

Nishka Katoch

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ML engineer specialising in medical imaging, computer vision and production systems. Published at MICCAI 2024 on domain adaptation. Built scalable pipelines, curated large-scale datasets and contributed to open-source frameworks used by 200+ researchers. Canadian work permit holder, open to working across different locations.

TECHNICAL SKILLS

Languages: Python, C++, Java, SQL, HTML/CSS, JavaScript

Tools: Linux, Git, Jupyter, SSH, ROS, Unity, Docker, Ivadomed, MuJoCo, Django, PostgreSQL, Milvus, AWS

ML/DL Frameworks: PyTorch, TensorFlow, MONAI, Pandas, NumPy, Scikit-learn, Hugging Face, Ivadomed, AxonDeepSeg

Specialized: Computer Vision, Generative Models, Medical Imaging, Applied ML

EDUCATION

M.Sc., Computer Science (ML & AI Thesis) – University of Montréal (Mila)

Sep 2021 – Aug 2025

- **Supervisor:** Prof. Julien Cohen-Adad and Prof. Guy Wolf
- **Thesis:** Multi-Contrast Image-to-Image Translation for Axon and Myelin Segmentation

B.Tech., Computer Science – Banasthali University

Jul 2017 – May 2021

EXPERIENCE

Maker's Lab, Tech Mahindra - AI Research Intern

Aug 2025 – Oct 2025

- Benchmarked 15 embedding models for RAG systems, optimising retrieval latency from 850ms to 180ms (79% reduction) whilst maintaining 94% accuracy across 50,000 documents.
- Built production ML pipelines with Docker and Milvus handling 1,000+ daily queries with 99.2% uptime over 8-week testing period.
- Implemented monitoring system tracking model performance, latency and error rates in real-time.
- Developed data quality frameworks detecting duplicates and content issues, improving accuracy by 8% through strategic filtering.
- Investigated quantum-enhanced deepfake detection, designing 4-qubit and 8-qubit parameterised quantum circuits integrated with Vision Transformers as exploratory research.

NeuroPoly Lab, Polytechnique Montréal - Graduate Researcher

Jan 2022 – Aug 2025

- Developed deep learning models for axon and myelin segmentation in histology images, enabling large-scale automated morphometry analysis for neuroimaging workflows.
- Built and curated datasets from 2,000+ histology samples across 3 imaging modalities (TEM, SEM, brightfield), establishing annotation protocols achieving 95% accuracy.
- Created SyncDiff-based domain adaptation pipeline improving segmentation accuracy by 12% on out-of-distribution data (published MICCAI 2024), reducing annotation requirements by 80%.
- Built MONAI-based pipelines deployed across 5 research projects, reducing training time by 40% and inference time by 35% through optimisation.
- Investigated privacy-preserving synthetic data generation using latent diffusion models, achieving 80% Dice score without requiring previous labels.
- Contributed to Ivadomed and AxonDeepSeg open-source frameworks used by 200+ researchers globally, adding features and improving documentation.

Custom Quality Build - AI Intern

Apr 2024 – Mar 2025

- Built computer vision pipeline using SAM for furniture segmentation and Stable Diffusion for design variations, processing 500+ images for client projects.
- Reduced segmentation time from 45 to 8 seconds per image (82% reduction) through model optimisation, batching and quantisation.
- Designed REST API with FastAPI serving 200+ daily active users, implementing quality control achieving 95% client satisfaction.
- Optimised inference pipeline using TorchScript compilation, reducing memory footprint by 50%.

Maker's Lab, Tech Mahindra - ML Research Intern

Dec 2023 – Jan 2024

- Developed Hindi ASR system achieving 91% accuracy across 5 regional dialects.
- Conducted comparative analysis of 20+ ASR architectures (wav2vec2, Vakyansh), identifying optimal approaches for Indic languages.
- Curated and annotated 100+ hours of Hindi speech data across multiple dialects, establishing annotation guidelines.

Centre for Railway Information Systems (CRIS) - Web App Development Intern

Jun 2020 – Nov 2020

- Developed 4 production Django modules serving 200+ daily users, reducing manual processing time by 65% through workflow automation.
- Optimised PostgreSQL database schemas through normalisation and indexing, reducing data redundancy by 60% and improving query performance by 40%.
- Implemented automated testing suite achieving 85% code coverage, reducing production issues by 70%.
- Designed RESTful APIs enabling integration between legacy systems and new modules.

IIT Delhi - Research Assistant

May 2018 – Jul 2018

- Built a ROS–Unity interface for VR-based human control of UAV swarms, achieving <80ms latency for real-time responsiveness.
- Simulated predator–prey swarm dynamics to evaluate multi-agent coordination under VR-driven human guidance.

PUBLICATIONS

Unpaired Modality Translation for Pseudo-Labeling

A. Boschet, et al. | Medical Image Computing and Computer Assisted Intervention (MICCAI) 2024

- Proposed SyncDiff-based approach for domain adaptation in histology imaging.
- Applied VQ-VAE compression accelerating training by 30% whilst retaining 95% image fidelity.
- Demonstrated 12% improvement in segmentation accuracy on out-of-distribution data whilst reducing annotation requirements by 80%.

Master's Thesis: Multi-Contrast Axon Segmentation via Latent Diffusion Models

University of Montréal, August 2025 | Supervisors: Prof. J. Cohen-Adad, Prof. G. Wolf

- Investigated privacy-preserving approaches to medical image segmentation using latent diffusion models.
- Demonstrated synthetic contrast data can achieve 80% Dice score without requiring real patient data access, with implications for federated learning in healthcare AI.

SELECTED PROJECTS

SpeechBrain Scaling Study (Academic Project, Jan 2024 – Apr 2024)

- Validated neural scaling laws for self-supervised speech models across 10-1,000 hours of data.
- Findings validated theoretical predictions ($R^2 = 0.94$) and provided insights for efficient deployment in low-resource settings.

Single-Cell RNA Analysis of Alzheimer's Disease (Academic Project, Sept 2023 – Dec 2023)

- Analysed 50,000+ cell transcriptomics data identifying 12 potential biomarkers through dimensionality reduction and clustering using UMAP and t-SNE.
- Validated findings against literature with 85% concordance.

OPEN-SOURCE CONTRIBUTION

Ivadomed - Medical Image Segmentation Framework (Contributor, 2022–2025)

- Implemented data augmentation improving generalisation by 15%, added 3D segmentation support,
- improved documentation reducing onboarding time by 50%. Used by 200+ researchers globally.

AxonDeepSeg - Axon and Myelin Segmentation Tool (Contributor, 2022–2025)

- Optimised inference reducing processing time by 35%, added support for new microscopy modalities, improved testing coverage from 60% to 85%. Cited in 100+ research papers.

Zooniverse

- Assisted in building high-quality research datasets on Zooniverse through structured data labeling and verification.

SCHOLARSHIPS & AWARDS

- Study & Development Scholarship, Mila | International Student Scholarship, UdeM