

Abdul Rehman Khan

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Education

MS in Computer Science (Ongoing)

Nov. 2021 - Oct. 2023

Pakistan Institute of Engineering and Applied Sciences

Islamabad, Pakistan

CGPA: 4.00 / 4.00 (Expected Gold Medal)

The research-based thesis explores Hybrid CNN-Transformer approaches for medical image segmentation and proposes multiple publishable techniques, including MaxViT-UNet under Dr. Asifullah's Supervision.

BS in Computer and Information Sciences

Sep. 2017 - Jul. 2021

Pakistan Institute of Engineering and Applied Sciences

Islamabad, Pakistan

CGPA: 3.87 / 4.00 (Gold Medalist)

The research-oriented thesis improves Mask-RCNN for Lymphocyte Detection in histopathology images. This research led to contributions in numerous publications under Dr. Asifullah's Supervision.

Intermediate

Sep. 2015 - Jun. 2017

Punjab College of Sciences

Gujranwala, Pakistan

Intermediate in Pre-Engineering major with 93% Grades

Matriculation

Sep. 2013 - Jun. 2015

St. Joseph's English High School

Gujranwala, Pakistan

Matriculation in Computer Science major with 90% Grades

Technical Skills

Programming

Python, Matlab, Java, C, C++, Javascript

Python Libraries

PyTorch, Tensorflow, Keras, Opencv-Python, Scikit-Learn, Matplotlib, Seaborn, Pandas, Numpy

Software Development

Databases (SQL, Mongo, Firebase), Web Development, Android Development

Typesetting & Drawing

LaTeX, Microsoft Office, Draw.io

GRE (General)

Quantitative (163), Verbal (149), Analytical (3)

Languages

Urdu (Native), English (TOEFL: 96)

Projects

Medical Image Segmentation using Hybrid CNN-Transformer Techniques

MS Thesis Project

2023

Explored the drawbacks of current CNN-only and Transformer-only techniques, then proposed various Hybrid CNN-Transformer ideas, achieving several publishable results. The proposed techniques employ the idea of Multi-Axis Attention for effectively capturing local and global information, crucial for segmentation purposes. [\[Link\]](#)

Lymphocyte Detection using Mask-RCNN

2021

BS Thesis Project

From a research perspective, the thesis exploits Mask-RCNN for Lymphocyte Detection in Histopathology images. On the development side, a Web-Interface was created to facilitate pathologists in lymphocyte detection. [\[Link\]](#)

Blood Cell Classification using Resnet

2020

Semester Project

Performed Blood Cell classification using Resnet in PyTorch on an open-source dataset. [\[Link\]](#)

Person Detection and Counting in video using TensorFlow

Semester Project

2019

Performed Person Detection and Counting in video frames using MobileNet in TensorFlow Python.

Awards and Honors

Jul. 2021	Gold Medal: "First Position in BS Computer and Information Science Degree"	Islamabad
Jul. 2019	IEEE Region-10 Website Contest: "First Position in IEEE Region-10 Website Contest"	Islamabad
2017 - 2021	Govt. Scholarship: "Achieved four years scholarship for outstanding academic performance"	Islamabad
2017 - 2021	STEP-PGC Scholarship: "Achieved four years scholarship for outstanding academic performance"	Islamabad
Feb. 2017	National Physics Talent Contest: "Among Top 25 Participants"	Islamabad
Nov. 2016	National Science Talent Contest: "Among Top 50 Participants"	Islamabad

Volunteer Services

WEB MASTER

IEEE Student Branch

PIEAS, Islamabad

Aug. 2020 - Mar. 2021

Served as a member of the executive team at the IEEE PIEAS student branch.

Volunteer in IEEE PSYWSC'18, IEEE WIE ILS'19 and TedX PIEAS'19

PIEAS, Islamabad

IEEE Student Branch

Aug. 2018 - Nov. 2019

Head Web-Team in PSYWSC and TedX AND Member Executive Committee in IEEE WIE ILS.

Publications

- [1] Rauf, Z., Khan, **Khan, A. R.**, Sohail, A., Khan, Asif et al. "Lymphocyte detection for cancer analysis using a novel fusion block based channel boosted CNN." *Scientific Reports* 13.1 (2023): 14047., 2023. [\[Link\]](#)
Abstract: In this work, we propose a novel Boosted Channels Fusion-based CNN "BCF-Lym-Detector" for lymphocyte detection in multiple cancer histology images. The proposed network initially selects candidate lymphocytic regions at the tissue level and then detects lymphocytes at the cellular level. The proposed "BCF-Lym-Detector" generates diverse boosted channels by utilizing the feature learning capability of different CNN architectures. The assessment of the proposed "BCF-Lym-Detector" show substantial improvement in terms of F-score (0.93 and 0.84 on LYSTO and NuClick, respectively).
- [2] **Khan, A. R.**, Khan, Asif "MaxViT-UNet: Multi-Axis Attention for Medical Image Segmentation." *arXiv:2305.08396*, 2023. [\[Link\]](#)
Abstract: The proposed MaxViT-UNet architecture consists of an encoder-decoder network with a hybrid decoder block. The decoder block is designed to harness the power of both convolution and self-attention mechanisms. The convolution mechanism is used to extract local features, while the self-attention mechanism is used to capture both local and global features. The two mechanisms are combined using a multi-axis attention mechanism, which significantly enhances the discriminative capacity between the object and background regions.
- [3] Khan, A.*, Rauf, Z., Sohail, A., **Khan, A. R.**, Asif, H, Asif, A., Farooq, U. "A survey of the Vision Transformers and their CNN-Transformer based Variants" *arXiv:2305.09880*, 2023. [\[Link\]](#)
Abstract: This survey presents a taxonomy of recent vision transformer architectures, with a focus on hybrid architectures. It also discusses the key features of these architectures, such as attention, positional embeddings, and multi-scale processing, and convolution. The survey concludes by highlighting the potential of hybrid vision transformers and pointing toward the future directions.
- [4] Ali, M. Liaqat, **Khan, A. R.**, Khan, A. *. "Channel boosting based detection and segmentation for cancer analysis in histopathological images." *19th International Bhurban Conference on Applied Sciences and Technology (IBCAST)*, IEEE, 2022. [\[Link\]](#)
Abstract: Pyramid Vision Transformer Channel Boosted Lymphocyte Detection (PVTCLB-Lymph-Det) is a new computer-aided diagnostic system for detecting lymphocytes in tumor stroma. It is based on the idea of channel boosting to enhance the learning capacity of the model. The proposed system was evaluated on a dataset of H&E stained images and achieved an F-score of 88.92%. This suggests that PVTCLB-Lymph-Det can be used to effectively detect lymphocytes and may aid pathologists in solving medical diagnostic problems.
- [5] Zafar, Muhammad Mohsin, **Khan, A. R.**, Khan, A. *. "Detection of tumour infiltrating lymphocytes in CD3 and CD8 stained histopathological images using a two-phase deep CNN." *Photodiagnosis and Photodynamic Therapy*, 37 (2022): 102676. [\[Link\]](#)
Abstract: This work presents a "Two-Phase Deep Convolutional Neural Network based Lymphocyte Counter (TDC-LC)" to detect lymphocytes in CD3 and CD8 stained histology images. The proposed pipeline sequentially works by removing hard negative examples (artifacts) in the first phase using a custom CNN "LSATM-Net" that exploits the idea of a split, asymmetric transform, and merge. Whereas, in the second phase, instance segmentation is performed to detect and generate a lymphocyte count against the remaining samples. The proposed TDC-LC outperforms the existing models in identifying and counting lymphocytes with high Recall (0.87) and F-score (0.89).
- [6] Khan, A. T.*, **Khan, A. R.**, Li, S.. "Optimally configured gated recurrent unit using hyperband for the long-term forecasting of photovoltaic plant." *Renewable Energy Focus*, 39 (2021): 49-58. [\[Link\]](#)
Abstract: In this paper, we have presented the Hyperband Gated Recurrent Unit model for power, voltage, and current forecasting of the photovoltaic power plant. The model has a monthly prediction horizon with a temporal resolution of a day. We used the Hyperband technique for the optimal selection of the hyper-parameters. We trained our model on 11 months of data and predicated the outputs for the 12th month. The proposed model achieved promising results with minimum error.
- [7] **Khan, A. R.**, Khan, A. T*, Salik, M., Bakhsh, S. "An optimally configured HP-GRU model using hyperband for the control of wall following robot." *Int. J. Robot. Control Syst*, 1.1 (2021): 66-74. [\[Link\]](#)
Abstract: In this paper, we presented an autonomous control framework for the wall-following robot using an optimally configured Gated Recurrent Unit (GRU) model with the hyperband algorithm. The selection of hyper-parameters of the GRU model is a complex optimization problem with local minima. To overcome this problem, we used a hyperband algorithm for the selection of optimal parameters. The proposed HP-GRU model is used on a dataset of SCITOS G5 robots with 24 sensors mounted. The results show that HP-GRU has a mean accuracy of 0.9857 and a mean loss of 0.0810, and it is comparable with other deep learning algorithms.