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Umar Khan

Experience

February '23 - Present
Machine Learning Engineer and Product Design,
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 (Ground-up Framework Developed).
- 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.
- Cursor MCP for directory and code discovery.
- MemoryCore a memory infra for LLM's

October '20 - October '21
Associate Researcher,
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 was oriented around two aspects of industrial research. solving challenging problems with novel ideas and converting those ideas commercial products.

- Solved data inadequacy problems with TabAUG: A novel tabular **Data Augmentation** technique for improving data efficiency in **table structure recognition** in document images. Achieved SOTA results. ***Accepted in ICDAR2021***
- Solved **granular document classification** with a novel approach of Word pool based **Text Colorization** for template classification in **Insurance Document Images** for Automated Extraction. ***Collaboration with PhelixAI.*** SOTA results on custom dataset.
- Specie based max n-count calculation using **Fish Tracking and Specie Classification** for biodiversity estimation. ***Collaboration with Australian Institute of Marine Sciences***

June '19 – September '20 **Machine Learning Engineer**,
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 and 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 of tagging **Vertical and Horizontal** tables. This reduced labeling time from an average 7 seconds per image to 2 seconds per image.

Publications

2023 **WordVIS: A Color Worth A Thousand Words**,
U. Khan, *S.Saifullah, S.Agne, A.Dengel, and S.Ahmed*,
(Used in production,), Arxiv.

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.

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.

Skills

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