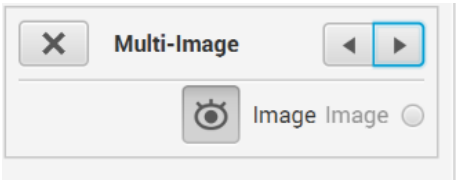
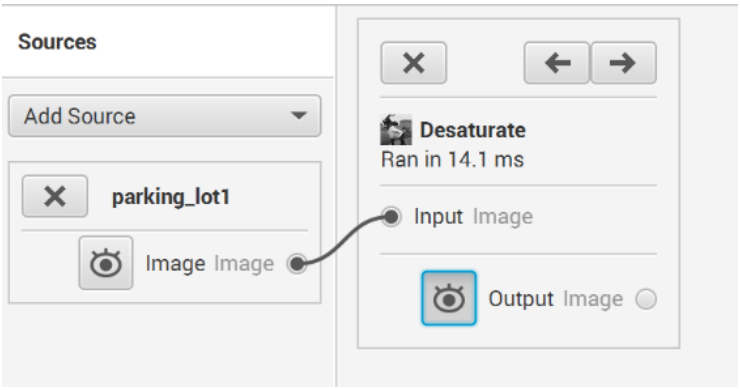
GRIP is a “computer vision engine” software that allows users to use OpenCV and other image analysis functions on an image, viewing the modifications step-by-step. It is also helpful in comparing pipeline runtimes.

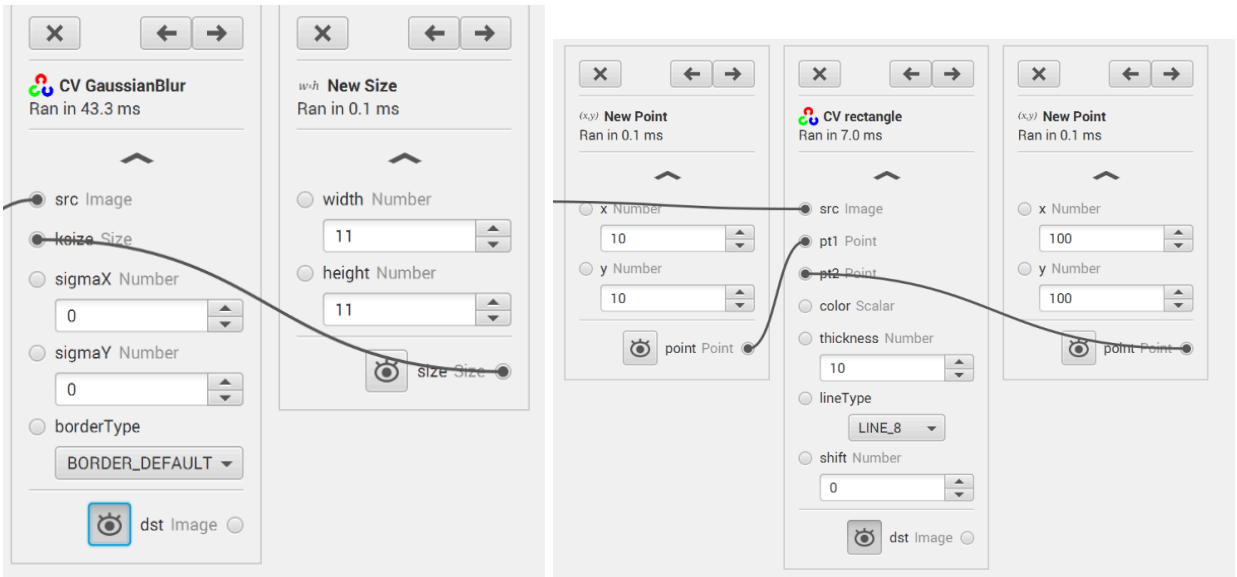
1. **Download and install latest release** from GitHub
2. **“Add source” in the left sidebar and upload your image(s)**
    a. Press the “eye icon” to see image/webcam video in Preview
    b. Multiple images: move through using the arrows.



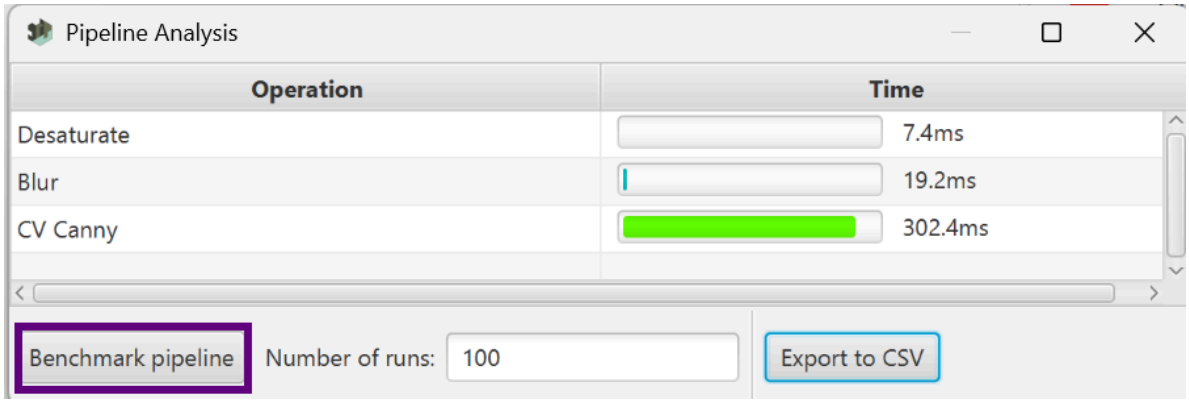

3. Click **functions in the Operation palette** to add into the bottom section.
    a. Drag source or function outputs into function inputs.
    b. Use the “eye icon” to view the image preview at different points in the pipeline.



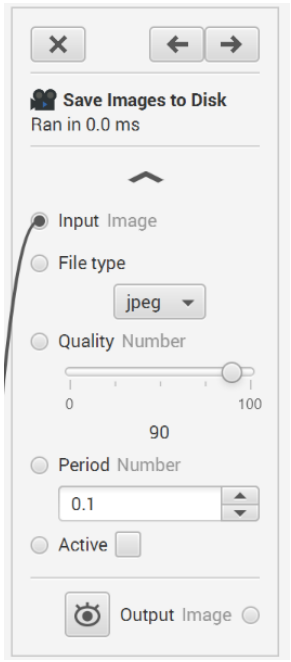

    c. If a function requires a “size” or “point” input, use the respective card from the Operations palette and connect output->input.

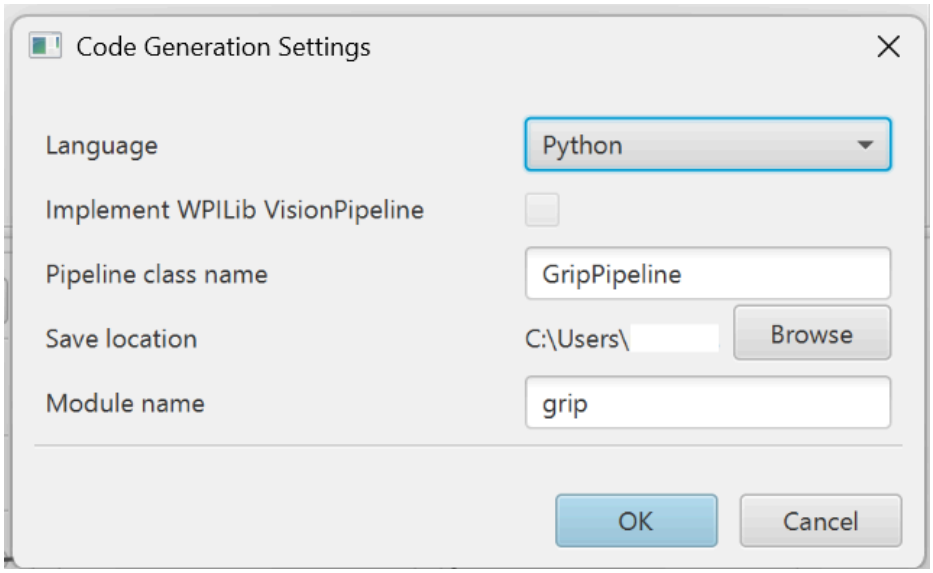


4. **Runtime** of each function in a pipeline is measured for one instance of it running. To compute an average runtime, use Tools->Analyze->Benchmark pipeline to run it multiple times and compute the average runtime and standard deviation.




5. **Saving progress**:
    a. Result images can be periodically saved using the "Save Images to Disk" function
    b. The pipeline itself can also be saved as a .grip file (File->Save/Save As)
    c. The pipeline can also be **exported as code** (Tools->Generate Code) in Python, Java, and C++




**Potentially relevant functions**

- Blur (built-in): box blur, Gaussian blur, median filter, bilateral filter
- Gaussian blur (OpenCV): implements sigmaX/sigmaY, allows a wider radius to be used to calculate blur of a pixel without increasing the kernel size and runtime
- Desaturate (built-in): grayscale

- cvtColor (OpenCV): converts from one color space to another, includes grayscale
- Mask (built-in): masks out an area of interest
- HSL/HSV Threshold (built-in): filter pixels based on hue/saturation/value/luminance
- RGB Threshold (built-in): color filter
- Canny (OpenCV): Canny edge detection algorithm
- Find Lines + Filter Lines (built-in): find and filter line segments by length

For more details, see GRIP operations wiki or OpenCV documentation

**Notes**

- More detailed tutorial provided by WPI includes a 1.5-hour long YouTube video
- GRIP can deploy directly to ROS, but not ROS2.