Muhammad Uzair Khattak

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LinkedIn: LinkedIn portfolio

Education

Master of Science, Computer Vision August. 2021 – Present
Mohamed Bin Zayed University of Artificial Intelligence (MBZUAI), Abu Dhabi *CGPA 4.00/4.00*

- Graduate research student supervised by Dr. Salman Khan and Dr. Fahad Khan
- Major courses: Human and Computer Vision, Machine Learning, Visual Object Recognition and Detection

Bachelor of Electrical Engineering Sept. 2017 – June 2021
School of Electrical Engineering and Computer Science (SEECS) *CGPA 3.84/4.00*
National University of Sciences & Technology (NUST), Islamabad, Pakistan

- Final year thesis: "Low-Cost Whole Slide Image Scanner with Deep Learning Applications"
- Major courses: Machine Learning, Computer Vision, Signal Processing, Embedded Systems, Microprocessor Systems

Research Interests

- Exploring multi-modal modals for video understanding tasks
- Efficient transfer learning techniques with prompt learning for vision-language models
- Expanding Multi-modal models for zero-shot image-recognition and open-vocabulary object detection

Publications

* indicates equal contribution

Fine-tuned CLIP models are efficient video learners *Nov 2022 (under-review)*
Hanoona Rasheed, **Muhammad Uzair Khattak***, Muhammad Maaz, Salman Khan, Fahad Khan*

MaPLe: Multi-modal Prompt Learning *Sept 2022 (under-review)*
***Muhammad Uzair Khattak**, Hanoona Rasheed, Muhammad Maaz, Salman Khan, Fahad Khan*

Object Detection in Aerial Images: A Case Study on Performance Improvement *Oct 2022 (ICAIoT 2022)*
Adnan Khan, **Muhammad Uzair Khattak***, Khaled Dawoud*

Bridging the Gap between Object and Image-level Representations for Open-Vocabulary Detection *May 2022 (NIPS 2022)*
Hanoona Rasheed, Muhammad Maaz*, **Muhammad Uzair Khattak**, Salman Khan, Fahad Khan*

Investigating and Improving Common Loop Closure Failures in Visual SLAM *July 2022 (under-review)*
*Saran Khaliq, Muhammad Latif Anjum, Wajahat Hussain, **Muhammad Uzair Khattak**, Momen Rasool*

Experience

Graduate Research Assistant Aug 2021 – Present
MBZUAI Computer Vision Lab (CVL)
Main research topics: Object detection with transformers, Multi-modal modals, Prompt learning, Video understanding tasks

- Adapting vision-language models for action recognition, object recognition and open-vocabulary object detection
- Transformers based models including DETR and MDETR for generic and class-agnostic object detection
- Teaching assistant for Machine Learning course (ML701)

Undergraduate Research Assistant May 2019 – May 2021
Signal Processing and Machine Learning (SIGMA) Lab in collaboration with TUKL
R&D Center, SEECS, NUST, Islamabad, Pakistan

Main research topics: Medical Imaging, Signal processing, AI on Edge devices, Embedded systems

- Performance metrics comparison of Deep learning image models on NVIDIA Jetson TX2 and Jetson Nano 4GB kit (GitHub)
- Implementation of LeNet Neural Network on ARM-CORTEX M4 discovery board in CMSIS-NN library
- Real-time auto-focusing with Laplacian filter as focus metric. Integrated algorithm with stepper motors circuitry
- Segmentation of keratin pearl and epithelium tissues using UNET in Whole Slide images
- Participant in international AI competition "Plant Pathology 2020 - FGVC7, CVPR-2020" (GitHub)

Artificial Intelligence Intern Oct. 2020 – April 2021
i engineering Group, Islamabad, Pakistan

- Worked on project "Base station security (BTS) system", created dataset at BTS sites in Pakistan for intruder detection
- Implemented quantized MobileNet model in PyTorch on NVIDIA JETSON Nano 2GB developer kit
- Developed RESTFUL API using Flask and deployed on Heroku web server
- Integrated AI system with i engineering servers and IP camera to provide real time intrusion detection
- Automated the pipeline (updating and shutting down AI algorithm remotely, fetching debug logs) using shell scripts

Projects

Transformers Transforming Vision Sept 2021 – Dec 2021

- Explored state of the art vision transformers for image recognition including ViTs, DeiTs and T2T-ViTs
- Performance scalability comparison of ViTs and DeiTs with CNNs (ResNets) w.r.t pretraining dataset size
- Fintuned pretrained ViTs and ResNets on downstream datasets CIFAR10, CIFAR100 and CUB-200 (GitHub)

Optimizing Deep Learning models with TensorRT Augest 2020 – Nov. 2020

- Deep Learning model optimization techniques including weights quantization, layer fusion and kernel auto-tuning supported by NVIDIA TensorRT framework
- Optimization of AI models (YOLOv4, ResNets) using TensorRT to increase real time inference performance on edge devices including Jetson Nano and Jetson TX2
- Performance metrics comparison of FPS, inference time and accuracy before and after model optimization

Low-Cost Whole Slide Image (WSI) Scanner with Deep Learning Applications Nov 2020 – June 2021

- Designed Low-Cost Whole Slide Image (WSI) scanner to generate WSIs and perform Deep Learning applications
- Prototype implementation of electrical scanning system (RAMPS 1.4 and Arduino Mega) for acquisition of Bio-medical images, using 3D printed structures and electronic circuits. Designed schematics and PCB of hardware circuitry in EAGLE
- Developed Image stitching algorithm using OPENCV, Numpy and scikit-learn. Used cross-correlation and Laplacian blending to acquire results comparable with open source MS ICE stitching software
- Trained YOLOv4 on BCCD dataset for detection of blood cells in Whole Slide Images. Acquired 94.9% F1-Score on test set
- Comparison of performance metrics by training YOLOv4 on commercial WSI scanner dataset and locally generated dataset (using our scanner) for Mitotic Cells detection
- Developed executable graphical user interface (GUI) using Tkinter

Understanding the limitations of CNN based pose regressions models for Scene Localization Oct. 2020 – March 2021

- Explored DL based approaches in Scene localization problem for autonomous robots
- Used custom dataset ”1-KM” to understand the drift of CNN pose regressors MapNet and PoseNet in large scenes
- Implementation of visualization software for converting 3-D scene poses to 2-D image projections on RGB images using camera poses and 3D point cloud data

Technical Skills

Languages: Python, C/C++, MATLAB, Assembly and embedded C, SQL, JavaScript, HTML/CSS
Programming: PyTorch, fast.ai, Keras, Latex, TensorRT, Brevitas, Flask, Tkinter, Scikit-learn
Tools: Linux, PyCharm, VS code, Git, QuPath, Google Cloud Platform, Heroku, tableau, AUTOCAD

Honours and Awards

- Second position in Dubai Roads and Transport Authority’s (RTA) Transport Hackathon, 2022.
- First position in ADAFSA Agrithon 2021, organized by Abu Dhabi Argiculture and Food Security Authority
- Third position in Hack for Space Hackathon, organized by G42 and coders(hq), UAE.
- Winner of the MBZUAI Dogs vs. Cats challenge, 2021 (report and github repository)
- Rector’s gold medal award for best undergraduate thesis, NUST
- Among the first batch of NVIDIA certified AI Jetson specialists in the world
- Featured in official blog of NVIDIA regarding acknowledgment of AI skills on NVIDIA embedded systems (Blog)
- High achievers award recipient from DEAN of SEECS
- Selected for a fully funded research internship at Technical University of Munich (TUM), Germany for summer 2020

Extracurricular Activities

- Team captain of SEECS, NUST table tennis team
- Mentor at ACM Peer-to-Peer Mentorship program
- Organized ”Mall of Humanity” project to distribute clothes to deserving families in the backward areas of Pakistan
- Co-led community service program ”Meet the Seniors”, aiming to connect high school students with undergraduate students of different fields and universities for face to face mentor-ship sessions

Other services

- Serving as a reviewer at TPAMI Special Issue on *Transformers in Vision*
- Attended CVPR-2022 Computer Vision conference virtually
- Attended NVIDIA GTC 2021 AI Conference virtually
- Technical workshop presenter on ”Deep Learning using PyTorch”, talk organized by IEEE SEECS, NUST (Recorded session)
- Mentor and project evaluator for new batch of SIGMA lab interns, NUST, Pakistan

Interests

- Multiplayer Computer Games, Traveling, Watching movies, Table Tennis, Football, Cricket