Patel Muhammed Iyas

Unit 65, 350 Columbia Street West, Waterloo, Ontario - N2L 6G5
Email id: jhb.muhammed@gmail.com

Ph: +1 226-899-8165
Linkedin
Github
Google Scholar

AREAS OF INTEREST

Computer Vision, Machine Learning, Remote sensing, Software Development

ACADEMIC DETAILS

Year	Degree	Institute	CGPA
Fall 2022 - Present	MASc. Systems Design Engineering	University of Waterloo	85.5/100
2017-2022	Dual Degree (B.Tech + M.Tech) Industrial and Systems Engg , Micro Spl. in Optimization Theory And Applications	IIT Kharagpur	8.92/10

PUBLICATIONS

- Patel, M., Chen, X., Xu, L., Chen, Y., Scott, K. A., & Clausi, D. (2024). Region-Level Labels in Ice Charts Can Produce Pixel-Level Segmentation for Sea Ice Types. In Proceedings of the ICLR 2024, Machine Learning for Remote Sensing (ML4RS) Workshop.
- Chen, X., Patel, M., Pena Cantu, F. J., Park, J., Noa Turnes, J., Xu, L., ... & Clausi, D. A. (2024). MMSeaIce: a collection of techniques for improving sea ice mapping with a multi-task model. The Cryosphere, 18(4), 1621-1632.
- Chen, X., Patel, M., Xu, L., Chen, Y., Scott, K. A., & Clausi, D. A. (2023). Weakly Supervised Learning for Pixel-level Sea Ice Concentration Extraction using AI4Arctic Sea Ice Challenge Dataset. IEEE Geoscience and Remote Sensing Letters.
- Patel, M. I., Singla, S., Mattathodi, R. A. A., Sharma, S., Gautam, D., & Kundeti, S. R. (2021, October). Simulating Realistic MRI variations to Improve Deep Learning model and visual explanations using GradCAM. In 2021 IEEE International Conference on Cloud Computing in Emerging Markets (CCEM) (pp. 1-8). IEEE

PROJECTS

Whale detection from Large Aerial Images | Prof. D Clausi | Prof. L Xu | VIP Lab | University of Waterloo

Sept 2022 - Present

- Developed an innovative training pipeline tailored for small object detection, achieving an impressive **90% precision and recall rate** on a challenging whale dataset from the Department of Fisheries and Oceans (DFO), characterized by the whales' small size and the presence of numerous similar-looking objects
- This custom pipeline utilizes large image slices that significantly surpass existing wildlife detection models in performance by enhancing model contextual learning.
- Shipped **the model into production** using Labelstudio, an annotation tool equipped with capabilities for **online learning**. This implementation facilitates real-time model enhancements and is used by the DFO to support their conservation efforts and research activities.

Sea Ice Segmentation from multiple satellite sensors | Prof. D.Clausi | Prof. L Xu | VIP Lab | University of Waterloo

Foundation model for SAR imagery

- Developed a foundation model using Masked autoencoders on SAR images using large amounts of SAR data
- The developed model outperforms the specialist model in Sea ice classification by 5% using only 50% of the labeled data
- Currently conducting additional experiments to validate the foundation model's robustness across a range of downstream tasks, ensuring its versatility in various applications.

Jan 2023 - Present

AutoIce Competition

- Developed a multi-task UNet model for the detailed segmentation of ice concentration, types, and floe size directly from the fusion of multiple sources of data (Synthetic Aperture Radar, Passive Microwave, Wind, surface temperature)

- Introduced innovative techniques like SAR variable downscaling, spatial-temporal encoding, and strategic input feature selection to significantly enhance model accuracy.
- This solution achieved **first place** in the **Autoice** competition hosted by the European Space Agency (ESA), securing a prize of **3,000 euros**

Pixel level segmentation from Region level labels

- Developed a novel loss function that facilitates the training of pixel-level segmentation models using only region-level labels, bypassing the need for labor-intensive pixel-wise annotation
- This newly developed method outperforms the Auto ICE competition model and has significantly better accuracy(12% average) for minority classes

Professional Experience

Research Intern | Philips Innovation Campus Bangalore | Philips India Limited
Brain Landmark detection using HighRes3DNet *May* 2021 - July 2021

- Manually revised the annotations of more than 184 MRI images to improve the Ground truth quality with a higher inter-annotator agreement
- Boosted deep learning model performance by 45% by implementing realistic data augmentation strategies for 3D Brain MRI images using the TorchIO library, accounting for machine and patient variations.
- Contributed to software quality by engaging in unit testing and debugging, alongside conducting a comprehensive literature survey on active learning algorithms, leading to the development of a versatile PyTorch framework that supports customization for both models and datasets.

Remote Research Intern | Prof. Panagiotis Kalnis, Computer Science | King Abdullah University of Science and Technology, Saudi Arabia
Personalized Federated Learning with Communication Compression June 2020 - Aug 2020

- Simulated a federated learning environment in **Pytorch** where training is happening across multiple decentralized edge devices holding sensitive data, without exchanging the data to address the **data privacy** concerns and sharing the locally trained model instead
- Implemented lossy Compression schemes on local models to reduce the amount of data communicated when clients are communicating their local models to the central server, thus addressed the **communication bottlenecks** in training
- Implemented state of the art **Compressed Loopless Gradient Descent (L2GD)** algorithm, and benchmarked its performance on real datasets

SKILLS AND EXPERTISE

Programming languages: Python | C | C++ | Matlab | Shell scripting

Softwares/ Tools: Linux | Git | Slicer 3D | IBM CPLEX (optimization software) | SLURM | LabelStudio (data labelling service) | LaTeX

Libraries (Python)**:** Pytorch | Tensorflow | mmdetection | mmsegmentation | OpenCV | pandas | Flask | PyQt4 | wandb

AWARDS AND ACHIEVEMENTS

- Awarded International Master's Award of Excellence (IMAE) valued at **CA$12500** by the University of Waterloo
- Awarded Lalit Chugh and Hira Ahuja International Graduate Scholarship valued at **CA $10000** by the University of Waterloo
- Awarded **Inspire Scholarship** by the Department of Science and Technology, Govt. of India
- Awarded US **$3000** scholarship under the **VSRP program** to do a remote research internship at King Abdullah University of Science and Technology (KAUST), Saudi Arabia

COURSEWORK INFORMATION

Courses: Programming and Data Structures(Theory+Lab) | Probability and Statistics | Linear Algebra | Data Analytics | Statistical Image processing | Big Data Processing | Optimization and Heuristics methods | Non-Linear Programming | Machine learning Foundations and Application | Remote sensing

MOOCs: Machine Learning by Stanford | Deep Learning specialization by deeplearning.ai | Machine Learning AZ™: Hands-On Python & R In Data Science | Introduction to algorithms by MIT