

# Umar Khan

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## Experience

February '23 - **Machine Learning Engineer and Product Innovation,**

Present *DeepReader*, Kaiserslautern, Germany.

Working as a Machine learning Engineer and ML Ops Engineer in building various Deep Learning based document extraction automation products. My current role includes both developing various Deep Learning based models and managing a team for brainstorming and developing new products. Due to various reason the specifics of the products under development have not been described here but can be further elaborated on request. A non exhaustive list of recent topics that I have worked on are described below:

- Metadata Expansion for Description Based Extractions.
- Multi-Agent Data Extraction Automation Pipeline.
- Large Language Models and Retrieval Augmented Generation (NER's with LLM).
- Extraction Language Models with Layout Embedding.
- Image Based Tabular Data Extraction and Structure Extractions.
- Named Entity Recognition Models Based on Transformers and GNN's.
- Handwritten Document OCR with Transformers.

### Latest Works:

- Usage and Training of Quantized LLM's (Reference: LLamaCPP).
- Implementation of Teacher Student Model Systems for Small Data Trainings with QLORA.
- Multi-Agent Systems for Data Generation.
- Document Structuring through GeoLayoutLM.
- Effective Zero Ghost Inference of LLM's.

October '21 - **Machine Learning Engineer,**

Present *DFKI*, Kaiserslautern, Germany.

Working as a Machine learning Engineer and Associate Researcher for DeepReader GmbH. My current role includes developing various Deep Learning based architectures for document data extraction automation including but not limited to Document Classification, Named Entity Recognition and Table Structure Extraction.

October '20 - **Associate Researcher,**

October '21 *DLL NCAI*, Islamabad, Pakistan.

Working as a member of the primary research group under the supervision of Prof. Dr. Faisal Shafait. My role at DLL NCAI has been oriented around two aspects of same challenge to solve challenging problems with novel ideas and converting those ideas into generalized research publications.

- TabAUG: A novel tabular **Data Augmentation** technique for improving data efficiency in **table structure recognition** in document images. **Accepted in ICDAR2021**
- Achieved state of the art results on a custom dataset with the novel idea of Word pool based **Text Colorization** for template classification in **Insurance Document Images** for Automated Extraction. **Collaboration with PhelixAI**
- Specie based max n-count calculation using **Fish Tracking and Specie Classification** for biodiversity estimation. **Collaboration with Australian Institute of Marine Sciences**
- **LayoutLM** Based Name Entity Recognition from Medical Insurance Documents, Deployed an Entire Flask Based swagger documented REST-API for PhelixAI.

June '19 **Machine Learning Engineer,**  
September '20 *Dcube Technologies, Islamabad, Pakistan.*

My main role in the company revolved around Engineering scalable solutions for our multitude of clients by implementing and deploying Deep Learning based architectures to the cloud infrastructure.

- Successfully deployed an end-to-end **Tabular Data Extraction** pipeline. Main challenge involved dealing with data scarcity and data complexity. *Collaboration with CloudSDS*
- Designed and Implemented a novel **Data Augmentation** technique for a small dataset allowing us to train and deploy the **Table Structure Extraction** algorithm based on GNN. This project was further developed into TabAUG publication *Accepted in ICDAR2021*
- We deployed a cloud based **Recommendation System** that was auto inference on changes in the google analytic data for users and items. *Collaboration with AARZ*
- Built a python package **PyTabulate** for generating tables **Metadata** allowing for visualizing and understanding table datasets. This package also formed the basis for the statistical driven augmentations in **TabAUG**.
- Custom **Data Labeling Tool** for tagging **Vertical and Horizontal** tables. This reduced labeling time from an average 7 seconds per image to 2 seconds per image.

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## Publications

- 2023 **WordVIS: A Color Worth A Thousand Words,**  
*U. Khan, S.Saifullah, S.Agne, A.Dengel, and S.Ahmed,*  
(Used in production, pre-print maybe available soon).
- 2021 **TabAug: Data Driven Augmentation for Enhanced Table Structure Recognition,**  
*U. Khan, S. Zahid, M.A. Ali, A. Ul-Hasan and F. Shafait,*  
(Accepted in ICDAR 2021), [Arxiv](#).
- 2021 **Content-Driven Document Colorization for Table Detection,**  
*M.A. Ali, S. Zahid, U. Khan, A. Ul-Hasan and F. Shafait,*  
Pre-print available, [Pre-Print](#).

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## Education

2021–Present **Masters in Informatik (Intelligent Systems),**  
*RPTU (Technical University of Kaiserslautern), Kaiserslautern, Germany.*  
**Supervisor:** *Prof. Dr. Sheraz Ahmed*  
**CGPA:** 1.3

2015–2019 **Bachelor's of Engineering in Software Engineering,**  
*SEECS-NUST (National University of Sciences and Technology), Islamabad, Pakistan.*  
**Supervisor:** *Prof. Dr. Faisal Shafait*  
**CGPA:** 3.46 / 4.0

**Final Year Thesis:** Map-less & Autonomous Navigation for Quadcopters

We worked on developing an autonomous system of maneuverability for navigating a quadcopter to a relative target location in a controlled environment. We used a semi-supervised CNN for depth map estimation using the monocular sensor. Using depth map with the optical flow sensor on board the quadcopter a relative flight path was estimated for reaching the target.

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## Internships

Jul 2017 — **Requirements Engineering,**

Sep 2017 *AAWAZ, Islamabad, .*

AAWAZ is an application that has a focus on providing AI and visual driven tools to help accelerate and improve learning in Autistic children to give them a chance to learn and develop learning skills as close as possible to normal children. My role was designed around Requirements Engineering for the product in developed. I was one of the payoneers who joined the project and my ideas went into the final product. the product also won IBM startup cup. The product is still in development and you can learn more about it here: [AAWAZ](#)

### Key Responsibilities:

- Stakeholder Surveys to stake out different Requirements
- Stakeholder Interviews for resolving conflicting Requirements
- Feasibility Matchup for Requirements and Resource Availability
- Application Concept Development
- Prototype Development in Unity 3D

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## Personal Commercial Projects

2019-2020 **Buyer Behavioral Clustering**, *I developed a prototype for behavioral clustering in buyer behavior and the products they would likely buy. This project was for Manager in SalesForce Germany for a company pitch. I have been endorsed by Nikolas Makris on Linked In and would be happy to provide more details if required..*

2019-2020 **Light Transfer**, *Developed a commercial tool for Vactor Manufacturing Inc (parent company Federal Signal Corporation) where highlights in source document images were detected and transferred to the target Document Images reducing their processing time from an average 16 minutes per document to 12 seconds per document with highly reliable system. I have been endorsed by Christopher Kip Ketner on Linked In and would be happy to provide more details if required..*

2019-2020 **Pneumonia Detection**, *Developed a web application for pneumonia detection for a doctor presenting the use of machine learning in medical imaging for a medical convention, our method of pneumonia detection achieved a 92% validation accuracy, the web application is still live and can be found [here](#).*

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## Skills

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|-------------------------------------|---------------------------|
| ○ <b>Computer Vision</b>            | ○ PyTorch, Tensorflow     |
| ○ <b>Data Extraction Automation</b> | ○ OpenCV, Numpy, NLTK     |
| ○ <b>System Architecture Design</b> | ○ Python, C++             |
| ○ Deep Learning Cloud Deployment    | ○ Flask, Django, REST API |
| ○ Requirement Engineering           | ○ Docker, Kubernetes      |