Rudraksh Kapil

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HIGHLIGHT OF SKILLS

A motivated M.Sc. CS developer skilled in deep/machine learning, computer vision, programming, research, and collaboration.
ML Expertise: 3+ YoE developing novel, SOTA deep models trained on large datasets to solve real-world problems: 5 papers.
Technologies: Proficient in Python + PyTorch, scikit, OpenCV, etc.; Exp. w/ LLMs, LLMs, AWS SageMaker, C++, Java, JS, SQL, Git.
Communication: Weekly presentations in multi-discipline (ML & non-ML) research groups, participation in conferences, 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, Statistical Methods for ML, Privacy and Fairness in ML, Research Methods.
- **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 2017 – APR 2021

National Institute of Technology, Warangal

- **Relevant Courses:** Data Structures and Algorithms, Object-oriented Programming, Systems Design, Software Engineering.
- **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 Developer (Remote Sensing) – Natural Resources Canada (Federal Govt.)
JUL 2023 – PRESENT

- 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, ODM, 3D computer vision, LiDAR point clouds.

ML/DL Researcher – Prof. Nilanjan Ray's Vision and Robotics Lab, UofA
SEP 2021 – AUG 2023

- Conducted cross-disciplinary research to solve undefined problems with a group of 4 from the forestry department and NRCan.
- Specialized in deep learning computer vision applied to forest health management with RGB-thermal drone/satellite imagery.
- Delivered presentations on latest research findings during bi-weekly update meetings of 15-member group.

Skills: Python, PyTorch, TensorFlow, OpenCV, NumPy, Pandas, scikit-learn, scikit-image, seaborn, R, Git, Pandas, Research, CNNs, Presentation, Object detection, Multi-modal fusion, Video tracking, Species classification, Transfer learning, Self-supervised learning.

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, Collaboration, 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 Stores - Agile team.
- 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
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.

ML/DL PUBLICATIONS

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**, S. M. Marvasti-Zadeh, N. Erbilgin, and N. Ray, "Shadowsense: Unsupervised domain adaptation and feature fusion for shadow-agnostic tree crown detection from rgb-thermal drone imagery," in *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV**)*, January 2024. *In print*.

[2] **R. Kapil**, G. Castilla, S. M. Marvasti-Zadeh, D. Goodsman, 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.

[3] **R. Kapil**, S. M. Marvasti-Zadeh, D. W. Goodsman, 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.

[4] 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.

[5] 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.

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, C++, ROS, ORB-SLAM, OpenSfM, CARV 3D Reconstruction, Ubuntu, OpenCV, Eigen, Pangolin, Unity 3D, C#

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, LLMs, GPT, RetinaNet, RCNN, CUDA, Spark.

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.

Selected Unity Applications: (1) Flick To Kick Rugby, (2) Maximum Velocity
APP DEVELOPMENT

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 APP DEVELOPMENT

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.

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, pyshp, GIS, 3D computer vision, Ray-tracing, Computer graphics, Linear algebra, Computational geometry.

Attentive-normalized Image Generation
BACHELOR'S THESIS

- Improved a deep network that generates images from layouts by using attentive normalization to enhance photo-realism.

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.