

## HIGHLIGHT OF SKILLS

A motivated M.Sc. CS graduate highly skilled in machine/deep learning, programming, data processing & analysis, and collaboration.

**ML Experience:** 3+ years in academia devising novel, SOTA deep models for image data: 4 publications + 1 upcoming at WACV.

**Technologies:** Proficient in Python + PyTorch, scikit, OpenCV, etc.; experienced with AWS, C++, Java, and S.Eng. (Git, CI/CD, etc.).

**Communication:** Weekly presentations in multi-discipline (ML & non-ML) research groups, conference presentations, & teaching.

## EDUCATION

### M.Sc. in Computer Science

SEP 2021 – AUG 2023

University of Alberta (UofA)

- **Thesis:** Advancing Forest Health Monitoring: Harnessing the Power of Deep Learning Computer Vision for Remote Sensing
- **Relevant Courses:** 3D Computer Vision, Machine Learning, Privacy and Fairness in Machine Learning.
- **GPA:** 4.0/4.0 · **Awards:** (1) Outstanding Thesis, (2) Anina Hundsdoerfer Scholarship (3) Full-funding from CS Department.

### B.Tech. in Computer Science & Engineering

SEP 2021 – AUG 2023

National Institute of Technology, Warangal

- **Relevant Courses:** Data Structures and Algorithms, Object-oriented Programming, Systems Design, Computer Networks.
- **GPA:** 8.87 / 10 – First Division with Distinction (Top 10%) & received entrance scholarship for academic excellence.
- **GRE:** 338 / 340 – 170 Quantitative, 168 Verbal, 5.5/6.0 Analytical Writing and Analysis. · **TOEFL:** 120/120.

## WORK EXPERIENCE

### ML/DL Researcher – Prof. Nilanjan Ray's Vision and Robotics Lab, UofA

SEP 2021 – AUG 2023

- Conducted cross-disciplinary research with a group of 4 from the forestry department and NRCan to publish novel papers.
- Delivered presentations on latest research findings during bi-weekly update meetings of 15-member group.
- Trained incoming lab students on best practices for experimentation and implementation of research papers.

**Skills:** Python, R, PyTorch, Keras, OpenCV, NumPy, Pandas, scikit-learn, scikit-image, seaborn, Git, Pandas, Research, Presentations, Object detection, Image classification, Multi-modal image registration, Transfer learning, Self-supervised learning.

### ML Remote Sensing Analyst (FSWEP) – Natural Resources Canada

JUL 2023 – AUG 2023

- Developed a DSM-based open-source tool to project bounding boxes from drone images to geo-located polygons in GIS.
- Leveraged 3D computer vision & depth estimation through ray-tracing to achieve projection with >95% accuracy.
- Designed a YOLOv8-based detector for Ash trees from a city-wide orthomosaic of Edmonton with 70% average precision.
- Presented progress updates to senior research scientists and tailor code implementation according to 'client' feedback.

**Skills:** Python, PyTorch, Object detection, Drone remote sensing, GIS, Agisoft, Pix4D, OpenDroneMap, 3D computer vision, Algebra.

### Lead Student Instructor – CS Department, UofA

SEP 2022 – DEC 2022

- Managed the Content Support functional team of 5 Teaching Assistants (TAs) for a Python intro course of 1000+ students.
- Supervised weekly meetings for progress updates and training first-time TAs on pedagogy and carrying out functional tasks.
- Reviewed 15 lab assignments, 10 quizzes, and 16 sets of lecture slides to proactively identify issues and improve content.
- Taught core coding concepts during labs to 40+ students. Marked 100s of assignments and provided 1-1 feedback for all.
- Received role based on exemplary performance as regular TA during previous 2 semesters for various courses.

**Skills:** Python, Content creation, Quality control, Teaching, Mentoring, Code review, Team management, Delegation.

### Lead Programmer – GBit Studios Game Development

JAN 2019 – JUN 2021

- Spearheaded the production of 4 new Unity (C#) & Android (Java) games published to the Apple & Google Mobile Stores.
- Interviewed and trained 50+ prospective recruits by hosting tutorial classes and 1-1 sessions to selected 5 candidates.
- Trained an autonomous AI system via reinforcement learning using Unity ML Agents for simulating realistic enemy behavior.

**Skills:** Unity, C#, C++, Java, Android Studio, Swift + Xcode, Project management, Data structures, Object-oriented programming.

### Product Development Intern – Smart Content Team, Oracle Corporation

JUL 2020 – AUG 2020

- Developed 2 models to compute color distribution of imaged objects segmented by Mask R-CNN with 98% accuracy.
- Integrated these into Oracle's Content Management System to enhance the visual search engine via tagging automation.
- Awarded 2nd place in the Oracle All-India Interns' Hackathon alongside two teammates by top ranking executives.
- Received a full time employment offer from Oracle based on exceptional performance, 1 year in advance of graduating.

**Skills:** Python, Jupyter, Oracle databases, SQL, PL/SQL, Unix Shell, Javascript, HTML, CSS, XML, JSON.

## PEER-REVIEWED RESEARCH PAPERS

*All are publicly available. For abstracts and links to each, kindly refer to my [website](#).*

**Skills:** Experimental evaluation • Devising and training SOTA DL methods • Optimization • Handling large datasets (preprocessing, cleaning, labeling, visualization) • Reading & writing (LaTeX) academic papers • Presenting & networking at conferences • Visualizing via figures • Identifying & solving practical problems creatively • Leadership & collaboration • Project & time management • Organization.

- [1] **R. Kapil**, G. Castilla, S. M. Marvasti-Zadeh, D. Goodman, N. Erbilgin, and N. Ray, "Orthomosaicking thermal drone images of forests via simultaneously acquired RGB images," *MDPI Remote Sensing Journal, Featured Paper*, vol. 15, no. 10, p. 2653, 2023.
- [2] **R. Kapil**, S. M. Marvasti-Zadeh, D. W. Goodman, N. Ray, and N. Erbilgin, "Classification of bark beetle-induced forest tree mortality using deep learning," in *Visual observation and analysis of Vertebrate And Insect Behavior Workshop at ICPR*, 2022.
- [3] S. Gupta, **R. Kapil**, G. Kanahasabai, S. S. Joshi, and A. S. Joshi, "SD-Measure: a social distancing detector," in *IEEE 12th International Conference on Computational Intelligence and Communication Networks (CICN)*, pp. 306–311, 2020.
- [4] A. S. Joshi, S. S. Joshi, G. Kanahasabai, **R. Kapil**, and S. Gupta, "Deep learning framework to detect face masks from video footage," in *IEEE 12th International Conference on Computational Intelligence and Communication Networks (CICN)*, pp. 435–440, 2020.

## RELEVANT PROJECTS

*For an extended list, kindly refer to my [website](#).*

### Open-source Thermal Orthomosaicking GUI Tool

RESEARCH CODE RELEASE

Already being used by remote sensing researchers in Alberta, Sydney, and South Wales.

- Packaged the proposed algorithm in my MDPI paper as a Windows GUI tool to facilitate easy use and further improvement.

**Skills:** Python, bash, PyQt5 & Designer, Docker, Git, CI/CD, CUDA, OpenDroneMap, OpenSfM, OpenMVS, WSL, MeshLab, GDAL.

### Image to GIS (& vice versa) Projection Tool

NRCAN PROJECT

- Developed an open-source tool to map boxes from local drone image space to specified global projection space (e.g., UTM).

**Skills:** Python, rasterio, fiona, pyshp, QGIS & ArcGIS, Git, CI/CD, 3D computer vision, Ray-tracing, Computer graphics.

### AWS SageMaker Projects

CLOUD-DEPLOYED NLP & COMPUTER VISION MODELS

- (1) Image classification model [ICPR] deployed as: (i) pre-trained inference endpoint; (ii) trained w/ transfer learning & custom data.
- (2) BERT model for sentiment classification: fine-tuned transfer learning, k-fold cross validation, cloud-deployed inference model.

**Skills:** AWS SageMaker, Python, Cloud deployment, Natural language processing, BERT, LLM, GPT, RetinaNet, RCNN, CUDA, Spark.

### Predictive Display for Robotic Arm Tele-operation

GRADUATE COURSE PROJECT (3D CV)

- Accomplished dynamic texturing of a simulated 3D environment to overcome communication delay in robotic tele-operation.

**Skills:** MATLAB, Python, ROS, OpenSfM, CARV 3D Reconstruction, ORB-SLAM, Ubuntu, OpenCV, Eigen, Pangolin, Unity 3D, C#.

### Privacy, Fairness, and Equity of GAN-generated Data

GRADUATE COURSE PROJECT (P&F IN ML)

- Investigated the relationships and tradeoffs between privacy, fairness, and utility in GAN-generated synthetic tabular data.

**Skills:** Python, PyTorch, TensorFlow, scikit-learn, Encoders, Jupyter, NumPy, pandas, Deep GAN models, Differential privacy.

### Attentive-normalized Image Generation

BACHELOR'S THESIS

- Improved a deep network that generates images from layouts by using attentive normalization to enhance photo-realism.
- Authored a bachelor's thesis detailing the methodology, experimentation process, and results of this 'final-year' project.

**Skills:** Python, PyTorch, and Deep CNN-based GANs, Git, CI/CD, Technical writing, LaTeX, Presentation.

### Backpropamine - Research Paper Implementation

REINFORCEMENT LEARNING

- Implemented a self-modifying RNN with differentiable neuro-modulated plasticity to speed-up AI maze navigation by 20%.

**Skills:** C++, Python, AI, OpenGL, Reinforcement learning, Research, Version control, Visualization, Technical documentation, LaTeX.

### Selected Unity Games: (1) Flick To Kick Rugby, (2) Maximum Velocity

GBIT STUDIOS GAMES

Published games, each with >1000 installs on iOS and Google Play (Android).

- Programmed various gameplay physics mechanics and necessary systems like menu and shop navigation.
- Designed several 3D models, particle systems, and animations using Maya/Blender and integrated these into the games.

**Skills:** C#, Unity, Swift, Xcode, Scripting, Graphics, Maya, Blender, UI/UX, Animation, Scripting, Multi-media/platform dev., Testing.

### Android Application: Revenge of the Sudoku

JAVA APPLICATION

Published game with >1000 installs on Google Play (Android).

- Developed novel game independently on Android Studio with Java and published it to Play Store.

**Skills:** Java, Android Studio, Kotlin, CSS, XML, JSON, IntelliJ, Javascript, Backtracking, Emulators, APIs, UI/UX design, Deployment.