This week, you'll build 6 projects that go from basic image manipulation to creating augmented reality. Each project builds on the previous one, so work through them in order.

What You'll Need:

- Install these packages:

pip install opencv-python numpy

Project 1: The Digital Darkroom

Goal: Learn to load, display, and transform images like a photo editor.

Your Tasks:

1. Load an image and display it in a window
2. Print the image's dimensions and color channels
3. Split the image into Blue, Green, and Red layers - display each separately
4. Create a "channel-swapped" version (swap Red and Blue)
5. Crop and resize the image
6. Convert to grayscale and create custom filters (warm tones, vintage look)

Hint: Remember `cv2.imread()`, `cv2.imshow()`, and that images are just NumPy arrays.

Project 2: The Video Wizard

Goal: Work with live video and create interactive drawings.

Your Tasks:

1. Access your webcam and display the live feed
2. Play a video file from your computer
3. Draw shapes (rectangles, circles) and text on the video
4. Create a simple "paint" program that draws where you click
5. Add a screenshot feature (save frame when you press 's')

Hint: Use `cv2.VideoCapture(0)` for webcam. The key to video is processing frame by frame in a loop.

Project 3: The Shape & Color Detective

Goal: Make your program detect objects by color and shape.

Your Tasks:

1. Track a colored object (like a bright pen) using HSV color space
2. Find and draw contours around detected objects
3. Filter out small/noisy detections
4. Draw bounding boxes around the largest detected object
5. **Bonus:** Detect specific shapes (squares, circles, triangles)

Key Tools: `cv2.inRange()`, `cv2.findContours()`, and contour area filtering.

Project 4: The Smart Selfie App

Goal: Create fun face filters and effects using face detection.

Your Tasks:

1. Detect faces in images using Haar Cascades
2. Implement real-time face detection on webcam
3. Add a "privacy blur" over detected faces
4. Create a virtual glasses filter that sticks to faces
5. Count and display how many faces are in view

Magic Function: `cv2.CascadeClassifier()` - your gateway to instant face detection.

Project 5: The Motion Tracker

Goal: Detect movement and track objects as they move.

Your Tasks:

1. Use background subtraction to highlight moving objects

2. Clean up the detection using erosion/dilation

3. Draw boxes around moving objects in real-time

4. Track the path of the largest moving object

5. Create a "security system" that alerts when something enters a defined zone

Hint: Background subtractors can separate moving objects from static scenes.

Project 6: Augmented Reality Marker

Goal: Final Project - Create AR by overlaying digital content on real-world markers.

Your Challenge:

Create a program that detects a special marker (like a colored paper or printed code) and places a virtual image/video on top of it.

Step-by-step:

1. Detect your marker (using color or shape detection)

2. Find the marker's corners and perspective

3. Prepare your virtual content (image/logo)

4. Overlay the content perfectly onto the marker

5. Watch as digital content appears in your physical world!

Getting Help & Resources

- OpenCV documentation: https://docs.opencv.org/

- Google any error messages - someone has probably solved it!

- Don't get stuck - ask questions and share what you're building with us.