CAPSTONE PROJECT

# Image Segmentation and Object Detection

PRESENTED BY

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# OUTLINE

- Problem Statement
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# PROBLEM STATEMENT

Manual object detection and image labeling is tedious, especially with high-resolution images and large datasets. There's a need for an automated image segmentation system to detect and highlight objects of interest efficiently.

# PROPOSED SOLUTION

**Proposed Solution:**

The proposed system aims to automate image segmentation and object detection using K-Means clustering and color-based masking techniques. It processes a user-selected image and identifies prominent objects based on color grouping and contour detection.

- **Image Acquisition:**
  - Users upload any image from their local system.
  - The image is resized and converted to appropriate color formats for processing.
- **Image Segmentation:**
  - The image is flattened into pixel data and passed through K-Means clustering (k=4).
  - This groups similar color pixels, effectively segmenting the image.
- **Cluster Masking:**
  - A selected cluster is highlighted by replacing its pixels with blue.
  - The masked image is used to focus object detection on that segment.

# PROPOSED SOLUTION

- **Color Space Conversion:**
  - The masked RGB image is converted to HSV format.
  - HSV values are used to isolate the highlighted cluster with precise thresholds.
- **Object Detection:**
  - Thresholded mask is processed to find contours.
  - Top 3 largest contours are selected.
  - Bounding boxes are drawn around the detected objects.
- **Deployment:**
  - The entire pipeline is deployed as a web application using Streamlit.
  - It allows interactive image upload, processing, and displays results in a clean column layout.
- **Evaluation:**
  - Visual outputs include: Original, Segmented, Masked, HSV, Thresholded, and Final detection.
  - Effectiveness is determined through successful identification of meaningful object clusters.

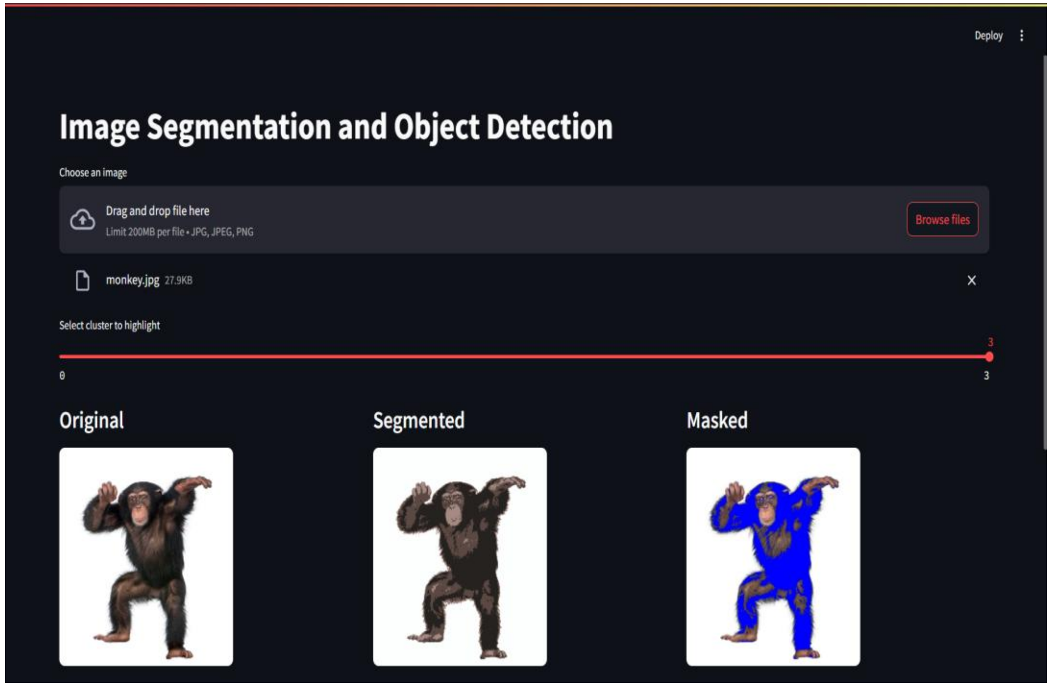
# SYSTEM APPROACH

- **Platform:** Python
- **Framework:** Streamlit (for web interface)
- **Libraries:** OpenCV, NumPy, PIL, Matplotlib
- **Input:** User-selected image from the local system
- **Output:** Multiple processed image visualizations in a 3-column layout

# ALGORITHM & DEPLOYMENT

- **Algorithm:**
  - K-Means clustering for image segmentation (k=4)
  - HSV masking for object isolation
  - Contour detection for bounding box creation
- **Steps:**
  1. Upload and convert image
  2. Apply K-means to group pixels
  3. Highlight chosen cluster in blue
  4. Convert to HSV and apply threshold
  5. Detect and outline objects with bounding boxes
- **Deployment:**
  - Built with Streamlit for interactive web experience
  - Real-time image processing and visualization

# RESULT



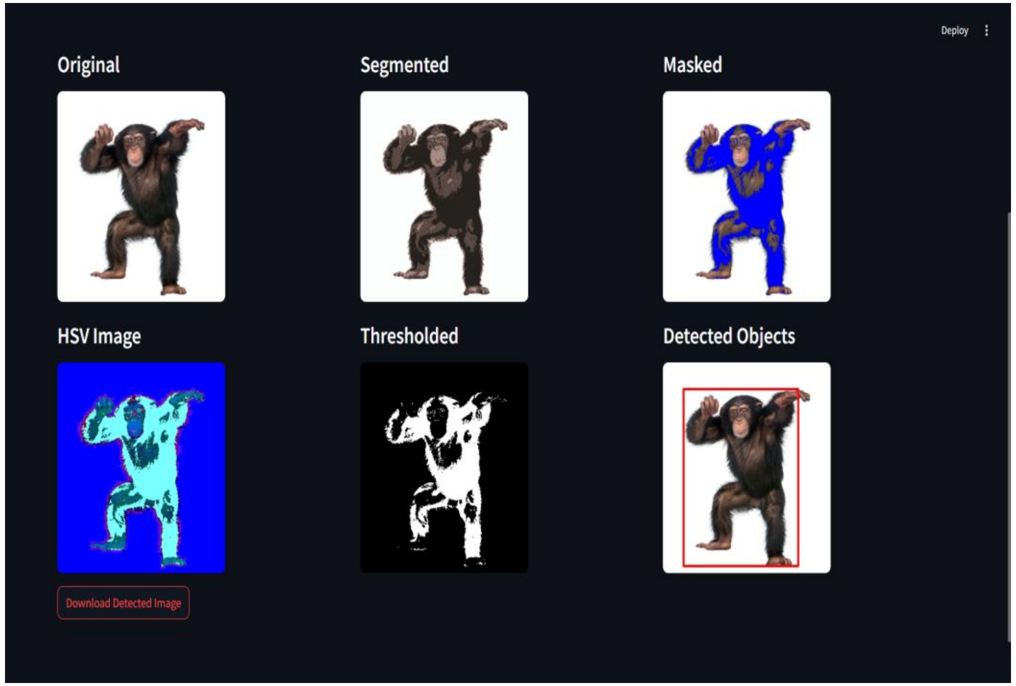
## Image Segmentation and Object Detection

Choose an image

Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG

monkey.jpg 27.9KB

Select cluster to highlight: 3



# CONCLUSION

The system successfully segments images, highlights a selected cluster, and detects major object boundaries. This workflow demonstrates a lightweight and effective method for basic object detection and image segmentation without deep learning.

# FUTURE SCOPE

- Allow user to choose the cluster number for masking
- Add support for video stream input and real-time object detection
- Incorporate more advanced segmentation methods like GrabCut or DeepLab
- Extend to domain-specific applications: medical imaging, traffic monitoring, etc.

# REFERENCES

- OpenCV Documentation: https://docs.opencv.org
- Streamlit Documentation: https://docs.streamlit.io
- Scikit-learn: https://scikit-learn.org
- K-means Clustering: MacQueen, J. (1967). Some Methods for Classification and Analysis of Multivariate Observations

- GitHub : https://github.com/Fakruddin002/Image-Segmentation-and-Object-Detection.git

# Thank you