Puneesh Deora

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Education

M.A.Sc., University of British Columbia 2022-Present
Major: Electrical and Computer Engineering
Advisor: Prof. Christos Thrampoulidis

B. Tech., Indian Institute of Technology Roorkee 2016-2020
Major: Electronics and Communication Engineering
Thesis: Compressive Sensing MRI Reconstruction using GANs
Advisors: Prof. Saumik Bhattacharya & Prof. P. M. Pradhan

Interests

Theoretical machine learning (ML), Optimization

Selected Publications

1. **P. Deora***, R. Ghaderi*, H. Taheri*, C. Thrampoulidis. On the Training and Generalization of Multi-head Attention, in *TMLR, and HiLD at ICML 2023*.
2. **P. Deora***, B. Vasudeva*, C. Thrampoulidis. Implicit Bias and Convergence Rates for Self-Attention. (to be submitted to NeurIPS)
3. **P. Deora***, B. Vasudeva*, V. Sharan, C. Thrampoulidis. Fast Test Error Rates for Gradient-based Algorithms on Separable Data, in *HiLD at ICML 2023, and ICASSP 2024*.
4. **P. Deora**, C. Thrampoulidis. On weighted cross-entropy for label-imbalanced separable data: An algorithmic-stability study, in *ICASSP 2023*.
5. B. Vasudeva*, **P. Deora***, S. Bhattacharya, P. M. Pradhan. Compressed Sensing MRI Reconstruction with Co-VeGAN: Complex-Valued Generative Adversarial Network, in *WACV 2022*.
6. B. Vasudeva*, **P. Deora***, S. Bhattacharya, U. Pal, S. Chanda. LoOp: Looking for Optimal Hard Negative Embeddings for Deep Metric Learning, in *ICCV 2021*.
7. **P. Deora***, B. Vasudeva*, S. Bhattacharya, P. M. Pradhan. Structure Preserving Compressive Sensing MRI Reconstruction using Generative Adversarial Networks, in *CVPR Workshops 2020*.

(*equal contribution)

Research Experience

Graduate Research Assistant UBC
Advisor: Prof. Christos Thrampoulidis Jan'22 - Present

- Developed finite-time generalization bounds for re-weighted losses (label-imbalanced data) with GD training using algorithmic stability tools. Paper
- Worked on developing training convergence and generalization bounds for multi-head attention under NTK Separability. Paper
- Established global convergence rates for implicit bias of self-attention with GD.

Visiting Researcher ISI Kolkata
Advisors: Prof. Saumik Bhattacharya & Prof. Umapada Pal June'20 - Sep'21

- Analyzed the gradients of various deep metric learning losses and proposed a novel loss. Paper
- Proposed to find optimal hard negatives for deep metric learning loss functions. Obtains upto 7.2% increase in retrieval, 5.8% increase in clustering performance. Paper | Slides
- Designed an ISP-inspired model for RAW to RGB conversion. Ranked 4^{th} in mean opinion score in an AIM workshop challenge, ECCV 2020. Code | Paper

Undergraduate Researcher (Bachelor's Thesis) IIT Roorkee
Advisors: Prof. Saumik Bhattacharya & Prof. P. M. Pradhan June'19 - July'20

- Developed a novel complex-valued GAN framework for reliable reconstruction of both magnitude and phase content of compressed sensing MR images. Uses significantly fewer ($\sim$77$\times$) parameters, obtains upto 15.7% increase in PSNR as compared to real-valued approaches. CODE | PAPER | SLIDES
- Worked on a GAN-based model aiming to preserve the structural content in the reconstructed CS-MR images. Obtains upto 8.2% increase in PSNR. CODE | PAPER

Undergraduate Researcher IIT ROORKEE
Advisors: Prof. P. M. Pradhan & Prof. S. Dasgupta MAY'18 - NOV'18
- Worked on the FPGA Implementation of a fetal heart rate monitoring system. PAPER

OTHER PROJECTS

- Invariant Risk Minimization and its failure cases [REPORT] UBC | Spring'22
- Low-light Image Enhancement [CODE | REPORT] IIT Roorkee | Spring'19

AWARDS AND ACHIEVEMENTS

2024 UBC Four Year Doctoral Fellowship (4YF)
2021 Selected for the **Eastern European Machine Learning (EEML)** Summer School
2020 Singhal's Tech. for Society Award for **best Bachelor's thesis** at institute level
2020 Finalist INAE Innovative Student Projects Award **for Bachelor's thesis**, 30 nominations nationwide
2020 3AI Pinnacle Student of the Year Award **for Bachelor's thesis**
2016 IIT JEE Advanced **All India Rank 1123**, 99.4 percentile

SKILLS

Prog. Languages Python, C++
Libraries & Tools PyTorch, TensorFlow, Keras, Matlab, Git, LaTeX

SERVICE

Volunteer ICLR 2021, ICML 2021
Reviewer NeurIPS 2023, ICLR 2024

TEACHING EXPERIENCE

TA, Spring'23 ELEC221: Signals and Systems

COURSES

Graduate Statistical Learning Theory, Convex Optimization, Causal ML, High-dimensional probability
Undergraduate Deep Learning, Digital Image Processing, Digital Signal Processing, Probability & Statistics Maths.-I (Matrix Algebra, Vector Calculus), Mathematical Methods (Solving ODEs & PDEs), Fundamentals of Object Oriented Programming, Data Structures