■ Project Documentation: Image Classification + Detection + Angle

1. Project Overview

This project performs three main tasks on images: Classification (what the object is), Detection (where the object is), and Angle Estimation (how it is rotated). By combining these, the system can recognize and visualize objects with their direction.

2. Tools and Libraries Used

Library	Purpose
OpenCV (cv2)	Image processing, contour detection, drawing boxes
NumPy	Mathematical and array operations
Matplotlib	Displaying images in notebook
TensorFlow / Keras	Building and training CNN classification model
Math	Calculating object rotation angles

3. Project Workflow

Step 1: Import all libraries (OpenCV, NumPy, TensorFlow, Matplotlib).
Step 2: Define constants like image size and contour area.
Step 3: Display images properly using show_bgr function.
Step 4: Build CNN model for Cat vs Dog classification.
Step 5: Detect objects using contours and find their angle.
Step 6: Annotate detected objects with bounding boxes, labels, and arrows.
Step 7: Run demo on sample images.

4. Summary

Task	Description
Classification	Recognizes what the object is
Detection	Finds where it is located
Angle Estimation	Measures how the object is rotated
Output	Displays results visually on the image

5. Conclusion

This project combines basic computer vision and deep learning to detect, classify, and understand object orientation. It can be applied in robotics, automation, and visual monitoring systems where recognizing direction and type of objects is essential.