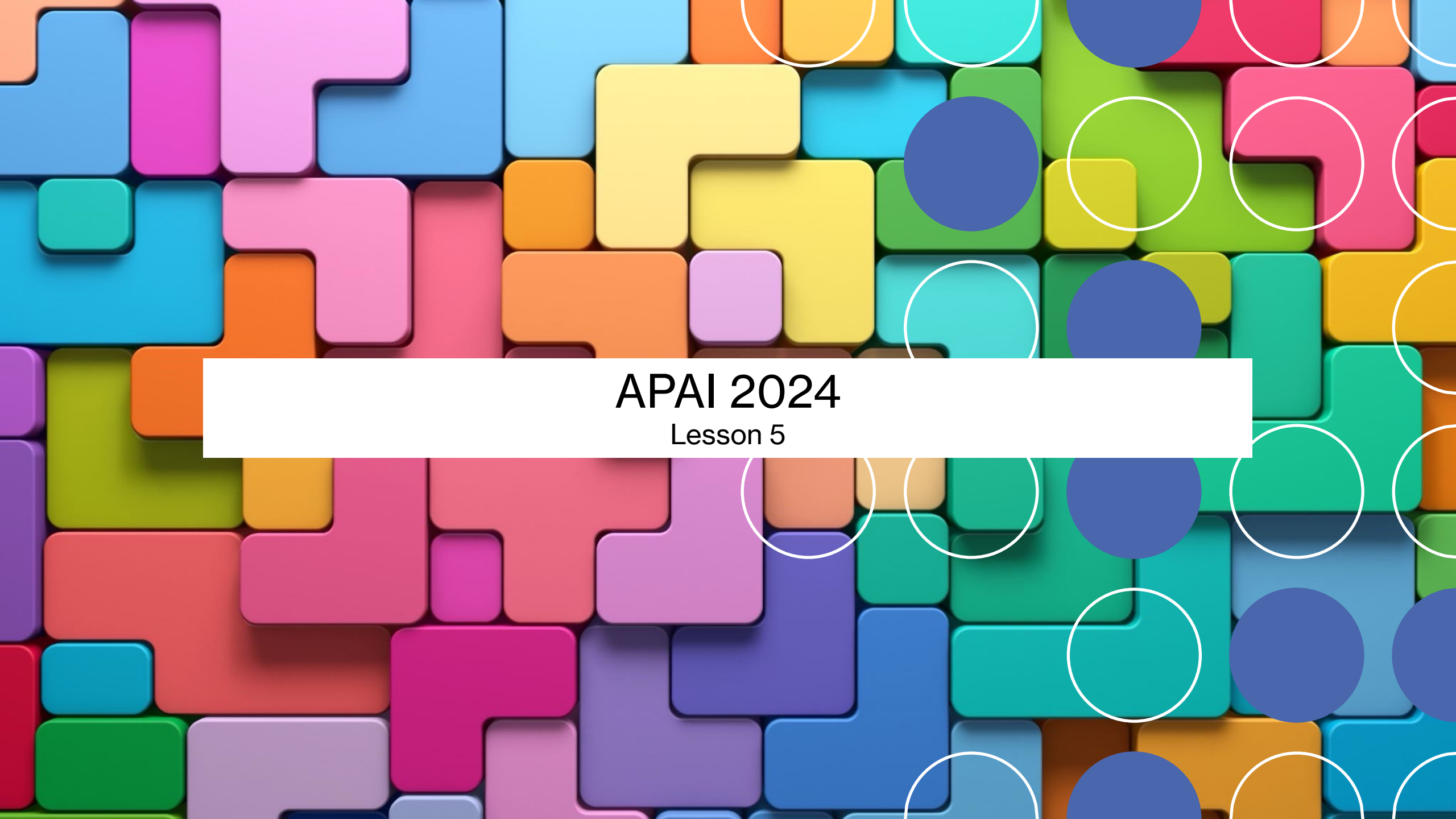
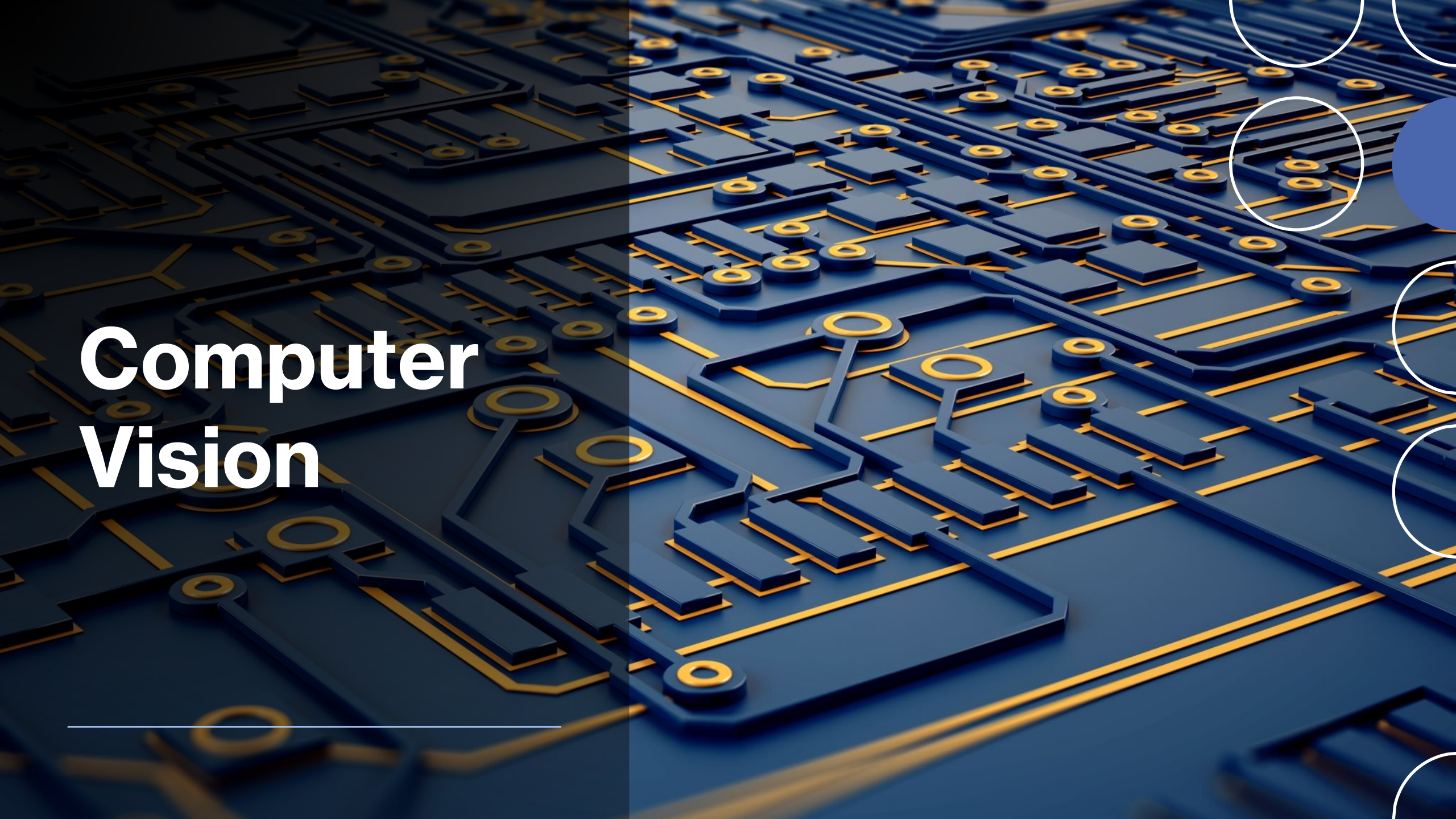


APAI 2024

Lesson 5

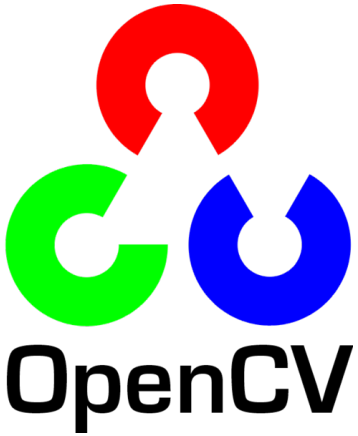


Computer Vision

Computer Vision

- The goal of computer vision is to make useful decisions about real physical objects and scenes based on sensed images.

Computer Vision – Libraries



- OpenCV is one of the most widely used and versatile computer vision libraries. It provides a comprehensive set of tools for image and video processing, including object detection, tracking, segmentation, and more. It supports various programming languages such as Python, C++, and Java.

Computer Vision – Libraries

TensorFlow

- TensorFlow is primarily known as a deep learning framework, but it also offers a rich set of tools for computer vision tasks through its TensorFlow Graphics and TensorFlow Hub modules. It's highly flexible and widely used for tasks like image classification, object detection, and image generation.

Computer Vision – Libraries

- Similar to TensorFlow, PyTorch is a deep learning framework that provides strong support for computer vision tasks. It's known for its dynamic computational graph and user-friendly interface, making it popular among researchers and practitioners alike.

Computer Vision – Libraries

- Dlib is a modern C++ toolkit containing machine learning algorithms and tools for creating complex software in C++ to solve real-world problems. It's particularly strong in face detection and facial landmark detection, among other tasks.

Computer Vision – Libraries

- scikit-image is a Python library for image processing. While it may not have the deep learning capabilities of TensorFlow or PyTorch, it offers a wide range of classical image processing techniques, such as filtering, morphology, and feature extraction.

Computer Vision – Libraries

- The Intel OpenVINO Toolkit is a comprehensive toolkit for developing applications that leverage deep learning and computer vision. It includes optimized libraries for deep learning inference and computer vision tasks, making it suitable for commercial applications where performance and efficiency are critical.

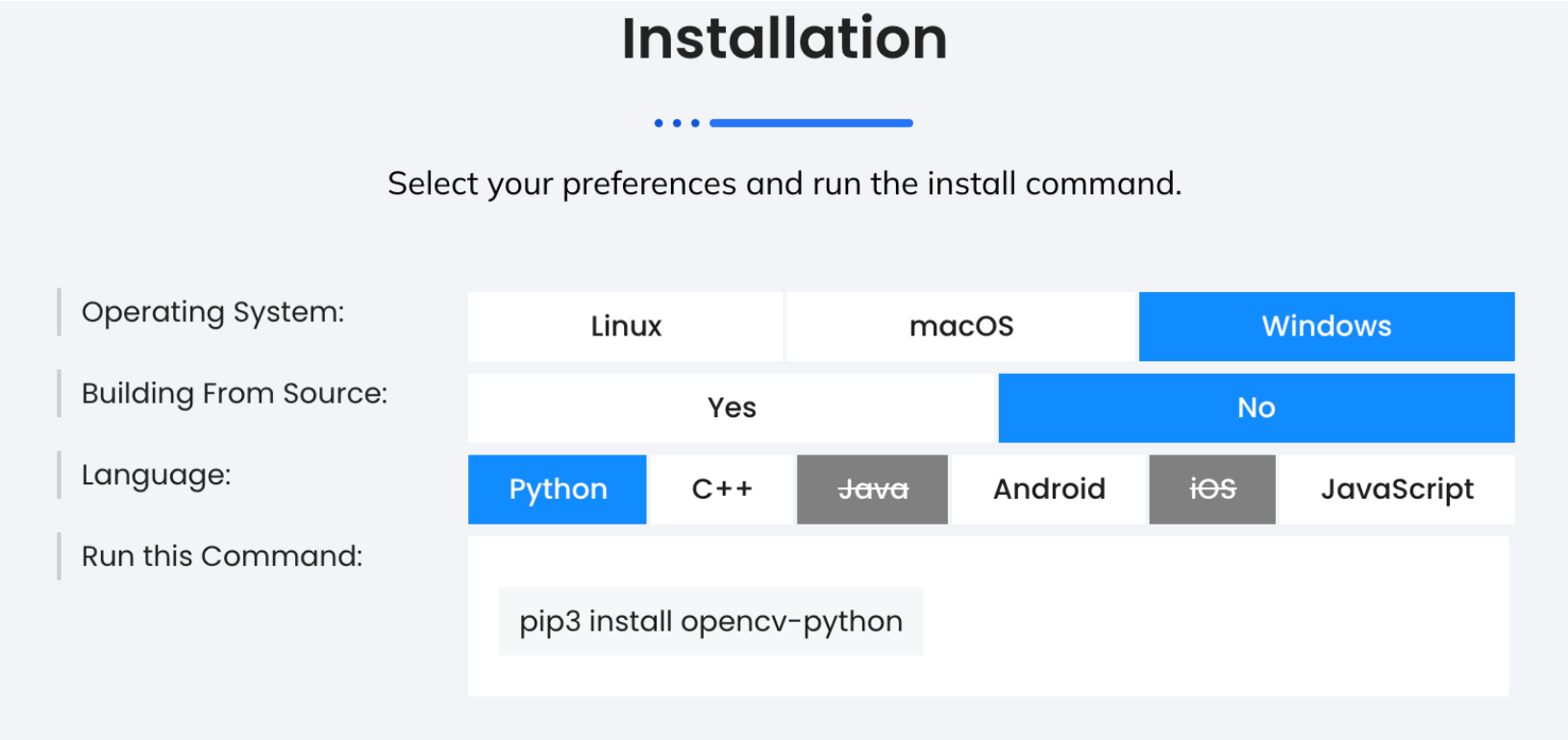
Computer Vision – Libraries

- HALCON is a comprehensive library for machine vision developed by MVTec Software GmbH. It offers a wide range of tools and algorithms for image processing, pattern recognition, deep learning, and 3D vision. HALCON is widely used in industrial automation, quality control, and inspection systems.

OpenCV

- Official Webpage https://opencv.org/

OpenCV


Installation
Select your preferences and run the install command.
Operating System:
Linux
macOS
Windows
Building From Source:
Yes
No
Language:
Python
C++
Java
Android
iOS
JavaScript
Run this Command:
pip3 install opencv-python

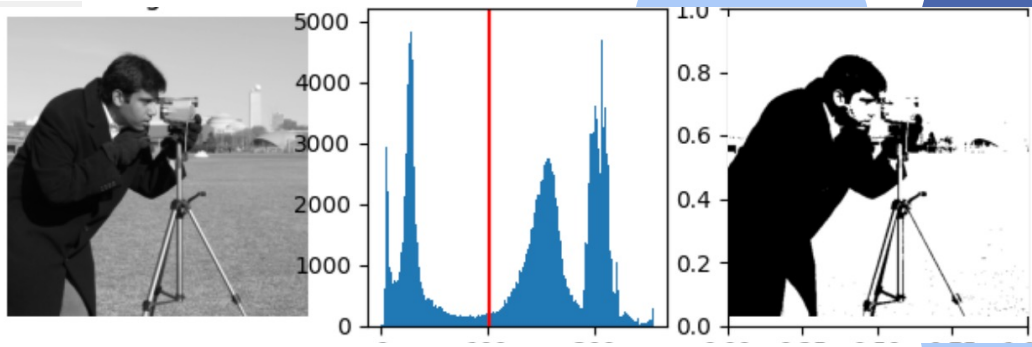
OpenCV

Basic Image Operations

- Image thresholding, Bitwise operations and Masking
- Creating Digital signatures using Alpha Blending
- Color space conversion and different Color Spaces

Histograms and Color Segmentation

- Image Histograms and enhancement using Histogram Equalization
- Deforestation analysis using Color Segmentation
- Satellite Imagery analysis using GeoTIFF Images



OpenCV

Image Filtering and Enhancement

- Reading and Writing videos using OpenCV
- Motion Detection analysis using Background Subtraction
- Build an Intruder Detection System

Video Processing and Analysis

- Reading and Writing videos using OpenCV
- Motion Detection using Background Subtraction
- Build an Intruder Detection System

OpenCV

Image Restoration Techniques

- Image Filtering using Convolution Operations
- Edge Detection using Sobel Filters and Canny algorithm
- Artistic Renderings using Image Filters

Image Registration Techniques

- Noise Reduction using Median and Bilateral Filters
- Image Inpainting for Image Restoration
- Building a streamlit application on image restoration using Inpainting.

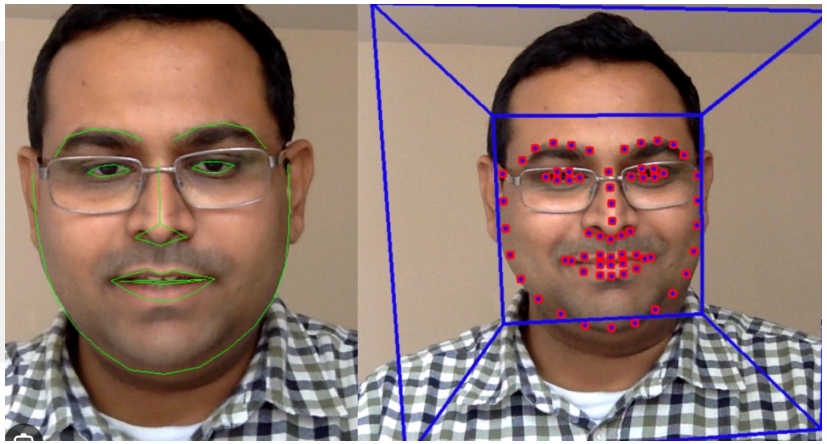
OpenCV

Deep Learning using OpenCV

- Introduction to OpenCV's DNN Module.
- Image Classification using OpenCV DNN Module
- Super-Resolution on Images

Face and Landmark Detection

- Face Detection using DNN Module
- Facial Landmarks Detection
- Building a Real-time Blink Detection application



OpenCV

Human Pose Estimation

- Human Pose Estimation using MediaPipe
- Sports Analytics using MediaPipe
- Human Segmentation using Mediapipe

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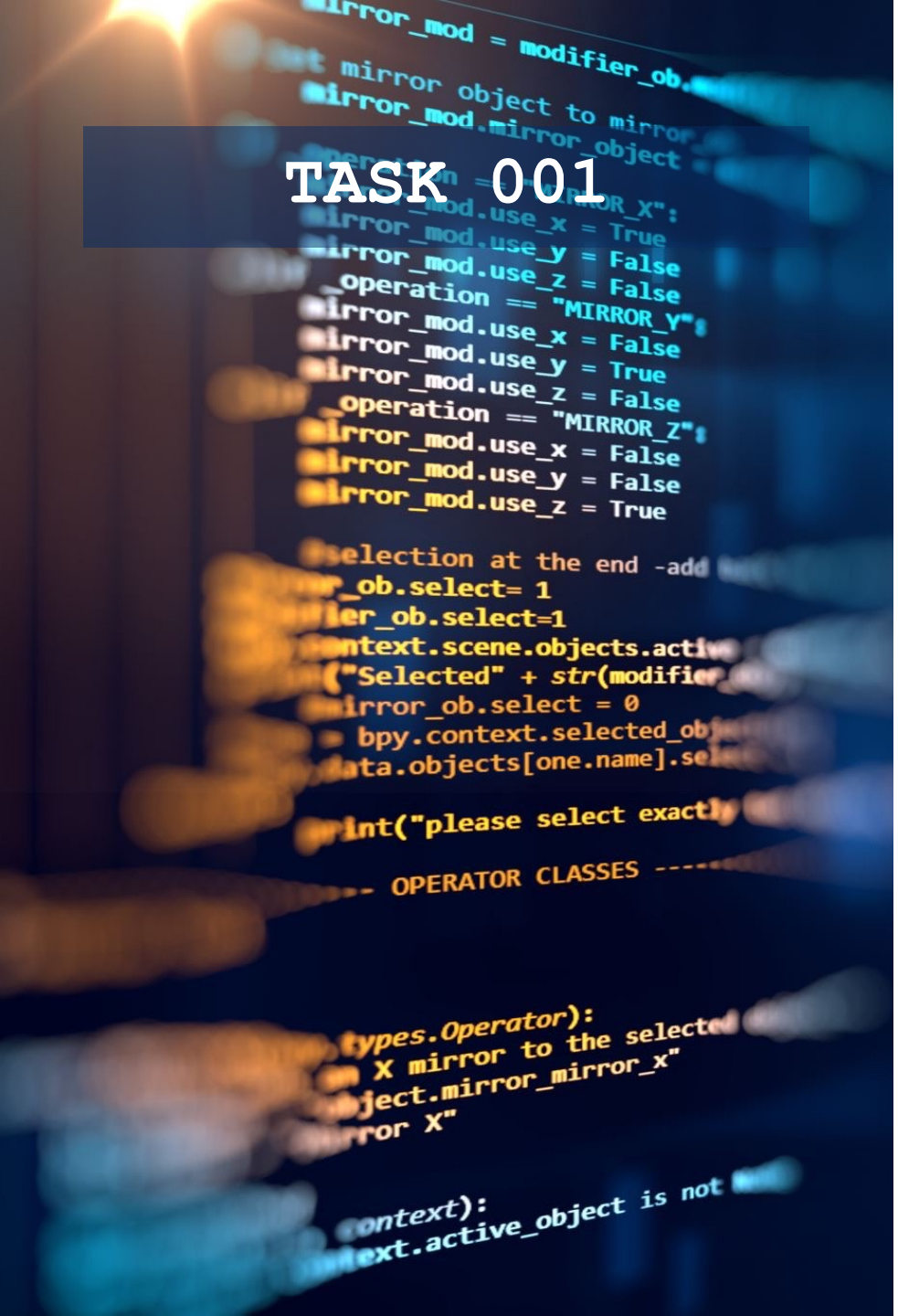


Read and Display Image

- Read the image named "Chess_board.jpg" using OpenCV.
- Display the image.
- Convert Image to Grayscale
- Display the grayscale image.
- Apply Gaussian blur to the grayscale image with a kernel size of 5x5.
- Display the blurred image.

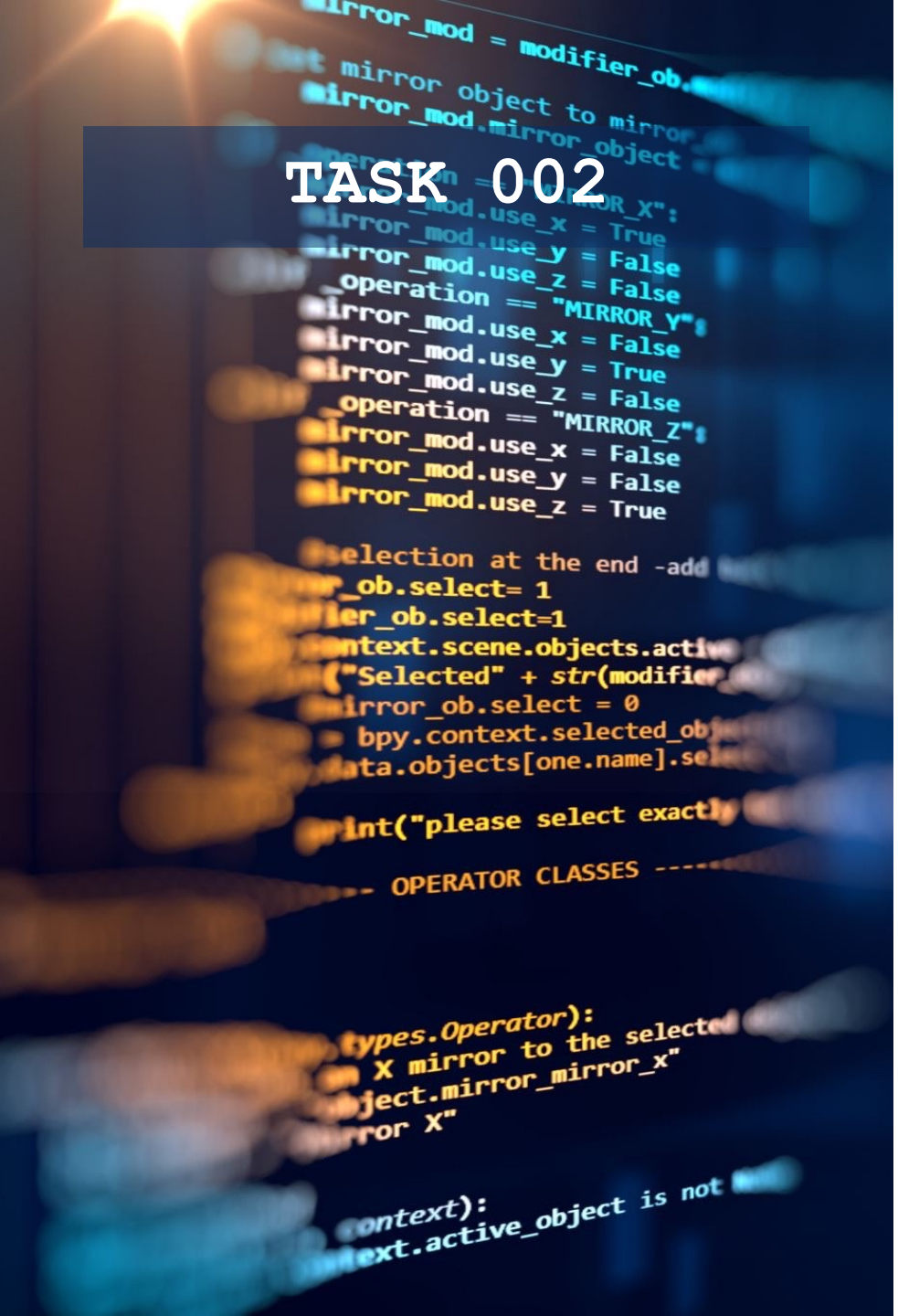


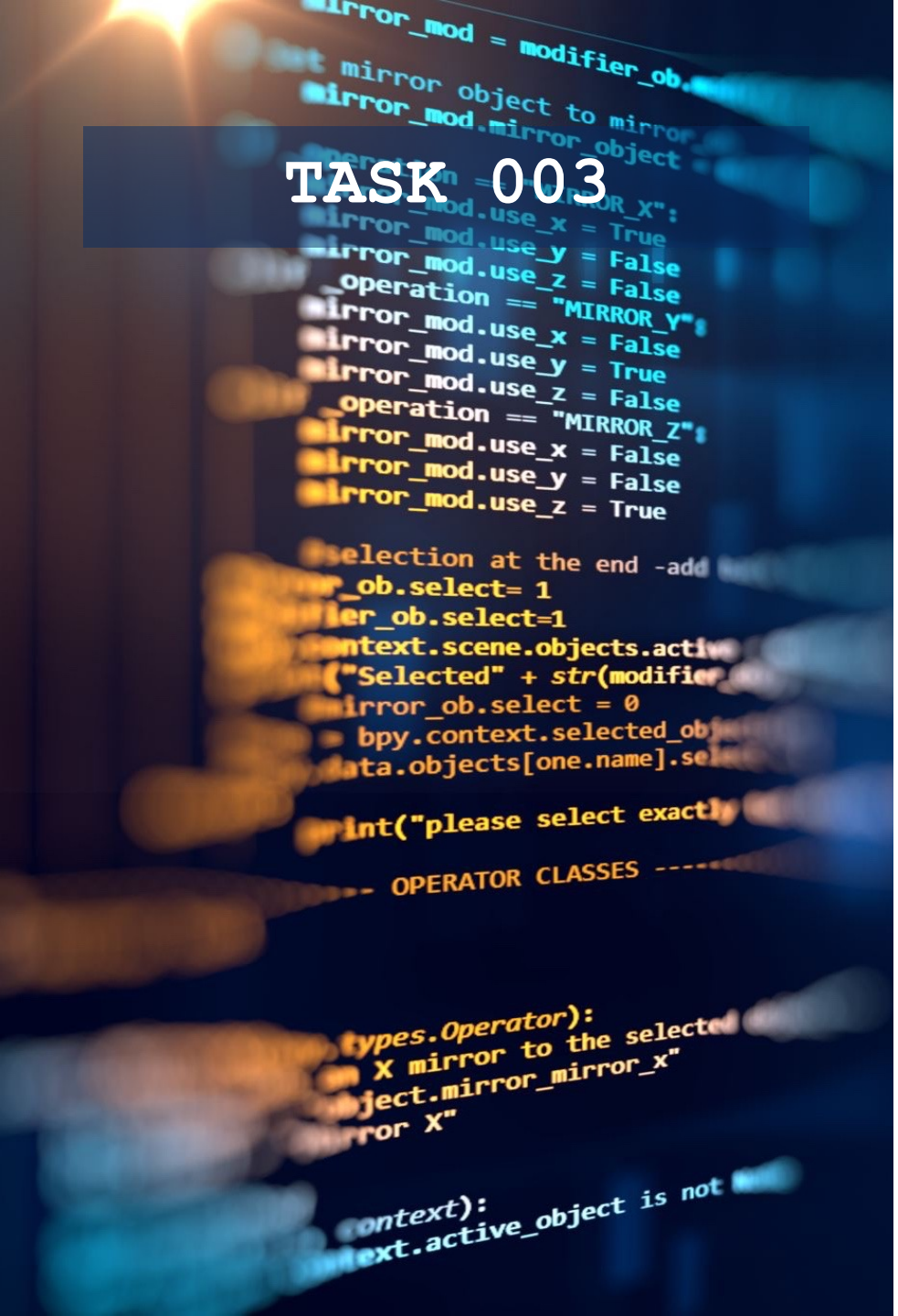
Image Manipulation

Geometrical Manipulation:

- Rotate the original image by 45 degrees clockwise.
- Display the rotated image.

Image Thresholding:

- Apply binary thresholding to the original image.
- Display the thresholded image.



Line Detection and Cross Identification

https://github.com/clipsound/APAI2024_student

Line Detection (implement):

- Use the Hough Line Transform to detect lines in the grayscale image.
- Draw the detected lines on the original image.
- Display the image with detected lines.

Cross Identification (implement):

- Implement a function to identify crosses formed by the intersection of lines.
- Draw circles or rectangles around the identified crosses.
- Display the image with marked crosses.

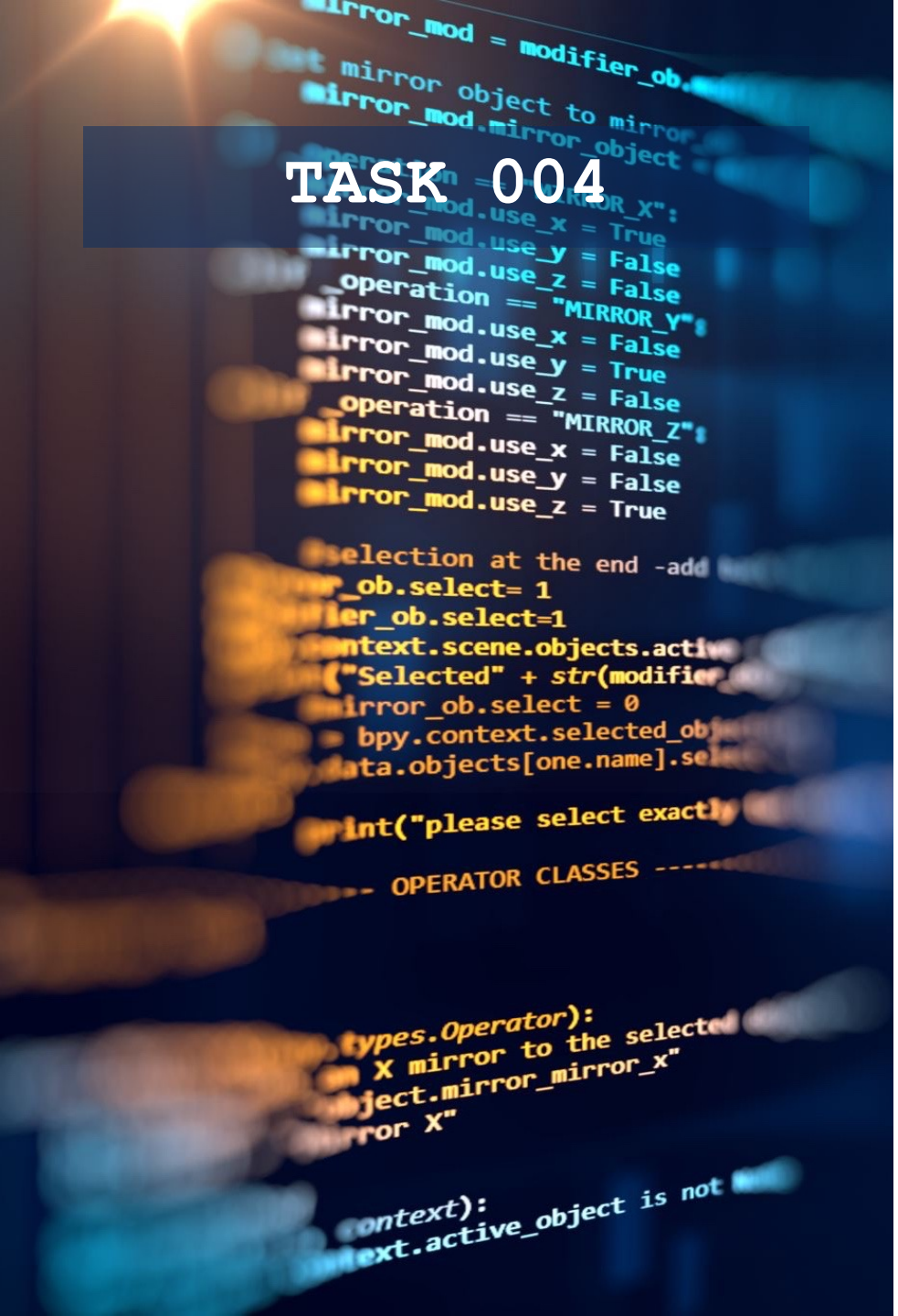


Image Features

https://github.com/clipsound/APAI2024_student

Corner Detection (implement):

- Use the Shi-Tomasi corner detection to find corners in the grayscale image.
- Mark the detected corners on the original image.
- Display the image with marked corners.

Histogram Calculation (implement):

- Calculate and plot the histogram of pixel intensities for the grayscale image.

Thanks