Shah Rukh Qasim

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Projects and Experiences (Highlights)

Jan 2018–Jan 2019 **Technical Student – Research Intern at CERN**, *Geneva, Switzerland*, Code, Supervisors: Maurizio Pierini Jan Kieseler.

HGCal, short for High Granularity Calorimeter, is a planned upgrade for the general purpose detector CMS. Deep learning has become very famous in high energy physics recently. However, HGCal poses certain challenges to traditional machine learning approaches like CNNs because of its non-homogeneous geometry and sparse data. We have been looking into different *graph based machine learning methods* to tackle this challenge and to see how they perform. We have been working on problems like denoising, ID (classification of particles given showers) and clustering (separating showers of different particles of each other). We have tested old methods and have also developed novel approaches.

In addition to this, I have made tiny contributions to CMS Software as per our needs. I have also worked on CUDA for fast clustering for the CMS software, which began as part of the patatrack hackathon.

June–Sept 2017 **Research Intern at Computer Vision and Mixed Reality**, *Hoschule RheinMain*, Wiesbaden, Germany, Supervisors: Prof. Dr. Adrian Ulges Prof. Dr. Ulrich Schwanecke | Feedback.

This project involved underwater video processing for fish analysis and counting. I worked as a research intern in Germany at CVMR Lab in Hoschule RheinMain under the supervision of Dr. Adrian Ulges and Dr. Ulrich Schwanecke. I implemented two state-of-the-art approaches from CVPR 2016 and CVPR 2017 and evaluated them for counting both fish and people. I also worked on generating synthetic data.

2015–Now **TUKL R&D Lab, SEECS**, *Islamabad*, Pakistan, Supervisor: Dr. Faisal Shafait.

I spent most of my free time in the research lab during the last two years (minus my time abroad) of my undergrad working under Dr. Faisal for various research and development projects. I mostly worked on document processing, working on problems like invoice parsing, form data extraction, and table detection and parsing. I was also honored to guide junior students through their projects.

2015–2016 **Freelancing**, *Profile*.

In my free time, I worked on different freelance projects which were mostly Android apps. I have worked with many people from many countries and developed different types of apps for them. Please follow the link to my profile to read my detailed reviews.

Publications

July 2018 - Feb 2019 **S.R. Qasim. J Kieseler. Y Iiyamaa. M. Pierini. Learning representations of irregular particle-detector geometry with distance-weighted graph networks (Under review - European Physical Journal - C (EPJ C)** Paper, Code

Most of the work I did while being part of CERN is presented in this paper. We explored existing graph based machine learning on clustering in irregular geometry calorimeter. In addition to that, we introduced two more graph networks which outperformed the existing ones.

Feb-April 2017 **A Gilani, S.R. Qasim. I Malik. F Shafait. Table Detection using Deep Learning (ICDAR 2017)** Link

I worked on solving the complex problem of table detection with Azka. I wrote the evaluation/transformation code and Azka ran the experiments. Both of us contributed to paper writing and generating ideas equally. We introduced Faster RCNN to improve performance over traditional methods (But in the actual conference, other people had also published similar approaches which used Faster RCNN). And furthermore, we also used distance transforms to show they work better than normal images for the problem. (It makes sense since these transform capture alignment information more precisely which is important for tabular structure recognition.)

Feb-April 2019 **S.R. Qasim. H Mahmood. F Shafait. Rethinking table parsing using deep learning (Under review - ICDAR 2019)**

Redefined table parsing problem using graph theory such that it is compatible with graph neural networks. Designed a novel architecture to make use of convolutional and graph neural networks. In addition to this, we introduced a new dataset and employed a novel monte-carlo based technique to reduce memory consumption.

Education

2014–2019 **Bachelor of Engineering in Electrical Engineering**, *NUST (National University of Sciences and Technology)*, Islamabad.

- Took a gap year after 7th semester (2018) to do research at CERN. Rejoined in February 2019.
- **Expected graduation: May 2019**
- Teaching Assistant - For the course of Data Structures and Algorithms
- Spent most of my free time in last two years in TUKL lab working on different research projects

Conferences/Workshop

July 2018 **Thirty-fifth International Conference on Machine Learning (ICML 2018), Stockholm, Sweden**

Aug 2018 **Fourth Machine Learning in High Energy Physics Summer School 2018, University of Oxford, United Kingdom**

Jan 2019 **Applied ML Days 2019 (AMLD 2019), EPFL, Lausanne, Switzerland**

Teaching/Supervision

Summer 2018 **Supervisor (secondary)**, *CERN OpenLab student working on Generative Models for Calorimeter Simulation*, Geneva, Switzerland.

Assisted summer interns in their research project, providing insight, suggestions, training data, and code examples.

Summer 2018 **Supervisor (secondary)**, *CERN OpenLab student working on Noise filtering for Calorimeters with Autoencoders*, Geneva, Switzerland.

Assisted Summer interns in their research project, providing insight, suggestions, training data, and code examples.

Fall 2017 **Teaching Assistant**, *Course of data structures and algorithms*.

Helped with evaluation, designing problems, semester project and resolving queries.

2017 **Supervisor (secondary)**, *Junior students doing research internship at TUKL lab*, Islamabad, Pakistan.

Helped evaluate new interns for the lab and then guided two of them through their projects. Projects for students assigned to me were related to document processing.

Awards

July 2018 Student Volunteer, ICML 2018, Stockholm, Sweden

May 2017	Research internship offer from at Hochschule RheinMain, Germany for summer 2017
2015	Winners at SEECS Social Hackathon, Programming competition in all of SEECS. We were the only team which comprised only of Freshmen
2015	Winners Special Category for counter terrorism at FICS (Finding Innovative and Creative Solutions) competitions among all branches of NUST
2015	2nd position all of Pakistan for an app development competition PTA National App Awards

Skills

Languages	C++, C++11, Python, Java
Toolkits	TensorFlow, PyTorch, Numpy, OpenCV, CUDA, Tesseract, MATLAB, OMNeT++, Boost and more
Others	Adobe Illustrator, Android

Non-professional interests

Travelling, mountain biking, road biking, hiking, reading philosophy (of morals and science), behavioral economics and psychology