Muhammad Uzair Khattak

muzairkhattak.github.io

Email : muzair.khattak99@gmail.com
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
- MS Thesis: "Effective transfer of vision-language models with prompt learning for image and video tasks"
- 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

- Undergraduate student supervised by Dr. Hassan Aqeel Khan and Dr. Faisal Shafait
- 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

- Multi-modal modals for video understanding tasks, zero-shot image recognition and open-vocabulary object detection
- Efficient transfer learning techniques with prompt learning for robustness and generalization of vision-language models
- Test time optimization, self-supervised learning

Publications

* indicates equally contributing authors

Learning Self-regulating Prompts for Vision-Language Models *March 2023 (under-review)*
Muhammad Uzair Khattak*, Syed Talal Wasim*, Muzammal Naseer, Salman Khan, Ming-Hsuan Yang, Fahad Khan*

Video-FocalNets: Spatio-Temporal Focal Modulation for Video Action Recognition *March 2023 (under-review)*
Syed Talal Wasim, **Muhammad Uzair Khattak***, Muzammal Naseer, Salman Khan, Mubarak Shah, Fahad Khan*

Fine-tuned CLIP models are efficient video learners (Paper) (Code) *Feb 2023 (CVPR-2023)*
Hanoona Rasheed, **Muhammad Uzair Khattak***, Muhammad Maaz, Salman Khan, Fahad Khan*

MaPLe: Multi-modal Prompt Learning (Paper) (Code) *Feb 2023 (CVPR-2023)*
Muhammad Uzair Khattak*, Hanoona Rasheed, Muhammad Maaz, Salman Khan, Fahad Khan*

Bridging the Gap between Object and Image-level Representations for Open-Vocabulary Detection (Paper) *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 (Paper) *July 2022 (under-review)*
*Saran Khaliq, Muhammad Latif Anjum, Wajahat Hussain, **Muhammad Uzair Khattak**, Momen Rasool*

Experience

Graduate Research Assistant Aug 2021 – Present
Intelligent Visual Analytics Lab (IVAL), MBZUAI, Abu Dhabi
Main research topics: Object detection with transformers, Multi-modal modals, Prompt learning

- Explored CLIP adaptation for action recognition, object recognition and open-vocabulary object detection
- Worked on transformers based detectors 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

- Optimization of AI models (YOLOv4, ResNets) with TensorRT on edge devices including Jetson Nano and Jetson TX2
- Implementation of LeNet Neural Network on ARM-CORTEX M4 discovery board with 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)
- Teaching assistant for Complex Variables and Transforms course (MATH-232)

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

Robust generalization of Vision-Language models Jan 2023 – Present
- Addressing the over-fitting problem of soft prompts during fine-tuning of Vision-Language models
- Designing novel loss formulation and optimization techniques to overcome prompt over-fitting

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
- Benchmarking of ViTs and ResNets on downstream datasets CIFAR10, CIFAR100 and CUB-200 (GitHub)

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

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

- MBZUAI graduate studies scholarship holder
- 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 2021, 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

Academic services

- Serving as a reviewer at NeurIPS-2023, ICCV-2023, ICML-2023, CVPR-2023 & TPAMI Special Issue on *Transformers in Vision*
- Attended NeurIPS-2022, CVPR-2022 & NVIDIA GTC 2021 conference virtually
- Workshop presenter on ”Deep Learning using PyTorch”, talk organized by IEEE SEECS, NUST (Recorded session)
- Technical trainer at ”AI at the Edge” workshop, organized by AI Lounge, Pakistan
- Mentor and project evaluator for new batch of SIGMA lab interns, NUST, Pakistan

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

Interests

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