

Internship Completion Report

Role: Data Science Intern

Company: NullClass

Introduction

This report documents my internship journey at NullClass as a Data Science Intern. The internship focused on developing advanced image colorization systems using deep learning, computer vision, and semantic segmentation. Over the 2-month period (07-07-2025 to 07-09-2025), I worked on multiple tasks integrating dataset augmentation, semantic segmentation, historical context modeling, and real-time applications. The internship aimed to enhance both my technical expertise and my ability to design and deploy end-to-end ML solutions.

Background

Image colorization is a crucial area of research in computer vision, where grayscale images are transformed into realistic color representations. The technology has applications in restoring historical images, film/media enhancement, medical imaging, and artistic rendering. Despite its potential, challenges such as semantic understanding, dataset limitations, and real-time processing requirements remain. This internship provided the opportunity to address these challenges by implementing innovative approaches like dataset augmentation, semantic segmentation for targeted colorization, and historical time-based palette adaptation.

Learning Objectives

1. To gain hands-on experience in training and optimizing colorization models.
2. To explore dataset augmentation techniques for improving model generalization.
3. To apply semantic segmentation for targeted and multi-object colorization.
4. To design a historical-aware model that adapts to different time periods.
5. To develop real-time systems capable of processing video streams.
6. To improve proficiency in Python, TensorFlow/PyTorch, and OpenCV.
7. To practice end-to-end ML workflow: preprocessing, training, evaluation, deployment, and GUI development.

Activities and Tasks

1. Visualizing the Colorization Process – Implemented intermediate visualization of grayscale-to-color transformations.
2. Dataset Augmentation to Improve Colorization – Applied rotation, flipping, brightness/contrast adjustment.
3. Semantic Segmentation for Targeted Colorization – Integrated U-Net/DeepLab with GUI support.
4. Time-Based Historical Image Colorization – Built classifier for eras and time-period-specific palettes.
5. Real-Time Multi-Object Colorization – Implemented real-time video segmentation and GUI.

Skills and Competencies

- Python, TensorFlow, PyTorch
- OpenCV and image preprocessing
- CNNs, GANs, U-Net, DeepLab
- Model optimization: quantization, pruning
- GUI development: Tkinter, PyQt, Gradio
- Git/GitHub for version control
- Evaluation metrics: accuracy, confusion matrix, precision, recall, F1-score

Feedback and Evidence

Models were validated against benchmark datasets. Visual evidence included comparisons of grayscale, predicted, and ground truth images. Documented improvements from augmentation and segmentation in evaluation reports. GUI demonstrations provided interactive validation. Final accuracy exceeded the 70% threshold.

Challenges and Solutions

1. Overfitting due to limited dataset size → Applied augmentation and transfer learning.
2. High computational requirements for real-time → Used pruning, quantization, GPU acceleration.
3. Ensuring historical accuracy → Curated datasets and era-based palettes.
4. Designing user-friendly GUIs → Iterative testing and refinement.

Outcomes and Impact

- Successfully developed five distinct colorization models.
- Improved accuracy and robustness with augmentation.
- Designed GUIs for targeted and real-time applications.
- Achieved accuracy >70% across tasks.
- Strengthened ML and CV expertise with real-world use cases.

Conclusion

The internship at NullClass was a transformative learning experience. I gained in-depth exposure to colorization techniques, segmentation methods, real-time ML pipelines, and GUI-based deployment. The tasks enhanced my technical expertise, problem-solving ability, and understanding of real-world Data Science applications. Completing these projects within the timeline not only met the program requirements but also prepared me for future roles in AI, computer vision, and deep learning.