

# 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 *Workshop on High-dimensional Learning Dynamics, ICML 2023*. (Under review in TMLR)
2. **P. Deora\***, B. Vasudeva\*, C. Thrampoulidis. Implicit Bias and Convergence Rates for Self-Attention. (to be submitted to ICML 2024)
3. **P. Deora\***, B. Vasudeva\*, V. Sharan, C. Thrampoulidis. Fast Test Error Rates for Gradient-based Algorithms on Separable Data, in *Workshop on High-dimensional Learning Dynamics, 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

Advisor: Prof. Christos Thrampoulidis

UBC

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

Advisors: Prof. Saumik Bhattacharya & Prof. Umapada Pal

ISI KOLKATA

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<sup>th</sup> in mean opinion score in an AIM workshop challenge, ECCV 2020. [CODE](#) | [PAPER](#)

### Undergraduate Researcher (Bachelor's Thesis)

Advisors: Prof. Saumik Bhattacharya & Prof. P. M. Pradhan

IIT ROORKEE

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

*Advisors: Prof. P. M. Pradhan & Prof. S. Dasgupta*

IIT ROORKEE  
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

- 2022, 2023 Awarded the UBC International Tuition Award
- 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