# A Appendix

## A.1 A small tutorial on ImprovCV

This tutorial gives a brief example of how to use ImprovCV. It shows how to get started and explains the core features of the program. The following image shows the GUI plus extra information added in red.
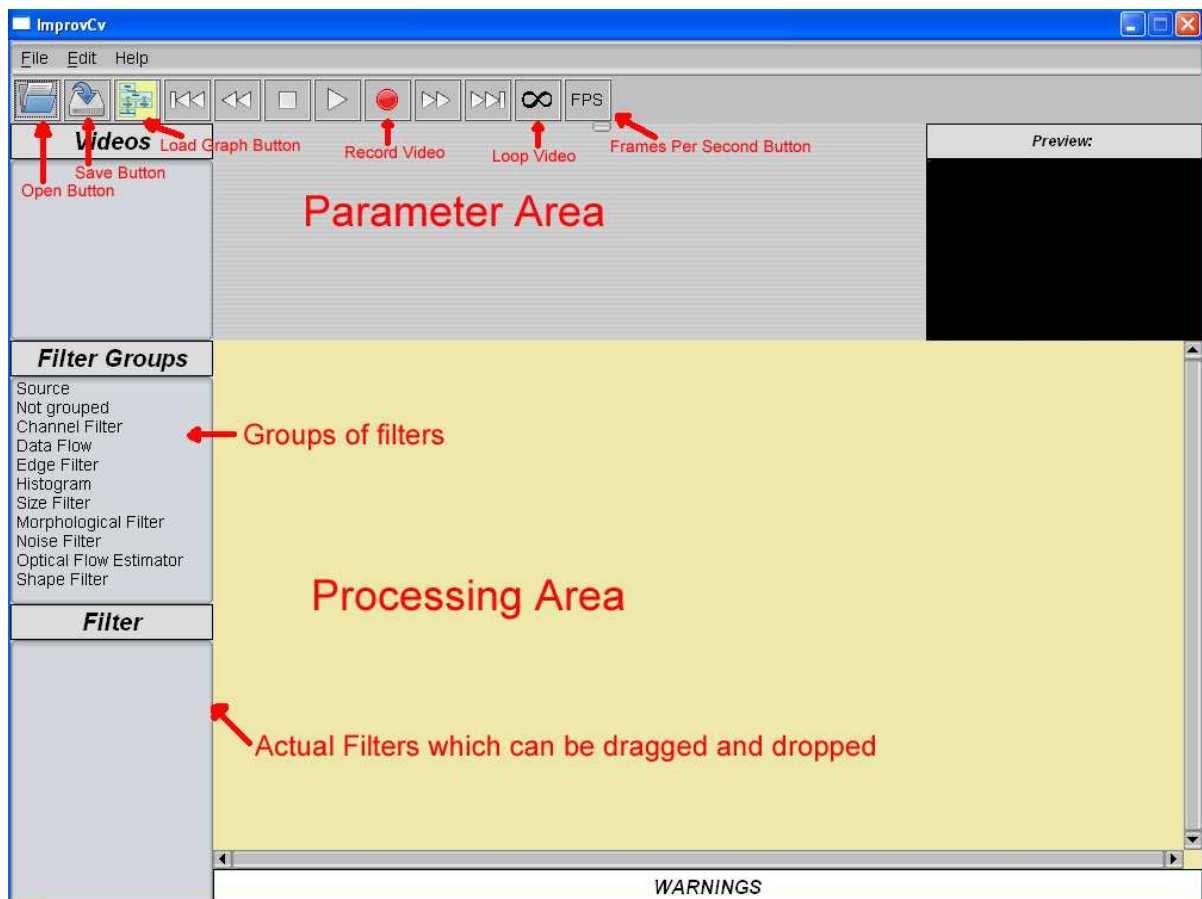


Figure A.1: Example Image showing how the plain GUI with additional information

**Features:**

- Loading a source

- Adding a filter

- The warning window

- The preview window

- Saving and Loading

- Deleting filter/s

- Stereo image processing

- Recording a video

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## A.1.1  Loading a source

There are 4 differnt ways of loading a video:

1. Click on *File* on the menubar and select the open menuitem, then simply brows the video you want to load via the file browser that will pop up

2. Click on the *Open* button on the button bar, rest is the same as above

3. Use shortcut ctrl+o, rest as above

4. Click on the *Source* item of the list *Filter Groups*, drag the Source listitem from the list appearing in Filter list, drop it in the processing window. Click on the occurring blue box called *source*, a checkmenubar occurs in the parameter area. Select *Connect Video*, rest is the same as above. The next image shows this case.

   If webcams are connected to your computer, there will be a checkbox called *Connect Camera*. By selecting this, depending on the number of connected cameras, a new list in this checkbox list will occur. Select the wanted camera.

After having loaded a source, the respective image will appear in the video window.

By default the video will be in loop mode, that means it will be repeated over and over again. By clicking on the looping button, you can switch so the video will not be repeated after it is finished.

Furthermore, you can select the Frames Per Second by clicking on the *fps* button. A drop down menu will occur from where you can select the number of frames per second you want. Once a source is loaded, there will be two boxes on the processing window source and video display. By clicking on the video display, the display window pops to the front.
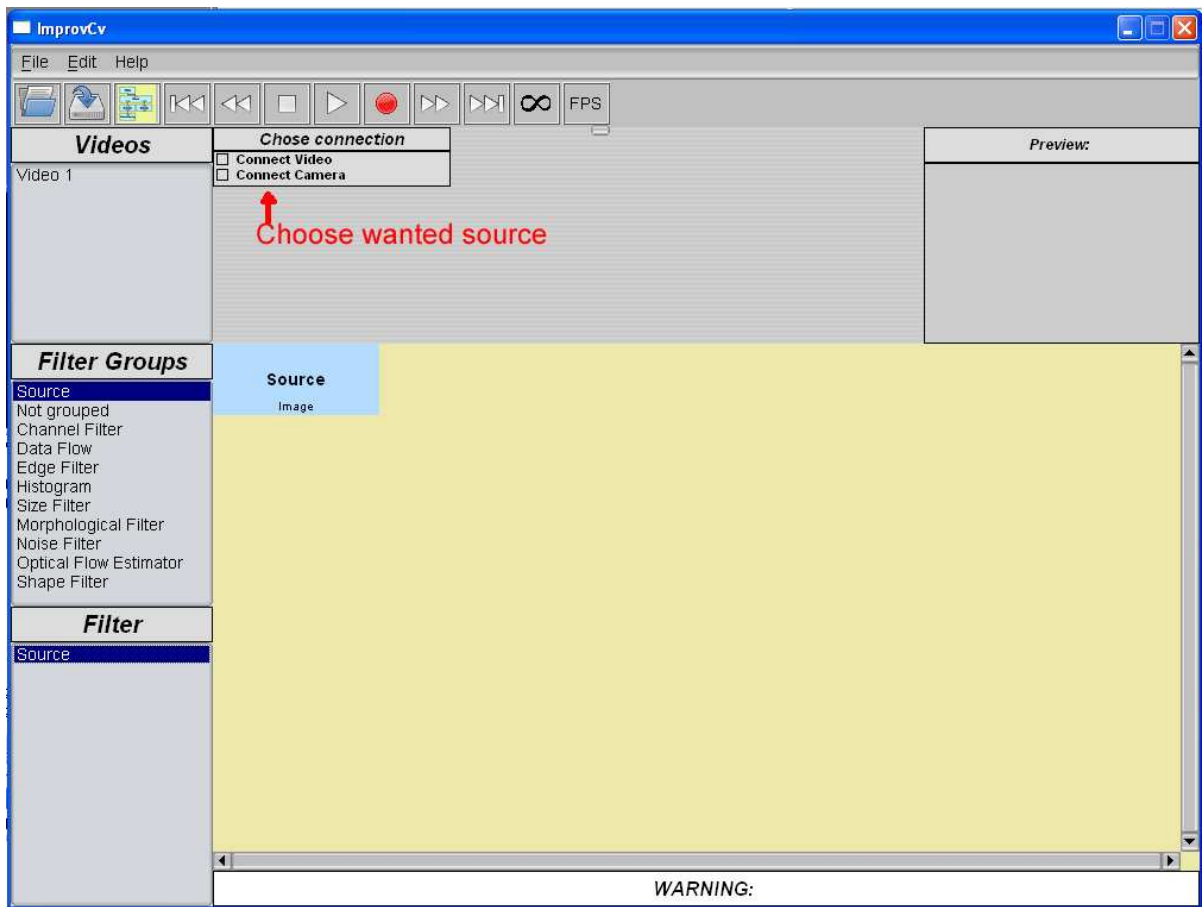
Figure A.2: Example Image showing how to connect a source

## A.1.2  Adding a filter

In this easy example, an edge detection should be performed. Thus, after having loaded a source you choose the group *Edge Filter* from the filter group list. All filters being part of this group will be shown in the list of the Filter window. In this example you chose the sobel filter for performing the edge detection. Just select it by clicking on it, hold the mouse button and drop it on the position you wish to add it to. The result is shown in the next image.
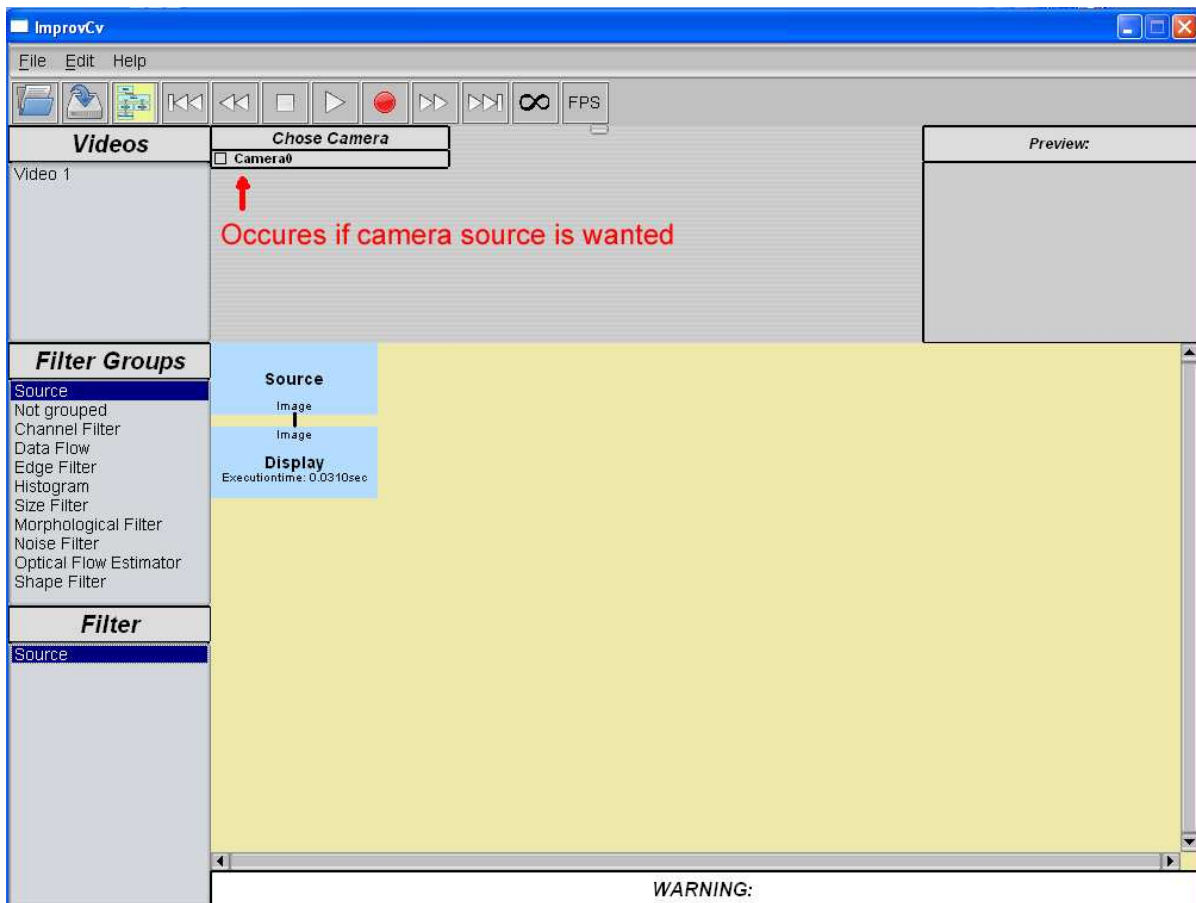
Figure A.3: Example Image showing how to connect a camera

## A.1.3  The warning window

As the input image of the sobel filter is an RGB image, and sobel requires a greyscale image, no processing will be performed. Instead, a warning is given in the warning window on the bottom of the GUI. The problem is solved by adding a greyscale filter in front of the sobel filter from the Channel Filter group.

## A.1.4  The preview window

Shown on the screen is always the output of the last filter in the graph. If you want to see the output of any other intermediate filter, you can either just click on the respective box and the output will be shown in the preview window plus in the headline over the preview window the name of the selected filter or you can add an extra display by adding the filter *ExtraDisplay* from the Data Flow group.
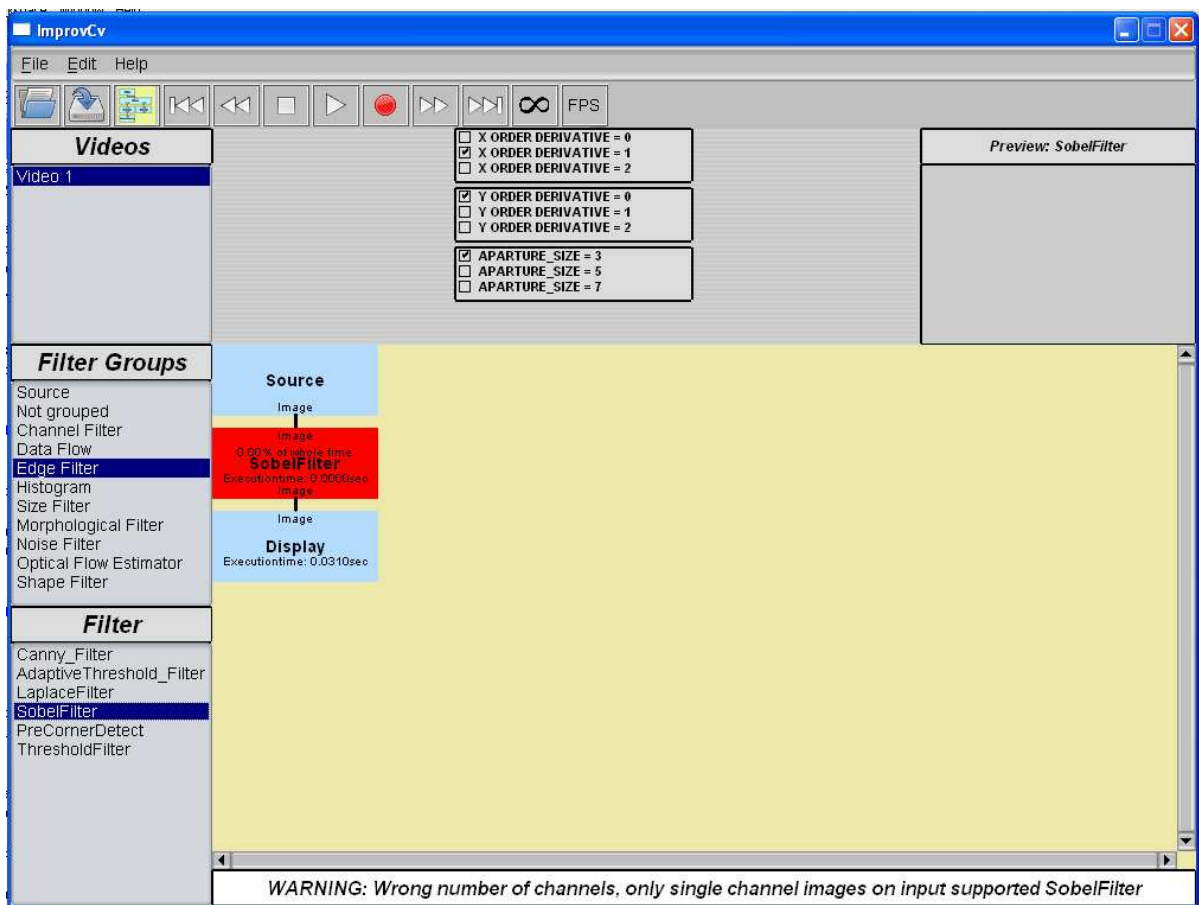
Figure A.4: Example Image showing a graph with one sobel filter

## A.1.5 Saving and loading

Once the graph is created, you can store it in an XML file to reuse it. Saving can be performed in 3 different ways: either by selecting the *save* menu item from File in the menubar, with the shortcut ctrl+s or by using the save button from the button bar. Either way, you just have to select the place where you want to store the xml file via the file browser, then type in NAME.xml and click save.

For loading a file you either load it by selecting load from the file menu, click the *load* button from the button bar or the shortcut ctrl+l. Each time, a file browser will occur where you select the wished xml file. If you want to load a new file into an already existing graph, you have to click on *source* before you perform the steps mentioned above.

## A.1.6  Deleting filter/s

If you wish to delete a filter from the graph, select the filter to be deleted by clicking on the respective box, then you can either click the *delete* button on you keyboard or select *Remove* from the *Edit* menu. If you want to remove all filters, you click on the source and hit ctrl+delete or select *clear graph* from Edit.

## A.1.7  Stereo Image processing

As already described, you can process images from web cams as well. Furthermore, the program has the ability of grabbing frames from more than one source and even better if two webcams are connected, the grabbing will be synchronized so the frames provided by the cameras are taken at the same time.

The stereo processing is performed by first connecting a source (video or camera) as describe above, then you have to add the filter called *StereoSource* shown in the next image.

The boxes in the parameter area occur by clicking on the *StereoSource* box. If you want to connect another video, you just select *Connect Video* and perform it in the same way as described before. If you have two cameras connected to your computer, you will have the possibility of choosing *Connect Camera*. If you select this, the second camera will automatically be connected and synchronized with the first connected camera.

The output image from the already connected source is on the first image-output on the left of StereoSource, and the new one on the second output. You can change this by selecting *swap output images* as shown in the image above and you can swap them back by selecting the respective checkbox.

## A.1.8  Recording a video

A resulting output can be recorded and stored in an .avi file. This is done by simply clicking on the *record* button, the red button in the button bar. Once clicked on it a file browser opens and you can select where to store the video and how to name it. When recording should be finished, click on the *pause* button in the button bar.
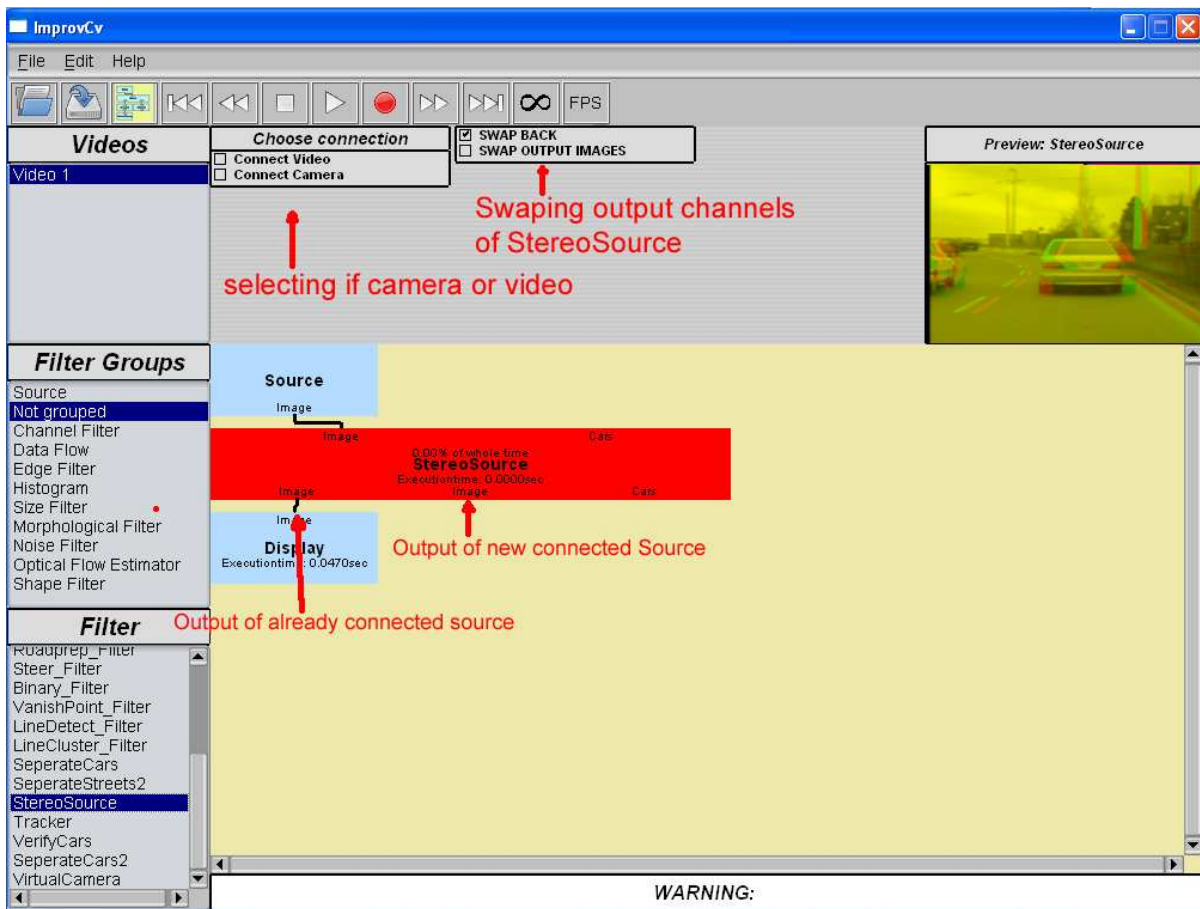
Figure A.5: Example Image for stereo processing

# A.2 Filters provided by ImprovCV

- GreyScaleFilter

- ColorConvFilter; Converts images to a number of color spaces

- InvertFilter; Inverts each pixel

- ChannelSelector; separates channels from image

- Visualizer

- BlendFilter; Adds or subtracts two images

- Multiplexer

- ExtraDisplay

- Histogram

- Histoequ; Equalizes image's histogram

- HistoThresh; Thresholds or normalizes image's histograms

- Erosion

- Dilation

- Morphological

- Thinning

- MedianFilter

- GaussianFilter

- MinMaxMeanFilter

- CalcFundamentalMatrix

- CreateDepthMap

- CreateRedGreen

- FindOuterLanes; finds the most outer lane-markings

- FillWithBlack; fills everything with black beyond the detected outer lane-markings

- FlipFilter

- OpenCvDepth

- RectifyImages

- RedGreen; Splits am image into two images by selecting the red and green channel

- RoadprepFilter

- SteerFilter

- BinaryFilter

- VanishPointFilter

- LineDetectFilter

- LineClusterFilter

- SeperateCars

- SeperateStreets2

- StereoSource

- Tracker

- VerifyCars

- SeperateCars2

- VirtualCamera

- OpticalFlowFilter

- OpticalFlowHsFilter

- HoughLinesFilter

- HoughCirclesFilter

- ClipFilter

- ClipXY

- PyrDownImage; Performs image down-sampling by 2

- PyrUpImage; Performs image up-sampling by 2

- SkyClip