular office hours and prepared lecture notes for graduate course on *Probabilistic Graphical Models*

### ACADEMIC MENTOR
Introduction to Electrodynamics, IIT Kanpur — Aug'15 - Aug'16

Conducted remedial classes and one-to-one mentoring sessions for academically deficient freshmen

## PROGRAMMING SKILLS

Jax, Numpyro, Pandas, Jupyter Notebooks, Plotnine, PyTorch, TensorFlow, R, GGPlot, Git, Dockers, VSCode

## SCHOLARLY ACHIEVEMENTS

2017 Received Academic Excellence Award by IIT Kanpur for the year 2014-15, 2015-16, & 2016-17
2016 Secured **Overall Winner** in Google Devfest for Course Recommendation web-app
2015 Received **Best** Overall Project for 2D shape replicator prototype
2014 Secured **99.86** percentile in JEE Mains 2014 from amongst 1.4 milllion candidates
2014 Awarded **Gold Medal** by SRDAV PUBLIC SCHOOL for 7 years of consecutive excellence

## COURSEWORK

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|---|---|---|
| MATHEMATICS & MACHINE LEARNING | Probabilistic Machine Learning | Natural Language Processing |
| | Reinforcement Learning | Linear Algebra and ODE |
| | Advanced Algorithms | Real Analysis |
| | Convex Optimization | Statistics I & II |
| VISION & IMAGE PROCESSING | Topics in Computer Vision | Principles of Communication |
| | Visual Recognition | Digital Image Processing |
| | Signals, Systems and Networks | Representation of Images |