Muhammad Uzair Khattak

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EDUCATION

Master of Science, Computer Vision August. 2021 – Present

Mohamed Bin Zayed University of Artificial Intelligence (MBZUAI), Abu Dhabi *CGPA 4.00/4.00*

- Major courses: Human and Computer Vision, Machine Learning, Visual Object Recognition and Detection
- Winner of the MBZUAI Dogs vs. Cats challenge, 2021 (report and github repository)

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

EXPERIENCE

Graduate Research Assistant Aug 2021 – Present

MBZUAI Computer Vision Lab (CVL)

- Research assistant at MBZUAI CVL lab, supervised by Dr. Salman Khan & Dr. Fahad Khan
- Research focused on transformers for multi-modal (vision-language) tasks and object recognition & detection
- Currently, experimenting with transformer based models including DETR, MDETR and ViTs for open-vocabulary object detection

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

- Explored AI on Edge Devices, built deep learning image classifiers on NVIDIA Jetson TX2 and Jetson Nano 4GB kit and evaluated performance metrics (GitHub)
- Implemented LeNet Neural Network on ARM-CORTEX M4 discovery board in CMSIS-NN library provided by ARM developers
- Implemented real-time auto-focusing algorithm using OpenCV in Python, used Laplacian filter as a focus metric. Integrated algorithm with stepper motors circuitry
- Trained UNET in fast.ai for binary segmentation of keratin pearl and epithelium tissues in Whole Slide images
- Mentored new batch of SIGMA interns and evaluated their projects
- Participated in international AI competition "Plant Pathology 2020 - FGVC7, CVPR-2020", achieved classification accuracy of 96.007% (GitHub)
- Delivered technical workshop on "Deep Learning using PyTorch", talk organized by IEEE SEECS, NUST (Recorded session)

Artificial Intelligence Intern Oct. 2020 – April 2021

i engineering Group, Islamabad, Pakistan

- Worked on project "Base station security system", created dataset at BTS sites in Pakistan for AI model
- Implemented MobileNet classification 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

Embedded Systems Engineer (Contract based) Aug. 2020 – Dec 2020

Sedenius Technologies (subsidiary of Sedenius Engineering GmbH) and NUST, Pakistan

- Explored Embedded Systems research aspects of Self Driving Cars
- Proposed Embedded and Electronic circuit design for "Mobile Data-logger for Test-bed Scale Car"
- Developed schematics and PCB design for "RC Autonomous Car" in EAGLE

Junior AI instructor, part time July 2020 – March 2021

AI Lounge, Islamabad, Pakistan

- Worked as a teaching assistant for various AI training sessions, mentored young students to make AI projects
- Technical trainer for "AI at the Edge", led workshop labs on quantization techniques using PyTorch and Brevitas
- Published blog, "PyTorch vs TensorFlow" on AI Lounge website (Blog)

PROJECTS

Transformers Transforming Vision Sept 2021 – Dec 2021

- Explored state of the art vision transformers for image classification including ViTs, DeiTs and T2T-ViTs
- Compared ViTs and DeiTs with CNN models (ResNets) and evaluated their performance scalability capabilities w.r.t pretraining dataset size
- Fintuned pretrained Vision Transformers and ResNets using pytorch timm library on downstream datasets CIFAR10, CIFAR100 and CUB-200 (GitHub)

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

- Explored DL model's optimization techniques including weights quantization, layer fusion and kernel auto-tuning supported by NVIDIA TensorRT framework through NVIDIA official Webinars
- Used NVIDIA TensorRT library in Python to optimize AI models (YOLOv4, ResNets) to increase real time inference performance on NVIDIA embedded edge devices including Jetson Nano and Jetson TX2
- Performance metrics: FPS, total inference time and accuracy were compared before and after optimization

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

- Designed Low-Cost WSI scanner to generate Whole Slide Images and perform Artificial Intelligence applications on those images
- Implemented prototype of electrical scanning system (using 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 in Python using OPENCV, Numpy and scikit-learn libraries. Used cross-correlation and Laplacian blending to acquire results comparable with open source stitching software
- Trained YOLOv4 object detection model on BCCD dataset to detect blood cells present in Whole Slide Images. Acquired 94.87% F1-Score on test dataset
- Evaluated performance metrics by training on commercial WSI scanner dataset and locally generated dataset (using our scanner) on YOLOv4 for Mitotic Cells detection
- Developed user friendly executable graphical user interface (GUI) using Tkinter and cx_Freeze

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

- Explored latest research topics in Scene localization problem for autonomous robots
- Used custom created dataset ”1-KM” to understand the drift of SOTA CNN based pose regression models MapNet and PoseNet in large scenes
- Wrote Python script to convert custom dataset (RGB images and VSFM camera poses) into 7-Scenes dataset format
- Implmented Python code for 3-D scene to 2-D image projection using camera poses and 3D point cloud data.
- Visualized the 2-D projection results on test images for both ground-truth poses and MapNet/PoseNet predicted poses

Real Time Facial Mask Detector March 2020 – March 2020

- Custom Neural Network model built using PyTorch for Mask classification
- Used MTCNN face detector to detect face from input photo using integrated camera
- Achieved 98.7% accuracy on test dataset (GitHub)

PAK-COVID19 HEARTBEAT March 2020 – June 2020

- Collected Pakistan COVID19 data from various sources including Kaggle and preprocessed it using Python
- Generated district-wise dataset and 2D graphs of various count metrics
- Visualized district-wise dataset on Pakistan maps using Tableau (GitHub)

Technical Skills

Languages: Python, C/C++, MATLAB, Assembly and embedded C, SQL, JavaScript, HTML/CSS
Frameworks: PyTorch, fast.ai, Keras, TensorRT, Brevitas NN Quantization, TensorFlow object detection api, Flask, Tkinter
Developer Tools: Linux, PyCharm, VS/VS code, Git, Anaconda, QuPath, Google Cloud Platform, Heroku, tableau, AUTOCAD
Libraries: Pandas, NumPy, Matplotlib, Scikit-learn, cx_Freeze

Honours and Awards

- Rector’s gold medal award for best undergradate thesis, NUST
- Among the first batch of NVIDIA certified AI Jetson specialists in the world
- Secured second position in Dubai Roads and Transport Authority’s (RTA) Transport Hackathon, 2022.
- Secured first position in ADAFSA Agrithon 2021, organized by Abu Dhabi Argiculture and Food Security Authority
- Secured third position in Hack for Space Hackathon, organized by G42 and coders(hq), UAE.
- 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 community service project ”Mall of Humanity” to distribute clothes among the deserving families in the backward areas of Rawalpindi, 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

Additional Courses and Certifications

- Attended NVIDIA GTC 2021 AI Conference (virtually)
- Machine learning (Stanford University) and Deep learning specialization (deeplearning.ai) courses (certification)
- Practical Deep learning course from fast.ai
- Introduction to computer-vision by Georgia Tech from Udacity (in-progress)
- Getting started in AI on Jetson Nano (NVIDIA)
- ”Web Engineering” minor course, SEECS, NUST

Interests

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