## **Application Utils (highgui, imgcodecs, videoio modules)**

**Overview**

These modules are used when we need to show images/videos on screen, read files from storage, or save them back to disk. They are the basic input/output functions of OpenCV.

### **1. highgui (High-Level Graphical User Interface)**

This module deals with creating and controlling image or video display windows.

* We can show images in different windows.
* We can wait for keyboard input before closing the image.
* We can close one or all windows when needed.

Important Functions:

* cv2.imshow(window\_name, image) - shows an image in a window.
* cv2.waitKey(ms) - waits for a key press for given milliseconds (0 is infinite wait).
* cv2.destroyAllWindows() - closes all opened windows.
* cv2.destroyWindow(window\_name) - closes a specific window.

### **2. imgcodecs (Image Codecs)**

This module is used to load images from storage and save them back.

* It supports many formats: JPG, PNG, BMP, TIFF, etc.
* We can read images in color, grayscale, or unchanged modes.

Important Functions:

* cv2.imread(path, mode) - loads an image.
  + cv2.IMREAD\_COLOR (default) - Loads color image without transparency.
  + cv2.IMREAD\_GRAYSCALE - Loads as grayscale.
* cv2.imwrite(filename, image) - saves an image.

### **3. videoio (Video Input/Output)**

This module is used to read video streams (like webcam or video file) and write videos to disk.

Important Functions:

* cv2.VideoCapture(source) - opens video file or camera.
  + 0 means default webcam.
* .read() - returns True/False and the current frame.
* cv2.VideoWriter() - saves video frames to a file.