

Project Report

Task 3 – Image Processing & Analysis Toolkit

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Subject: Computer Vision

Course: AIML-A

1. Introduction

The field of **Computer Vision** focuses on enabling computers to understand and interpret visual data. One of the key aspects of this domain is **image processing and analysis**, which involves applying various operations to images to extract meaningful information.

This project implements an **Image Processing & Analysis Toolkit** using **Python, OpenCV, and Streamlit**. The toolkit provides a **Graphical User Interface (GUI)** that allows users to upload images, perform transformations, apply filters, and analyze image properties interactively.

2. Objectives

- To build a simple and interactive GUI for image processing.
 - To apply different operations such as resizing, grayscale conversion, blurring, and edge detection.
 - To integrate **OpenCV** for image processing and **Streamlit** for GUI development.
 - To create a user-friendly platform for learning and experimenting with image analysis.
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3. Tools & Technologies

- **Programming Language:** Python
- **Libraries Used:**
 - OpenCV (cv2) – Image processing functions
 - Streamlit – GUI development

- Pillow (PIL) – Image handling
 - NumPy – Matrix operations
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4. System Architecture

Flow of the Application

1. **Image Upload** – User uploads an image in formats such as .jpg, .png, .tiff, etc.
 2. **Image Display** – The uploaded image is displayed in the interface.
 3. **Image Processing Operations** – Users can apply operations such as:
 - Grayscale Conversion
 - Image Resizing
 - Blurring (Gaussian/Median)
 - Edge Detection (Canny/Sobel)
 - Histogram Analysis
 4. **Result Display** – Processed image and analysis results are displayed in real-time.
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5. Implementation

- **Frontend (GUI):** Implemented with **Streamlit**, providing sidebar menus for image upload and operation selection.
 - **Backend (Processing):** Implemented with **OpenCV** for performing transformations and analysis on the uploaded images.
 - **Session Management:** Streamlit session state is used to store the original and processed images for smooth transitions.
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6. Results

- Successfully developed an interactive toolkit where users can experiment with different image processing techniques.
- Real-time visualization of original vs. processed images.

- Easy-to-use GUI suitable for beginners in computer vision.
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7. Applications

- Educational tool for learning computer vision basics.
 - Quick testing platform for image preprocessing tasks in AI/ML pipelines.
 - Can be extended into advanced projects such as **object detection, face recognition, or medical imaging analysis**.
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8. Conclusion

The **Image Processing & Analysis Toolkit** demonstrates how **Python, OpenCV, and Streamlit** can be combined to build interactive applications for computer vision. It provides an easy and effective way to explore fundamental image processing techniques, making it a valuable educational and practical tool.















