Aditya Mangal

Senior Research Engineer

AI Enthusiast, Innovative, Fast Learner

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WORK EXPERIENCE

Insurance Samadhan

Senior Research Engineer (full time)

01/2024 – Present *Noida*

Research Engineer (full time)

01/2023 – 12/2023 *Noida*

- Led a team of 6 members to successfully deliver complex projects.
- Designed and implemented a scalable architecture for the InSa-Engine by decoupling its services using **Docker containers**. Integrated **Amazon EFS** for common storage and **Apache Kafka** for efficient message brokering, ensuring robust communication and scalability across services.
- Developed an end-to-end solution for the **Know Your Policy (KYP)** feature, enhancing data management and compliance.
- Integrated **Retrieval-Augmented Generation (RAG)** and LLMs to enhance accuracy in key information extraction.
- Built a Vision-Language Model (VLM) to detect and extract structured table data from scanned documents.
- Integrated **Kafka** for efficient data streaming and processing within the system.
- Developed robust APIs using FastAPI, ensuring seamless communication between different system components.
- Created an **Information Extractor** that provides query-based answers in key-value format, improving data retrieval accuracy.
- Designed and implemented a GPU-based **server scaling algorithm** to optimize system performance and resource allocation with **AWS AutoScaling**.
- Contributed to achieving **ISO certification** by ensuring compliance with industry standards.
- Successfully integrated with **CAMS** (CAMS is India's largest Mutual Fund Transfer Agency that provides MF Services & Statements. Service partner to AIFs, Insurance Companies, Banks & NBFCs), **CDSL**.
- Developed an AI-powered document processing pipeline with Table Detection & Extraction, **De-skewing**, and **De-noising** modules, enabling accurate tabular data extraction, automatic image orientation correction, and removal of watermarks and noise for enhanced document clarity.

Eigenlytics Data Solution

Research Engineer (full time)

05/2022 – 12/2022 *Hyderabad*

Associate Data Scientist (full time)

07/2021 – 04/2022 *Hyderabad*

Data Science and Image Processing Intern

11/2020 – 06/2021 *Bengaluru*

- Gained experience in multiple AI domains, including computer vision, deep learning, and natural language processing, applying these skills to develop sophisticated solutions.
- Developed and implemented advanced algorithms for FinTech software, improving efficiency, accuracy, and decision-making capabilities.
- During my internship, designed and developed an **Optical Character Recognition (OCR)** system from the ground up, incorporating various AI technologies to enhance text recognition and processing accuracy.
- Engineered an automated system capable of making intelligent decisions based on real-time input data, leveraging AI to optimize operations.
- Developed robust face recognition and object detection models, contributing to more accurate identification and analysis in AI-driven applications.

TECHNICAL SKILLS

Key Skills: Machine Learning, Deep Learning, Computer Vision
Natural Language Processing, Statistical Analysis
Data Analytics, Quantitative Analysis
YOLO, Tesseract, LLAMA, LayoutLM, Transformers, RAG, LLM, Hugging Face

Development: Data Structures & Algorithms,
Cloud Deployment and Development on AWS EC2, Multi-GPU Handling, Docker, Sagemaker, Load Balancer, AutoScaler, Cloudwatch, Jenkins, Github, Gitlab, Bitbucket, MLFlow

Frameworks: TensorFlow, PyTorch, Keras, OpenCV, BERT, LangChain

Cloud MLOPs: AWS, GCP,E2E, FluidStack, Heroku. AWS Bedrock

Programming Languages: C/C++, Python, Dart, Assembly Language,Embedded C

Databases: MySQL, Firebase, MongoDB, AWS S3, ChromaDB, FaissDB, Milvus, Qdrants

Web Development: HTML, CSS, Bootstrap, JavaScript, Flask, Django, FastAPI

EDUCATION

B.Tech [Electronics & Communication Engineering]
Indian Institute of Information Technology, Surat
07/2017 – 06/2021 ***Gold Medalist 9..23 CGPA***

12th (HSC)
Board of Senior Secondary Education,Rajasthan
07/2015 – 05/2016 *88.60%*

LEADERSHIP SKILLS

Team Management – Sometime work as individual contributor and sometime take the team of players and manage the work with passion

Time Management – Deliver the solutions to problem by dividing problems into chunks

MY PYTHON LIBRARIES ON PYPI

Image-Data-Augmentor – a Python module designed to enhance the preprocessing pipeline for machine learning models by providing a robust set of image augmentation techniques. **Pypi Link**

Concurrent-Image-Read – a python module to read Image Files or Image List Concurrently with multi-threading. **Pypi Link**

LANGUAGES

English(US) *Professional Working Proficiency*

Hindi *Native or Bilingual Proficiency*

WORK EXPERIENCE

TaxHeal

Machine Learning Intern

11/2019 – 04/2020 *Work From Home*

- Research Projects: Led and executed multiple research assignments, focusing on computer vision and machine learning applications.
- Temple Image Classifier: Developed a specialized image classifier (CNN) for temple recognition within an app, utilizing TensorFlow Lite for efficient deployment on mobile devices.
- Facial Recognition Development: Employed data augmentation techniques in Keras to enhance facial recognition capabilities, enabling accurate identification using a single image.
- Facial Attendance System: Innovated a facial recognition-based attendance system, improving accuracy and efficiency in tracking attendance.
- Invoice Reader Development: Created an advanced invoice reader by integrating Optical Character Recognition (OCR) with Natural Language Processing (NLP) techniques, enabling automated extraction and processing of invoice data.

Energy Cloud Technology

Embedded System Intern

06/2019 – 06/2019 *Surat*

- PCB Design: Advanced skills in KiCAD for creating complex, reliable circuit boards.
- Hardware Modules: Proficient with ARDUINO UNO, ESP-32, TFT screens, and sensors like DHT-11, BME-280, and soil moisture sensors, integrating them into functional systems.
- Arduino Programming: Developed robust firmware for hardware control and data acquisition.
- Image Processing: Utilized MATLAB for advanced visual data analysis and manipulation.
- Data Analysis: Conducted complex data analysis with Python using Pandas and NumPy.
- Smart Agriculture Monitoring: Created an Android app for real-time monitoring of temperature, humidity, and soil moisture, integrating hardware and software for a user-friendly farming solution.

Haier Appliances India Pvt Ltd

Marketing Intern (full time)

12/2018 – 12/2018 *Jaipur*

- Sales and Marketing: Led sales and marketing activities to drive growth and customer outreach.
- Management Knowledge: Acquired understanding of business management and roles, including branch, logistics, financial managers, and managing director.
- Service Center Insight: Observed service center operations to learn about management and fieldwork.
- Field Marketing: Conducted field marketing, engaging with customers to refine strategies.
- Branch Analysis: Analyzed branch operations and marketing strategies to understand their impact on sales.

PROJECT

Fine-Tuning TinyLlama on WhatsApp Chats
-Personal Project
Fine-tuned **TinyLlama-1.1B** on personal WhatsApp chat data to build a custom AI chatbot capable of generating context-aware responses. Preprocessed and tokenized chat history, optimized training with **LoRA & PEFT**, and deployed the model for real-time interaction.

Improving SQL Queries with Fine-Tuning
-Insurance Samadhan
Fine-tuned **Llama-2-7B** to optimize SQL query generation and refinement, enhancing query efficiency and execution speed. Trained the model on a dataset of complex **SQL queries**, focusing on index optimization, join restructuring, and subquery simplification. Integrated **RAG-based** retrieval for contextual query recommendations and real-time query improvements.

ACHIEVEMENTS

Competition of GenAI in **AWS GameDay**
Secure 2nd Prize

Gold Medal awarded by **Deputy Director** of **ISRO Nilesh M. Desai**
Secure 1st Prize of ECE of 2017 batch

Competition of Line Tracer in Hertz 3.0 (03/2018)
Secure 1st Prize

Competition of ROBOMANIA SMPC-2018 (02/2018)
Secured 1st Prize

MJF Code 19 Hackathon (04/2020)
Recognised to be amongst the Top 250 entries

EXTRA CURRICULAR ACTIVITIES

Technical Head in SCOSH (07/2019 –03/2021)
Handle all technical task like website handling,etc

Content Writing job (10/2019 – 10/2019)
Did content writing job for Fran Biz Corp

Volunteer in JOYFEST and NIRVANA club (07/2019 – 06/2021)
Help poor and orphanage people by providing them food,clothes and book.Teach childern and celebrate festivals with them

WORKSHOPS ATTENDED

Internet of Things Workshop at IIT Delhi (10/2018)
organised by Robotech Labs at Rendezvous IIT Delhi.

Mobile Robotics Workshop at IIT Delhi (10/2017)
by Robosapiens Technologies Pvt. Ltd. at Rendezvous IIT Delhi

Sixth Sense Robotics Workshop at IIT Delhi (10/2017)
by Robosapiens Technologies Pvt. Ltd. at Rendezvous IIT Delhi.

Lean Startup Workshop at IIT Bombay (01/2018)
by The Entrepreneurship Cell, IIT Bombay, as a part E-SUMMIT-2018

PAPER PUBLICATION

A Novel Approach to Enhance the Image Quality without Changing its Resolution (Research is going on)
- **Under Dr. Pradeep Kumar Roy professor of IIIT Surat**

INTERESTS

Vlogging | Chess | Gaming | Electronics & IoT | Travelling

Startup Experience

Co-Founder & CEO of Kaspertech (08/2019 – 07/2020)

Kaspertech was a tech startup focused on developing innovative home automation products. We designed and built hardware devices and an accompanying mobile app from scratch, providing seamless control and automation for various household systems.

- Leadership: Founded and led Kaspertech, driving growth and strategy.
- Product Development: Created home automation products, including hardware and an app.
- Team Management: Built and managed a high-performance team.
- Business Development: Secured key partnerships, boosting revenue.
- Financials: Managed budgets, planning, and fundraising.

PROJECT

Prescription Scanning with LLM and RAG
-Personal Project
Developed an AI-powered system to extract structured data from handwritten medical prescriptions using **Retrieval-Augmented Generation (RAG) and LLMs**. Integrated a medicine vector database and Bedrock API for accurate entity recognition with **FAISS**

Image Super-Resolution with ViT
-Insurance Samadhan
Implemented an image super-resolution pipeline using SwinIR (ViT-based model) to upscale low-resolution images while preserving details. Leveraged PyTorch and OpenCV for data preprocessing and post-processing. Fine-tuned the model on a custom dataset to enhance real-world image quality, demonstrating ViT's capability in image restoration and enhancement.

Table Detection using Vision Language Models (on going)
-Insurance Samadhan
Fine-tuning Qwen2.5-VL-3B to detect and extract structured table data from scanned documents. Optimizing the model for accurate table boundary detection, cell segmentation, and text extraction. **PubTables-1M** Dataset.

ViT-based Image Captioning
-Personal Project
Developed an image captioning model by combining **ViT and GPT** to generate context-aware descriptions for images. Utilized **BLIP** (Bootstrapped Language-Image Pretraining) and **Hugging Face ViT** for feature extraction, integrating a transformer-based decoder for caption generation. Fine-tuned on a custom dataset to improve caption accuracy, enabling storytelling AI for image-based applications.

InSa-Engine
-Insurance Samadhan
Developed a service for extracting key information from insurance policy PDFs using in-house modules, Polifyx, and CAMS. Integrated RAG and LLMs for accurate and structured data extraction.

Language Translation (on going)
-Personal Project
Implemented an English-to-Hindi translation model using Transformer architecture in PyTorch. The model utilizes self-attention mechanisms and sequence-to-sequence learning to achieve accurate and context-aware translations.

Document Extraction using LayoutLM V3 (on going)
-Personal Project
Developed a key-value extraction system using LayoutLM V3 to accurately retrieve structured information from PDF documents. Utilized the SROIE dataset for training, achieving high accuracy in parsing and extracting data from complex document layouts.

Question-Answering Model
-Insurance Samadhan
This module was developed by fine-tuning a BERT model specifically on insurance policy documents. It also leverages K-Means clustering to group related questions into clusters. The solution is deployed within the Polifyx app, enabling users to ask questions via voice and receive accurate responses based on the trained model.

Watermark Removal Model
-Insurance Samadhan
Developed a model based on an advanced Y-shaped U-Net architecture to remove watermarks and reconstruct pixelated text. The model was trained on a custom-built dataset, enhancing its effectiveness in restoring and cleaning text within images.

Image-Data-Augmentor (**Python Library**)
-Personal Project
https://github.com/adityamangal1998/Image-Data-Augmentor
Developed a Python library for image data augmentation, capable of applying various techniques such as positional adjustments, noise addition, and color modifications to enhance the diversity and quality of image datasets.

Information-Extractor
-Insurance Samadhan
Developed a module for extracting key-value information from insurance policies using OCR-generated JSON data. The module leverages Named Entity Recognition (NER) and dictionary-based approaches for accurate information extraction and is fully configurable through a YAML file.

Page-Split-Detection
-Insurance Samadhan
Developed a module that detects A8 and A4 page layouts within a PDF file and splits A8 pages into A4 format. This module was built using the fine-tuning of the YOLOv8 model for precise layout detection.

Table-Detection
-Insurance Samadhan
This module employs an algorithm that detects table layouts by identifying table lines and segmenting them into distinct cells, including header cells, expanded cells, and non-header cells. It then reconstructs the table structure, integrating the extracted text data to form a coherent table representation.

Machine Translation and Transliteration
-Eigenlytics Data Solution
Developed a translation and transliteration model for converting OCR output from Hindi to English using a Transformer-based autoencoder in Natural Language Processing.

Concurrent –Image-Reader (**Python Library**)
- Personal Project
https://github.com/adityamangal1998/Concurrent-Image-Read
It is python library that I built to load and perform operations on image files concurrently with multi-threading

KYC Docs Extraction
-Eigenlytics Data Solution
This module is designed to extract data from various KYC documents, including PAN, Aadhaar, Voter ID, and Passport. It utilizes the YOLOv5 object detection algorithm to identify regions of interest (ROI) and then extracts text from these regions using Google OCR. A rule-based NLP approach is subsequently applied to extract the desired key-value pairs from the text.

OMR (Optical Mark Reader)
-Eigenlytics Data Solution
Localized various checkmark symbols, whether machine or human-generated, in noisy images using object detection algorithms such as YOLOv5 and RCNN. Achieved a model accuracy of 90-95% in detecting checkmarks despite multiple layers of noise.

D3 - Driver Drowsiness Detection
-Hackstack Hackathon
https://github.com/adityamangal1998/D3_HackStack
Developed an algorithm to detect driver drowsiness by analyzing multiple facial and head features, including detecting whether the driver is sleeping or yawning, with time-stamped results. The algorithm utilized 468 face landmarks from Google's MediaPipe library.

PROJECT

RoboDoctor (Healthcare Using AI)
-Hack36 Hackathon
https://github.com/adityamangal1998/RoboDoc_Hack36
Developed and deployed a Flask web app featuring machine learning models for predicting liver, brain, cancer, heart, and diabetes diseases, achieving an average accuracy of 92%. Recently added a COVID-19 prediction model, which uses X-ray, CT-scan images, and symptom data for accurate diagnosis.

De-Skewness of Document Images
-Eigenlytics Data Solution
Developed a multi-level decision module for skew correction in document images, capable of rotating incorrectly oriented images to their correct orientation. The module achieves an accuracy rate of 90-95%.

Super Resolution of low scale images
-Eigenlytics Data Solution
Developed a high-quality image restoration model using SRGAN (Super-Resolution Generative Adversarial Network) and LapSRN (Laplacian Pyramid Super-Resolution Network). The process involves splitting images into various sizes, feeding these segments into the model, and then recombining them to produce a high-resolution image with restored missing pixels.

Car Parking Solution
- Personal Project
https://github.com/adityamangal1998/Car-Parking-Solution
Developed a computer vision application designed to streamline car parking management by accurately detecting and guiding vehicles into parking spaces. The solution leverages traditional image processing techniques, avoiding the complexity of deep neural networks, while still delivering reliable performance and efficiency

Image Quality Assessment using DL
-Eigenlytics Data Solution
Developed a model that evaluates image quality by processing multiple segments of an image. The image is divided into segments, each undergoing a series of pre-processing steps before being fed into the model. The model generates scores for each segment, which are then averaged to produce a final score that determines the overall image quality.

Handwritten and Printed Text Image Classifier
-Eigenlytics Data Solution
Developed a model capable of classifying segmented images of handwritten and printed text. The model analyzes features such as texture, text style, pixel density, and text flow. It achieves an accuracy rate of 94-97% on realistic data.

De-Noising using Deep Learning
-Eigenlytics Data Solution
Developed and trained a denoising autoencoder using various model architectures and configurations on a synthetic dataset. The system effectively removed noise, such as scanned image artifacts, watermarks, and other disturbances, from images, enhancing their clarity and quality.

Printed Text OCR
-Eigenlytics Data Solution
Trained a model using a Connectionist Temporal Classification (CTC) based architecture on a scene-based dataset. Implemented a multi-level approach to accurately recognize and extract words from images. The pipeline achieves an accuracy range of 90%-95%, demonstrating effective text recognition in varied scene contexts.

E-PDFs document Extractor Pipeline
-Eigenlytics Data Solution
Developed a pipeline for extracting and arranging text from editable PDF documents, preserving the original layout. Achieved an extraction accuracy of 99.99%, ensuring high fidelity in text representation.

Invoice Reader and Filling System
-TaxHeal
Developed a pipeline to first convert invoice documents into a machine-readable string format and then extract key information such as GST number, seller name, and buyer name. This system efficiently processes various invoice types to capture and organize essential details.

Face Recognition attendance system
-TaxHeal
Developed a face recognition-based attendance system. Trained a model on a dataset of faces to identify individuals and predict their identity. The system greets recognized faces with their names and displays their timetable, streamlining attendance management.

Home Automation System with monitoring of electricity
-Energy Cloud Technology
Developed a home automation device that allows users to control appliances remotely via a mobile app. The system also monitors and displays electricity consumption, providing real-time insights and control over home energy usage from anywhere in the world.