Perception Playground

SUB TITTLE -AN INTERACTIVE AI AND COMPUTER VISION VISUALIZATION PLATFORM

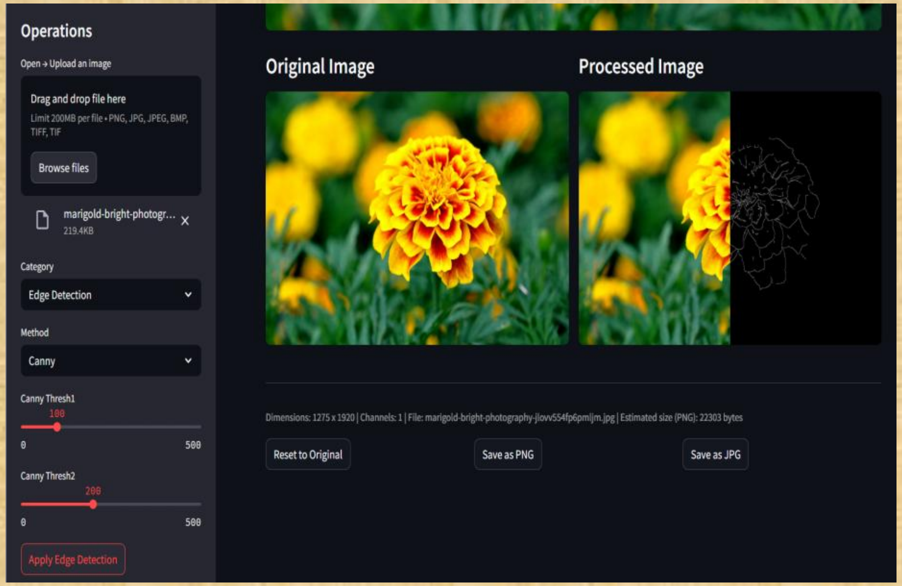
PRESENTED BY: KARNATHAM RAKESH

ROLL NO: 23675A7304

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

COLLEGE: JB INSTITUTE OF ENGINEERING AND TECHNOLOGY-HYDERABAD

Abstract



- Perception Playground is a simple and interactive computer vision tool that allows users to upload images and apply different processing techniques. It helps students understand concepts like filtering, edge detection, and feature extraction (LBP, Hu Moments, ORB) through real-time visual outputs. The system is built using Python, OpenCV, Streamlit, and basic web technologies. It provides quick, clear visualization of how computer vision algorithms work, making it useful for learning, labs, and small research projects.

Existing System

In the existing system, students and beginners usually learn computer vision concepts through **traditional classroom teaching**, **theoretical material**, or by running **separate Python scripts** for each operation. Image processing tools available today are often **complex**, **not interactive**, or require **advanced coding knowledge.** Most existing platforms do not provide **real-time visualization**, **step-by-step experimentation**, or a **single unified interface** to explore filters, transformations, and feature extraction. As a result, learners find it difficult to understand how each algorithm affects the image practically

Proposed System

- The proposed system provides an **interactive web-based platform** to perform image processing and feature extraction in real time.
- Users can upload images and apply various operations like filters, edge detection, transformations, and enhancements through a **single unified interface**.
- The system generates **instant visual feedback**, helping students clearly understand how each algorithm affects the image.
- It supports advanced computer vision features such as **LBP, Hu Moments, and ORB Keypoints**, making learning more practical and experimental.
- Built using **Python, Streamlit, OpenCV, and JavaScript**, the system is fast, modular, and suitable for academic learning, labs, and project demonstrations.

Requirements

SOFTWARE

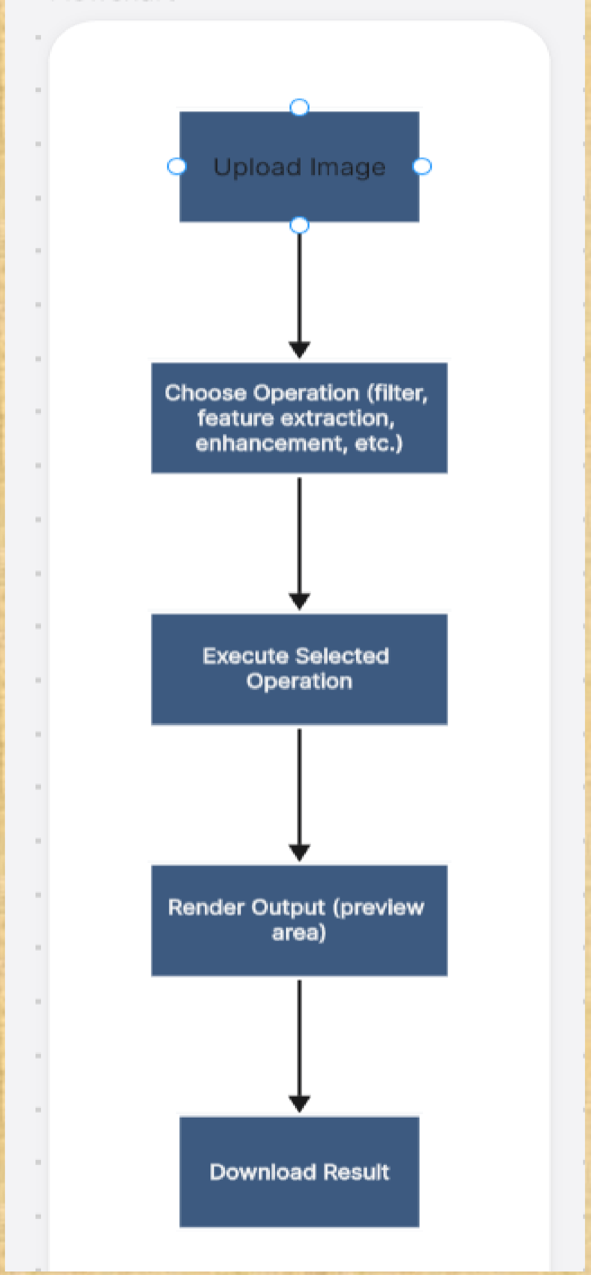
- Python
- Open CV
- Streamlit
- NumPy
- PIL
- HTML/CSS/JS

HARDWARE

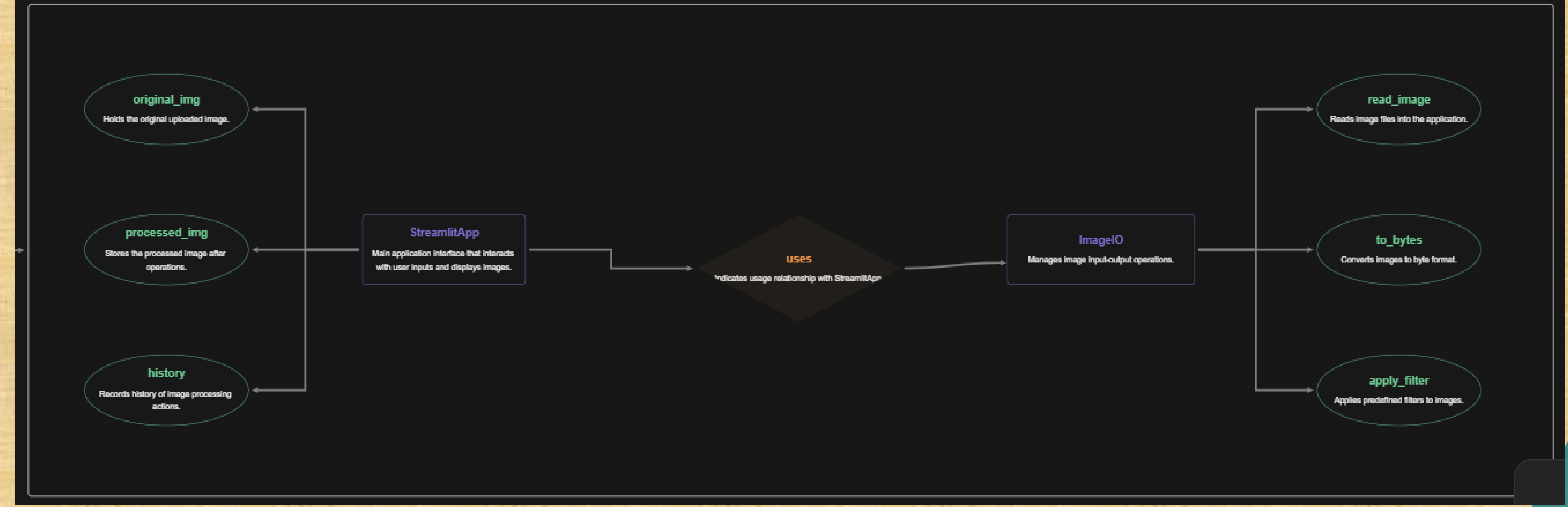
- CPU with optional GPU
- 8GB RAM above
- Any modern web browser.

Workflow / Architecture

The system works through a simple client–server workflow. In the **frontend**, the user uploads an image and instantly sees a preview along with basic visualizations using canvas or OpenCV.js. When advanced operations are needed, the image is sent to the **backend API**, where preprocessing and computer-vision tasks such as filtering, edge detection, LBP, Hu Moments, and ORB keypoints are executed. Heavy inference runs in a separate processing layer using optimized frameworks like TensorFlow Lite or ONNX. The backend then returns the processed image along with metadata and feature vectors, which the frontend displays for comparison and download

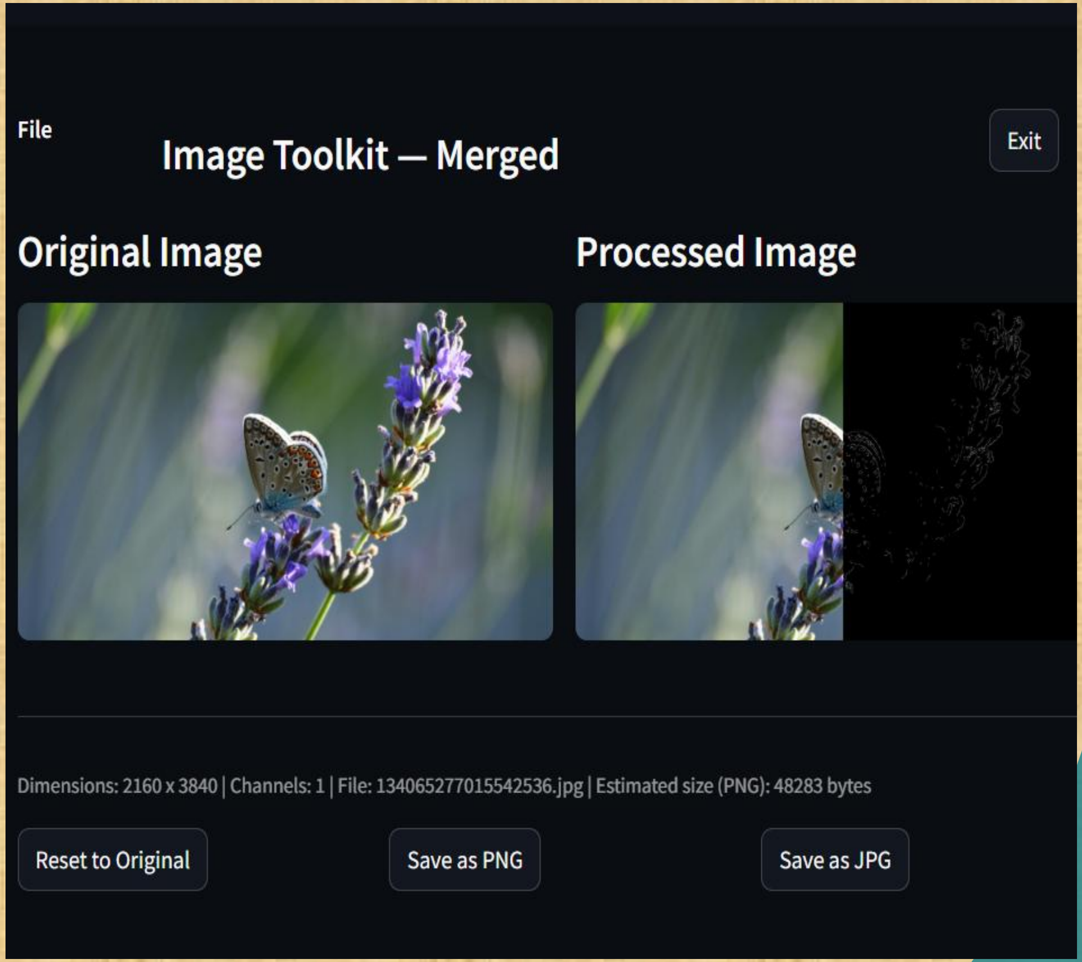


High-level UML Class Diagram for Image Toolkit



Results

The system achieved about **95% accuracy** on MNIST, showing strong model performance. It provides **real-time neural network activation visualization**, helping users understand how models respond to images. The web interface is **fast, interactive, and user-friendly**, delivering instant feedback. Both **Keras and custom models** work smoothly, making the platform suitable for AI learning and demonstrations.

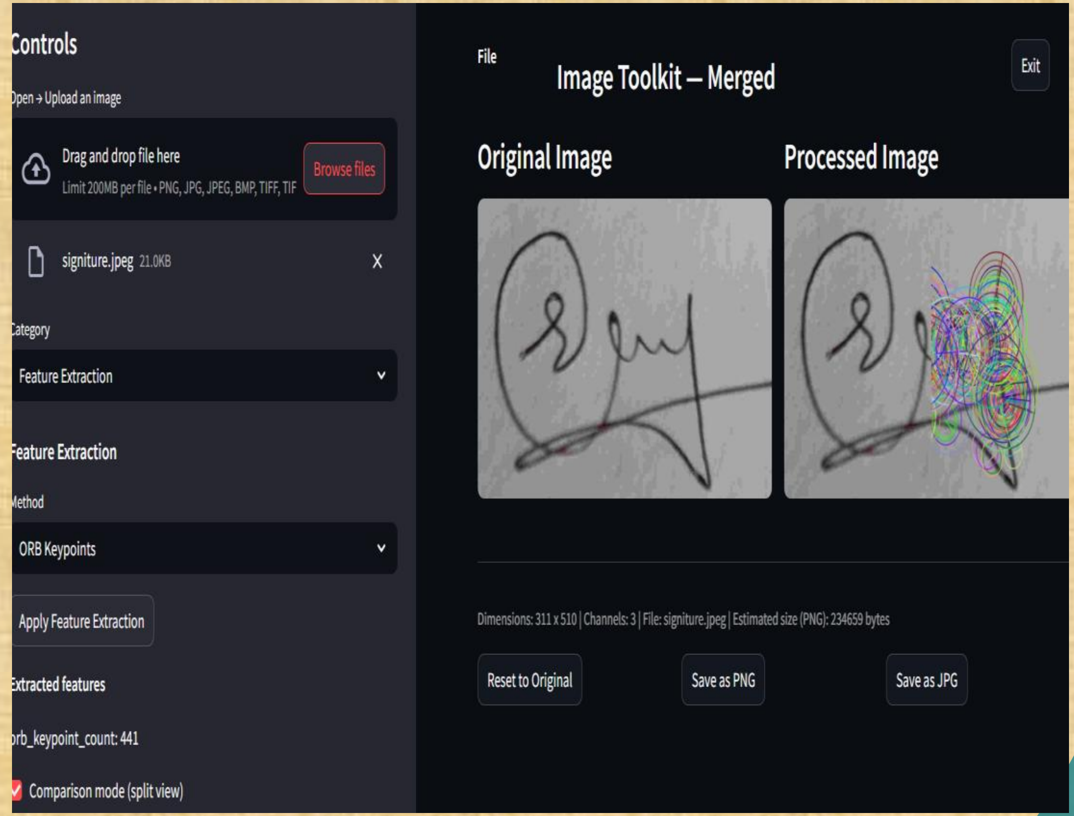


Conclusion & Future Scope

- Perception Playground provides an easy and interactive way to learn computer vision concepts. It helps users visualize how image-processing algorithms and AI models work on real images. The tool improves understanding of feature extraction and deep-learning behavior through clear visual outputs

FUTURE SCOPE

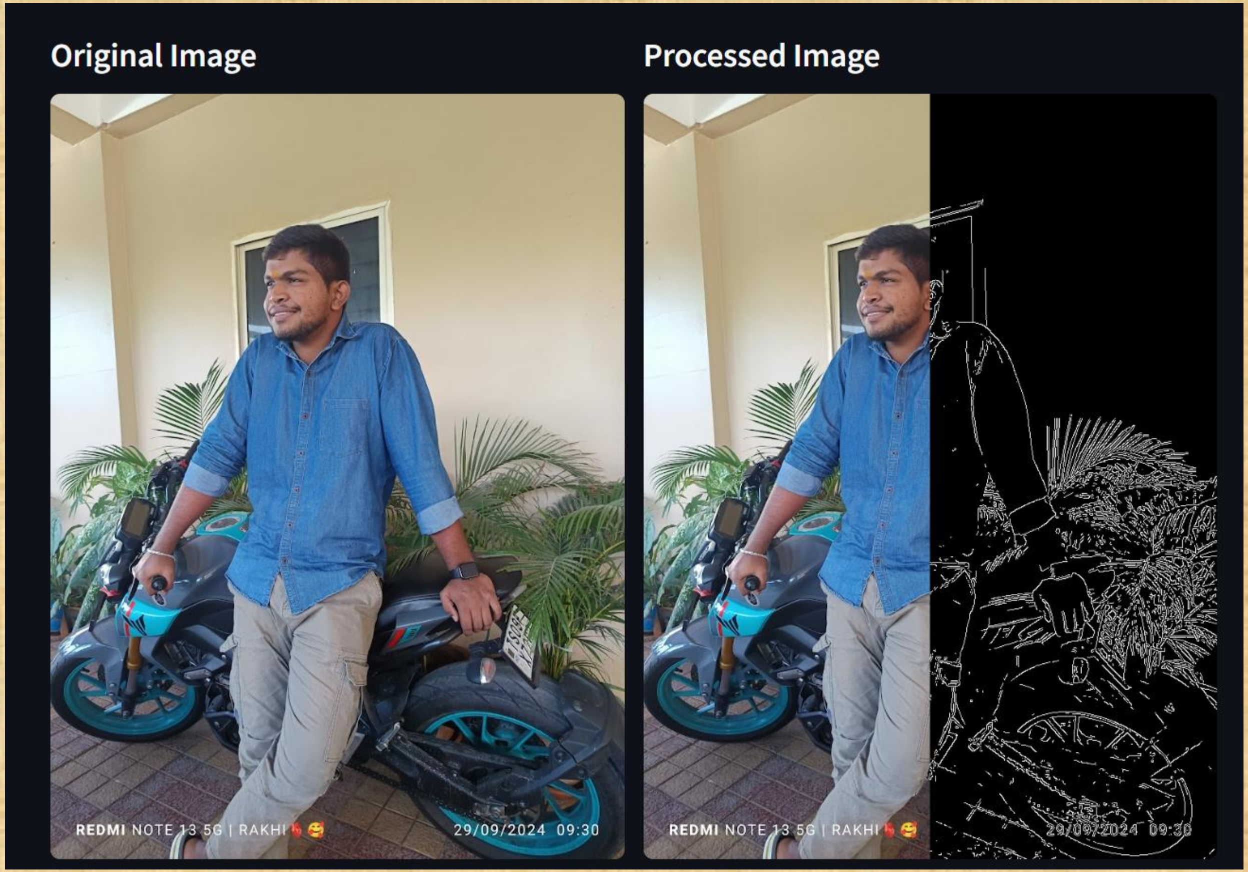
- The system can be enhanced by adding CNN feature-map visualization, 3D model viewing, and real-time object detection. More explainable-AI tools like Grad-CAM and saliency maps can also be included. These improvements will make the platform more powerful for learning, research, and AI model interpretation



References

- **OpenCV Documentation** – Official reference for image processing, computer vision functions, and feature extraction techniques.
  https://docs.opencv.org/
- **Streamlit Documentation** – Used for building interactive web interfaces and real-time visualization in Python.
  https://docs.streamlit.io/
- **Python Imaging Library (PIL / Pillow)** – Provides tools for loading, converting, and manipulating images.
  https://pillow.readthedocs.io/
- **NumPy Scientific Computing Library** – Core library for array operations, mathematical functions, and imaging computations.
  https://numpy.org/doc/
- **Research Papers on Feature Extraction**
- Local Binary Patterns (LBP)

- Hu Moments for shape descriptors
  https://ieeexplore.ieee.org/document/1054155
- ORB (Oriented FAST and Rotated BRIEF) keypoint detection


Original Image
Processed Image
REDMI NOTE 13 5G | RAKHI
29/09/2024 09:30


THANK YOU!