Syed Ali Tariq

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Computer vision and deep learning expert with over 7 years of experience in designing, training, and optimizing state-of-the-art deep learning models for various computer vision problems. Strong research and development skills, having authored more than ten research papers. Strongly motivated to achieve optimal results for any given task. Can work independently to solve problems. Good at multitasking and time management skills to meet deadlines. Effective at task delegation between team members and evaluating their performance.

Expertise

- **Computer Vision**: Artificial intelligence, explainable AI, deep learning, machine learning. Transformers and CNN-based model development for classification, segmentation, and detection tasks.
- **Generative AI**: Question-answering chatbots via RAG pipelines, SQL generation, and QA from CSV files or databases. Image inpainting and enhancement, GANs.
- **Data analysis and engineering**: Data exploration, processing, analysis, cleaning, and visualization to support business planning and decisions (Business Intelligence).
- **Code Optimization**: Conducting code reviews and optimizing logic and performance
- **AWS Cloud Platform**: Sagemaker, EC2, Lambda, CodeDeploy, CICD, ECS, ECR, S3, Cloudwatch, Bedrock.
- **Google APIs**: Expertise in location-based services using Google Street View, Maps, and Places APIs.
- **Video processing:** Efficient video compression using HEVC/H.265, MV-HEVC, and VVC**.**
- **Technologies**: Python, Tensorflow, Pytorch, Flask, OpenMMLab, LangChain, MySQL, Docker, CUDA.

Projects

- Developed a location generator tool for a transportation and logistics company to find ideal locations for locker placement via Google Maps and Places APIs, image classification, segmentation, and detection models.
- Developed a flask-based web app for the identification of TB, COVID-19, and Pneumonia using chest X-rays.
- TB classification and detection using transformer models.
- Fingerprint classification using multi-view CNN and Bayesian CNN.
- CNN-based seizure detection in newborns using EEG signals.
- Road segmentation using multi-view CNN.
- Fingerprint and palmprint biometrics identification speed up using parallel programming (CUDA).
- Enhance video compression of HEVC/H.265 and MV-HEVC via deep learning and optimized motion estimation for regular videos and Light Field (LF) content.

Education

Doctor of Philosophy (Computer Science), COMSATS University, Islamabad, Pakistan **2019 – 2024 (Expected)**

- Area of research: *Explainable Artificial Intelligence (XAI)*

Master of Science (Computer Science) Abasyn University, Islamabad, Pakistan **2014 – 2017**

- CGPA of 3.87 out of 4.0 **(Gold Medalist).** Thesis Title: *Palmprint matching using GPU*

Bachelor of Science (Computer and Information Sciences), PIEAS, Islamabad, Pakistan **2007 – 2012**

- CGPA of 2.72 out of 4.0

GCE O (Edexcel International) & A-Level (Cambridge)

- A-level from DHA Public School O&A Levels, Karachi, Pakistan. (77.5% equivalent) **2005 – 2007**
- O-level from The British School in Colombo, Colombo, Sri Lanka. (81.1% equivalent) **2003 – 2005**

Ph.D. Experience

Sep 2019 – Present

- Ph.D. research is focused on the **explainability** of convolutional neural networks (CNNs).
- This research aims to uncover the **reasons** behind a CNN model's decisions to improve their understanding and transparency, which is beneficial for high-risk environments such as medical imaging or autonomous vehicles.
- Developed a method that introduces a way of **knowledge extraction** through an in-built probe of the CNN.
- Introduced an optimization that can identify critical neurons to explain the model's decisions through **counterfactual** and **contrastive** reasoning.
- **Benefits of method**: security-critical applications, model debugging, model repair, model compression, misclassification analysis, adversarial attack detection, and machine teaching applications.

Work Experience

Artificial Intelligence Engineers Team Lead **May 2023 – Present**

SwipBox Pakistan Pvt. Ltd., Islamabad, Pakistan

- Key responsibility: Creating and managing the AI development process and overall infrastructure of the product.
- Performed **code reviews**, task reviews, and evaluations along with sprint planning.
- Developed and deployed Flask-based APIs to the **AWS Cloud** platform.
- Worked with **Google Maps** and **Places APIs** to suggest ideal locations to place lockers.
- Tested and integrated AI models into APIs, performed quality assurance, and deployed models to production.
- Developed a **GPT**-based chatbot using **Langchain** for **question-answering** from PDF files for customer support.
- Developed **SQL**-generating chatbot that answers questions from database and CSV files for statistical analysis and business intelligence-related queries.
- Developed utilization predictor and capacity forecasting tools to improve the company's logistical processes and guide **decision-making**.
- Developed a QR code enhancement tool for fixing damaged, low-quality, blurry, or noisy QR codes.

Artificial Intelligence Engineer **Feb 2023 – Apr 2023**

SwipBox Pakistan Pvt. Ltd., Islamabad, Pakistan

- Trained and **optimized** deep learning models for classification, detection, and segmentation tasks.
- Performed data extraction and validation to improve model performance and quality.
- Models testing and **evaluation** with the incorporation of **explainable AI** techniques.
- Developed **testing tool** for efficient model analysis and comparison with different versions.
- Developed models **postprocessing** techniques to improve accuracy.
- Improved and augmented training datasets with **image inpainting**.

Computer Vision Engineer **May 2022 – Jan 2023**

House of Technology Pvt. Ltd., Islamabad, Pakistan

- Working on several computer vision projects and writing **research proposals**.
- 360° virtual reality (VR) video compression using **Versatile Video Coding** (VVC/H.266).
- Worked on DL and deep reinforcement learning (DRL)-based methods for effective video compression.

Research Associate **Mar 2020 – Apr 2022**

Medical Imaging and Diagnostics Lab (MID), NCAI, COMSATS University, Islamabad.

- Developed state-of-the-art DL models for TB and COVID-19 detection using chest X-rays and CT scans.
- Currently hold the first position worldwide on TBX11K competition leaderboard: https://competitions.codalab.org/competitions/25848#results.
- Developed a Pulmonary Diagnostic System (PDS) for lung disease detection and deployed it to MS Azure cloud.
- Performed fieldwork to gather medical datasets from local laboratories and healthcare institutions.
- Assigned tasks to research assistants and MS students and monitored their performance.
- Authored research papers and funding proposals.
- Participated in exhibitions to showcase the developed products.

Trainer/demonstrator **Aug 2021**

- Designed and conducted hands-on training on developing and training CNNs and generative adversarial networks (GANs) for computer vision problems at beginner and advanced levels.

Teaching assistant **Jan 2019 – Jan 2020**

COMSATS University, Islamabad

- Assisted with administrative tasks, material preparation, and paper marking and uploading.
- Prepared and delivered tutorials on creating and training CNNs using TensorFlow/Keras.

Research Assistant **Apr 2019 – Mar 2020**

Medical Imaging and Diagnostics Lab (MID), NCAI, COMSATS University, Islamabad.

- Worked on identification and classification of various lung diseases using DL methodologies.
- Worked on development of web-based tuberculosis identification system using Python/Django framework, authored journal papers, and supervised MS students.

Research Assistant/Software Design Engineer **May 2016 – Mar 2019**

House of Technology Pvt. Ltd., Islamabad, Pakistan.

- Worked on research projects including tuberculosis identification, surgical telementoring system using HEVC, fingerprint classification, face recognition, and palmprint/fingerprint identification using parallel GPU programming (Nvidia CUDA). Light Field compression using HEVC and MV-HEVC.
- iOS chat app and auto parts app development. MS Excel reports using VBA and SQL.

Tools and skills

Following is the list of tools, technologies, and languages with expertise and experience:

Artificial intelligence: Python (TensorFlow, Keras, Pytorch) • OpenMMLab • NumPy • Flask • Pandas • Scikit-learn • Jupyter notebook

Development: HTML • CSS • Bootstrap • Javascript • MS Azure • iOS (Objective-C) • SQL • VBA

Others: HEVC/MV-HEVC • Matlab • Latex • Github • Docker • Nvidia CUDA • C++ • Linux

Certifications: Machine Learning - Coursera

Research Activities

Research projects

Research collaboration with Prof. Mårten Sjöström at Mid Sweden University, Sundsvall, Sweden, titled: "*Collaboration between Sweden and Pakistan to Investigate Rate Distortion Optimization for Light Field Compression*" - approved by The Swedish Foundation for International Cooperation in Research and Higher Education, STINT, 2019.

a. Worked on Motion Estimation (ME) optimization for Light Field (LF) compression using Multi-view extension of High-Efficiency Video Coding (HEVC/H.265).
b. Designed and conducted Deep Learning labs for the course "Computer Vision using Deep Learning Techniques with Hands-On Implementation in Python/Keras."

Journal publications

Explainable AI

1. **Syed Ali Tariq**, T. Zia, M. Ghafoor, "*Towards Counterfactual and Contrastive Explainability and Transparency of DCNN Image Classifiers*," Elsevier Knowledge-Based Systems, Sep 2022, https://doi.org/10.1016/j.knosys.2022.109901
2. Bismillah Khan, **Syed Ali Tariq**, Tehseen Zia, Muhammad Ahsan. David Windridge, "*Faithful Counterfactual Visual Explanations (FCVE)*," Elsevier Knowledge-Based Systems, March 2024, https://doi.org/10.1016/j.knosys.2024.111668

Classification

3. M. Ghafoor, **Syed Ali Tariq**, I. A. Taj, T. Zia, A. Abbas, A. Y. Zomaya, "*Fingerprint Identification with Shallow Multi-feature View Classifier*," IEEE Transactions on Cybernetics, Dec 2019. https://doi.org/10.1109/TCYB.2019.2957188
4. T. Zia, M. Ghafoor, **Syed Ali Tariq**, I. A. Taj, "*Robust Fingerprint Classification with Bayesian Convolutional Networks*," IET Image Processing, Feb 2019. https://doi.org/10.1049/iet-ipr.2018.5466
5. Z. Abideen, M. Ghafoor, K. Munir, M. Saqib, Ata Ullah, T. Zia, **Syed Ali Tariq**, G. Ahmad, and A. Zahra, "*Uncertainty Assisted Robust Tuberculosis Identification with Bayesian Convolutional Neural Networks*," IEEE Access, Jan 2020. https://doi.org/10.1109/ACCESS.2020.2970023
6. N. A. Khan, M. Ghafoor, M. Mohammadi, and **Syed Ali Tariq**, "*Convolutional Neural Networks based Time-Frequency Image Enhancement For the Analysis of EEG Signals*," Multidimensional Systems and Signal Processing, Feb 2022. https://doi.org/10.1007/s11045-022-00822-2

7. M. Usman, T. Zia, **Syed Ali Tariq**, "*Analyzing Transfer Learning of Vision Transformers for Interpreting Chest Radiography*", Journal of Digital Imaging, 2022. https://doi.org/10.1007/s10278-022-00666-z
8. T. Aitazaz, A. Tubaishat, A., F. Al-Obeidat, B. Shah, T. Zia, **Syed Ali Tariq**, "*Transfer learning for histopathology images: an empirical study*", Neural Computing & Applications, 2022. https://doi.org/10.1007/s00521-022-07516-7

Segmentation

9. M. Ghafoor, **Syed Ali Tariq**, M. Abu Bakr, Jibran, W. Ahmad, T. Zia, "*Perceptually lossless surgical telementoring system based on non-parametric segmentation*," Journal of Medical Imaging and Health Informatics, 2018. https://doi.org/10.1166/jmihi.2019.2512
10. M. Junaid, M. Ghafoor, K. Munir, A. Hassan, S. Khalid, **Syed Ali Tariq**, G. Ahmed, and T. Zia, "*Multi-feature View-based Shallow Convolutional Neural Network for Road Segmentation*," IEEE Access, Dec 2019. https://doi.org/10.1109/ACCESS.2020.2968965

Video compression

11. W. Ahmad, M. Ghafoor, **Syed Ali Tariq**, R. Olsson, M. Sjöström, "*Computationally efficient LF compressing using MV-HEVC framework*," IEEE Access, Sep 2019. https://doi.org/10.1109/ACCESS.2019.2944765
12. A. Hassan, M. Ghafoor, **Syed Ali Tariq**, T. Zia, W. Ahmad, "*High-Efficiency Video Coding (HEVC) based surgical telementoring system using Convolutional Neural Network*," Journal of Digital Imaging, March 2019. https://doi.org/10.1007/s10278-019-00206-2

Parallel programming

13. **Syed Ali Tariq**, S. Iqbal, M. Ghafoor, I. A. Taj, N. M. Jafri, S. Razzaq, T. Zia, "*Massively Parallel Palmprint Identification System using GPU*," Cluster Computing, 2017.; https://doi.org/10.1007/s10586-017-1121-z
14. M. Ghafoor, S. Iqbal, **Syed Ali Tariq**, N. M. Jafri, I. A. Taj, "*Efficient Fingerprint Matching Using GPU*," IET Image Processing, 2017. https://doi.org/10.1049/iet-ipr.2016.1021
15. M. Ghafoor, **Syed Ali Tariq**, S. Iqbal, I. A. Taj, N. M. Jafri, "*Robust palmprint identification using efficient preprocessing and two-stage matching technique*," IET Image Processing, Sep 2020. https://doi.org/10.1049/iet-ipr.2018.5736
16. M. Shafiq, I. A. Taj, M. Ghafoor, **Syed Ali Tariq**, A. Abbas, A. Y. Zomaya, "*Accelerating Fingerprint Identification using FPGA for Large-scale Applications*," Journal of Parallel and Distributed Computing, 2020. https://doi.org/10.1016/j.jpdc.2020.03.007

Achievements and Awards

- Currently hold the first position in TBX11K Tuberculosis Classification and Detection Challenge: https://competitions.codalab.org/competitions/25848#results
- Received Gold Medal with a GPA of 3.87 in MS degree from Abasyn University, Islamabad, Pakistan.

References

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