

KATYANI SINGH

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EDUCATION

Doctor of Philosophy, Computing Science **2025 – Present**

University of Alberta, Edmonton AB

GPA: 4.0/4.0

Supervisor: Dr. Nidhi Hegde

Thesis Focus: Fairness, Optimization, Robustness, and Transparency in Vision-Language Models

Master of Science, Computing Science (Thesis-based) **2021 – 2023**

University of Alberta, Edmonton AB

GPA: 3.9/4.0

Supervisor: Dr. Nilanjan Ray

Thesis: [Unsupervised Document Image Denoising for OCR](#)

Research Focus: Unpaired Document Image-translation using Generative Adversarial Networks

Bachelor of Technology, Computer Engineering **2016 – 2020**

MPSTME, NMIMS University, India

Rank: 2/120

RESEARCH EXPERIENCE

Graduate Research Assistant (PhD) **2025 – Present**

University of Alberta, Department of Computing Science

Edmonton, AB

Supervisor: Dr. Nidhi Hegde

- Conducting doctoral research on fairness, robustness, and transparency in vision-language models.
- Developing principled debiasing methods leveraging distributionally robust optimization (DRO) across multimodal architectures.

Graduate Research Assistant (MSc) **May 2021 – July 2023**

University of Alberta, Department of Computing Science

Edmonton, AB

Supervisor: Dr. Nilanjan Ray

- Conducted thesis research on unsupervised document image enhancement for OCR, funded by [Intuit Inc.](#) and [NSERC](#).
- Developed novel framework for unpaired image-to-image translation, achieving **state-of-the-art** results with **16.39% OCR improvement**. Published in IJDAR 2024.

Computer Vision Researcher **August 2020 – December 2020**

Eigenlytics Data Solutions Pvt. Ltd.

India

- Designed end-to-end OCR system for financial documents, **improving text localization accuracy by 28%** through adaptive morphological operations and layout-aware segmentation.

Computer Vision Researcher **April 2019 – February 2020**

iPing Data Labs LLP

India

- Proposed a novel model for defect detection in thermal insulation materials, **enhancing bubble detection accuracy by 32%** through adaptive filtering.

Machine Learning Researcher
Ytrre Software Solutions Pvt. Ltd.

May 2019 – June 2019
India

- Developed multimodal document understanding framework using LayoutLM-based classification, **achieving 89% classification accuracy** on heterogeneous document corpora.

INDUSTRY EXPERIENCE

Machine Learning / Computer Vision Scientist
Nextech3D.ai

2023 – 2025

- Architected text-to-image virtual photography pipeline using latent diffusion models with custom relighting, achieving photorealistic 4K product integration for major retail clients.
- Designed image-to-3D reconstruction system combining diffusion priors with NeRF, enabling high-fidelity 3D asset generation from single images.
- Built multimodal retrieval systems for 3D assets using contrastive learning, **improving search accuracy by 35%**.
- Deployed vision-language models (BLIP, InstructBLIP) for automated product metadata generation, **reducing manual annotation time by 80%** with **92% accuracy**.

TEACHING EXPERIENCE

Teaching Assistant, CMPUT 200: Ethics of Data Science and AI
University of Alberta, Department of Computing Science

Jan – Apr 2026
Edmonton, AB

Teaching Assistant, CMPUT 566: Introduction to Machine Learning
University of Alberta, Department of Computing Science

Sep – Dec 2025
Edmonton, AB

Teaching Assistant, CMPUT 175: Foundations of Computation 2
2022

University of Alberta, Department of Computing Science

Sep 2021 – May

Edmonton, AB

Teaching Assistant, CMPUT 101: Introduction to Computing
University of Alberta, Department of Computing Science

Sep 2021 – May 2022
Edmonton, AB

PUBLICATIONS

Singh K et al. Debiasing Language Models using Distributionally Robust Optimization. *Under Review*, 2026.

Singh K, Ray N. Unpaired Document Image Denoising for OCR using BiLSTM enhanced CycleGAN. *International Journal on Document Analysis and Recognition (IJDAR)*, 2024. [\[Link\]](#)

Singh K, Ray N. Document Image Cleaning using Budget-Aware Black-Box Approximation. *arXiv*, 2023. [\[Link\]](#)

Singh K et al. A Comprehensive Review of Convolutional Neural Network based Image Enhancement Techniques. *IEEE ICSCAN*, 2019. [\[Link\]](#)

RESEARCH PROJECTS

Fairness-Aware Synthetic Healthcare Data Generation

Formulated GAN-based framework for generating synthetic tabular healthcare data with provable fairness guarantees through multi-objective optimization. Demonstrated **40% reduction in demographic disparity** while maintaining **95% downstream task performance**.

Privacy-Utility-Fairness Tradeoffs in Synthetic Data

Conducted systematic empirical investigation comparing Tabular GAN, CTGAN, and PATE-GAN, characterizing fundamental tradeoffs between differential privacy guarantees, utility preservation, and fairness metrics.

Self-Supervised Learning for Brain MEG Signal Representation

Extended BENDR architecture with novel pretraining objectives combining Contrastive Predictive Coding (CPC) and masked language modeling. Demonstrated **15% improvement** in downstream classification tasks on limited labeled MEG data.

Neural Ensembles for Contextual Bandits

Proposed NE-TS and NE-UCB, novel algorithms leveraging ensemble neural networks with bootstrap resampling for uncertainty quantification in sequential decision-making. Comprehensive empirical evaluation characterized computational-performance tradeoffs for contextual bandit applications.

PROFESSIONAL DEVELOPMENT

AI Career Accelerator Participant

May 2022 – October 2022

Alberta Machine Intelligence Institute (AMII)

- Collaborated with AMII startup team ML scientists as domain expert, consulting startups through ML adoption journeys including problem identification, evaluation, and proof-of-concept planning and execution.

CIFAR Deep Learning + Reinforcement Learning Summer School

2024

AWARDS

Winner, Smart India Hackathon

2019

Developed autonomous invoice processing platform using RPA and deep learning; selected as **top solution among 10,000+ participants** nationwide.

TECHNICAL SKILLS

Programming	Python, C++, SQL
Deep Learning	PyTorch, PyTorch3D, Open3D, TensorFlow, JAX, CUDA
ML/CV Libraries	NumPy, Pandas, SciPy, Scikit-learn, OpenCV, Hugging Face
Specialized	Diffusion Models, GANs, NeRF, Vision-Language Models, DRO, Fairness Metrics
Cloud & Tools	Git, Google Cloud Platform, Azure, Weights & Biases, Docker