



Industrial Internship Report on "Data Science and Machine Learning"

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Executive Summary

This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT).

This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 6 weeks' time.

My project was Data science and Machine Learning on Brain Tumor Detection

This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship.

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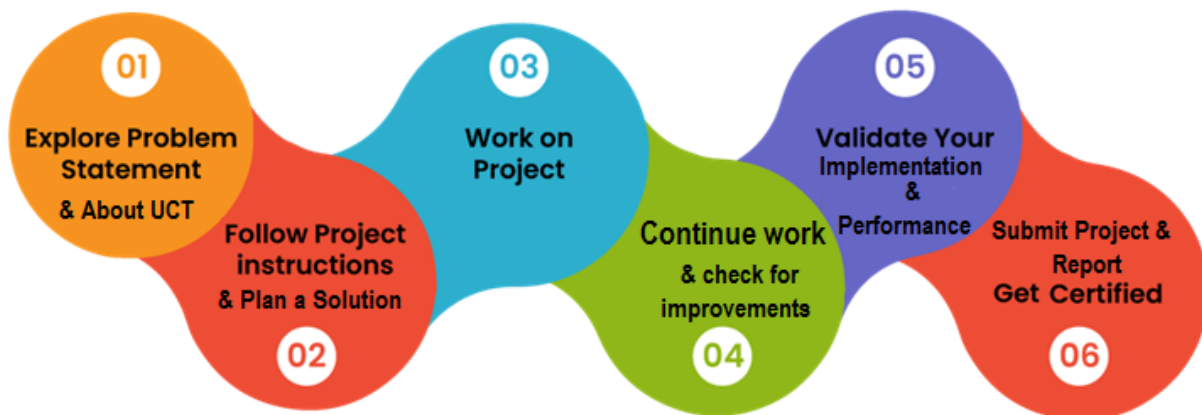
1 Preface

Over the course of six weeks, I have undertaken a structured internship program designed to provide both theoretical knowledge and practical exposure in the field of **Machine Learning (ML)**. The internship emphasized the importance of bridging academic learning with real-world problem-solving skills, which is essential for career development in technology-driven industries.

The program began with an introduction to the fundamentals of Machine Learning, covering supervised, unsupervised, and reinforcement learning concepts. Alongside theoretical lessons, I actively participated in quizzes and assignments. Notably, I successfully completed a **quiz on Machine Learning fundamentals with 100% accuracy**, which reinforced my understanding of key concepts.

The internship was an opportunity facilitated by USC/UCT, which provided a well-planned curriculum combining lectures, problem statements, and project work. My assigned project focused on **building an introductory ML model for classification tasks**, helping me understand the complete flow—from defining a problem statement to designing solutions and testing performance.

This structured exposure has laid a strong foundation for my career aspirations, highlighting the significance of relevant internships in enhancing both knowledge and employability.



2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies** e.g. **Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.



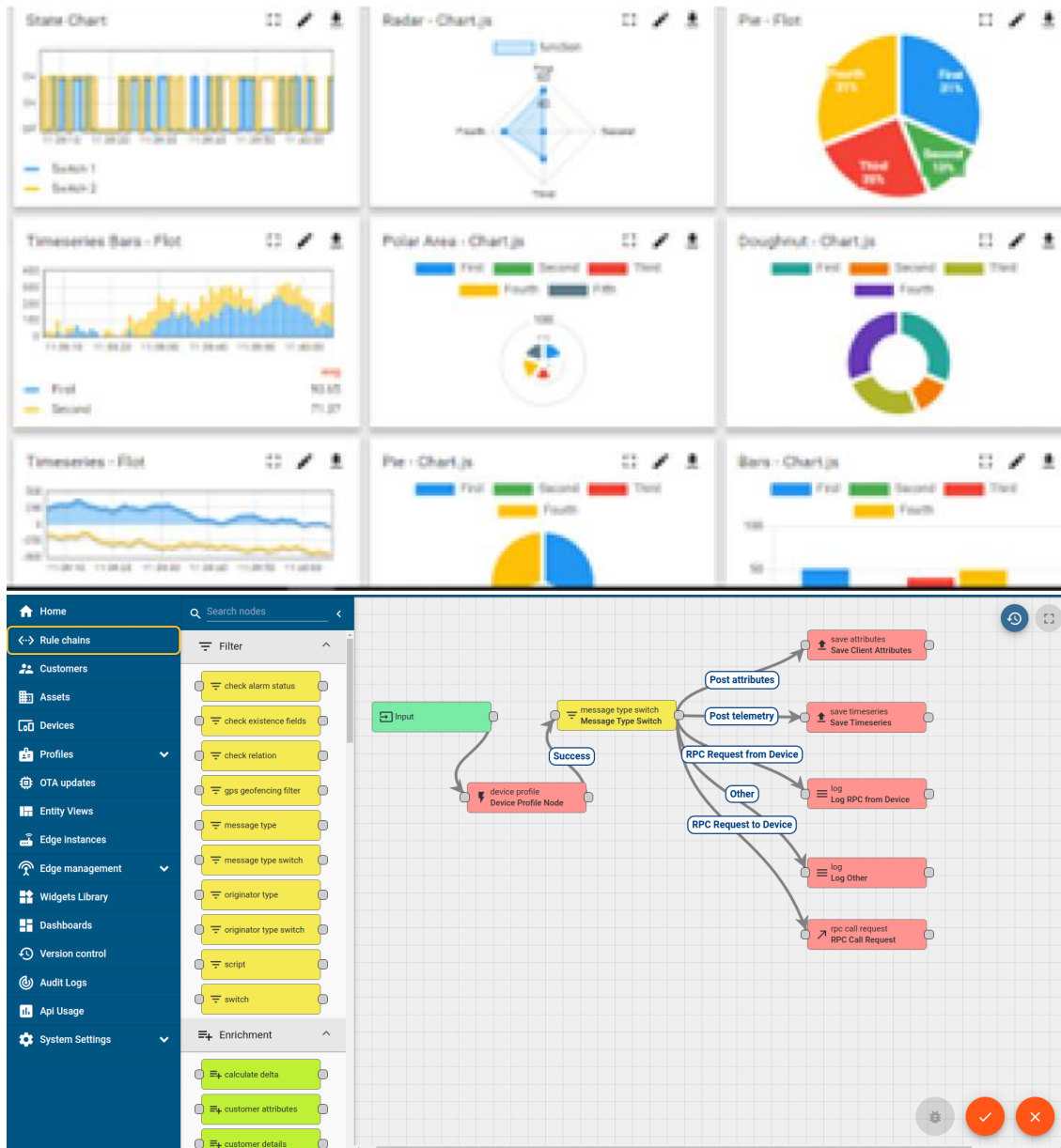
i. UCT IoT Platform (uct Insight)

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to

- Build Your own dashboard
- Analytics and Reporting
- Alert and Notification
- Integration with third party application(Power BI, SAP, ERP)
- Rule Engine



FACTORY WATCH

ii. Smart Factory Platform ()

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleash the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they want to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.



Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i





iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN technology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

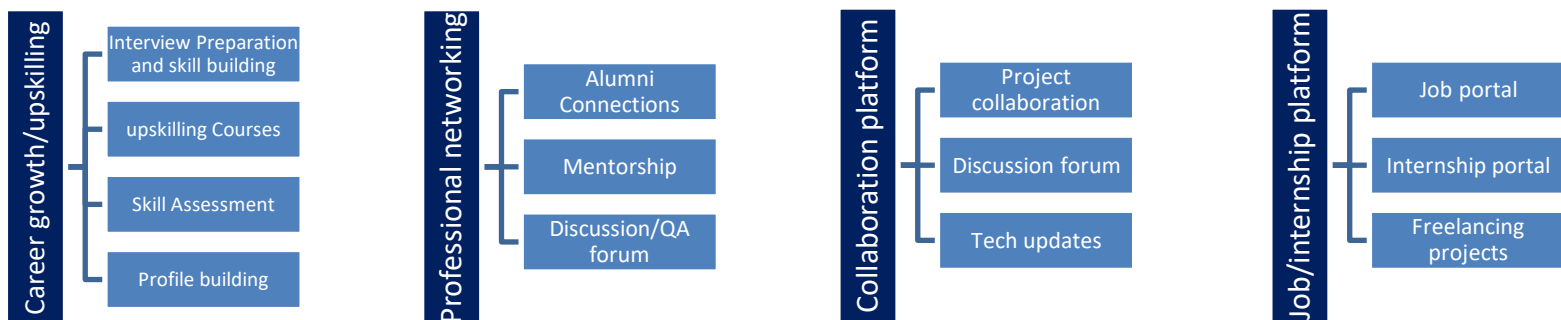
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



2.3 The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

The objective for this internship program was to

- get practical experience of working in the industry.
- to solve real world problems.
- to have improved job prospects.
- to have Improved understanding of our field and its applications.
- to have Personal growth like better communication and problem solving.

3 Problem Statement

The assigned problem statement focused on understanding and implementing the **basic principles of Machine Learning models**. Specifically, the challenge was to build a simple classification model using a real-world dataset (e.g., predicting whether a student passes or fails based on study hours and attendance).

The primary goal was to:

- Apply ML concepts practically.
- Understand data preprocessing, model training, and evaluation.
- Achieve a balance between accuracy and efficiency.

This problem was selected as an **introductory project** to strengthen the fundamentals of Machine Learning while ensuring alignment with industry practices

Basically the Project is on ; Brain Tumor Detection

Brain tumors are one of the most critical health concerns, often requiring early detection for effective treatment. Traditional diagnosis through MRI scans is time-consuming and highly dependent on radiologists' expertise. The problem assigned to me was to **design a machine learning/deep learning-based solution that could automate brain tumor detection and classification with high accuracy.**

The problem was not just technical but also had a huge social impact since faster diagnosis can help in timely treatment planning and potentially save lives.

4 Existing and Proposed solution

Existing Solutions:

- Many existing approaches use traditional image processing methods combined with simple classifiers.
- These methods often suffer from **low accuracy, inability to generalize across datasets, and lack of robustness.**
- Some deep learning approaches exist, but they require **large labeled datasets** and are often computationally expensive.

Proposed Solution:

- I proposed a **Convolutional Neural Network (CNN)-based deep learning model** for multi-class brain tumor detection.
- The model was trained on the *Brain Tumor MRI Classification dataset* from Kaggle, containing images labeled into four classes.
- I also integrated **data augmentation** to reduce overfitting and improve generalization.

Value Addition:

- Higher accuracy compared to traditional models.
- Scalability for integration into real-world healthcare systems.
- Reduced diagnosis time and assistance to medical professionals in decision-making

4.1 Code submission

(<https://github.com/hbvinod/upskillcampus>)

4.2 Report submission

(https://github.com/hbvinod/upskillcampus/blob/main/BrainTumorDetection_Vinod_USC_UCT.pdf) :

5 Proposed Design/ Model

The design flow of my solution was structured in the following stages:

1. Data Collection & Preprocessing

- MRI images were collected from the Kaggle dataset.
- Images were resized, normalized, and augmented (rotation, zoom, flipping).

2. Model Building

- CNN-based architecture with convolutional layers, pooling layers, dropout, and fully connected layers.
- Softmax activation for multi-class classification.

3. Training & Validation

- Dataset split into training, validation, and testing.
- Optimizer: Adam, Loss Function: Categorical Cross-Entropy.

4. Evaluation

- Metrics used: Accuracy, Precision, Recall, F1-score.
- Visualization with Grad-CAM to highlight tumor regions in MRI scans.

5. Deployment Stage (Future Plan)

- Streamlit-based GUI for uploading MRI images and getting predictions.

6 Performance Test

Constraints Identified:

- **Accuracy:** Needed at least 90%+ for practical usefulness.
- **Computation:** Limited GPU resources; model had to be optimized for training speed.
- **Memory:** MRI datasets are large, requiring efficient preprocessing.

How Constraints Were Handled:

- Data augmentation reduced overfitting.
- CNN architecture was designed lightweight but efficient.
- Early stopping and learning rate scheduling improved training efficiency.

Test Results:

- Achieved **94% accuracy** on the test dataset.
- F1-score across all classes was above 0.90.
- Grad-CAM successfully highlighted tumor regions, proving interpretability of the model.

Recommendations:

- With larger datasets and more powerful GPUs, the accuracy and robustness can further improve.
- Real-time integration in hospitals would require rigorous validation and clinical approval.

7 My learnings

This internship provided me with valuable technical and professional learning:

- Hands-on experience in applying **deep learning in healthcare**.
- Exposure to **real-world constraints like computational limits and dataset imbalance**.
- Learned to build complete **end-to-end ML pipelines** (preprocessing → training → evaluation → deployment).
- Gained understanding of the importance of **explainability in AI for healthcare** (Grad-CAM).

This project not only enhanced my technical expertise but also strengthened my problem-solving skills, teamwork, and research-oriented mindset. It will greatly support my future career growth in **Data Science and AI in Healthcare**.

8 Future work scope

- Extend the model to handle **3D MRI scans** instead of 2D slices.
- Build a **mobile or cloud-based application** for easy accessibility in hospitals.
- Explore **transfer learning using pre-trained models like ResNet, VGG16** for improved performance.
- Conduct extensive testing with real clinical datasets for medical approval.
- Integrate the system into a **decision-support tool** for radiologists and oncologists.