

**OLIVE (OpenCV LIVE)** is a web-based, visual programming tool for real-time image, video, audio and 3D processing. It uses **nodes** to represent functions and **wires** (connections) to define the flow of media data between them, leveraging **OpenCV.js**, **Three.js** and **MediaPipe**.

## I. System Requirements and Setup

- **Browser:** A modern web browser that supports **WebGL** and **JavaScript**.
- **Dependencies:** The application loads external libraries including `opencv.js` and `three.js`.
- **Status Check:** When the editor loads, the **OpenCV status** will be displayed in the interface, turning green once the library is ready.

## II. Core Editor Concepts

Component	Description	Interaction
<b>Node</b>	A block representing a specific function.	<b>Add:</b> Drop the Node into the <b>Graph Editor</b> . <b>Remove:</b> Select and <b>Right-click</b> or press <b>Delete</b> ( <i>continuous click on touchscreens</i> ).
<b>Port</b>	Connections for data flow. <b>Inputs</b> (left) receive data; <b>Output</b> (right) sends data.	<b>Create Connection:</b> Drag from an <b>Output Port</b> to an <b>Input Port</b> ( <i>on a touchscreen, click the output first and then the input</i> ).
<b>Wire</b>	Defines the flow of data from an output to an input.	<b>Delete Connection:</b> <b>Right-click</b> on the <b>Port</b> ( <i>continuous clicking for touchscreens</i> ).
<b>Fullscreen</b>	View media output in full screen.	<b>Double-click</b> on the image/video/canvas ( <i>continuous click when on a touchscreen</i> ).
<b>File</b>	Load and save graphs in <b>JSON</b> format.	<b>Click</b> the <b>Save</b> (💾) icon to save the project. <b>Click</b> the <b>Open</b> (📁) icon to load a project. Local media files must be manually uploaded as soon as the project (.olive) file is ready.

## III. Node Catalog and Basic Functionality

Nodes are organized into categories based on their role in the workflow.

### 1. Input Nodes

These nodes provide the starting media source for your graph.

- **Image / Video / Audio:** Upload a static image, a video or a sound file (or provide a URL to a media file or a *live stream*).
- **Camera / Microphone:** Capture a live video feed from your device's camera.
- **Parametric Lines:** Change the parameters and generate animated curves.

## 2. Processing Nodes

These nodes perform image and video manipulation using **OpenCV.js**.

Node Title	Primary Functionality	Key Controls & Parameters
<b>Gamma Correction</b>	Changes pixels' intensities.	Adjust <b>y</b> value.
<b>Histogram Equalization</b>	Equalizes the histogram, globally or locally.	Adjust the <b>Grid Size</b> for <b>CLAHE</b> (Contrast Limited Adaptive Histogram Equalization)
<b>Color Adjustment</b>	Manipulates the <b>HSV</b> color space.	Use the <b>Color Picker</b> to define the color (or the target range) and the sliders for new <b>Hue</b> and <b>Saturation</b> values. Includes <b>Full Range</b> and <b>Invert</b> options.
<b>Convolution</b>	Applies spatial filtering.	Select <b>Filter Type</b> (e.g. Gaussian Blur, Sobel Edges) and adjust <b>Kernel Size</b> or define a <b>Custom Kernel</b> .
<b>Morphology Rank</b>	Applies morphological operations and ranking filters.	Select <b>Filter Type</b> (e.g. Erosion, Dilation, Median), <b>Kernel Size</b> , and <b>Kernel Shape</b> (Rectangle, Ellipse, Cross).
<b>Polar Transformation</b>	Wraps the image using coordinate transformations.	Select <b>Effect Type</b> (Fish Eye, Cone, Swirl) and <b>Effect Strength</b> .
<b>Glitch Effects</b>	Applies dynamic visual distortions.	Select <b>Effect Type</b> (Shaking, Aberration, Fade, Glass) and <b>Effect Strength</b> .
<b>Thresholding</b>	Binarizes the color channels, using a global or local threshold.	Adjust the <b>Threshold Value</b> and select the <b>Type</b> (Binary, Otsu, Adaptive).
<b>Matrix Operations</b>	Adds, subtracts, multiplies, divides two images or applies min/max operations.	Select the <b>Operation Type</b> and the <b>Weights</b> for the inputs.
<b>Channel Mixer</b>	Remixes the <b>RGB</b> channels.	Adjust the <b>Percentage of Red, Green and Blue</b> at every color channel.
<b>Color Blending</b>	Replaces the color (e.g. Hue, Saturation) of an image with the color of another.	Select the <b>HSV</b> channels (Hue, Saturation, Value) to be replaced.
<b>Concatenation</b>	Merges the input images horizontally or vertically.	Adjust the percentage of <b>Overlap</b> with the slider.

<b>Transitions</b>	Classic <b>WebGL</b> transitions between two inputs.	Select <b>Transition Type</b> (e.g. Fade, Wipe, Radial) and adjust the <b>Duration</b> .
<b>Image Stitching</b>	Joins two images, based on common features.	No controls
<b>Superpixels</b>	Applies <b>K-means</b> clustering to the pixel colors.	Adjust the <b>K-Value</b> ( <i>number of colors</i> ).
<b>Background Subtraction</b>	Removes non-moving objects (background) from the input video.	No controls.
<b>Optical Flow</b>	Visualizes the optical flow with arrows.	Adjust the <b>Block Size</b> .
<b>Skeleton</b>	Applies the <b>Distance Transform</b> .	No controls.

### 3. Rendering Nodes

They render the input texture onto a **3D geometry** using **Three.js**.

- **Projection:** A specialized node that uses the input as a **projected texture** onto the scene. Use the mouse to **orbit and zoom** the camera. A spherical indicator represents the **Projector** which can be dragged using **Drag Controls**.
- **Mapping / Lighting:** UV mapping of the input image/video on a **GLTF Model** or a Plane, Cube, Sphere etc. The spherical indicator represents a **Point Light**. Adjust light's color and intensity with the color picker and the sliders.
- **3D Text:** renders custom 3D text. Adjust content, font, color, size and camera position.

### 4. Pose-Estimation Nodes

They track the human body using the **MediaPipe** library.

- **Human Pose:** Applies segmentation to the person (if any) and removes the background.
- **Character Animation:** pose-driven movement of an uploaded **VRM humanoid model**.

### 5. Output Node

This node does not have an Output Port.

- **Canvas Viewer:** This is the final step in the graph. It displays the result of the connected node. Click the **Pop-Out** icon (top right corner) to open the content in a new Window.

## IV. Additional Functions

In this section, special features (not described above) are presented.

### 1. Node Bypass

To temporarily deactivate a connected node, uncheck the box next to the Node Title (top right corner). This allows you to *test* the effect of a particular node on the data flow.

### 2. Control Ports

The **Human Pose Node** sends *pose estimation result data* through its Control Output. Connect this port to the Control Input (if available) of any node, in order to trigger specific events (e.g. *play* a video/sound or a transition, *pause* a video/sound already playing or *reverse* a transition, *position* the camera, *adjust* a slider value, *move* the model in a Character Animation Node etc.).

You may change the default gesture, that is raising and waving the right hand, from the **Settings** (⚙) menu on the top right corner of the Graph Editor.

### 3. Keyframes

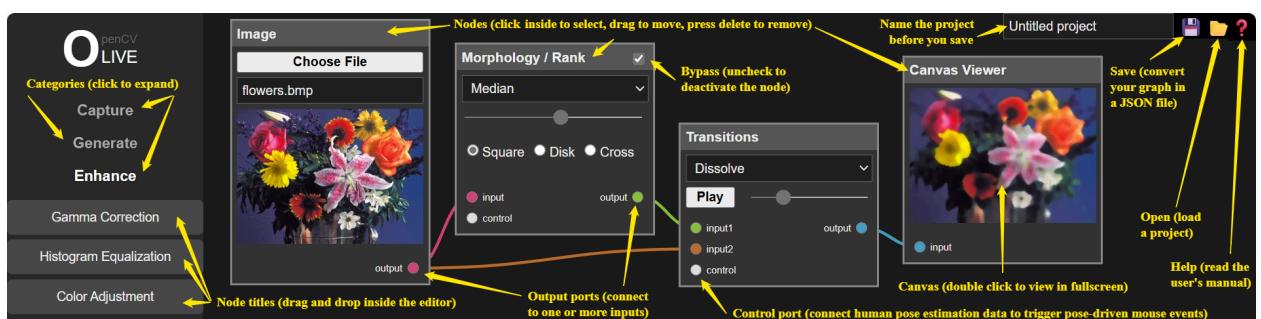
The **Countdown / Keyframes Node** allows for *time-driven* events triggering. Set the **Countdown Timer**, determine a **Target Value** (or two) for the affected parameters and connect the Control Output to any node's Control Input (except from the Character Animation Node that accepts only **MediaPipe** data from the Human Pose Node). The countdown starts by clicking the node's **Trigger Button**, or by another node's Control Output. To generate periodic triggers (**loop mode**) either connect the node output to *its own input*, or create a *chain of nodes* and connect the last output to the first (or any other) input.

### 4. Sound Filters & Effects

This node takes an audio (or video) as input and applies *audio processing* (e.g. Band Pass, Reverb, Flanger, Panning). It has an *input control port* that accepts data from any *output control port* (even its own), as well as an *output control port* that sends **Audio Analyzer** data to any *input control port* (except from the Character Animation Node as already mentioned). No more than one **Sound Filters & Effects Node** may be connected to a video/audio output.

## V. Graphical User Interface

<https://opencv-live.github.io/examples/images/gui.png>



## VI. Examples

<https://github.com/opencv-live/opencv-live.github.io/tree/main/examples>

To run the examples: hover over the **Open** (📁) icon at the top right corner of the Graph Editor and select a **Sample Graph** from the list. You may also download the **.olive files** (not the images folder) to your PC and then load any of them.

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