Imaging Whiteboard 2.0
User's Guide

Contents

Introduction 6
Installation 6
New in 2.0 6
The Whiteboard Metaphor 7
Controls in detail 14
Video Input controls 14
Camera Input 15
Image File Input 16
Video File Input 17
Test Pattern Control 18
Mandelbrot Input Control 19
Audio Video Input controls 20
Camera and Microphone Input Control 20
Audio File Input Control 22
Audio Video File Input Control 23
YouTube Input Control 24
TiVo input control 27
Video Output Controls 31
Output to Monitor 32
Output to Image File 33
Output to Video File 34
Audio Video Output Controls 36
Output to Audio Video Monitor 37
Output to Audio File 38
Output to Audio Video File 40
Pixel Operations 41
Brightness and Contrast 42
Image Invert 43
Threshold Control 44
Enhance Control 45
Add Noise control 47
Monochrome Control 48

Contrast stretch control 49
Temporal Operations 51
Frame Difference 52
Temporal Filter 53
Freeze frame 55
Delay Control 56
Repeat Control 57
Spatial Operations 58
Convolution 59
Morphological Operations 61
Advanced Operations 63
FFT Filter 64
Warp Control 68
Statistics 72
Histogram Control 73
Image Info Control 74
Audio Info control 75
Audio spectrum control 76
Eraser Functions 77
Tools 78
Save and Restore Whiteboard 78
File Converter 79
Logging Functions 80
Debug Logging 81
Progress Logging 82
Help Functions 83
Performance 84
Compromises 84
What helps? 84
Contact 85

Figure 1 : Imaging Whiteboard initial state. 7
Figure 2 : Video Input menu selection 8

Figure 3: Audio Video Input menu selection 8
Figure 4 : Output menu selection 9
Figure 5 : Audio Video Output menu selection 9
Figure 6 : Camera input settings 10
Figure 7 : Simple video viewer. 10
Figure 8 : Pixel operations menu.....11
Figure 9 : Image inversion.....12
Figure 10 : Motion detection with false alarm reduction.....13
Figure 11 : Camera input with settings expanded.....15
Figure 12 : Camera input with settings collapsed 15
Figure 13 : Image file Input with settings expanded.....16
Figure 14 : Image File Input with settings collapsed 16
Figure 15 : Video File Input with settings expanded 17
Figure 16 : Video File Input with settings collapsed.....17
Figure 17 : Test Pattern Control with settings expanded 18
Figure 18 : Test pattern Control with settings collapsed 18
Figure 19 : Camera and Microphone input with settings expanded 20
Figure 20 : Audio file input control with settings expanded 22
Figure 21 : Audio Video file input control with settings expanded 23
Figure 22 : YouTube input control with all dropdowns expanded.....24
Figure 23 : YouTube file retrieve dialog.....25
Figure 24 : YouTube control ready to use downloaded video 25
Figure 25 : YouTube control providing a downloaded video to the pipeline 26
Figure 26 : Location of retrieved YouTube files 26
Figure 27 : TiVo control with all dropdowns expanded 27
Figure 28 : TiVo log in dialog.....28
Figure 29: TiVo file download dialog 29
Figure 30 : TiVo file download progress dialog.....29
Figure 31 : TiVo control providing a downloaded video to the pipeline 30
Figure 32 : Color component separation using the threshold control 32
Figure 33 : Output to Image File with setting expanded.....33
Figure 34 : Output to Image File with settings collapsed 33
Figure 35 : Video File Output with settings expanded.....34
Figure 36 : Video File Output with settings collapsed 34
Figure 37 : Splitting a video file into separate images.....35
Figure 38 : Audio Video Monitor with all dropdowns expanded 37
Figure 39 : Output to Audio file control with settings expanded 38
Figure 40 : Extracting audio track from a YouTube video 39
Figure 41 :Audio Video Save control with settings expanded 40
Figure 42 : Brightness and Contrast Control with settings expanded.....42
Figure 43 : Brightness and Contrast Control with settings collapsed 42
Figure 44 : Image Inversion Control 43
Figure 45 : Threshold Control with settings expanded.....44
Figure 46 : Threshold Control with settings collapsed 44

Figure 47 : The Enhance control with settings expanded 45
Figure 48: The effect of enhancement on live image with histogram 45
Figure 49 : Enhancement applied to a photograph.....46
Figure 50 : Add Noise control with settings expanded.....47
Figure 51 : Live video with noise added 47
Figure 52: Monochrome control 48
Figure 53: contrast stretch applied to live video.....50
Figure 54: Extreme contrast stretch applied to live video 50
Figure 55 : Frame Difference Control.....52
Figure 56 : Frame Difference Operation.....52
Figure 57 : Temporal Filter control with settings expanded 53
Figure 58 : Temporal Filter Control with settings collapsed 53
Figure 59 : Temporal Filter operation 53
Figure 60 : Temporal Filter applied to a moving image.....54
Figure 61 : Freeze control passing through live video 55
Figure 62 : Freeze control passing through captured frame 55
Figure 63 : Delay control with settings expanded 56
Figure 64 : Repeat Control passing through live video 57
Figure 65 : Repeat Control repeating captured frame.....57
Figure 66 : Convolution Control with settings expanded.....59
Figure 67 : Convolution Control with settings collapsed 59
Figure 68 : Sobel filter applied to camera input 60
Figure 69 : Morphology Control with settings expanded.....61
Figure 70 : Morphology Control with settings collapsed.....61
Figure 71 : 5 x 5 Erosion applied to checkerboard test pattern.....62
Figure 72 : FFT Filter Control with mask and settings expanded.....64
Figure 73 : FFT Filter Control with mask and settings collapsed 65
Figure 74 : FFT Include high frequencies mask applied to checkerboard test pattern 66
Figure 75 : FFT Include high frequencies mask applied to blurred checkerboard test pattern ...66
Figure 76 : Vertical FFT Include high frequencies mask applied to blurred checkerboard test pattern 67
Figure 77 : Horizontal FFT Include high frequencies mask applied to blurred checkerboard test pattern 67
Figure 78 : Warp Control with settings expanded.....68
Figure 79 : Warp Control with settings collapsed.....68
Figure 80 : Zoom and rotation of live video 69
Figure 81 : Extracting a detail and using sharpening to reduce blurring 70
Figure 82 : Fisheye correction.....71
Figure 83 : Histogram control with view expanded 73
Figure 84 : Image Info Control with view expanded.....74
Figure 85 : Audio Info Control with all dropdowns expanded.....75
Figure 86 : Audio Spectrum Control with view expanded 76
Figure 87 : Converting mov to mp4 79
Figure 88 : Debug Logging Dialog.....81

Figure 89 : Progress Logging Dialog 82

Introduction

The Imaging Whiteboard is designed to allow the user to quickly whiteboard real-time imaging algorithms. As the algorithms are designed, they will be actively implemented allowing the user to see the results and modify the algorithm.

The Imaging Whiteboard is designed to work on a desktop computer running Windows 7 or later. Windows 8 and Windows 10 were used during development. It will not run on Windows XP, Linux, or iOS. The Imaging Whiteboard will run on a Windows tablet. The user interface is not designed to be finger friendly so a mouse is recommended.

The Imaging Whiteboard is a product of Sound Analysis.

Installation

Before installing the Imaging Whiteboard; make sure that you have version 4.8 (or later) of the .NET framework installed. If not, you can get it from Microsoft at:

Download .NET Framework 4.8 | Free official downloads (microsoft.com)

If you have a previous version or the Imaging Whiteboard installed, uninstall that first.

The installation files are delivered as a zip file. Extract the file to any location on your computer, and then run setup.exe.

New in 2.0

Audio Video controls

Input from TiVo on a local network

Input from YouTube

Save and Restore whiteboards

File format conversion tool

Fish-eye warping

Mandelbrot generator

Image resizing controls

More temporal controls

More pixel operations

The Whiteboard Metaphor

When the imaging whiteboard first starts it presents the user with a blank background.

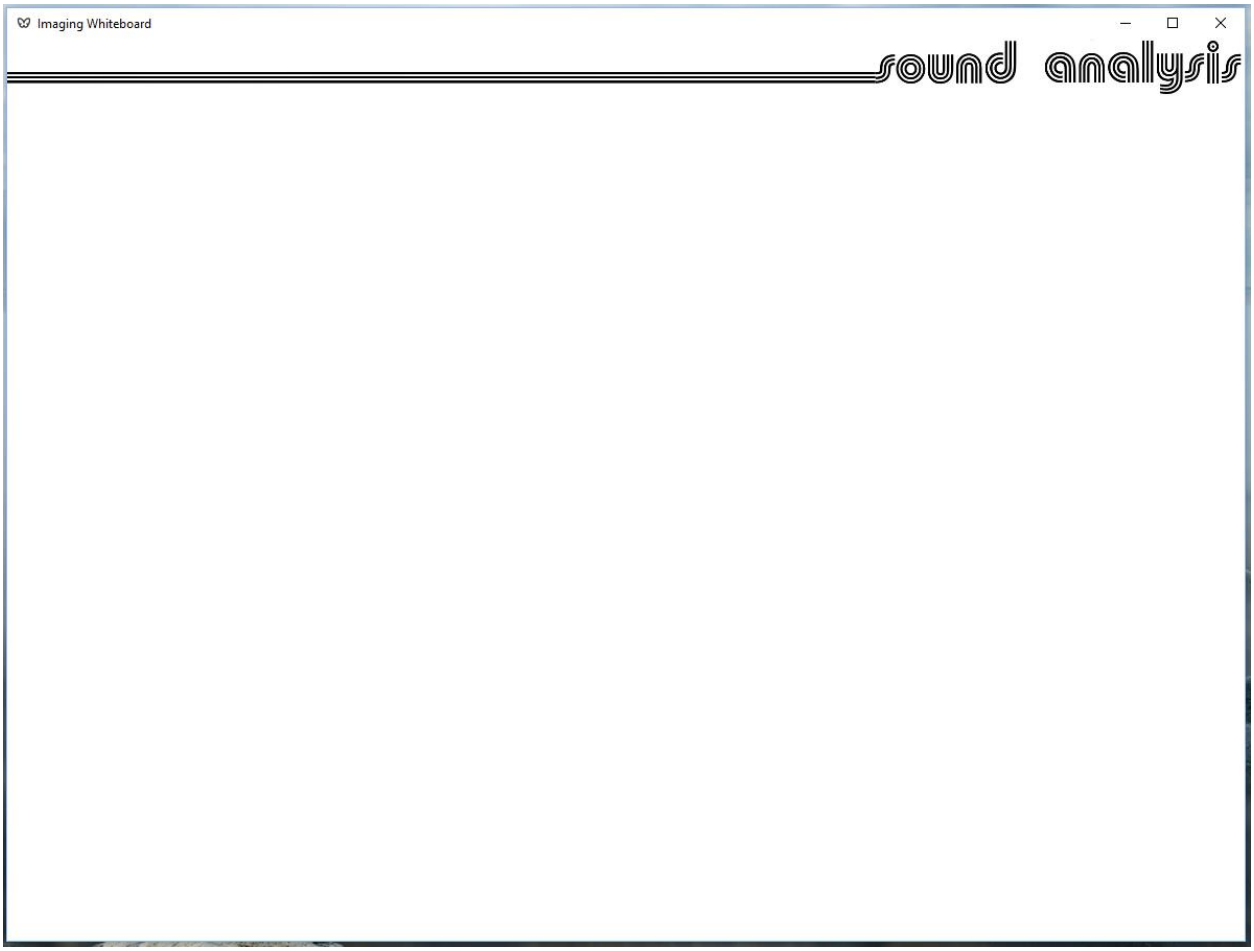


Figure 1 : Imaging Whiteboard initial state.

To draw on the whiteboard right click on the background and select imaging components from the menu. These components may be moved using the left or right mouse buttons, and connected to each other using the left mouse button.

Components may be configured by opening the settings expander.

Clicking on a control will give it a red outline. This has no effect on the operation of the control. This feature may be useful when discussing the algorithm with others, or in a teaching situation.

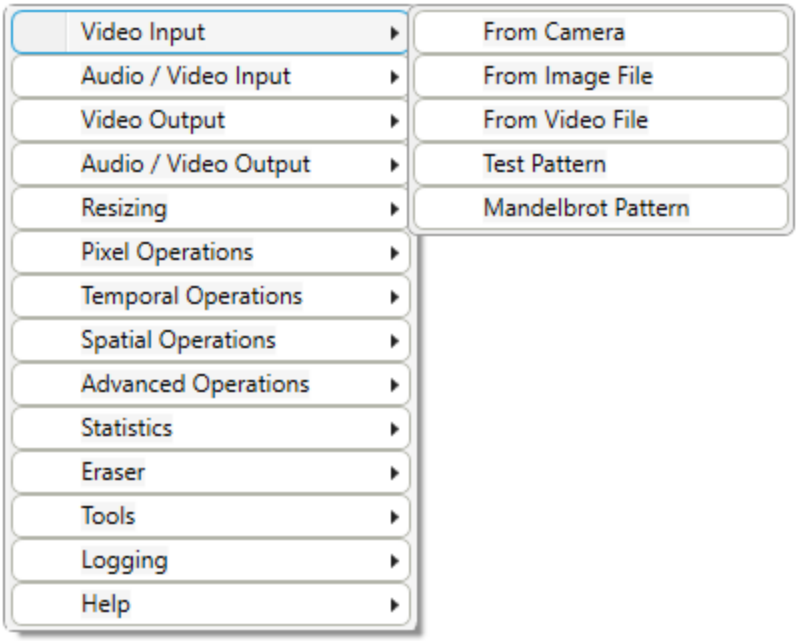


Figure 2 : Video Input menu selection

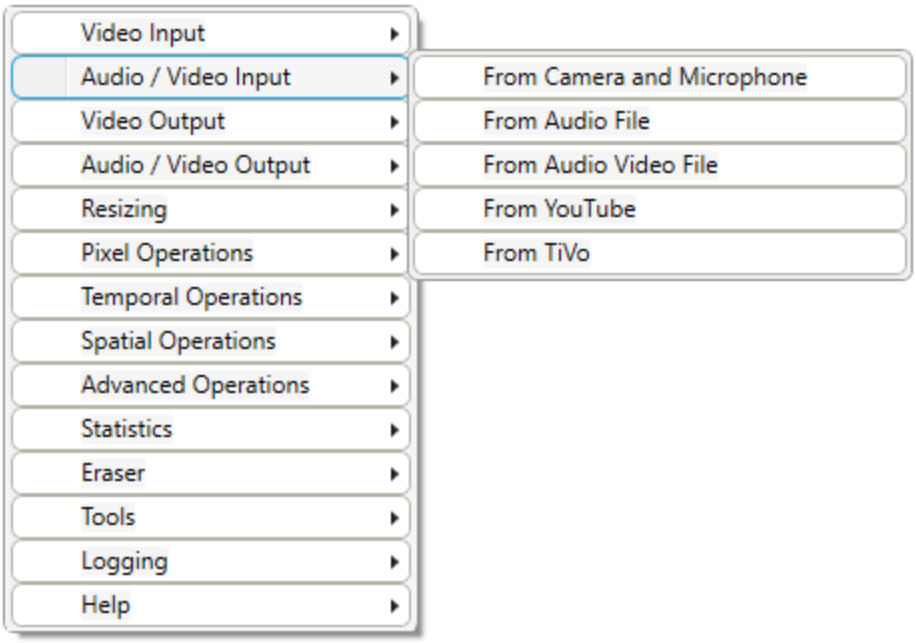


Figure 3: Audio Video Input menu selection

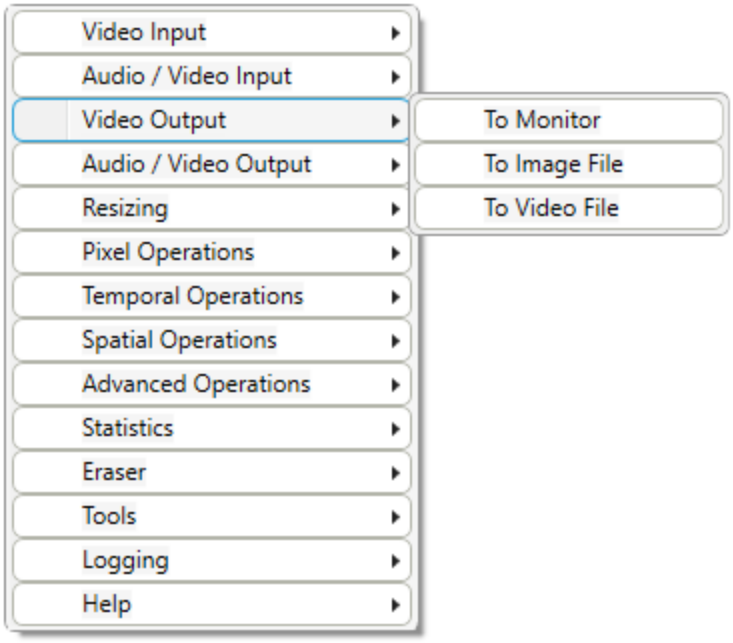


Figure 4 : Output menu selection

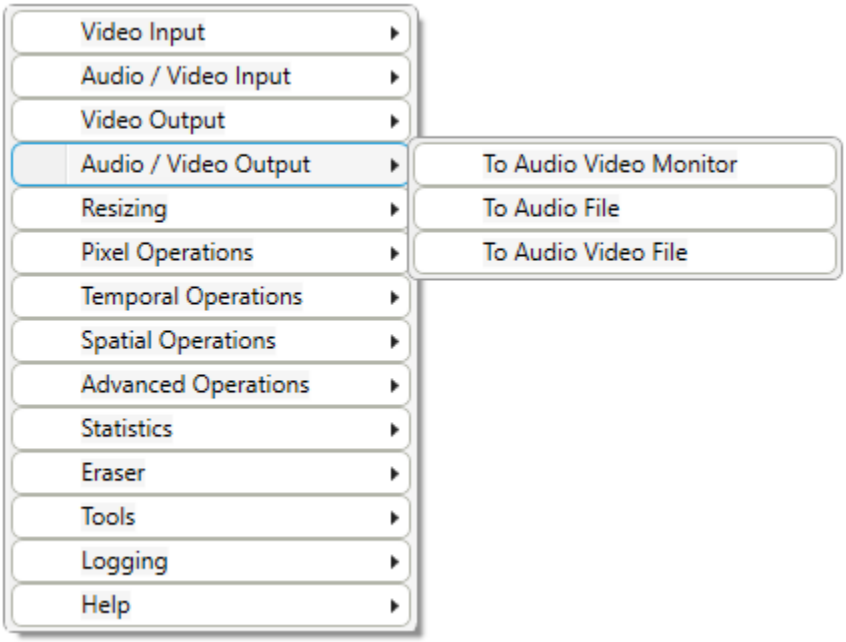


Figure 5 : Audio Video Output menu selection

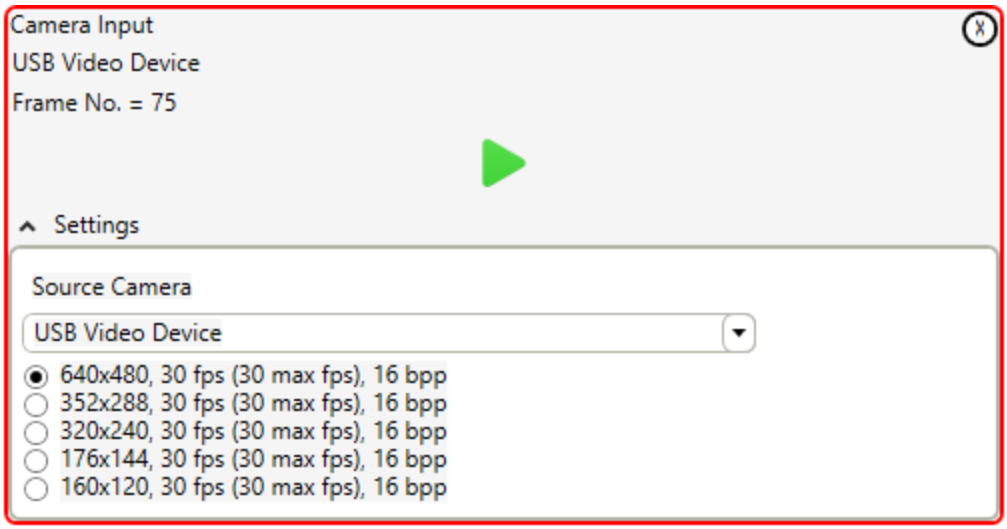


Figure 6 : Camera input settings

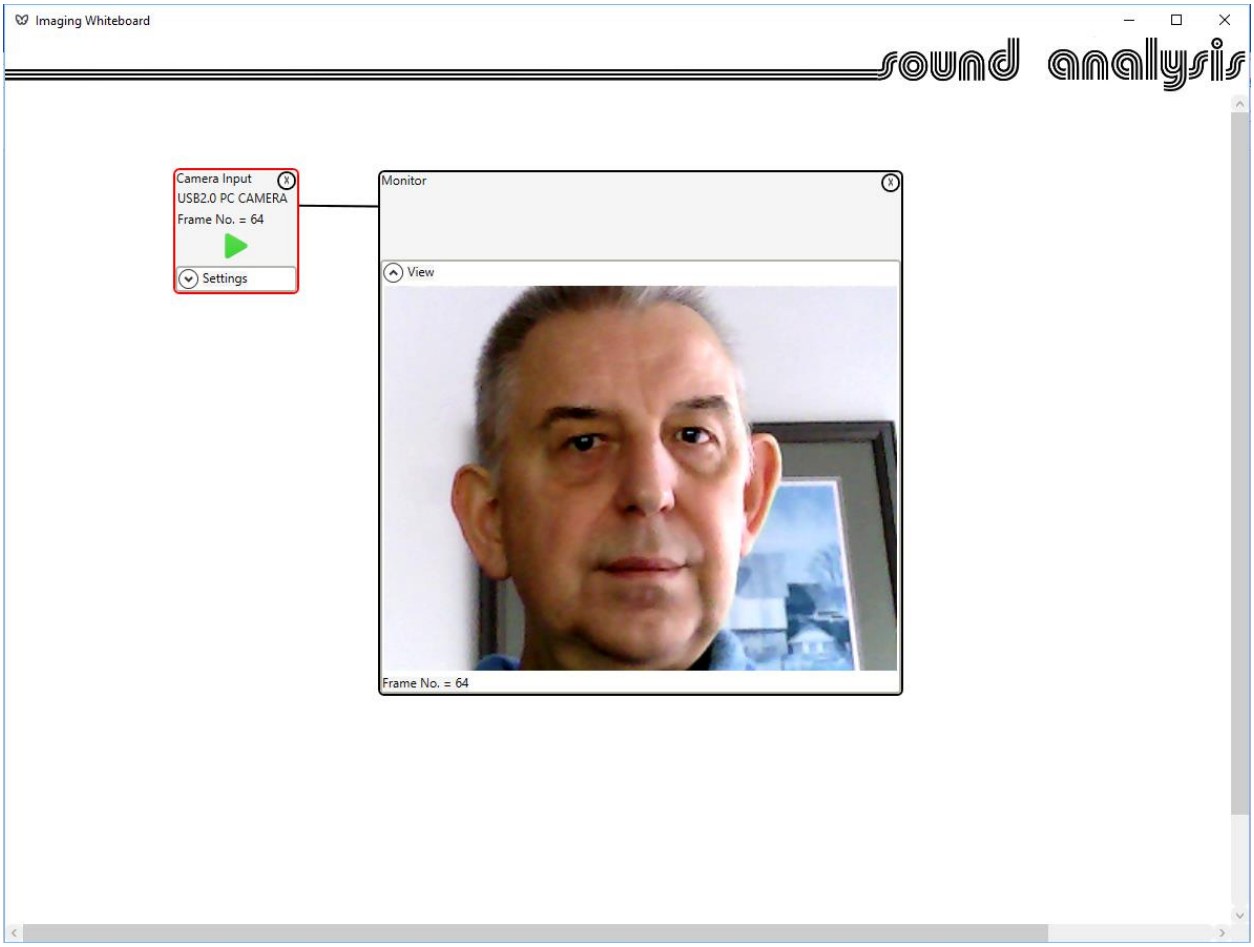


Figure 7 : Simple video viewer.

To add processing pick a control from one of the operations menus.

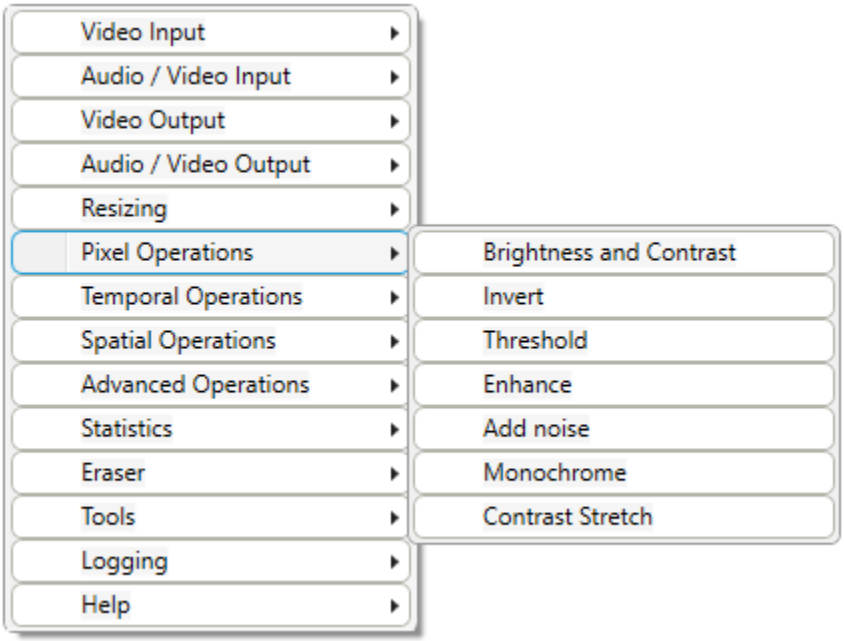


Figure 8 : Pixel operations menu.

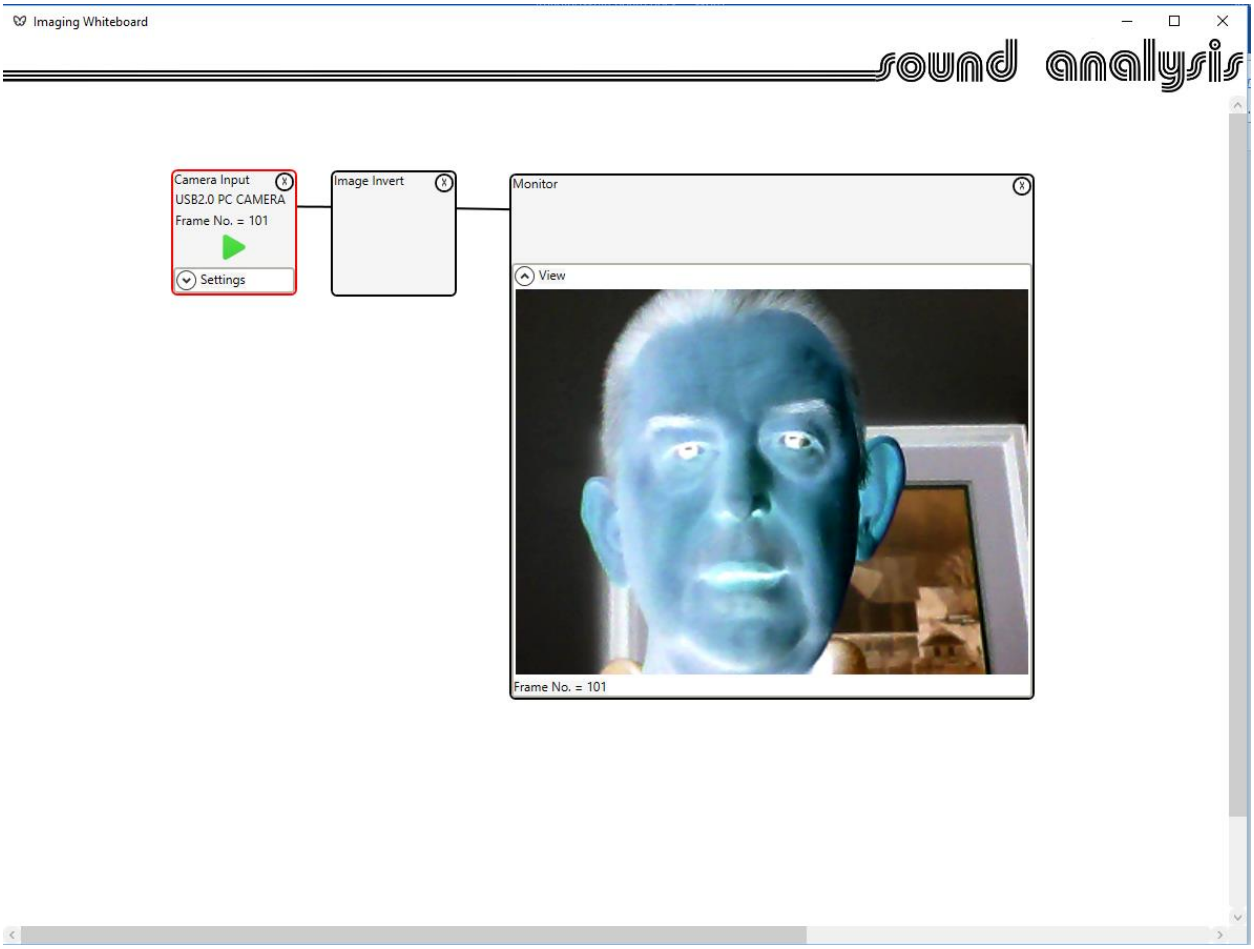


Figure 9 : Image inversion.

String multiple operations together for more complex algorithms.

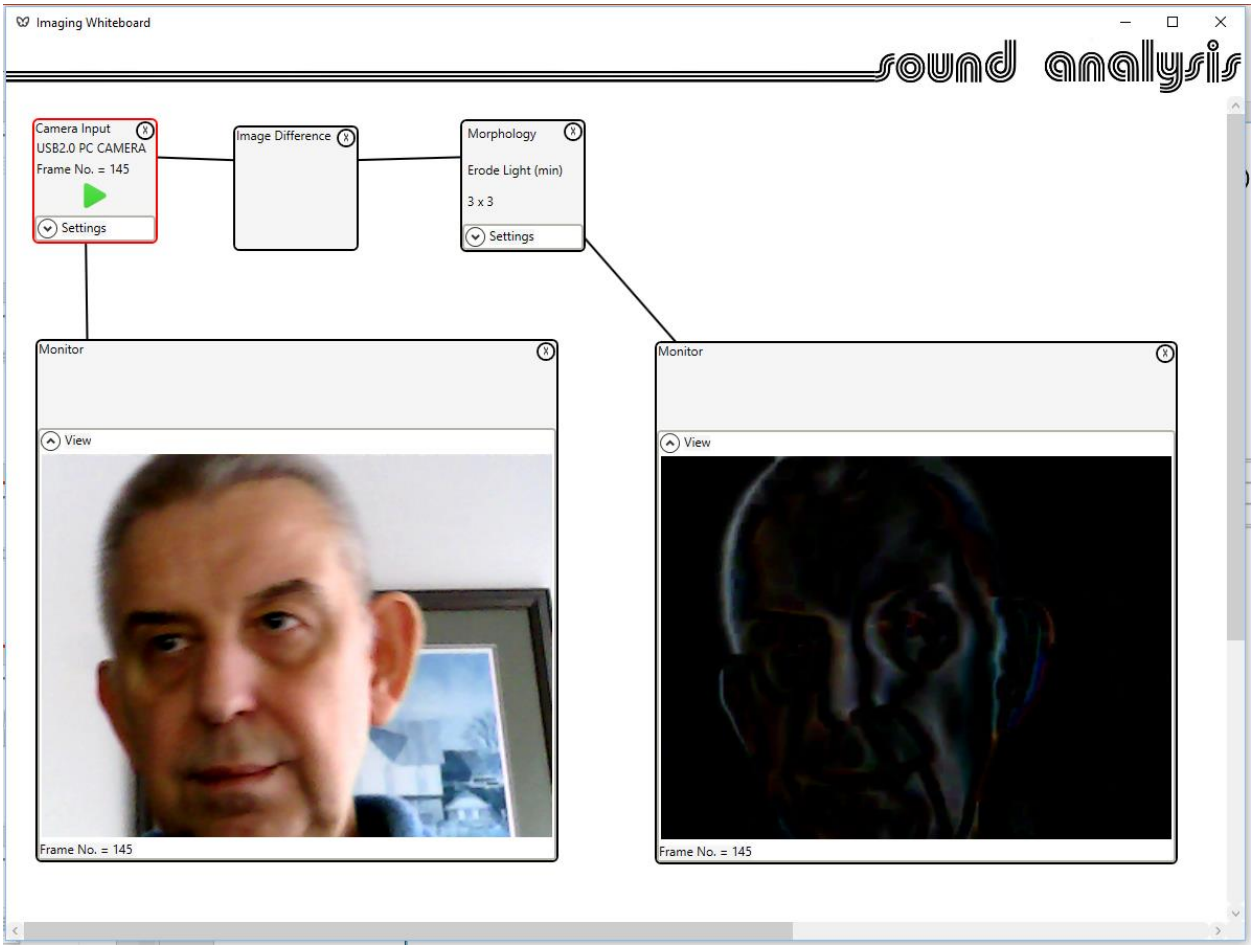
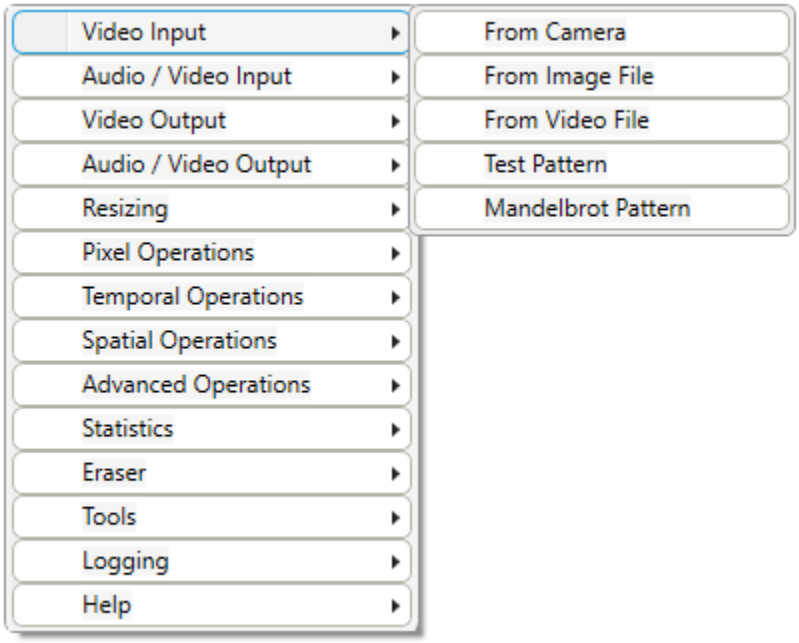


Figure 10 : Motion detection with false alarm reduction.

Controls in detail

Video Input controls



Camera Input

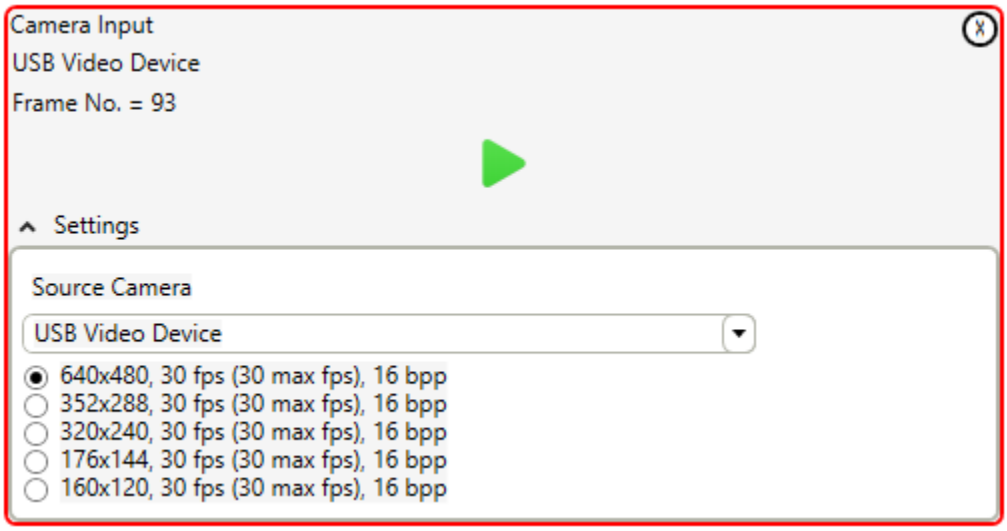


Figure 11 : Camera input with settings expanded

The camera input setting will allow the user to select a camera. A tablet such as the surface will have forward and rear facing cameras, either will be available. If there is only one camera that will be the default. Once the camera is selected the resolutions available from that camera will be displayed. Selecting a resolution will enable the camera and display the play icon.

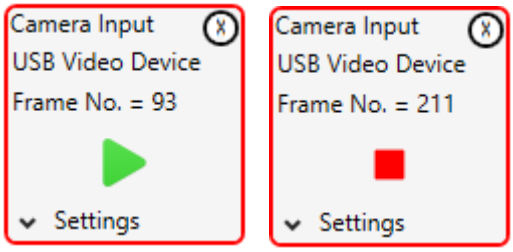


Figure 12 : Camera input with settings collapsed

With setting collapsed (after selecting the camera and resolution) will only display the device selected and the current frame number. A play / stop button will be provided.

Image File Input

Figure 13 : Image file Input with settings expanded.

The image input control will allow the user to select an image file from disc. Files with .bmp, ,jpg, or .gif may be selected.

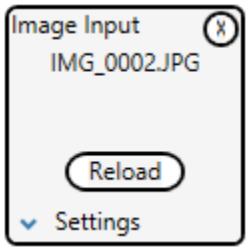


Figure 14 : Image File Input with settings collapsed

Once a file is selected and the settings are collapsed the file name will be displayed. A reload button will be available to reload the image, after changing the pipeline settings for example.

Video File Input

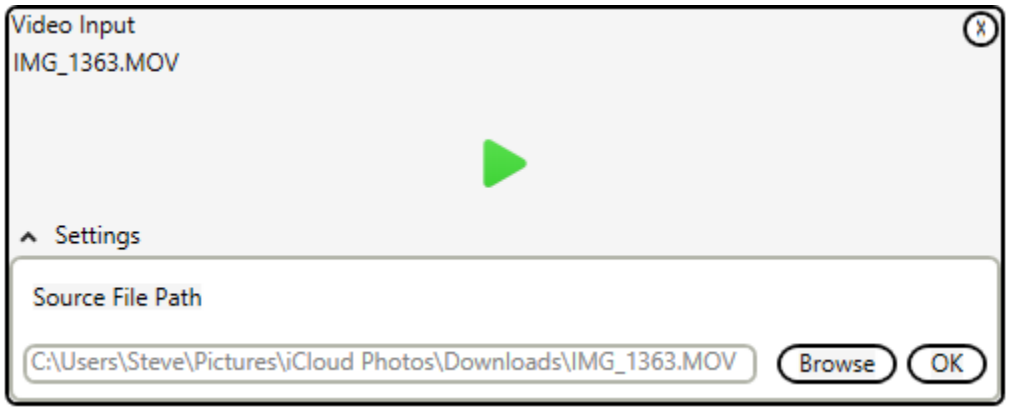


Figure 15 : Video File Input with settings expanded

The image input control will allow the user to select a video file from disc. Files with .wmv, .mov, .avi, .mp4, or .mpeg may be selected.

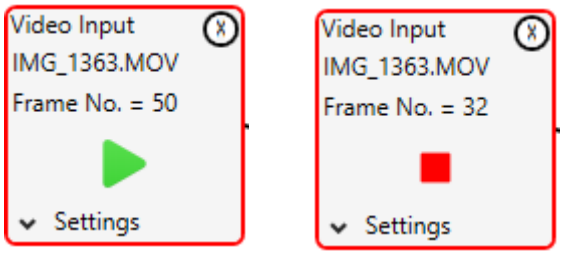


Figure 16 : Video File Input with settings collapsed

With setting collapsed (after selecting the video file) will only display the file selected and the current frame number. A play / stop button will be provided.

Test Pattern Control

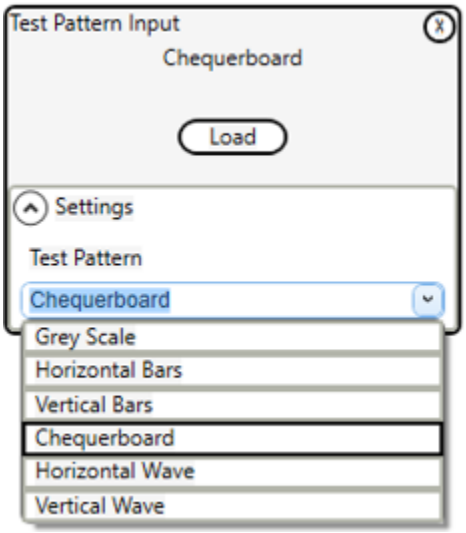


Figure 17 : Test Pattern Control with settings expanded

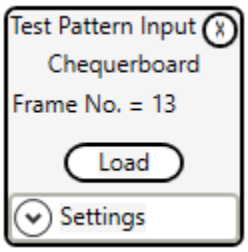


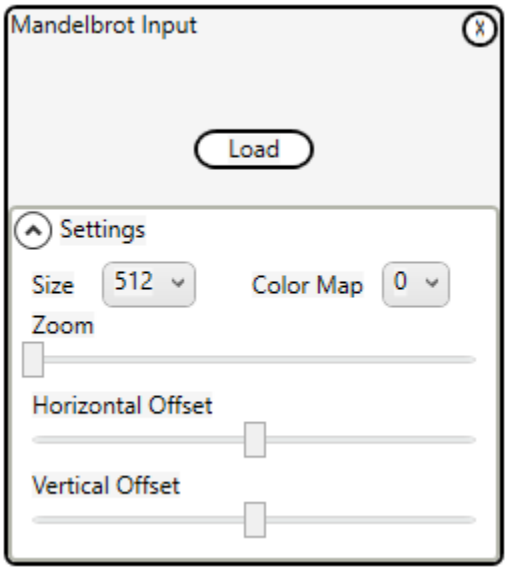
Figure 18 : Test pattern Control with settings collapsed

The test pattern control will generate test patterns to simplify the testing of algorithms.

When expanded the drop down will allow the use to select from a list of test patterns.

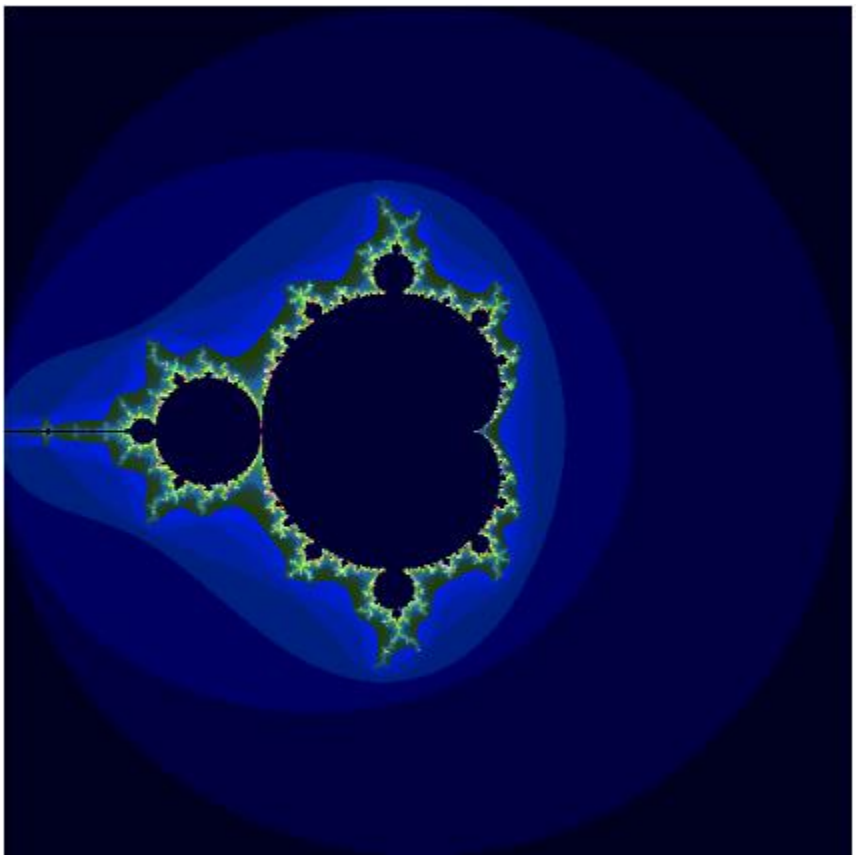
Test patterns are generated and sent when the load button is clicked.

Mandelbrot Input Control

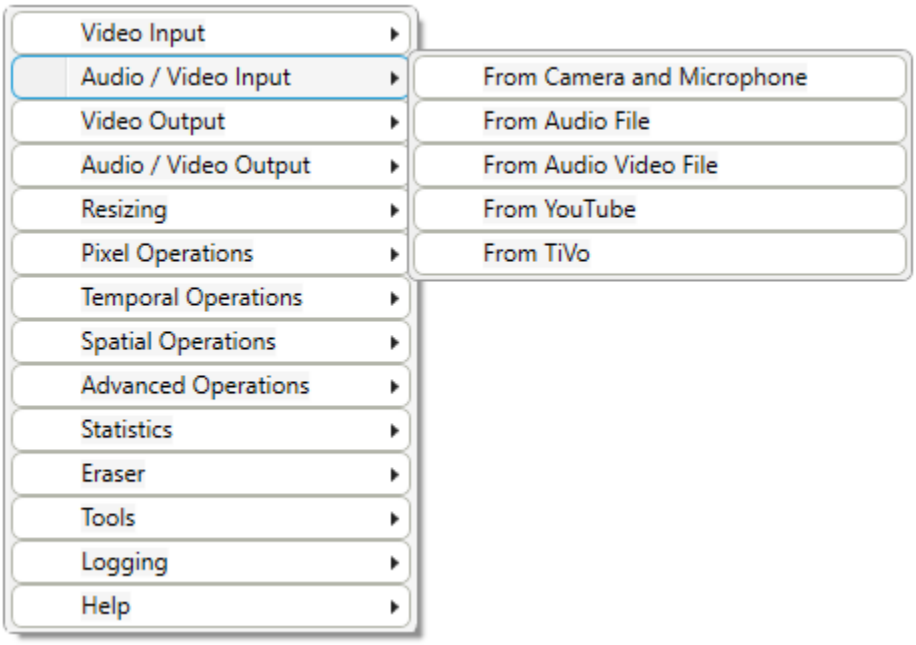


The Mandelbrot input control will generate a Mandelbrot pattern. The use may select for pattern size 256 to 4096 pixel wide and high. The user may zoom in from 1 to 64x, and apply horizontal and vertical offsets + or – 256 pixels. 4 different color maps are available.

The default settings will generate:



Audio Video Input controls



Camera and Microphone Input Control

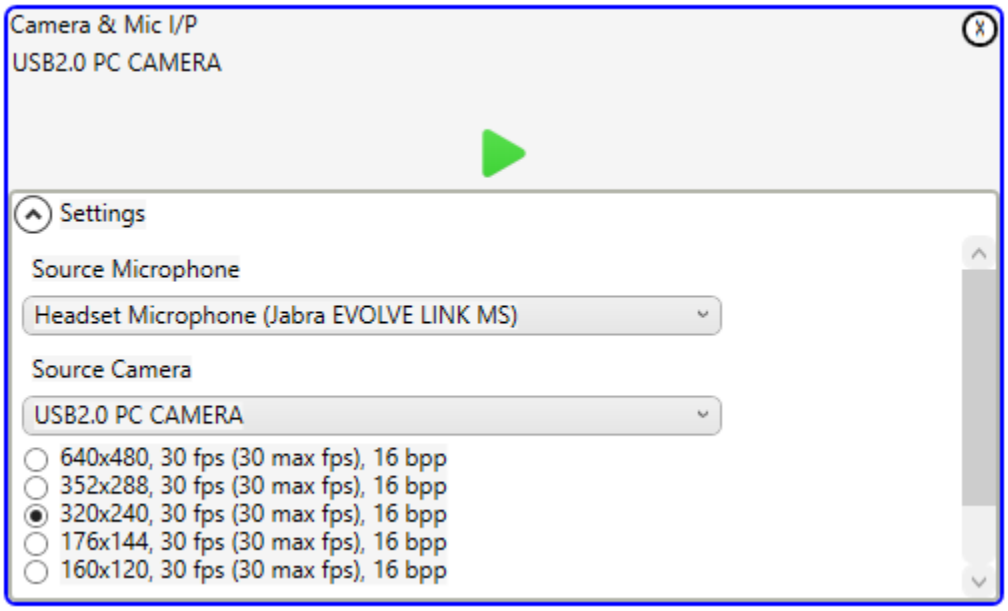


Figure 19 : Camera and Microphone input with settings expanded

The source microphone setting will allow the user to select a microphone.

The camera input setting will allow the user to select a camera. A tablet such as the surface will have forward and rear facing cameras, either will be available. If there is only one camera that will be the default. Once the camera is selected the resolutions available from that camera will be displayed. Selecting a resolution will enable the camera and display the play icon.

Audio File Input Control

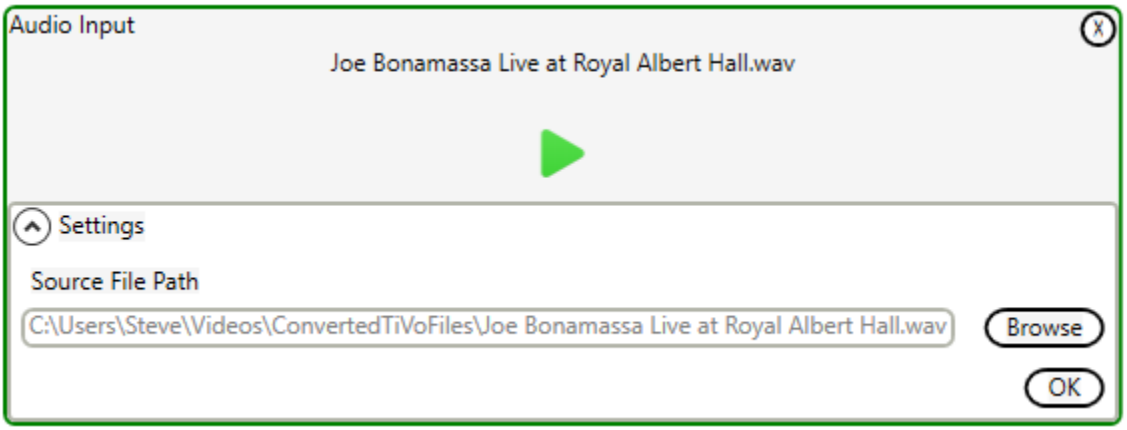


Figure 20 : Audio file input control with settings expanded

This control will allow the user to use a .wav audio file as input. Only .wav files are supported.

Audio Video File Input Control

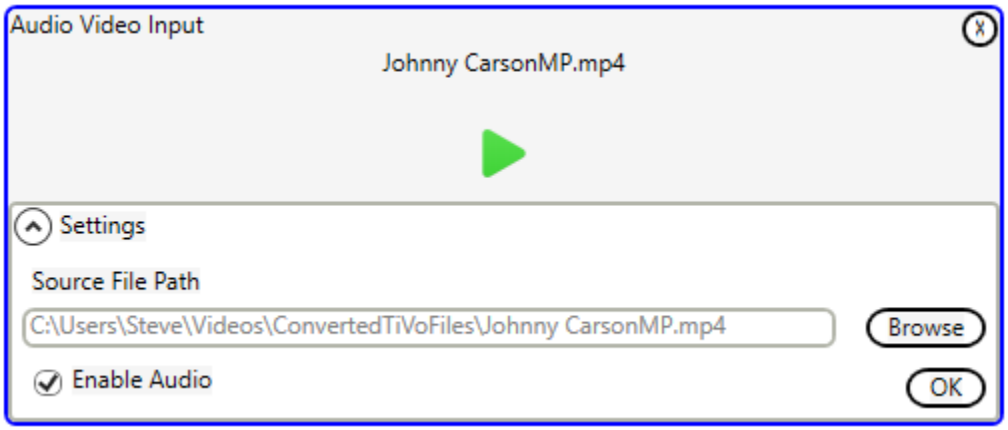


Figure 21 : Audio Video file input control with settings expanded

The image input control will allow the user to select a video file from disc. Files with .wmv, .mov, .avi, .mp4, .mpg, or .mpeg may be selected.

YouTube Input Control

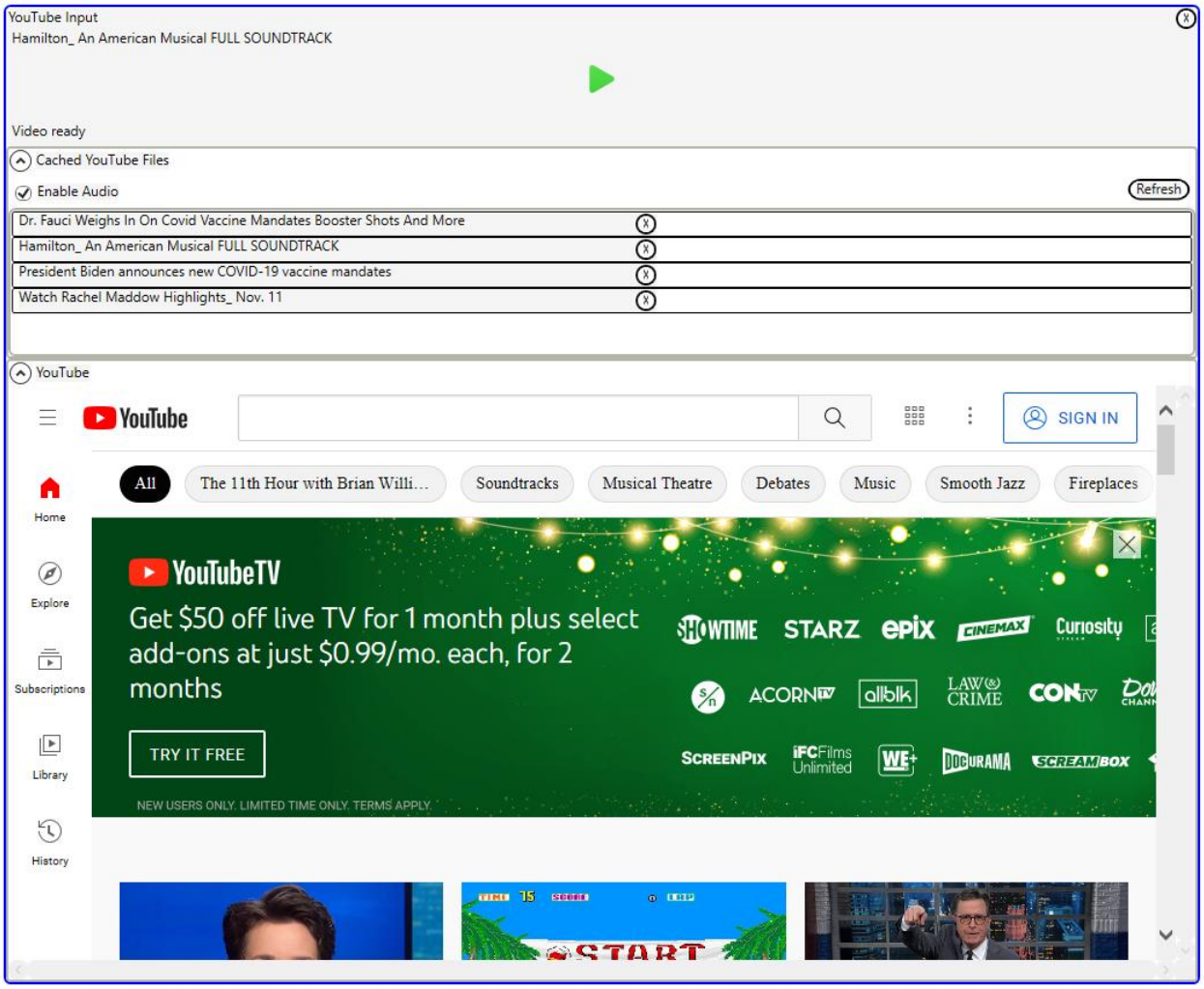


Figure 22 : YouTube input control with all dropdowns expanded

The YouTube input control will allow the user to download files from YouTube and to use those files as inputs.

The YouTube dropdown will display a browser control showing YouTube. The use may search YouTube for the file required, when this video is selected a file retrieve dialog will be displayed.

Clicking OK will start the file download, when this is completed, the video will play in the browser dropdown. Refreshing the Cached YouTube files list will show the new file.

Selecting the new file will make it available to use by the control.

Downloaded files are stored in the RetrievedYouTubeFiles folder under videos.

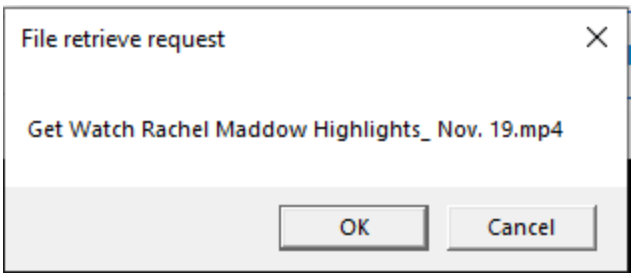


Figure 23 : YouTube file retrieve dialog

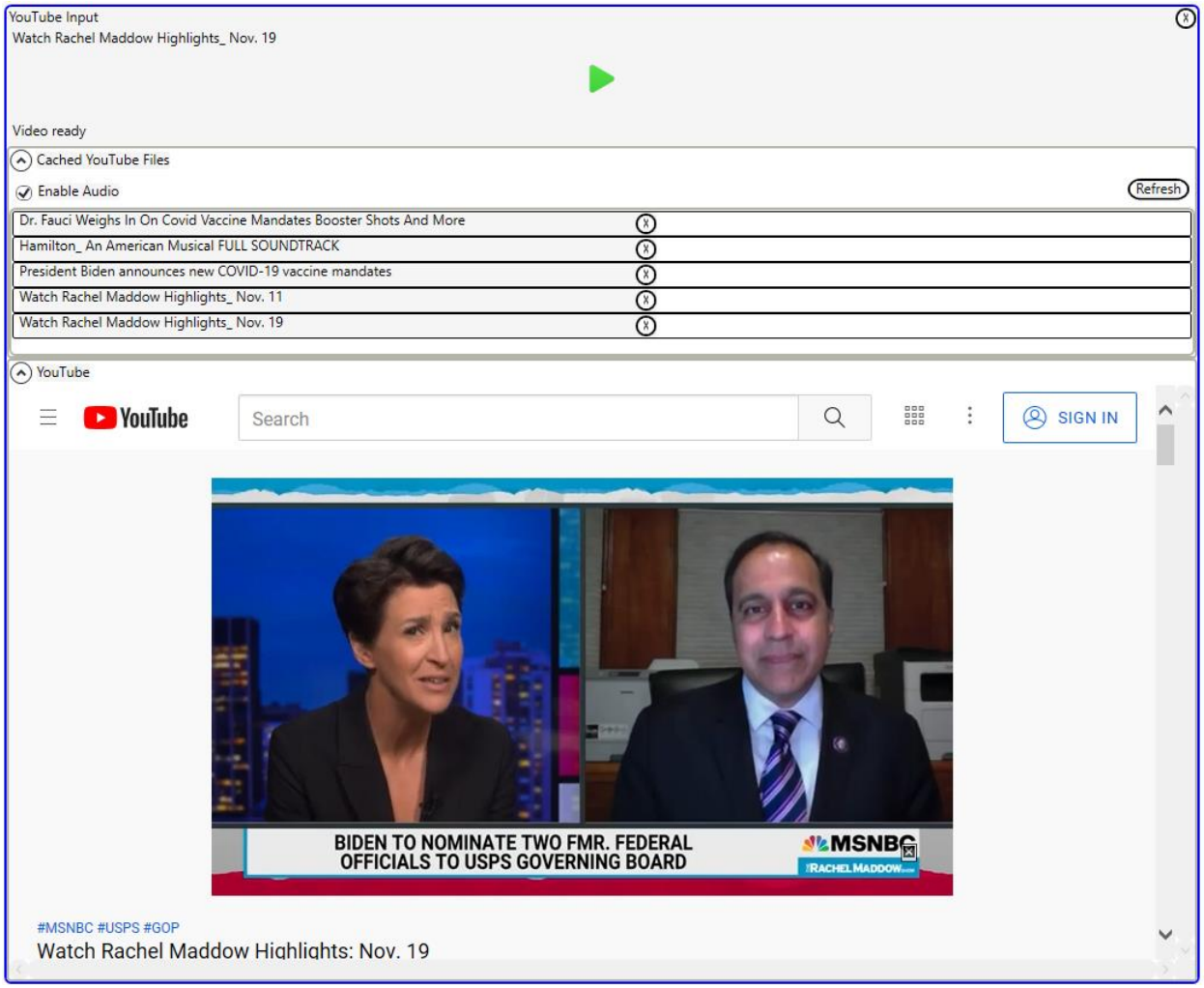


Figure 24 : YouTube control ready to use downloaded video

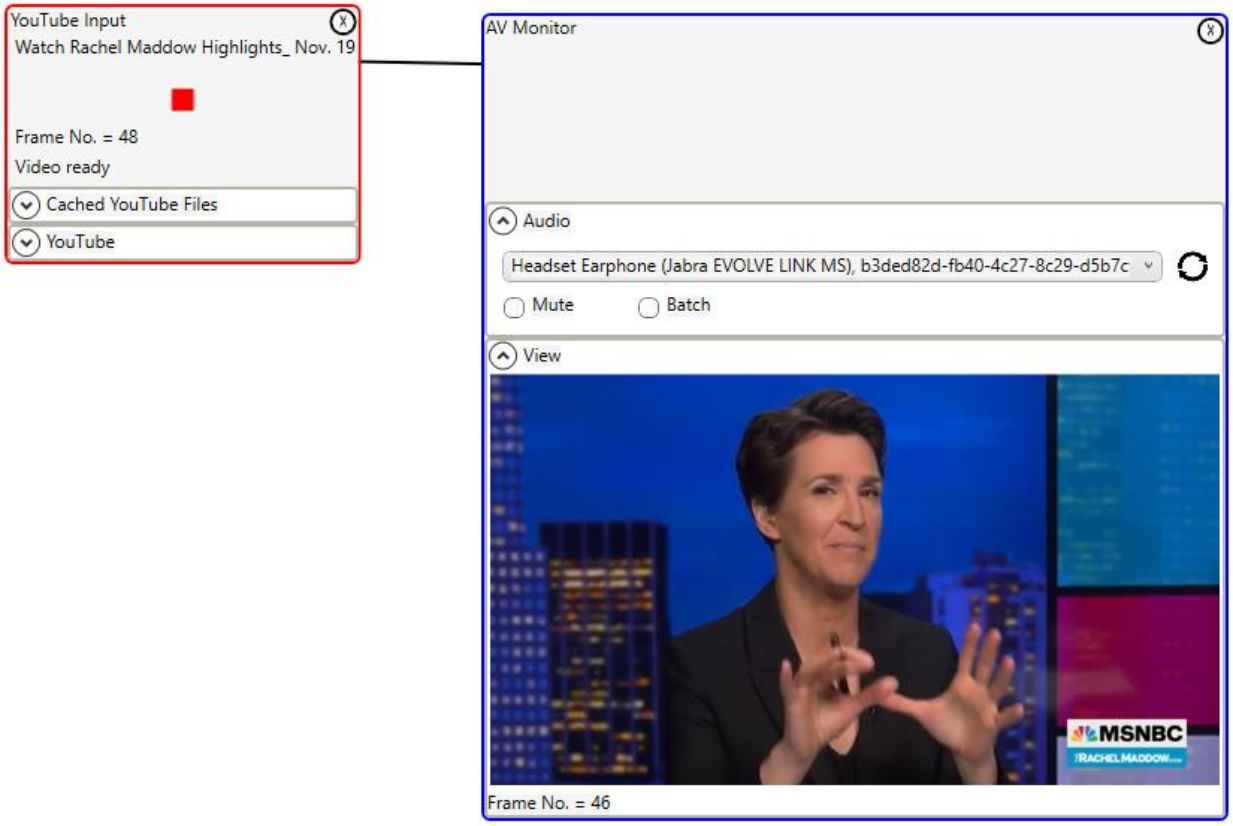


Figure 25 : YouTube control providing a downloaded video to the pipeline

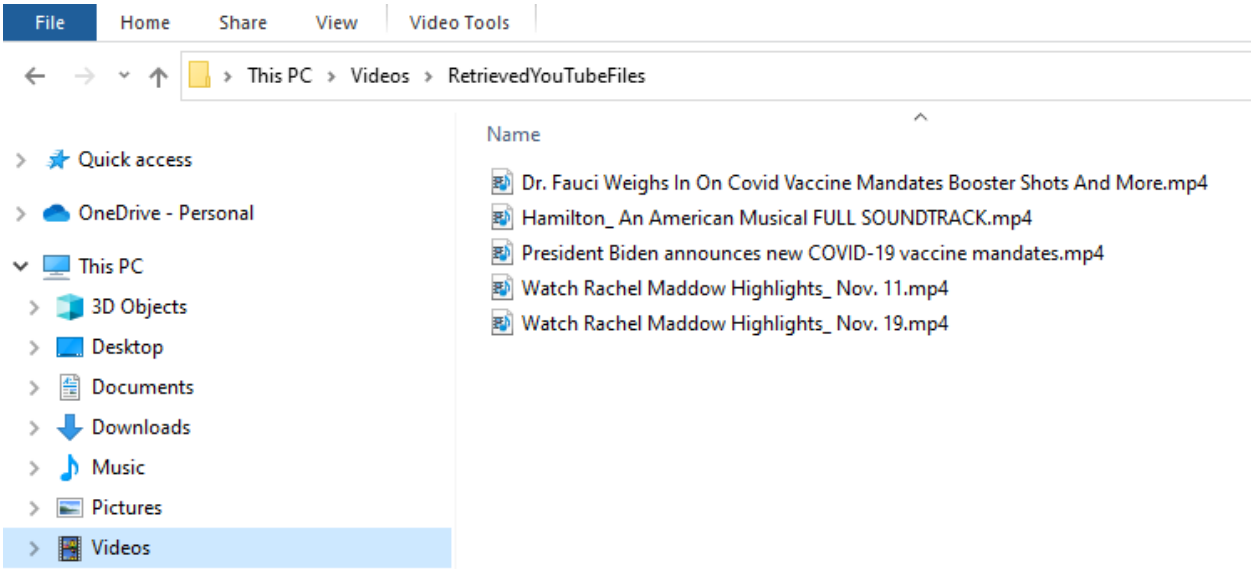


Figure 26 : Location of retrieved YouTube files

TiVo input control

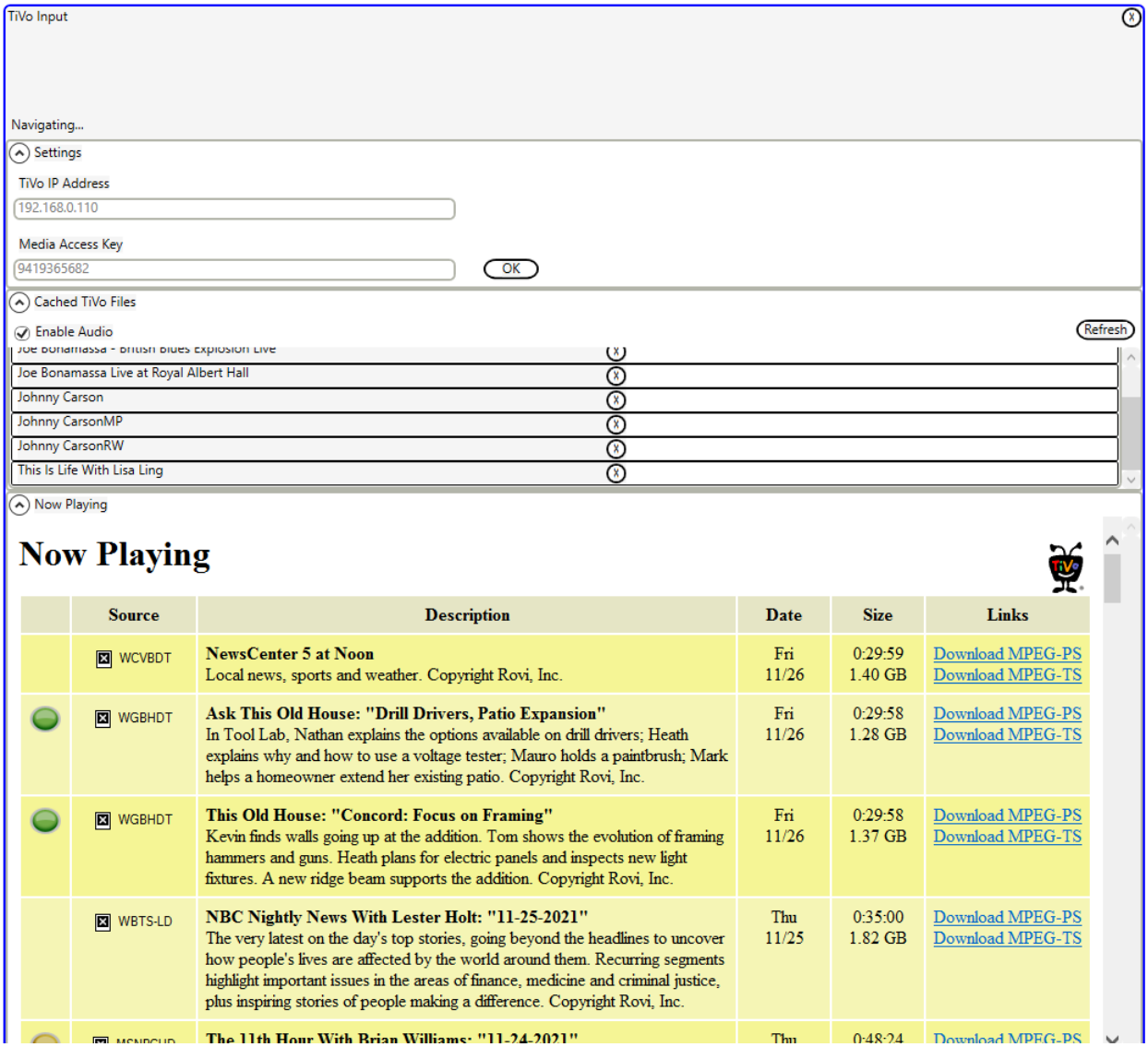


Figure 27 : TiVo control with all dropdowns expanded

The TiVo input control will allow the user to download files from a TiVo on the local network and to use those files as inputs.

Before using the control, the user should find the IP address of the TiVo, and the media access key (MAK).

The IP address can be found on the TiVo under Menu -> Settings -> Network Settings.

The MAK can be found on the TiVo under Menu -> Help -> Account & System Info -> Media Access Key.

These values should be entered in the settings dropdown of the control. Clicking OK will launch the log in dialog for the TiVo.

The user name is TiVo, the password is the MAK.

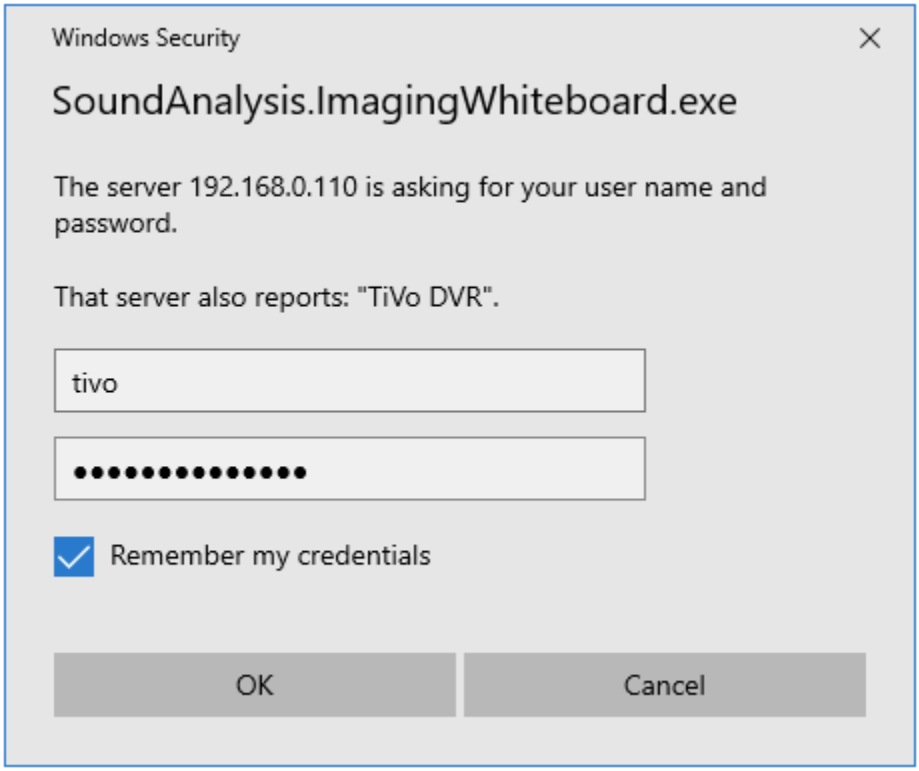


Figure 28 : TiVo log in dialog

Logging in will populate the Now Playing list, which will display the videos currently recorded on the TiVo. Each program will have two links to two versions of the video, the PS version is preferred here as this will decode more reliably.

To get the required video click the PS link.

On the File Download dialog click save.

Save the file in the downloads folder using the Save As dialog.

A progress dialog will be displayed.

When the download completes close the dialog, and refresh the Cached TiVo files list.

Click the new item on the list. The mp4 and wav files will be created.

When Video Ready is displayed the video is available to use by the control.

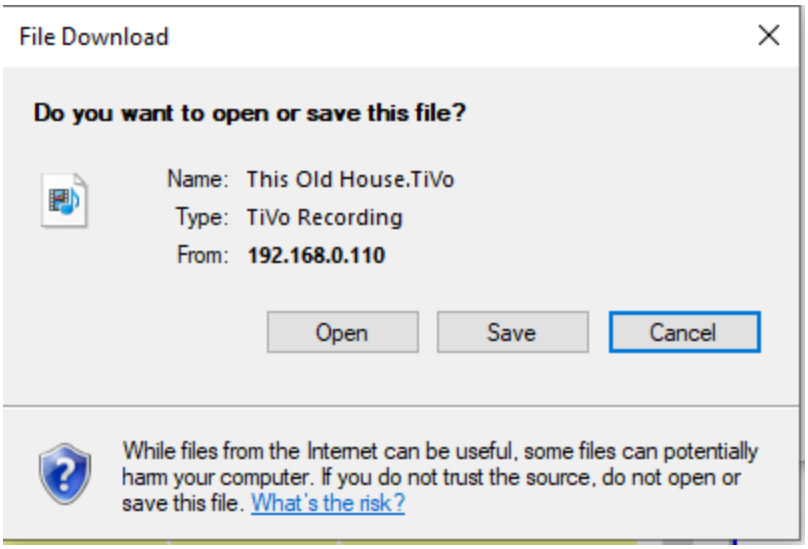


Figure 29: TiVo file download dialog

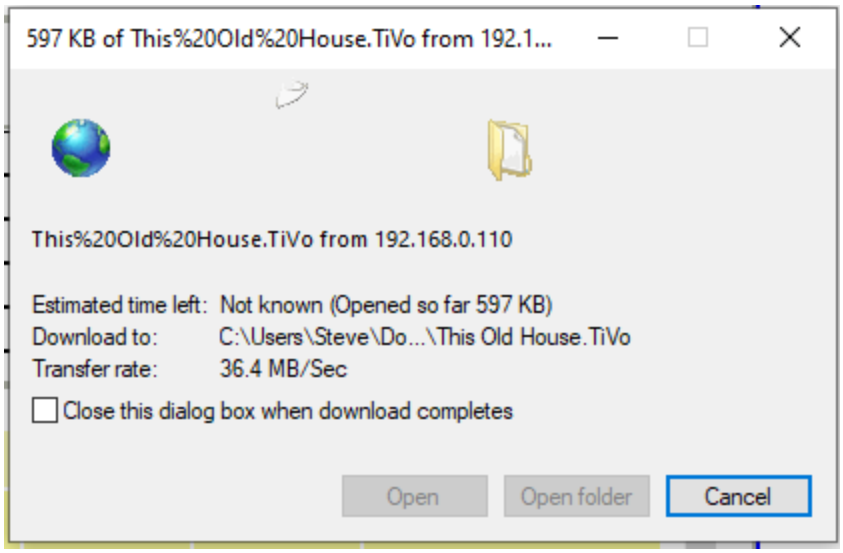


Figure 30 : TiVo file download progress dialog

The created files are under the videos directory in ConvertedTiVoFiles.

The TiVo file will be decoded to a .mpg file, this will be converted to a .mp4 file which will be used by the control.

A .wav file with just the audio, and a .xml file with the TiVo catalog information, will also be produced for convenience.

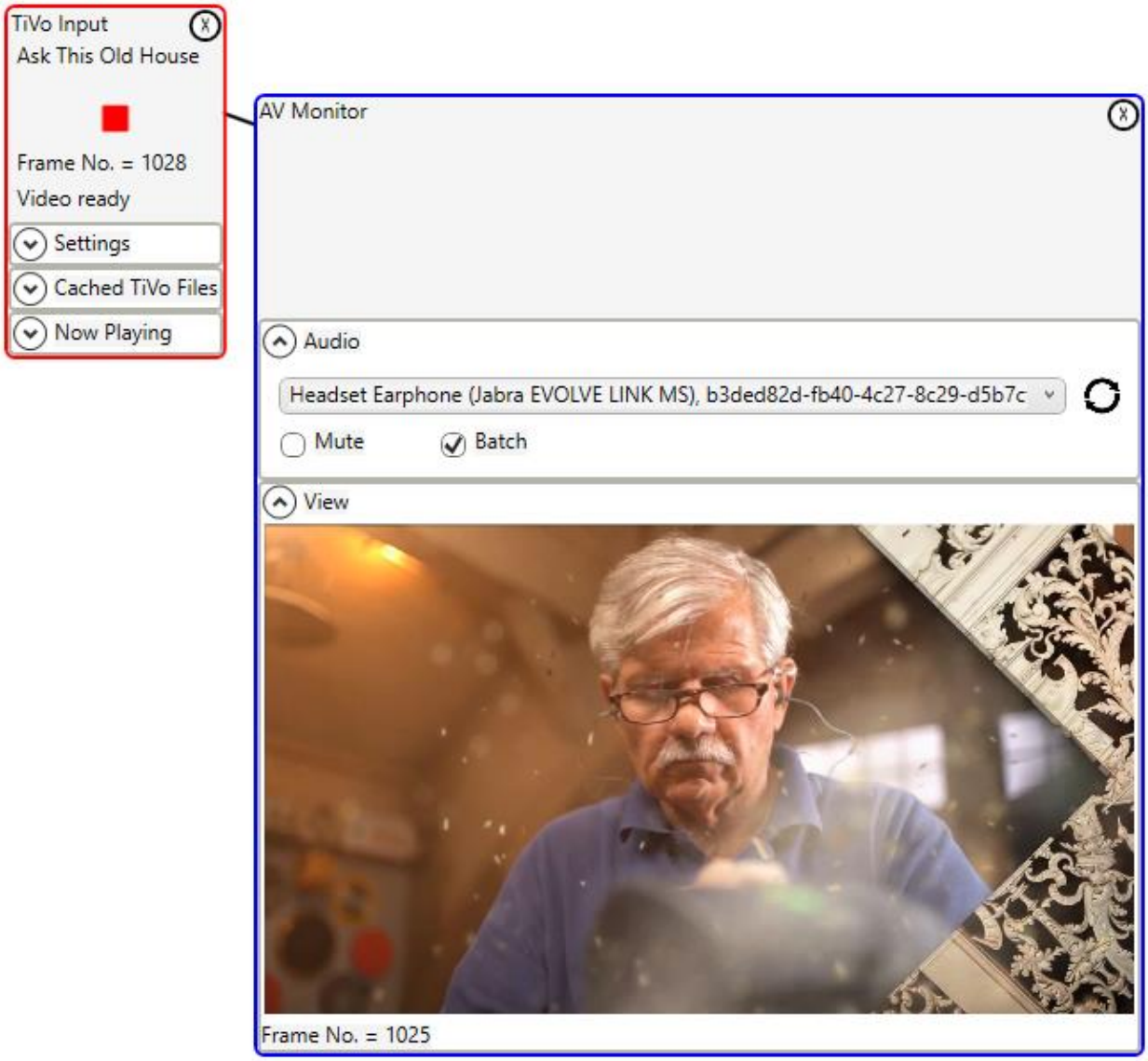
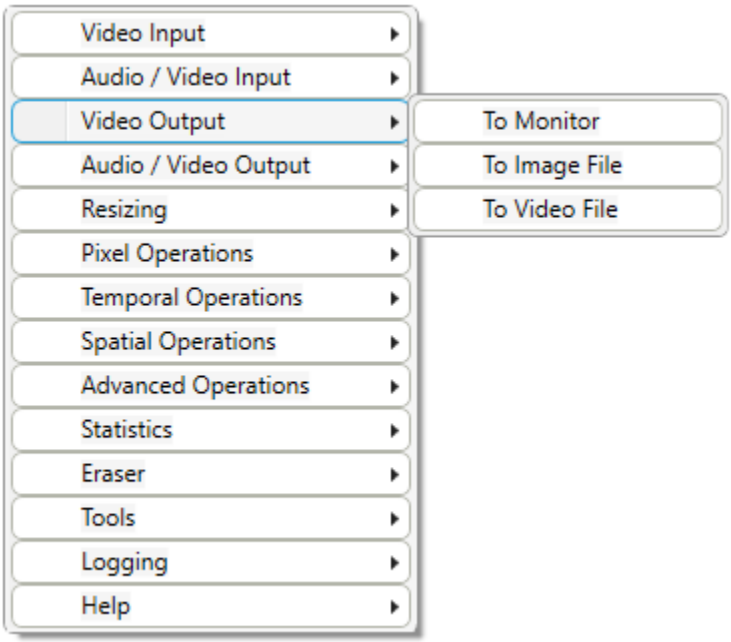


Figure 31 : TiVo control providing a downloaded video to the pipeline

Video Output Controls



Output to Monitor

This control will show the video. This is used to provide instant feedback. Multiple monitor controls may be opened at once to show the various stages of algorithms.

The view may be collapsed to save space on the whiteboard.

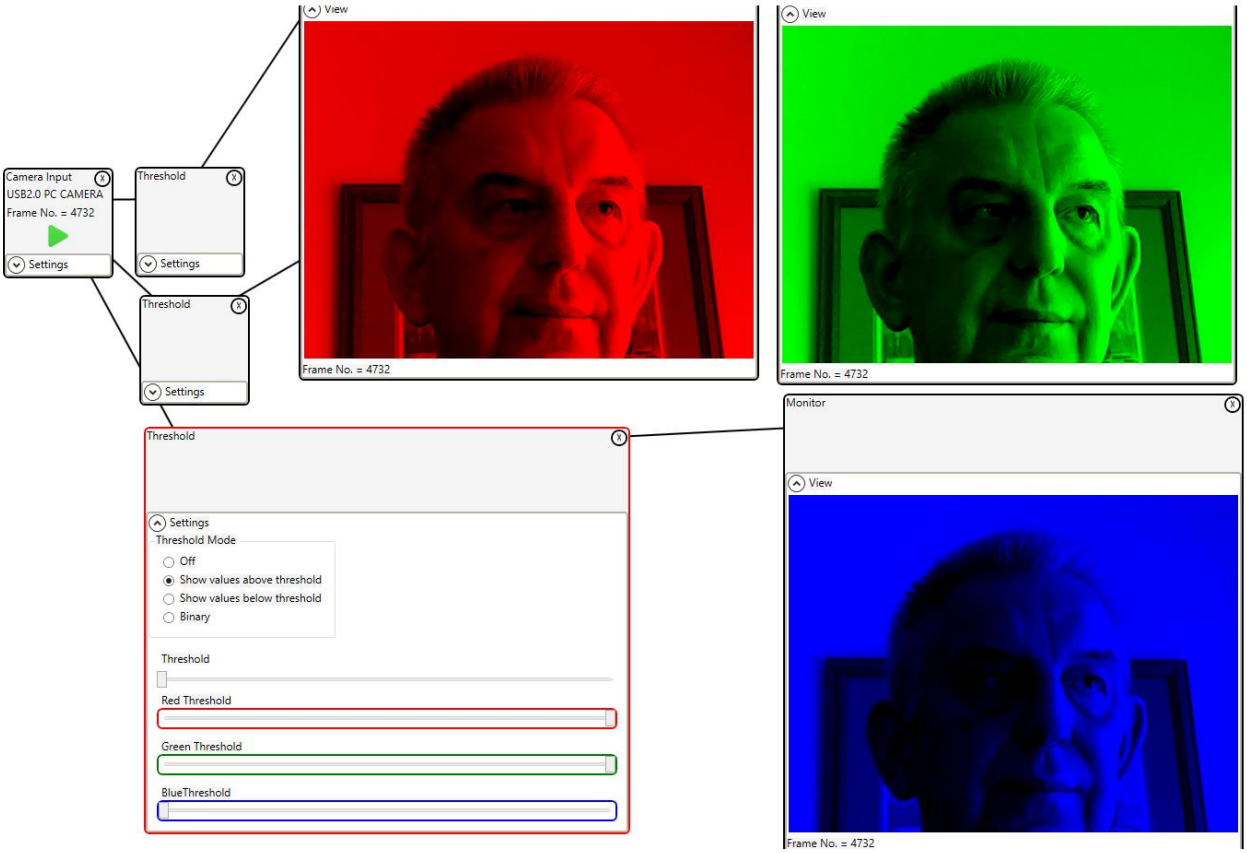


Figure 32 : Color component separation using the threshold control

Output to Image File

Figure 33 : Output to Image File with setting expanded

The image output control will allow the user to save an image file to disc. Files with .bmp, ,jpg, or .gif may be used.

Figure 34 : Output to Image File with settings collapsed

Once a file is selected and the settings are collapsed the file name will be displayed. The file name will auto increment if more than one image is saved, so if the input is from camera, for example, a sequence of still images will be saved.

Output to Video File

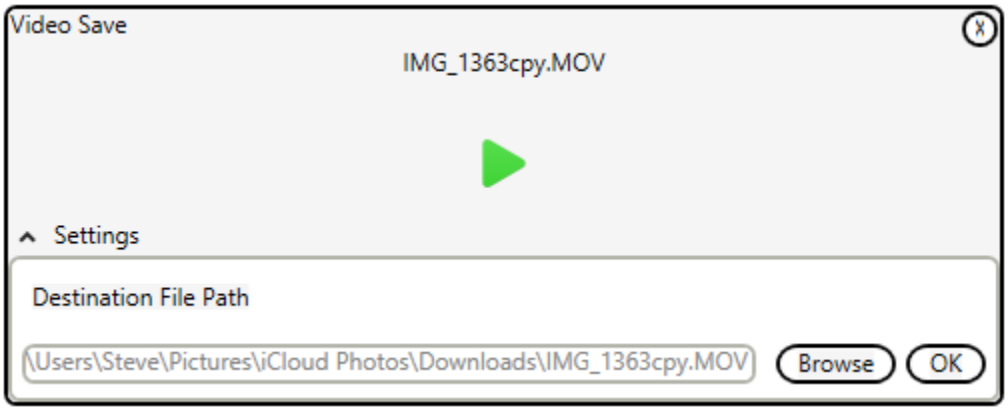


Figure 35 : Video File Output with settings expanded

The video output control will allow the user to save a video file to disc. Files with .wmv, .mov, .avi, .mp4, or .mpeg extensions may be created.

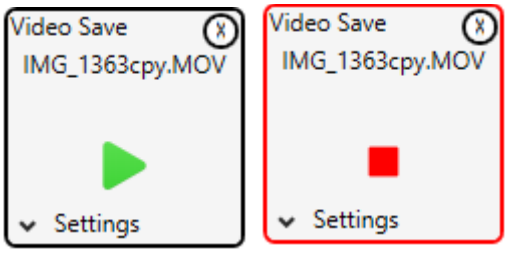


Figure 36 : Video File Output with settings collapsed

With setting collapsed (after selecting the video file) will only display the file selected.

A play / stop button will be provided to start and stop the recording. The file name will auto increment if the recording is stopped and started.

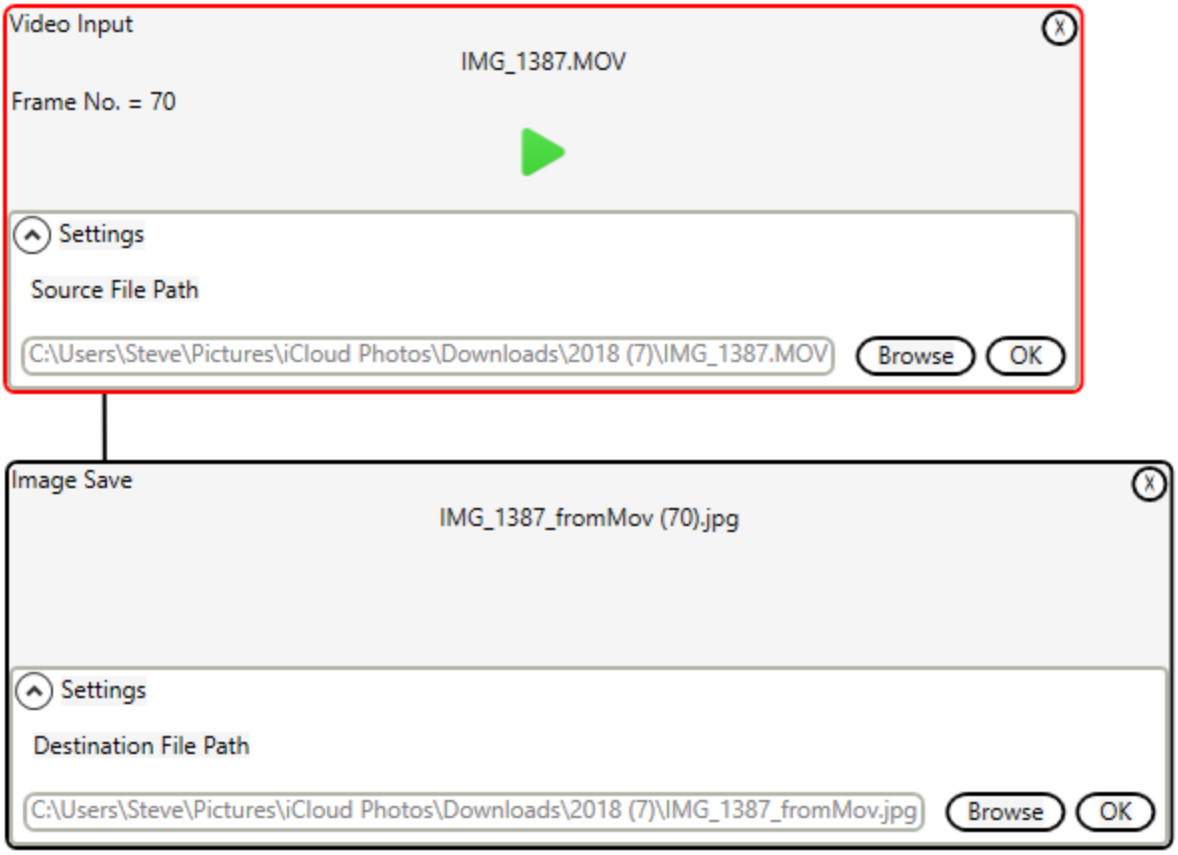
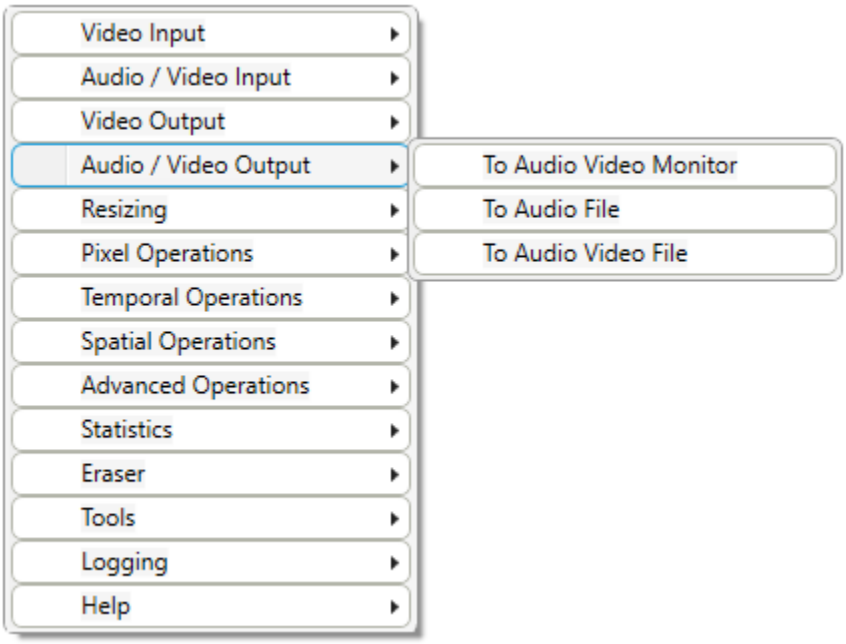


Figure 37 : Splitting a video file into separate images

A video file can be separated into a separate image file for each frame. Useful for those movies that an iPhone creates when you think you took a picture.

Audio Video Output Controls



Output to Audio Video Monitor

This control will show the video and also playback the audio. This is used to provide instant feedback. Multiple monitor controls may be opened at once to show the various stages of algorithms.

The audio and view expanders may be collapsed to save space on the whiteboard.

This is similar to the Monitor control but includes an audio settings expander. In this expander the user may select an audio output device from a dropdown list.

The audio for each frame will be played as each frame is displayed. If the video is playing at less than real-time this can be difficult to make sense of. The Mute checkbox will silence the audio. The Batch checkbox will cause the control to accumulate a couple of seconds of audio before playing, this will play the audio is big enough bursts that the user can make sense of it.

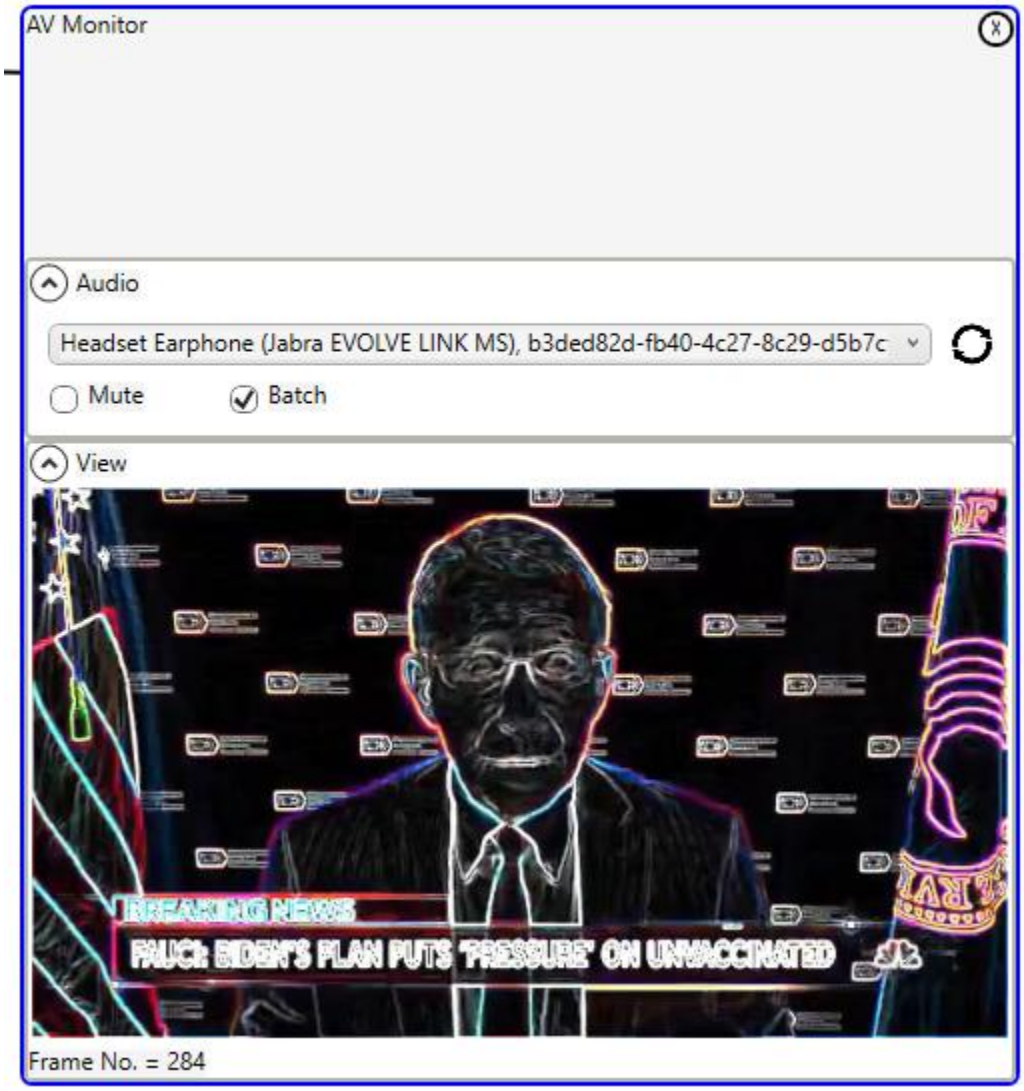


Figure 38 : Audio Video Monitor with all dropdowns expanded

Output to Audio File

The audio output control will allow the user to save a .wav audio file to disc. This will allow the audio to be saved separately from the video if just the audio track is required.

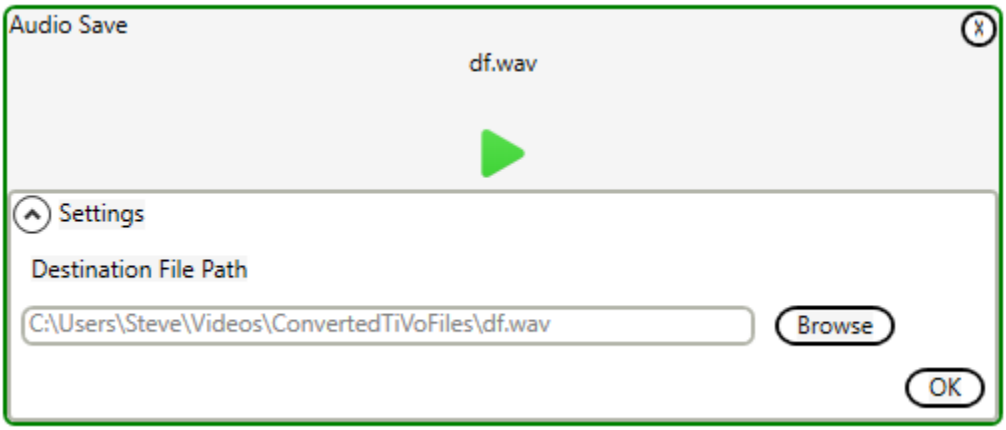


Figure 39 : Output to Audio file control with settings expanded

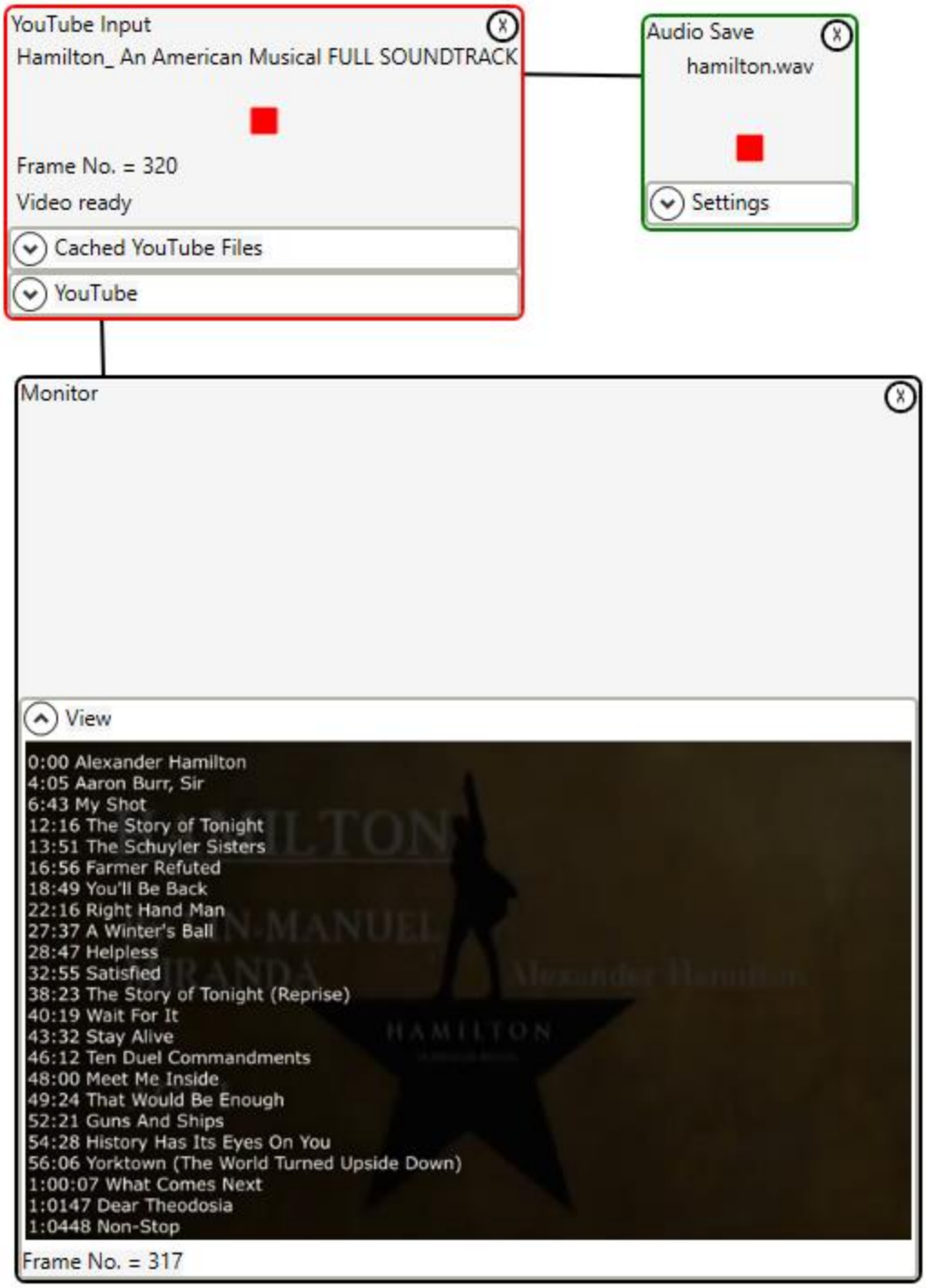


Figure 40 : Extracting audio track from a YouTube video

Output to Audio Video File

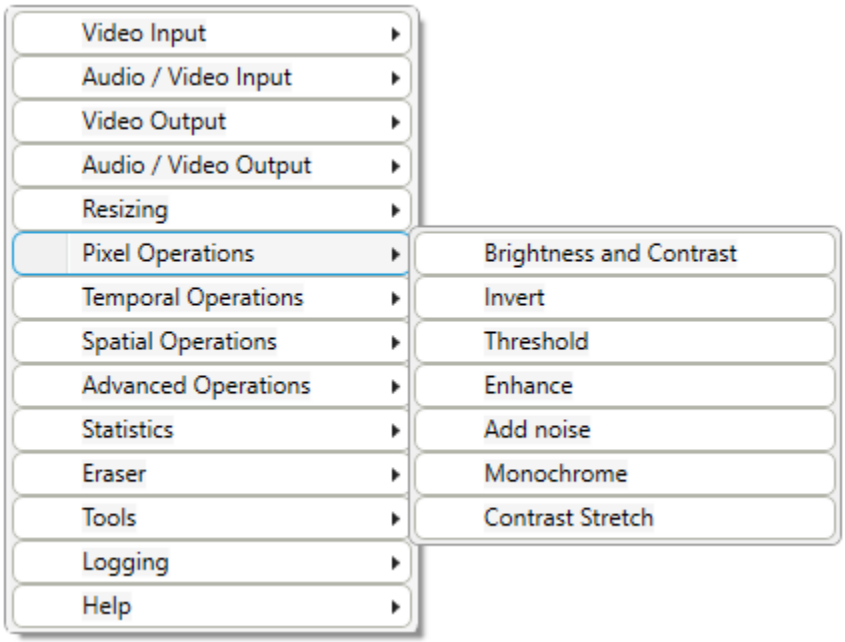
The video output control will allow the user to save an .avi audio video file to disc. If other formats are required a file conversion tool will be included, this is discussed later.

With setting collapsed (after selecting the video file) will only display the file selected.

Figure 41 :Audio Video Save control with settings expanded

When using the Audio Video save control the choice of input can make a difference to the quality of the file produced. Mp4 files are recommended. If the input comes from the YouTube or TiVo controls these will be mp4, if the input is from the Audio Video input Control the user should choose an mp4 file if possible, or use the file converter to produce an mp4 file.

Pixel Operations



Pixel operations are those which perform the same operation on every pixel without regard to neighboring pixels or preceding pixels.

Brightness and Contrast

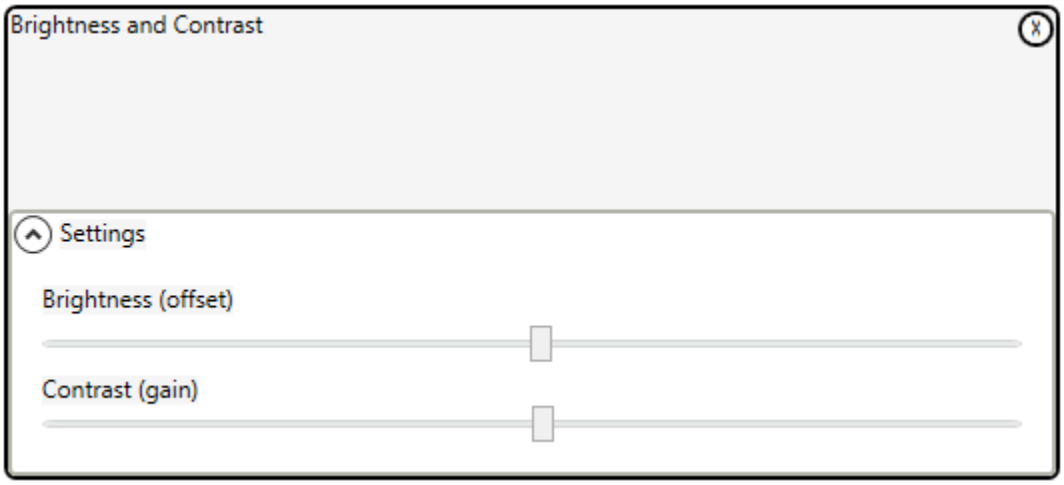


Figure 42 : Brightness and Contrast Control with settings expanded

Figure 43 : Brightness and Contrast Control with settings collapsed

Brightness will go from full black on the left to full white on the right.

Contrast will go from zero (mid grey) on the left to times 2 on the right.

In the center position the image will not be changed.

Image Invert

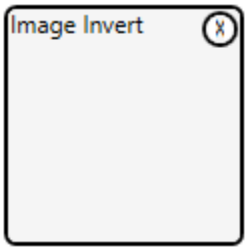


Figure 44 : Image Inversion Control

The image inversion control will simply invert the brightness of every pixel. There are no settings.

Threshold Control

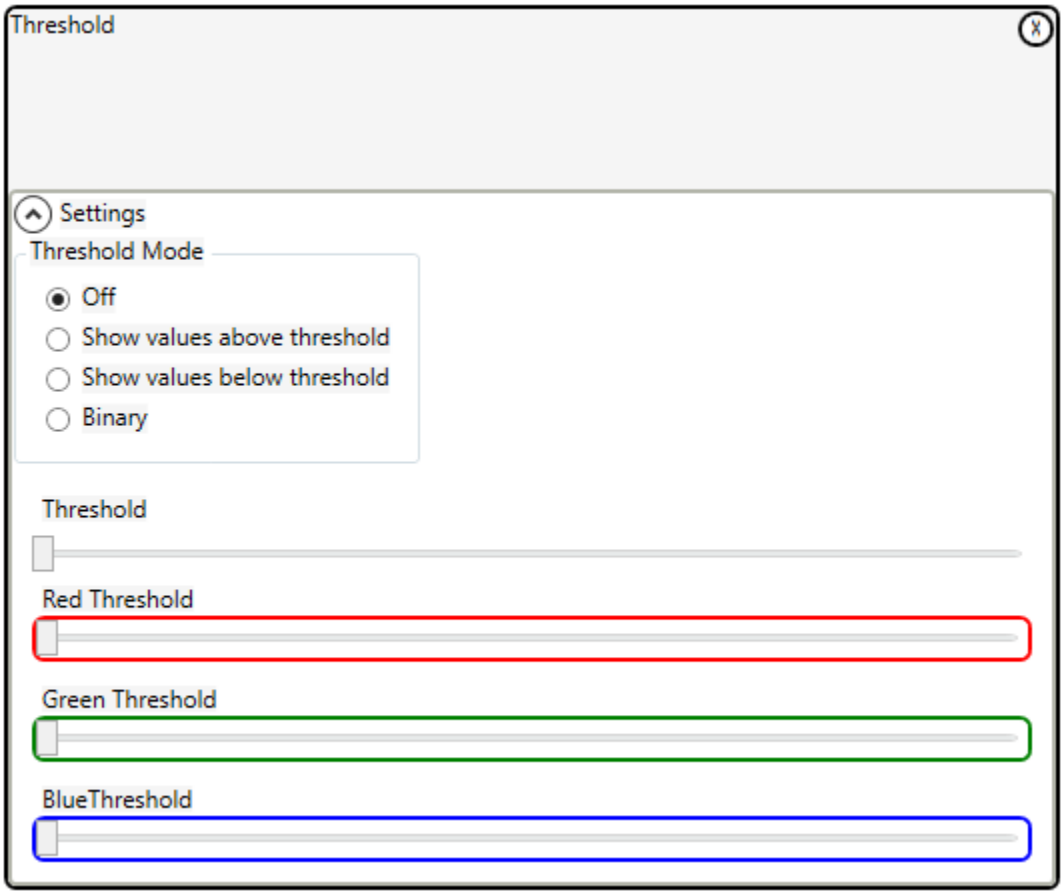


Figure 45 : Threshold Control with settings expanded

Figure 46 : Threshold Control with settings collapsed

Threshold values range from 0 (Black) on the left to 255 (White) on the right. Each color's threshold may be set independently or moved simultaneously by moving the top threshold slider. There are 4 modes:

Off – the image is not changed.
Show values above threshold – Pixels with a value greater than the threshold are displayed unchanged, others are black.
Show values below threshold – Pixels with a value less than the threshold are displayed unchanged, others are white.
Binary – Pixels with a value less than the threshold are displayed black, others are white.

Enhance Control

This control will allow the user to enhance the colors individually or collectively.

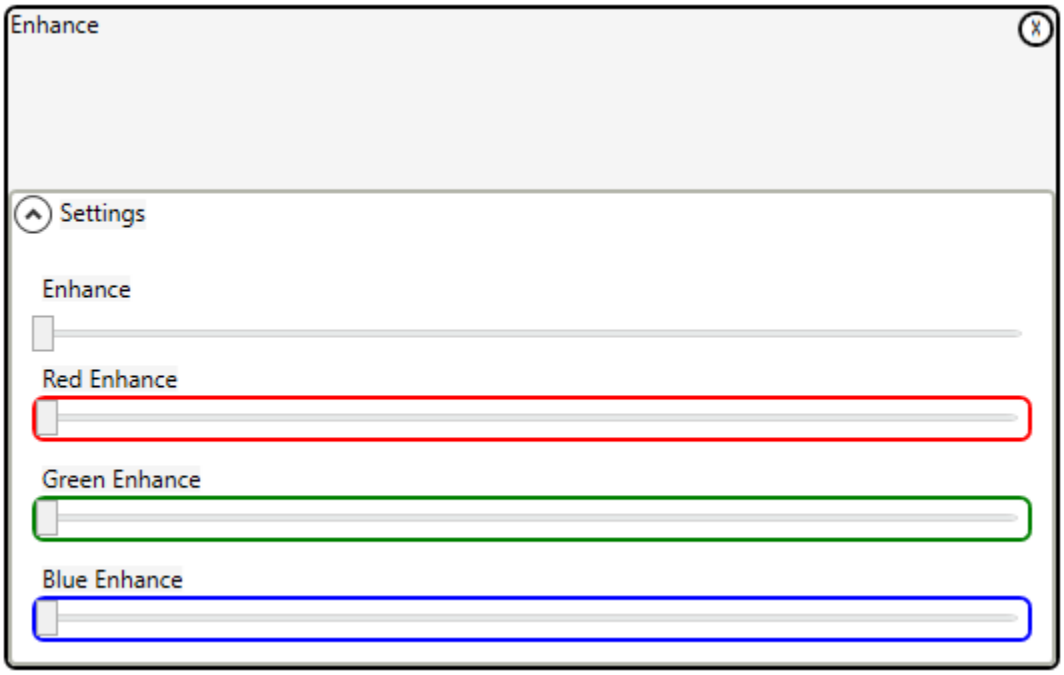


Figure 47 : The Enhance control with settings expanded

Figure 48: The effect of enhancement on live image with histogram

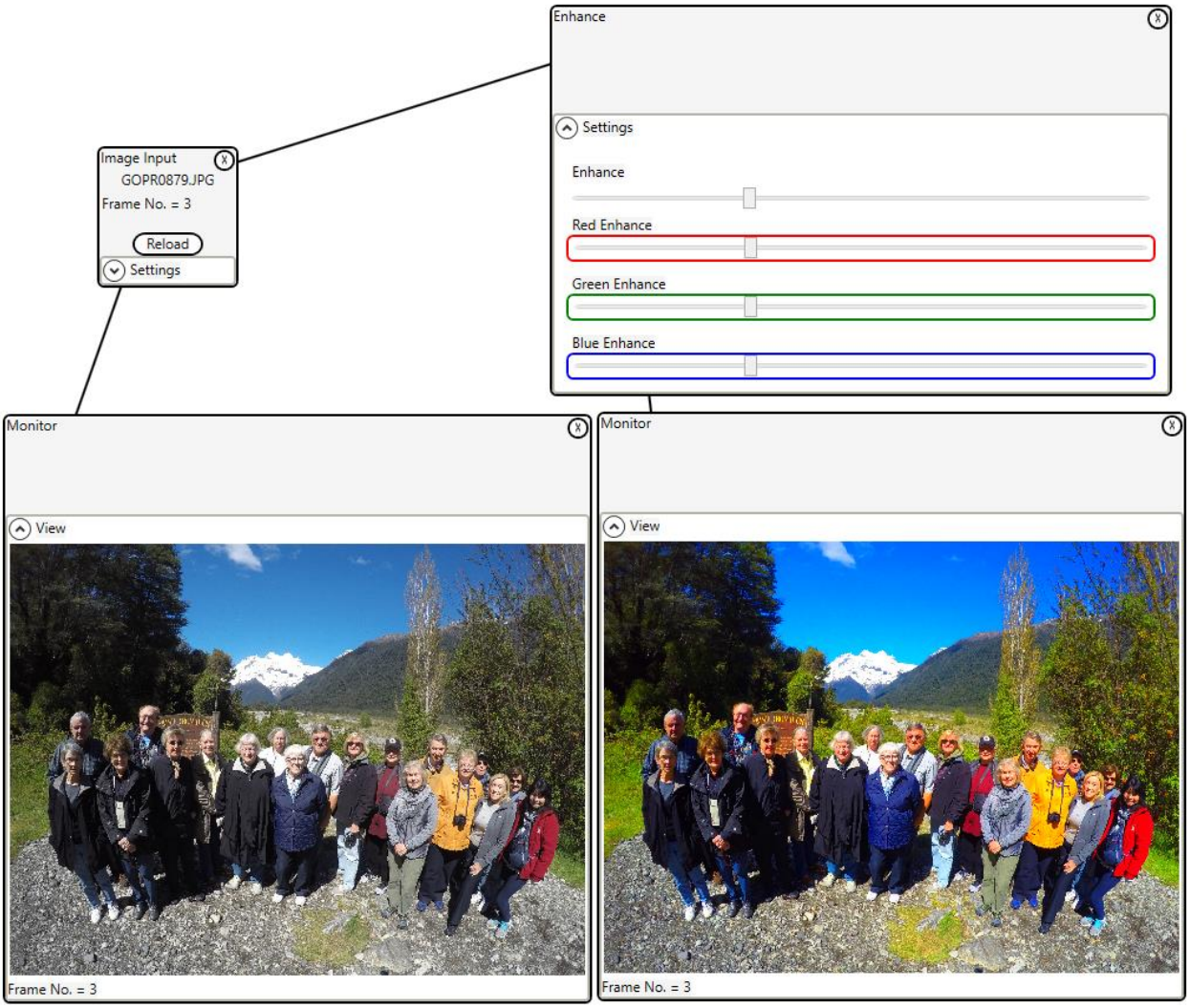


Figure 49 : Enhancement applied to a photograph

Add Noise control

The noise control will add pseudo random noise to the video.

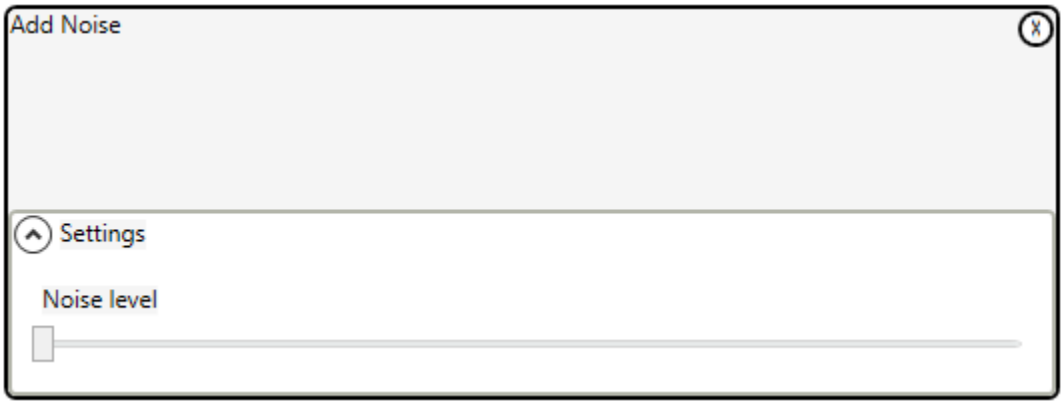


Figure 50 : Add Noise control with settings expanded

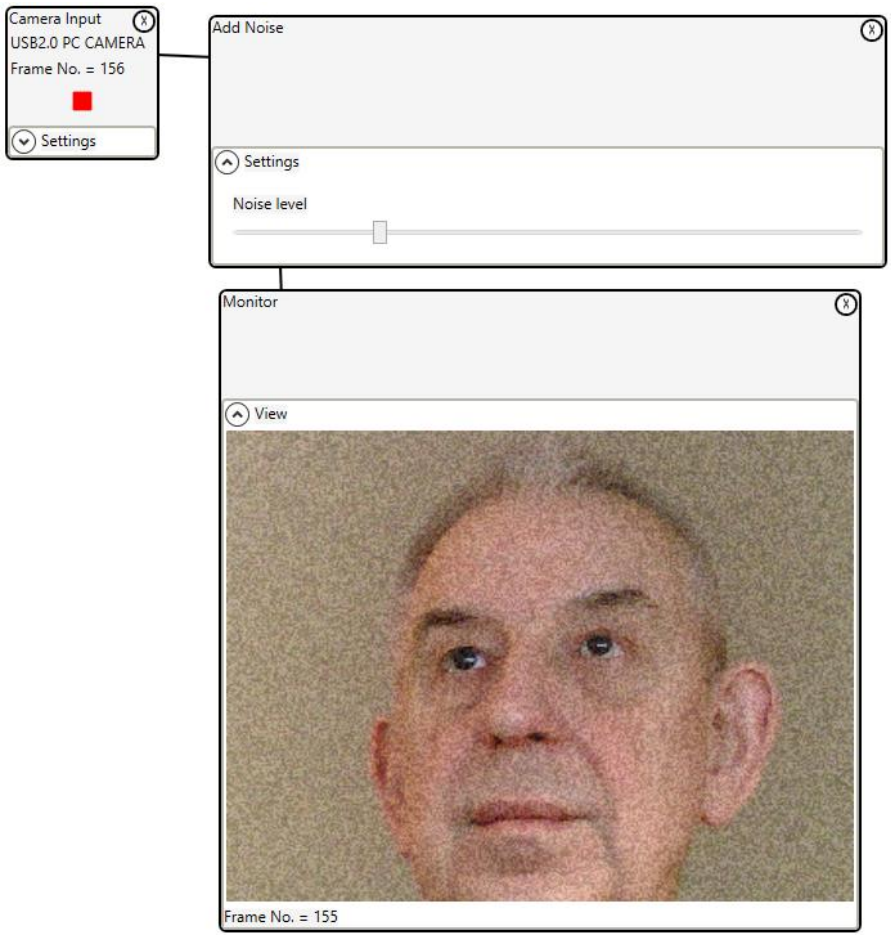


Figure 51 : Live video with noise added

Monochrome Control

The monochrome control will convert color images to grey scale images. There are no settings.

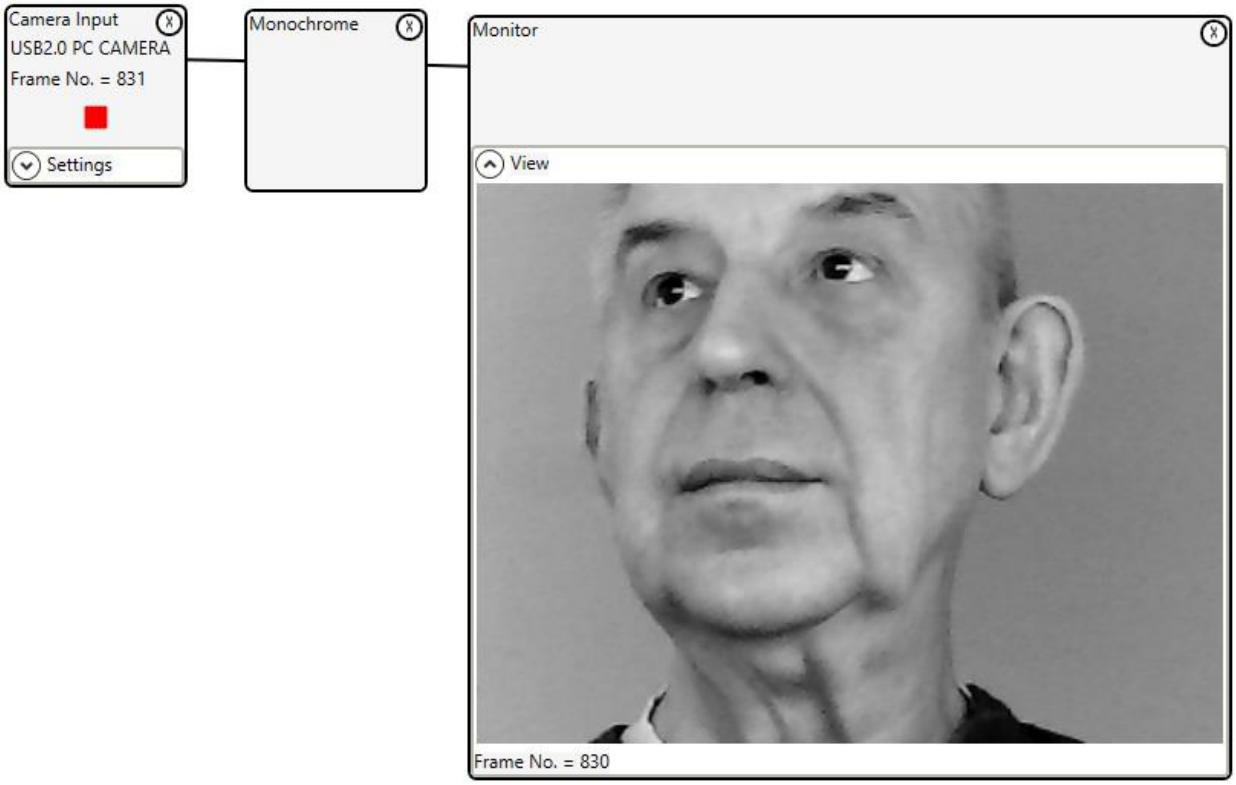


Figure 52: Monochrome control

Contrast stretch control

The Contrast stretch control will stretch the defined range of pixel values to fill the full pixel value range (0 – 255). This will be applied to all colors (using the All-range sliders) or to individual colors (using the color sliders).

The new pixel value will be calculated by:

1) Subtracting the lower level (top slider) from the pixel value.
2) Multiplying by 255 / range (bottom slider – top slider).
3) If the result is less than 0, 0 will be the result.
4) If the result is higher than 255, 255 will be the result.

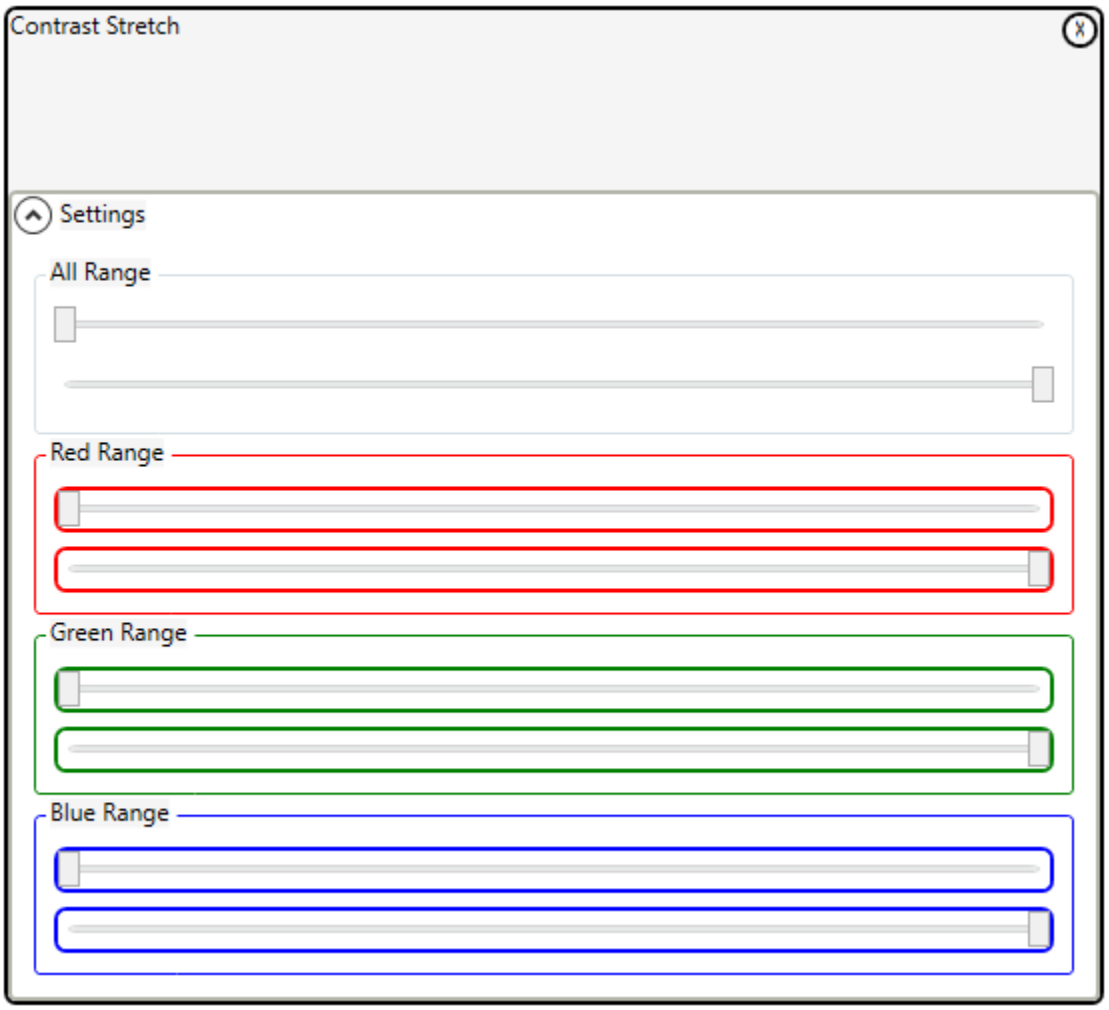


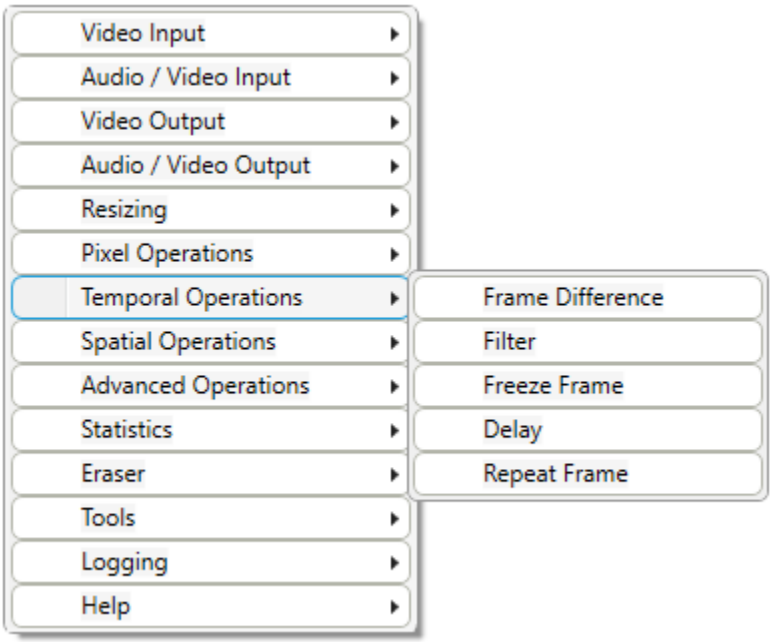
Figure 53: contrast stretch applied to live video

This may be used for histogram correction to make the most of the available pixel range.

Figure 54: Extreme contrast stretch applied to live video

Using very a small range can be used to show details at specific pixel values.

Temporal Operations



Temporal operations are those that set the value of a pixel based on its current value and its value in previous frames.

Frame Difference

Figure 55 : Frame Difference Control

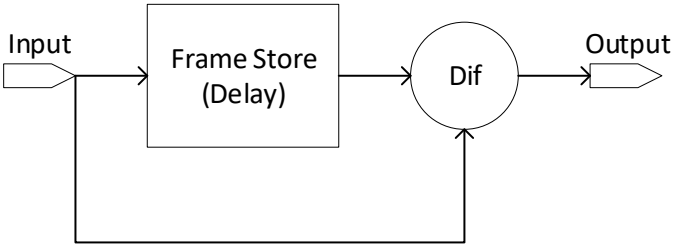


Figure 56 : Frame Difference Operation

The frame difference control will output the difference between the current frame and the previous frame on a pixel-by-pixel basis.

The are no settings.

Temporal Filter

Figure 57 : Temporal Filter control with settings expanded

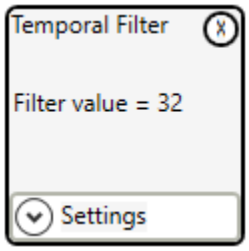


Figure 58 : Temporal Filter Control with settings collapsed

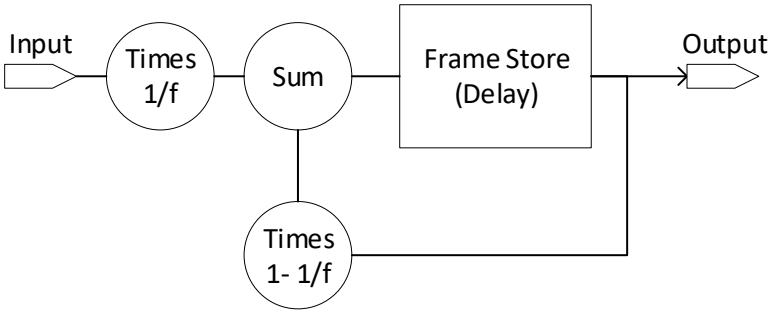


Figure 59 : Temporal Filter operation

The temporal filter will add a fraction of the incoming frame to a complimentary fraction of the output frame. For example, 1/10 input + 9/10 output.

The slider range is from 0 to 100 and is the percent of the outgoing image that is added.
A value of 0 means that all of the result comes from the input and no filtering is applied.
A value of 100 means that all of the result comes from the output freezing the image.
Values in between will apply filtering.
Generally, the value should be set high enough to remove noise, but not so high as to blur moving objects.

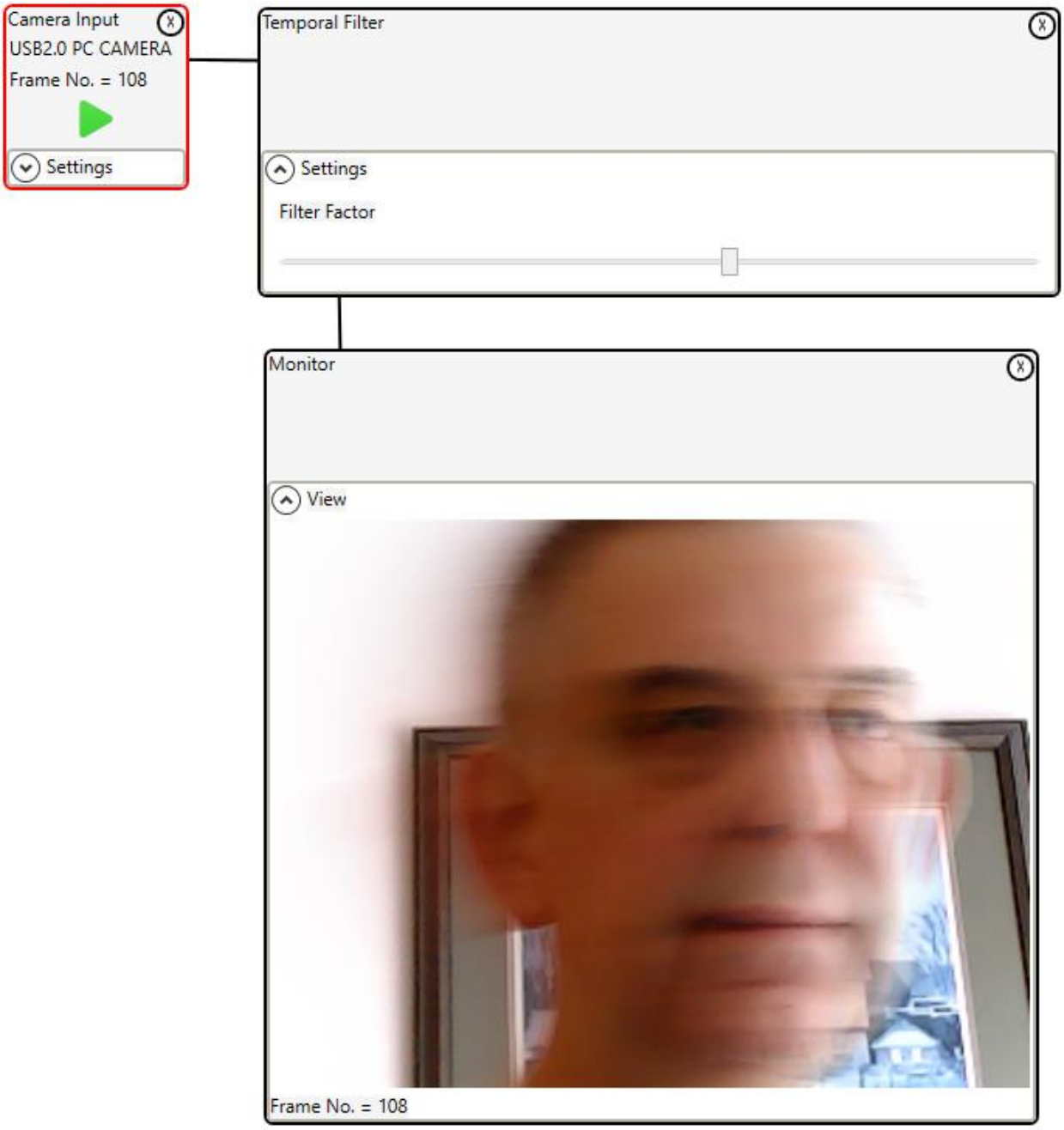


Figure 60 : Temporal Filter applied to a moving image

Freeze frame

Figure 61 : Freeze control passing through live video

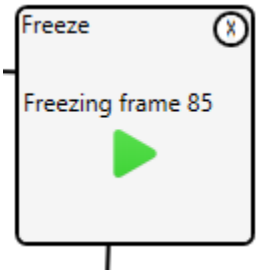


Figure 62 : Freeze control passing through captured frame

The Freeze control will allow a single frame to be captured from live video. Once a frame is captured it will be continuously feed to the next control(s) in the pipeline, it will be triggered by the frames in the input video.

Delay Control

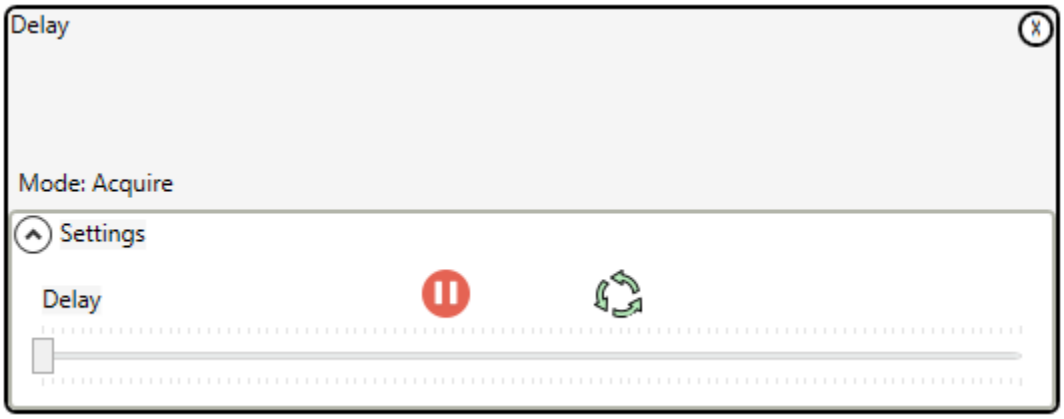


Figure 63 : Delay control with settings expanded

The delay control supports three time shifting modes:

1. Acquire

   In acquire mode the control will write received frames to the frame buffer (100 frames).The slide control will allow the user to delay live video by up to 100 frames.

2. Scrub

   Scrub mode is entered by clicking the pause button to freeze acquisition. The slide control will allow the user to scrub through the frames already acquired in the frame buffer.

3. Loop

   Loop mode is entered by clicking the loop button, this will freeze acquisition and loop through the frames acqired in the buffer.

Repeat Control

Figure 64 : Repeat Control passing through live video

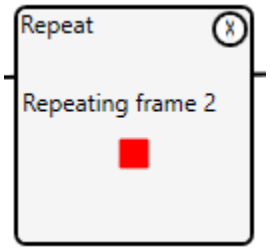
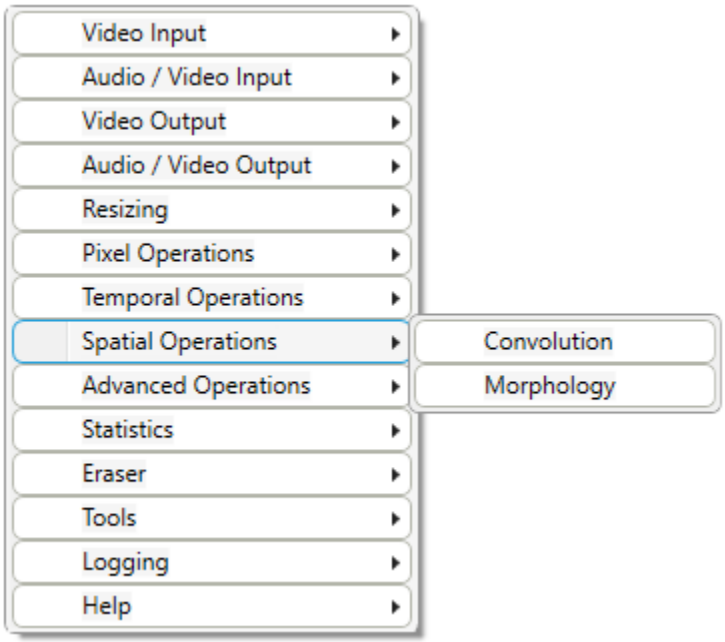


Figure 65 : Repeat Control repeating captured frame

The repeat control will send the last captured frame to the next control(s) in the pipeline. The frame will be continuously sent at a rate determined by the next control in the pipeline. It will allow the user to work on algorithms driven by a still image or test pattern without the need to keep reloading the input image.

Spatial Operations



Spatial operations are those that set the value of a pixel based on its current value and the values of neighboring pixels in the same frame.

Convolution

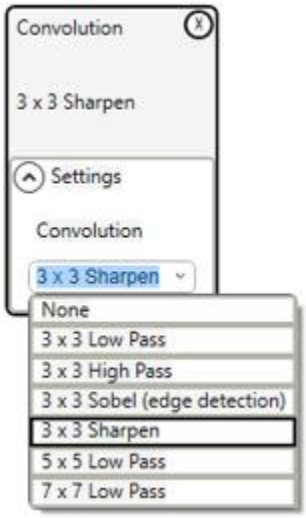


Figure 66 : Convolution Control with settings expanded

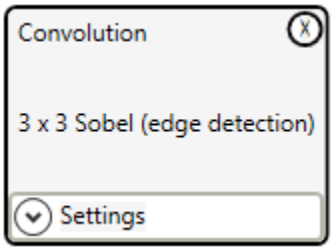


Figure 67 : Convolution Control with settings collapsed

A number of commonly use convolutions are provided.

3 x 3, 5 x 5, and 7 x 7 low pass:
These are used to remove high frequency components from the image

3 x 3 high pass:
This is used to remove low frequency components from the image

3 x 3 Sobel:
This is a combination of 2 convolutions, horizontal and vertical edge detection, resulting in edges of all orientations being detected.

3 x 3 Sharpen
This is used to enhance the high frequencies and to sharpen edges in the image.

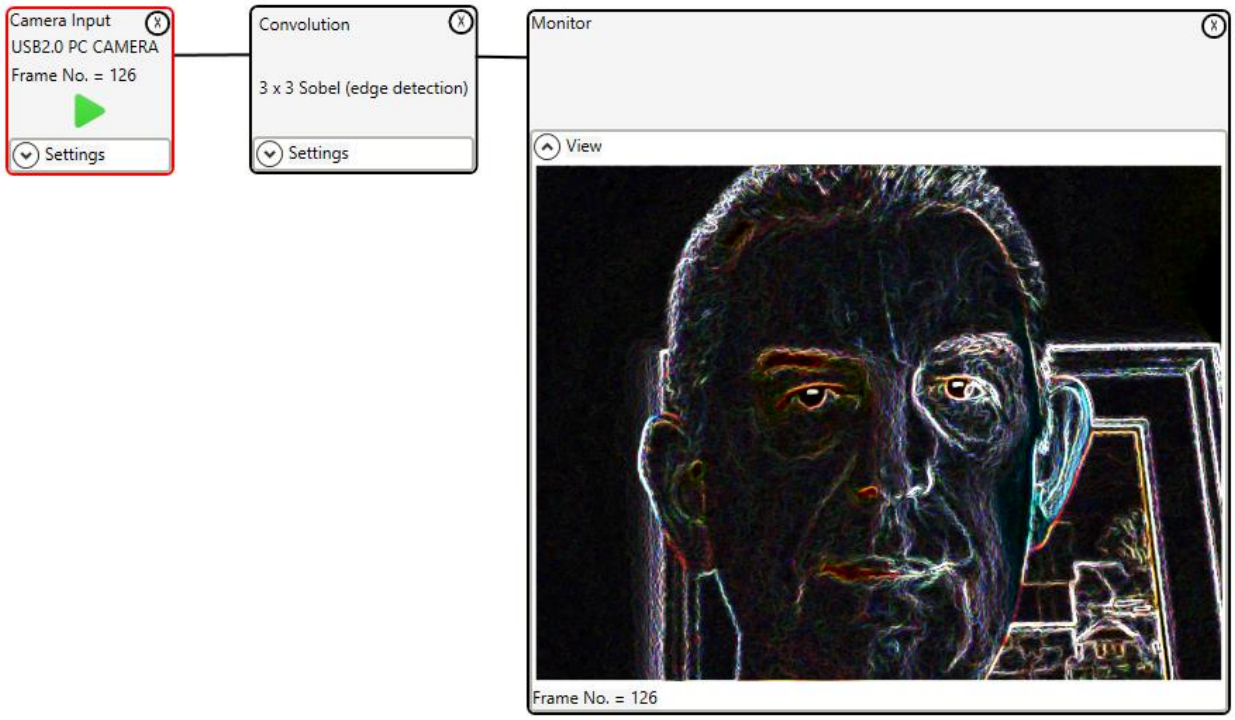


Figure 68 : Sobel filter applied to camera input

Morphological Operations

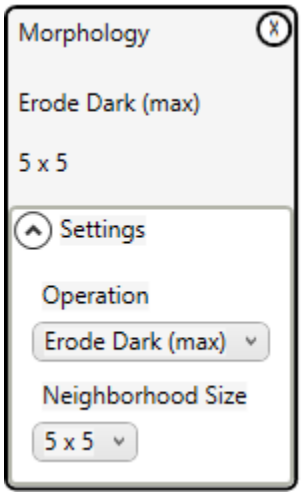


Figure 69 : Morphology Control with settings expanded

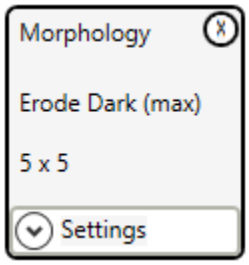


Figure 70 : Morphology Control with settings collapsed

Two kinds of morphological operations are provided:

Erode dark (max):

This takes the maximum valued pixel from the neighborhood.

Erode light (min):

This takes the minimum valued pixel from the neighborhood.

Three sizes of neighborhood are provided:

3 x 3, 5 x 5, and 7 x 7.

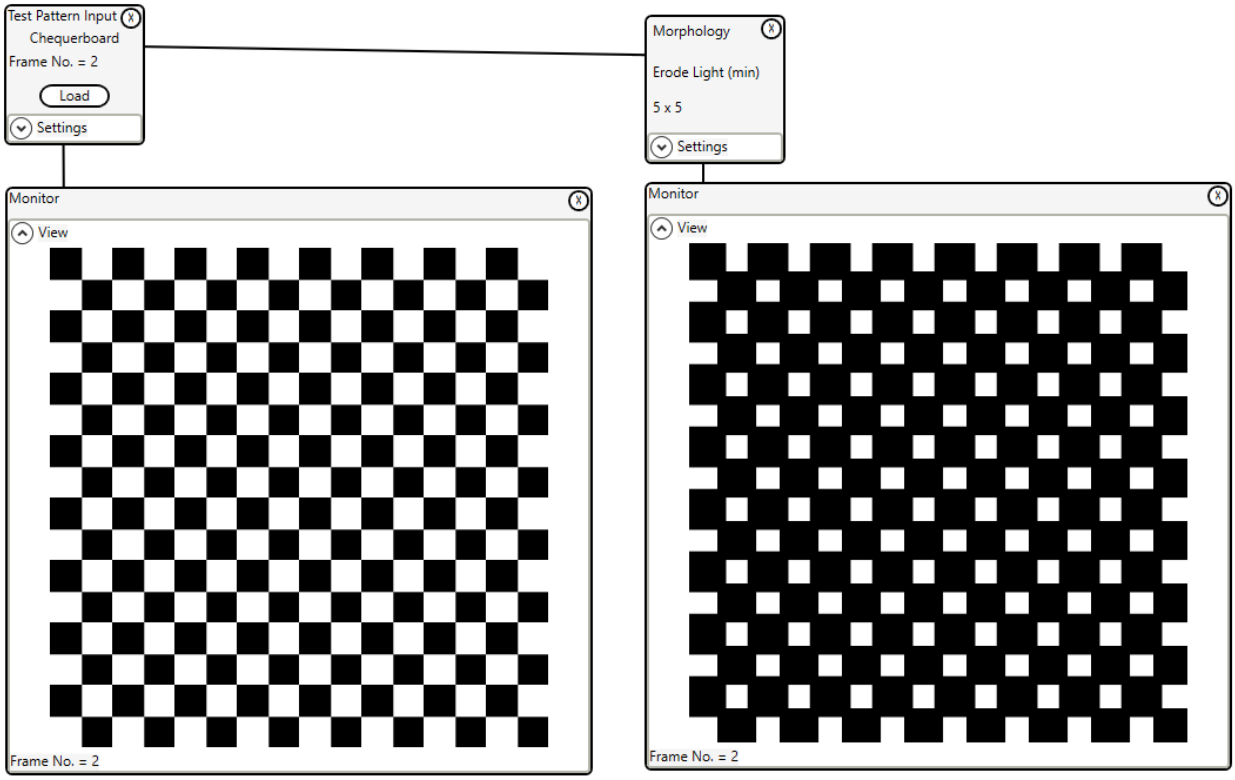
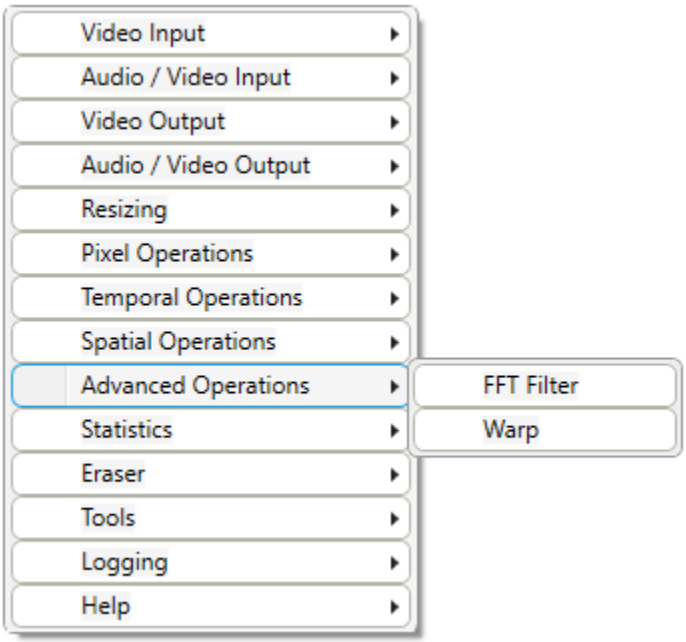


Figure 71 : 5 x 5 Erosion applied to checkerboard test pattern

Advanced Operations



FFT Filter

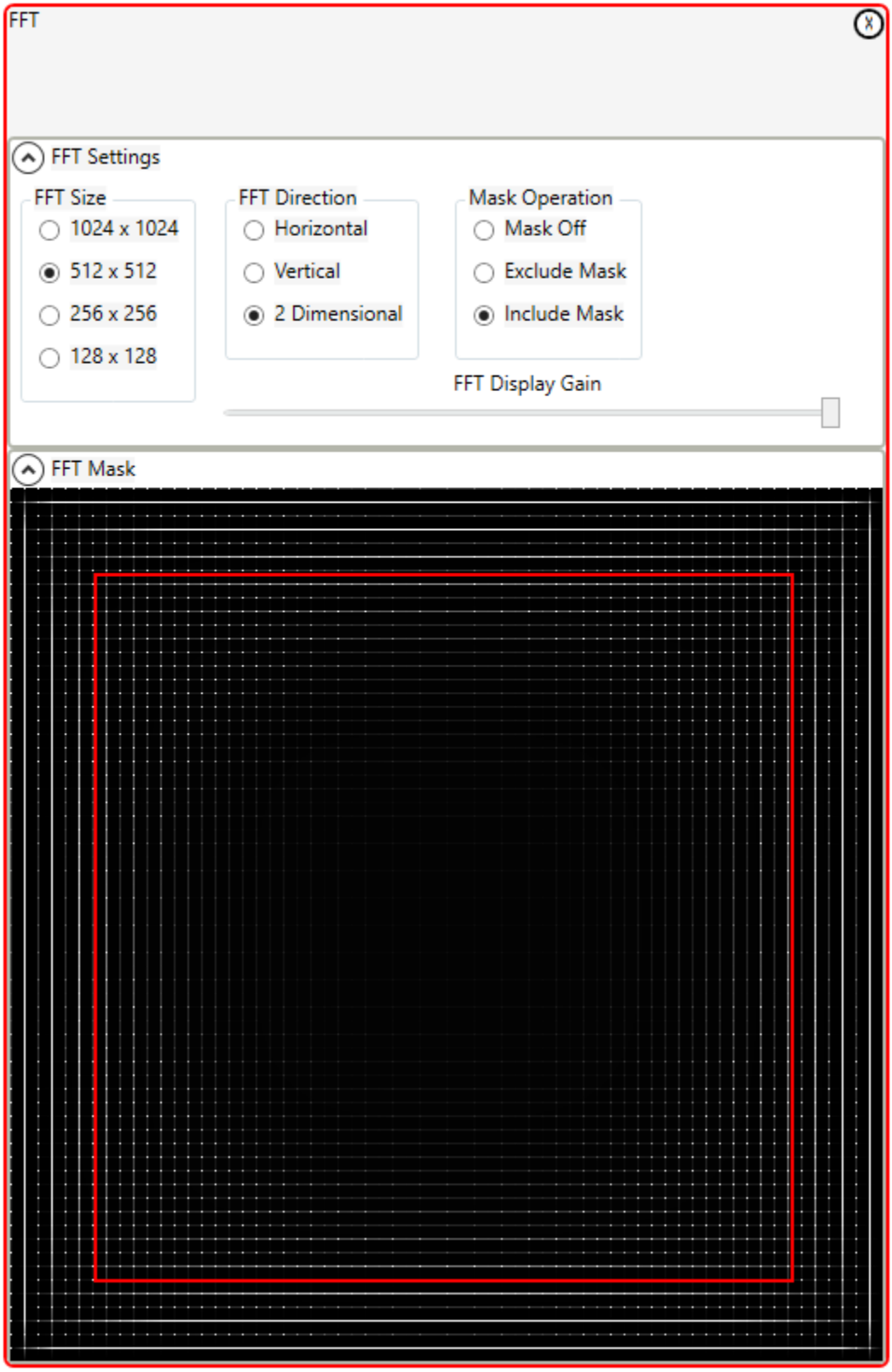


Figure 72 : FFT Filter Control with mask and settings expanded

Figure 73 : FFT Filter Control with mask and settings collapsed

The FFT filter control will provide FFT sizes of 128 x 128 to 1024 x 1024. The FFT will be performed on the center region of the input image. Should the user select an FFT size which is too large for the input image the FFT size will be reduced to fit under the covers (a warning will be logged). The output from the filter will be an image of the same size as the FFT performed.

FFTs may be performed in just the horizontal direction, or just the vertical direction, more commonly in both directions 2 Dimensional.

The mask operations offered are:
Off which will use all frequencies to reconstitute the original image.
Exclude which will use all frequencies not defined by the mask to reconstitute the image.
Include which will use all frequencies defined by the mask to reconstitute the image.

The output from the FFT is displayed in the mask expander and the user may use the left mouse button to position the mask. Note that the output from the FFT is symmetrical with high frequencies in the center of the mask area.

The output from the FFT has a large dynamic range which makes it difficult to show all of the high and low values. The control will dynamically adjust the output to best show the peak values, this may result in some low values not being visible. The FFT gain control may be used to adjust the FFT output gain if necessary.

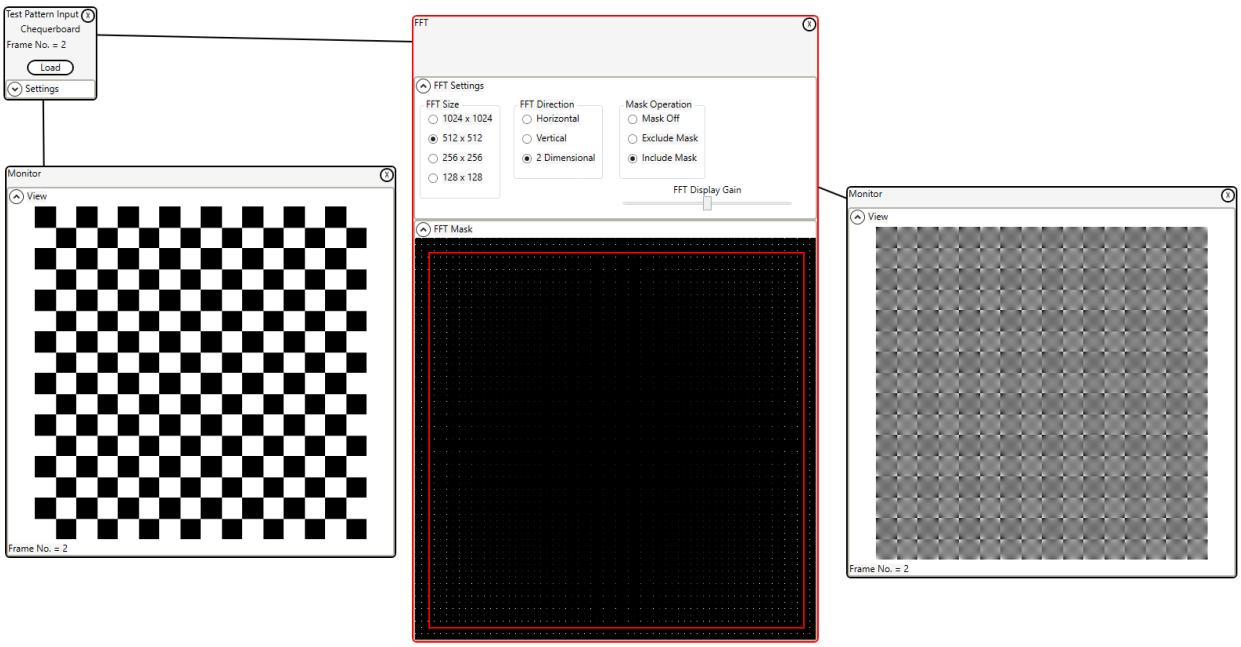


Figure 74 : FFT Include high frequencies mask applied to checkerboard test pattern

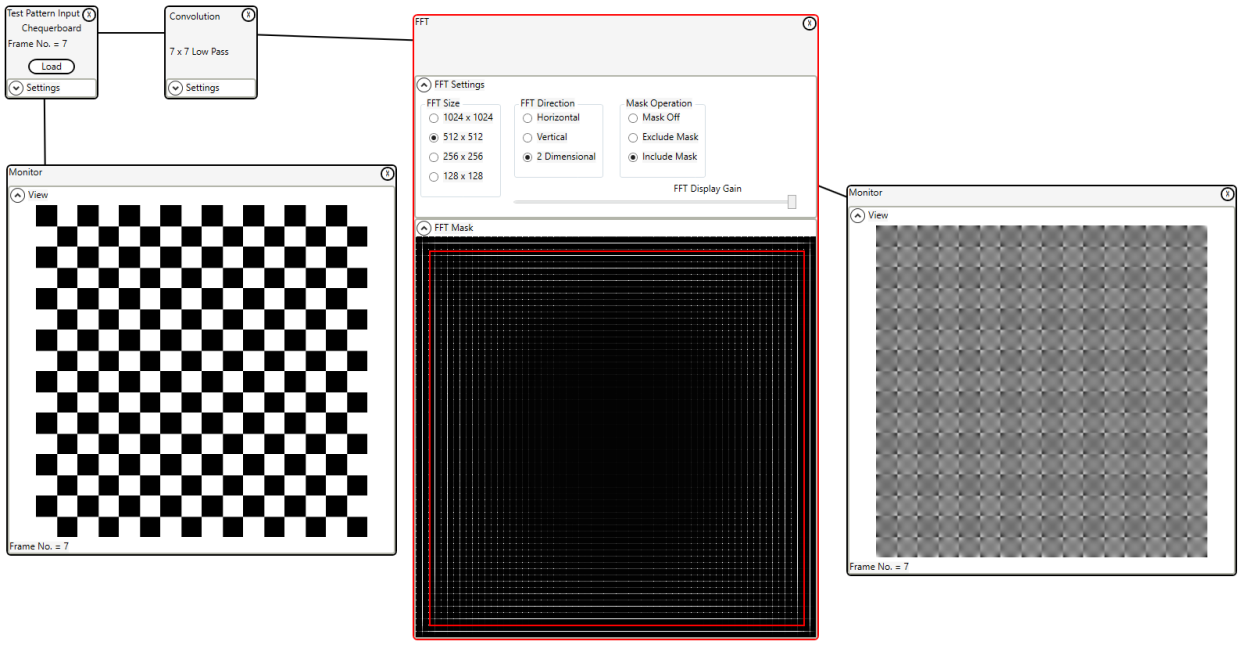


Figure 75 : FFT Include high frequencies mask applied to blurred checkerboard test pattern

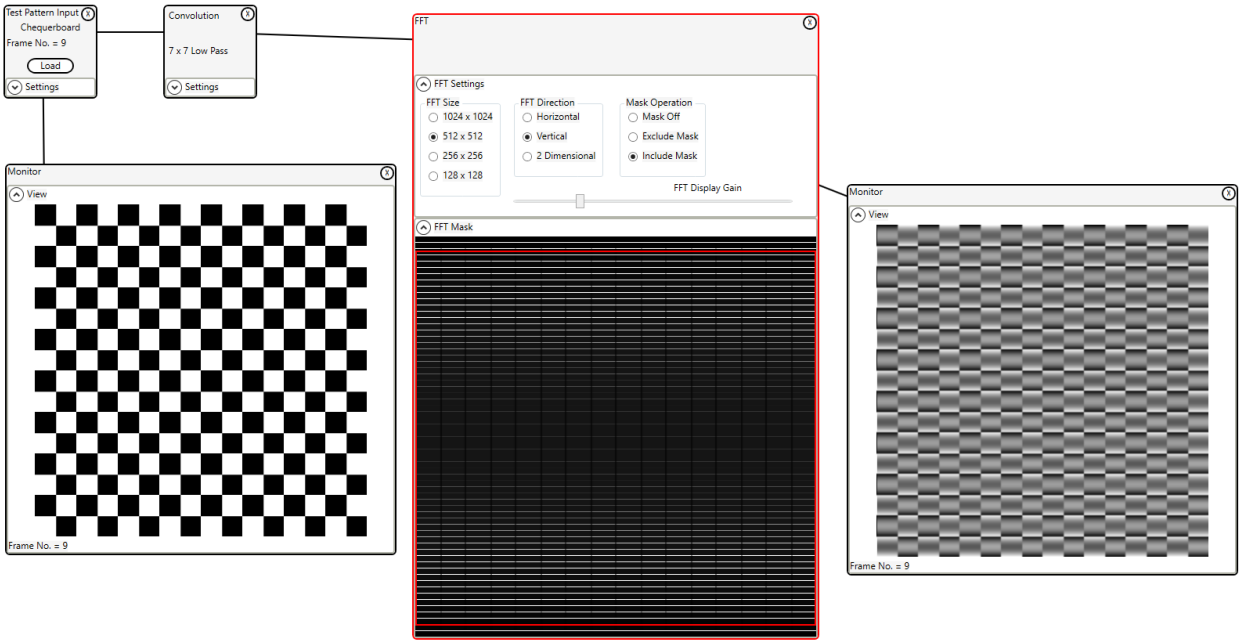


Figure 76 : Vertical FFT Include high frequencies mask applied to blurred checkerboard test pattern

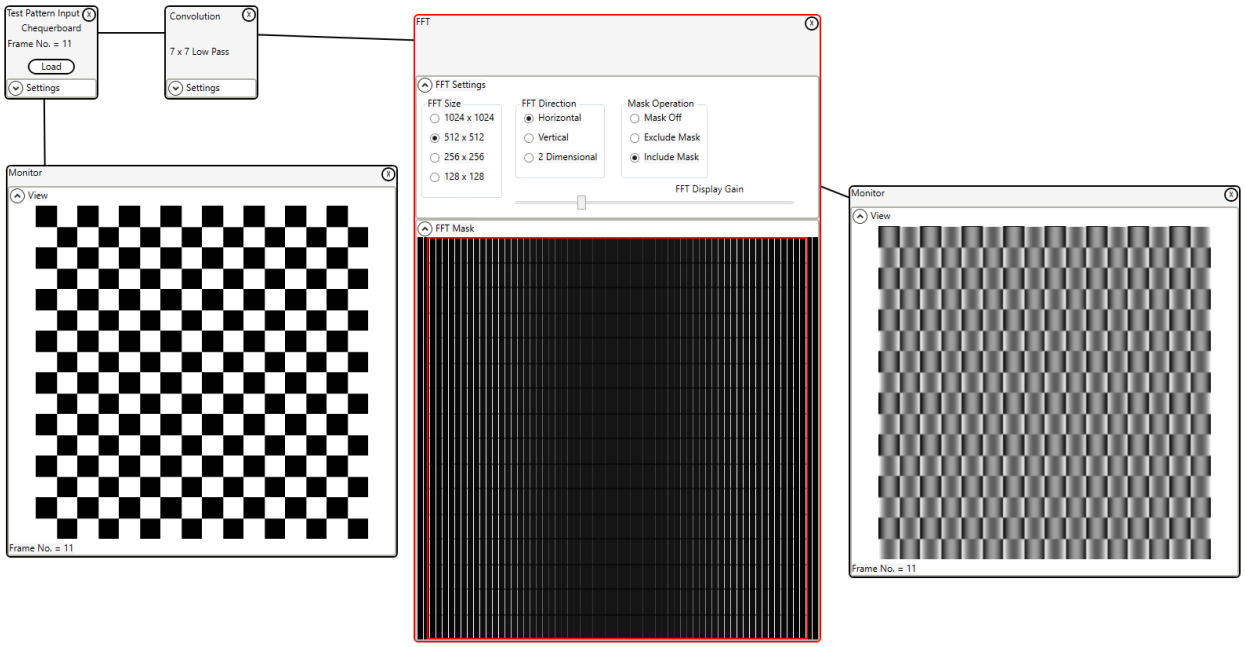


Figure 77 : Horizontal FFT Include high frequencies mask applied to blurred checkerboard test pattern

Warp Control

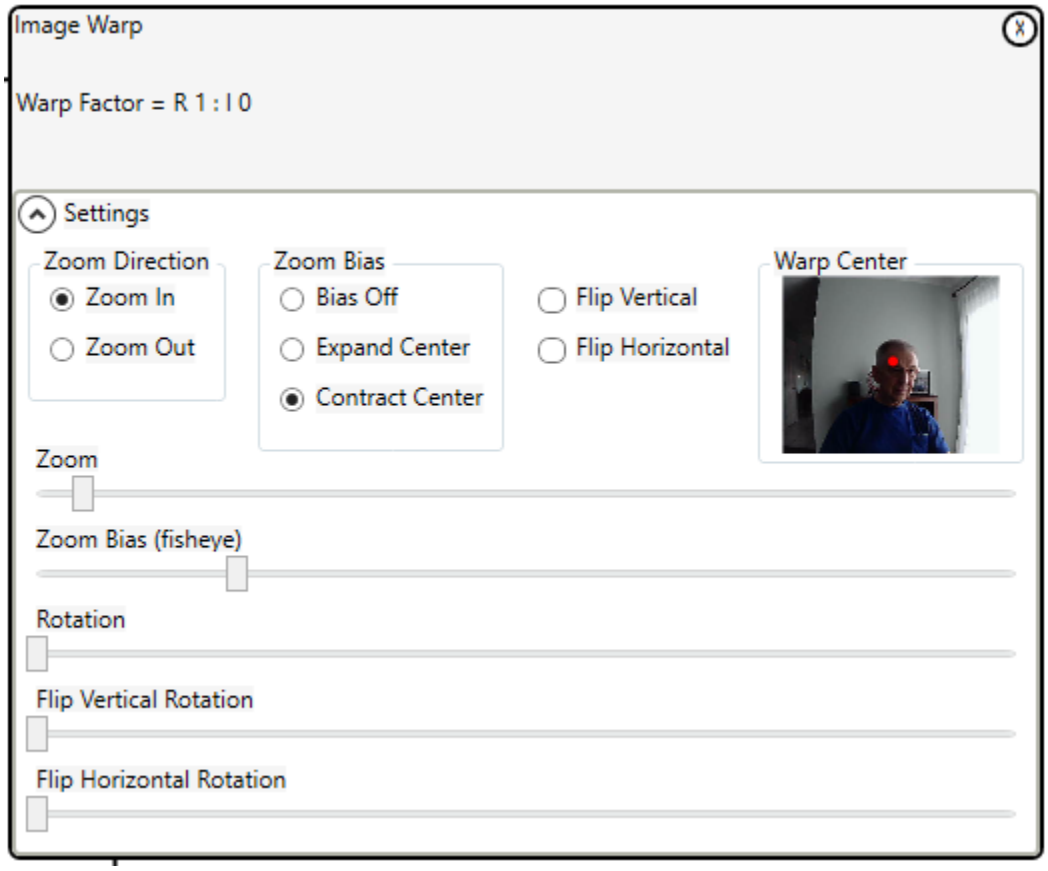


Figure 78 : Warp Control with settings expanded

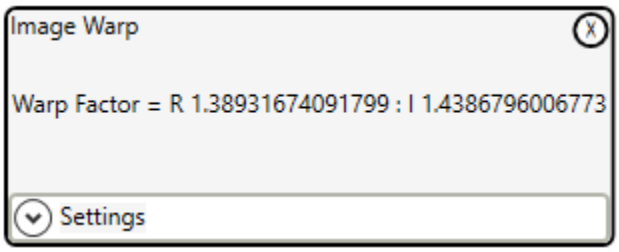


Figure 79 : Warp Control with settings collapsed

The warp control will perform basic warp functions, zoom, rotate and flip. All warps are performed with interpolation to avoid pixilation.

Zoom direction may be in or out. Flips may on or off, both may be used simultaneously.

Rotation will be from 0 – 360 degrees, 0 to the left of the slider 360 to the right.

The warp center is initially set at the center of the image, by clicking on the image the warp center can be repositioned. All warps are performed around the warp center. This is useful if for example you wish to zoom in on a particular point in the image.

The displayed warp factor is the complex number that is used to perform the warp, it is calculated from the zoom and rotation settings. Usually warping is an exercise in co-ordinate geometry, this warper uses complex number arithmetic. A single complex number is used to calculate the source pixel from the target pixel. The result is the same but the code is simpler and faster. [Using complex arithmetic to perform combination warps – Sound Analysis (sound-analysis.com)]

The 2.0 Warp control include fisheye correction functionality.

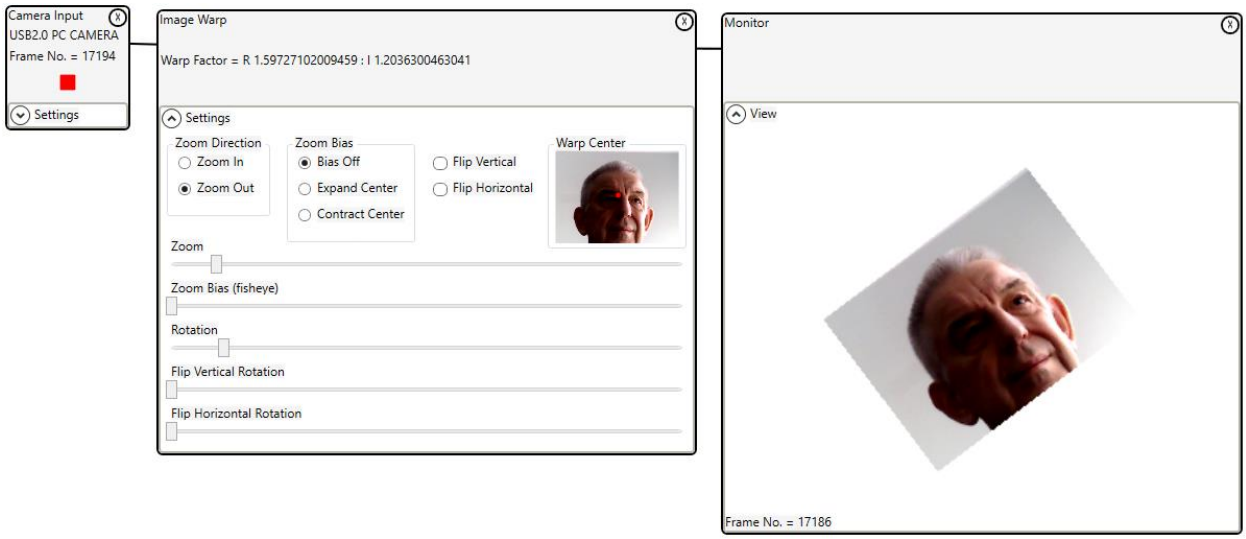


Figure 80 : Zoom and rotation of live video

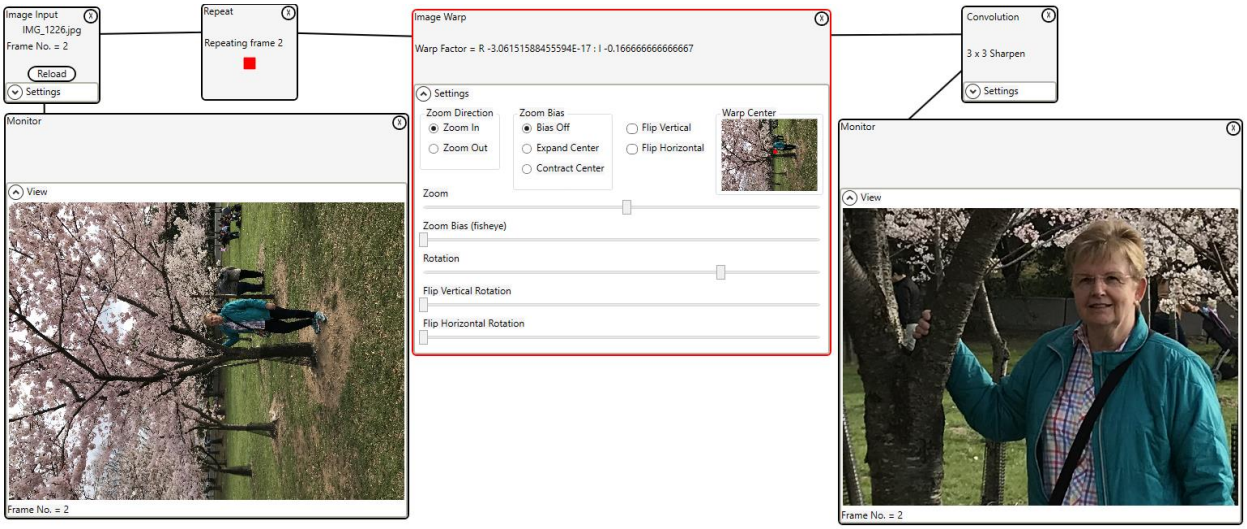


Figure 81 : Extracting a detail and using sharpening to reduce blurring

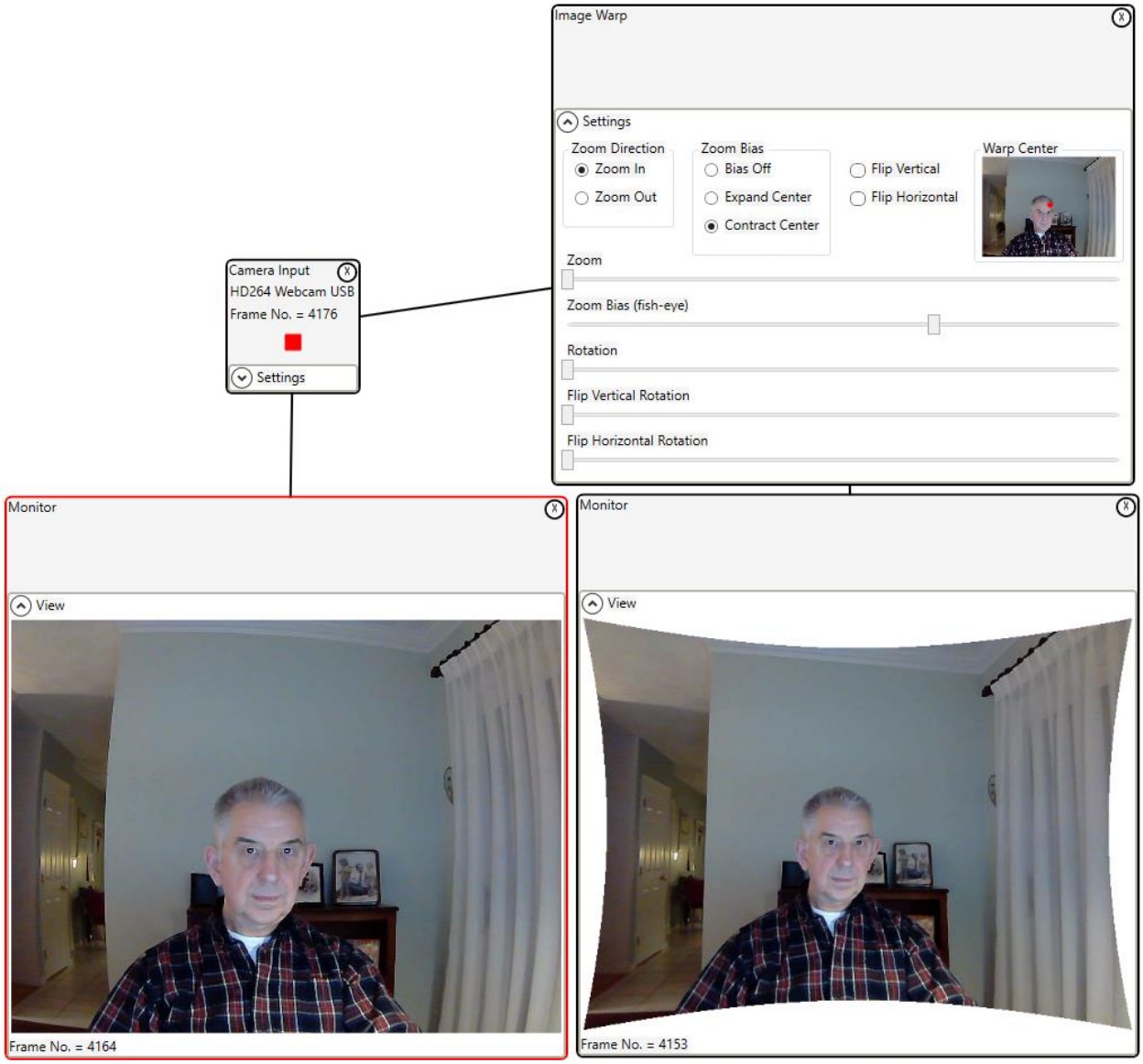
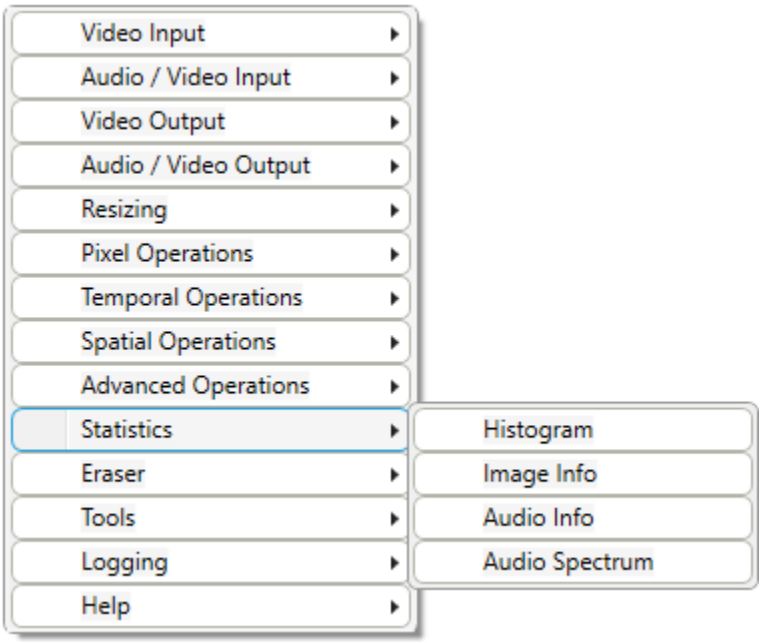


Figure 82 : Fisheye correction

Statistics



Statistical functions provide information about the image or audio.

Histogram Control

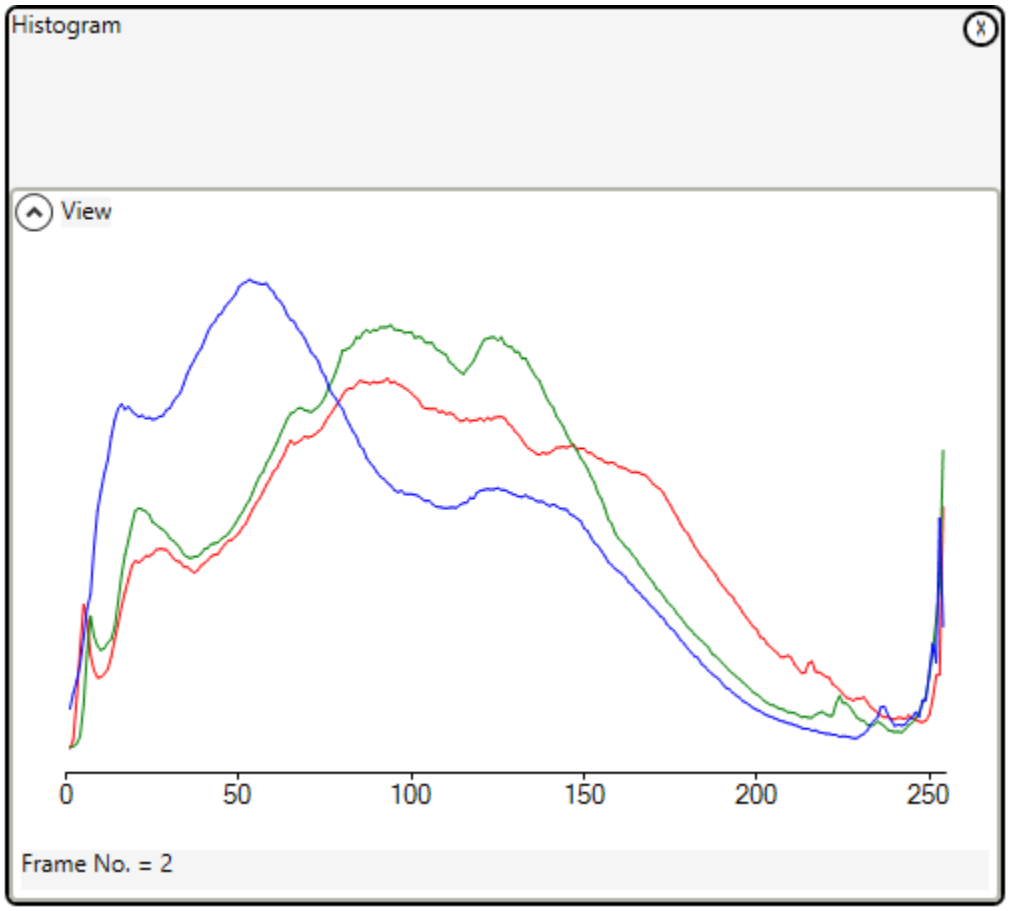


Figure 83 : Histogram control with view expanded

The histogram control will show graphically, for each color, the number of pixels of each value in the image. The view may be collapsed to save space on the whiteboard.

Image Info Control

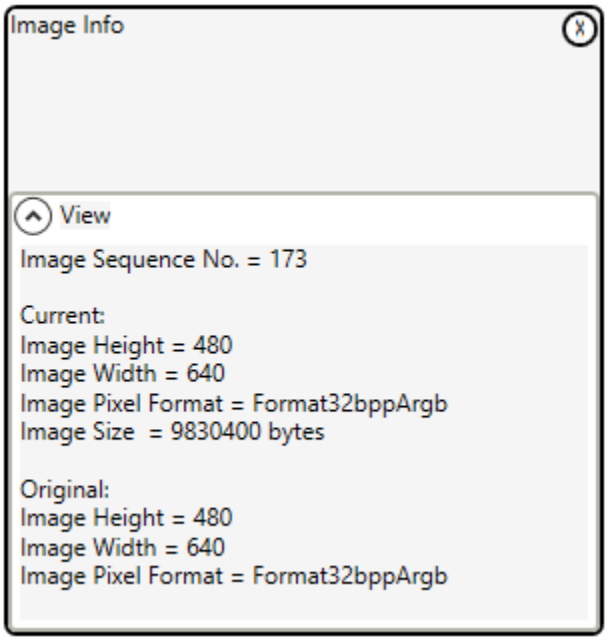


Figure 84 : Image Info Control with view expanded

The image info control will display basic information about the image. The current image is the double precision floating point image that is used for processing, the original image is the bitmap image that was originally acquired by the camera or from disc.

Audio Info control

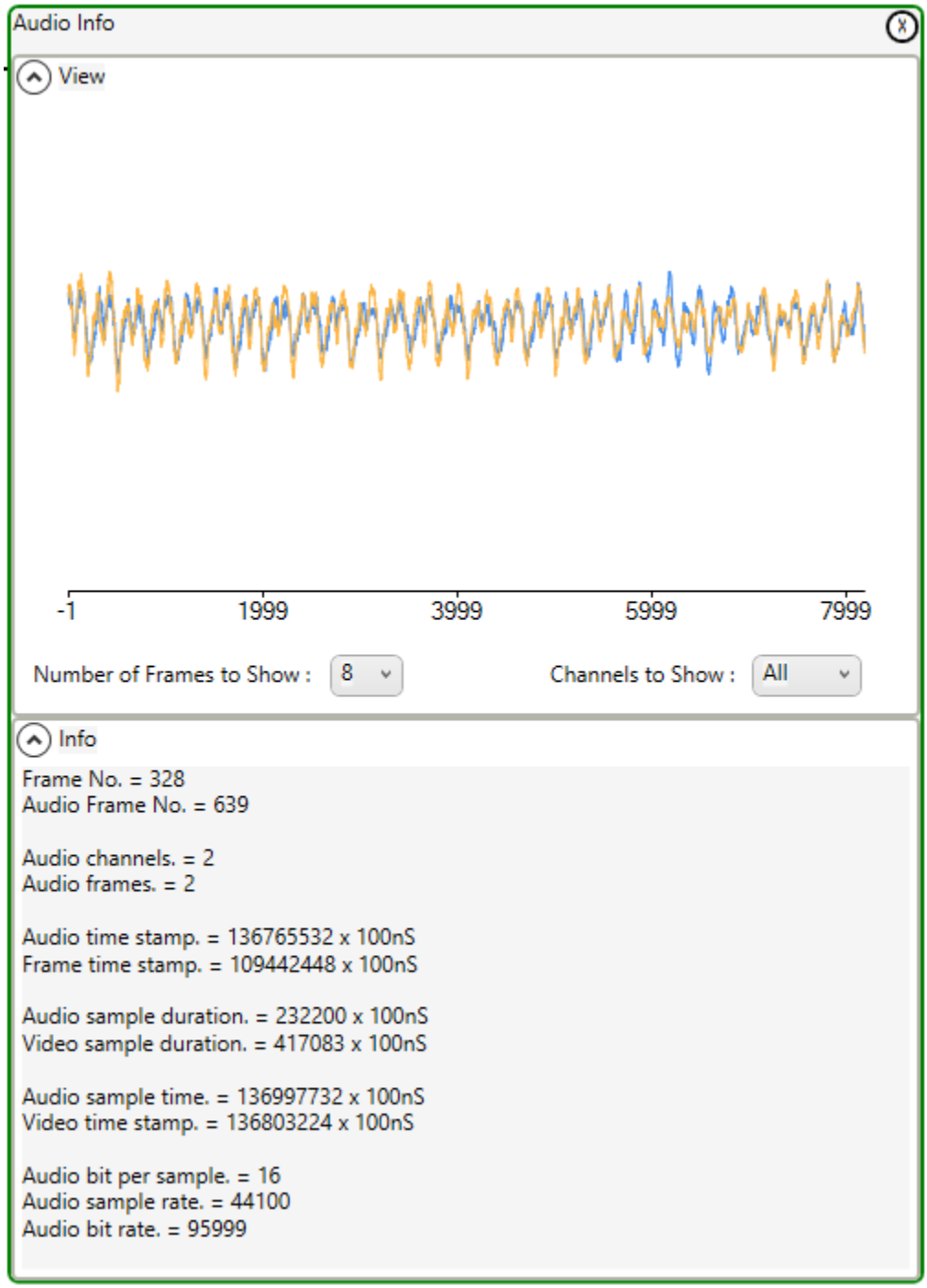


Figure 85 : Audio Info Control with all dropdowns expanded

The Audio Info control will display basic info about the audio for each frame. The number of frames to show dropdown will allow the user to choose how many audio frames are displayed at a time (1, 4, or 8) in the audio signal display.

Audio spectrum control

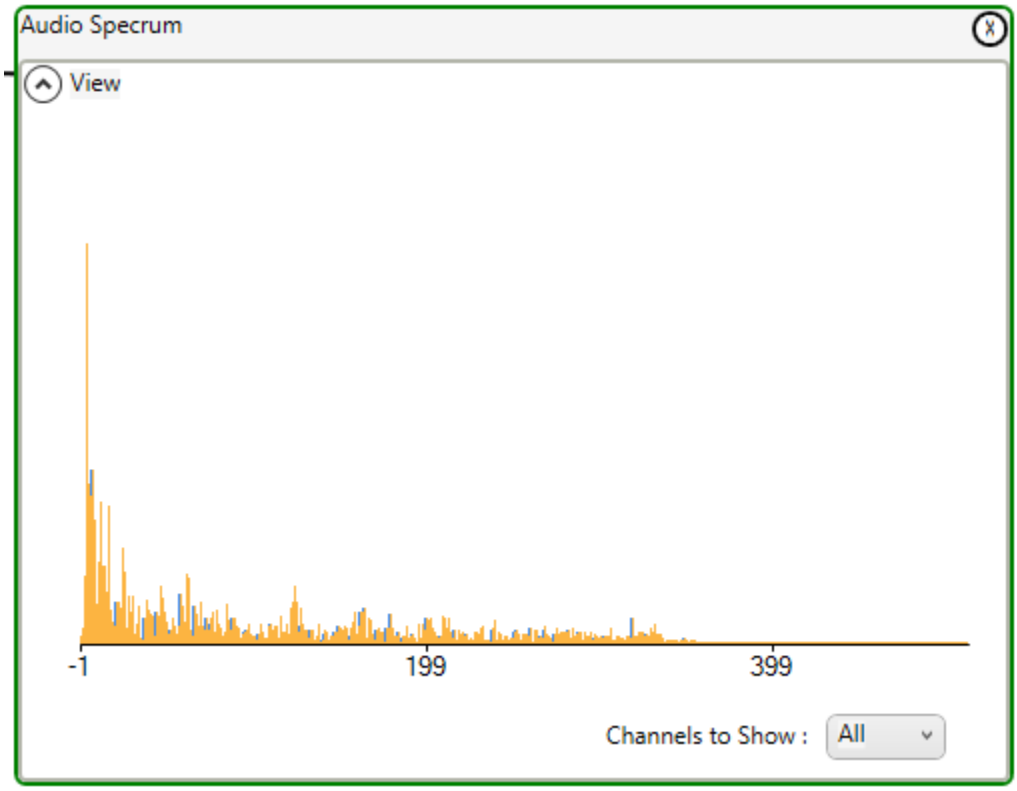
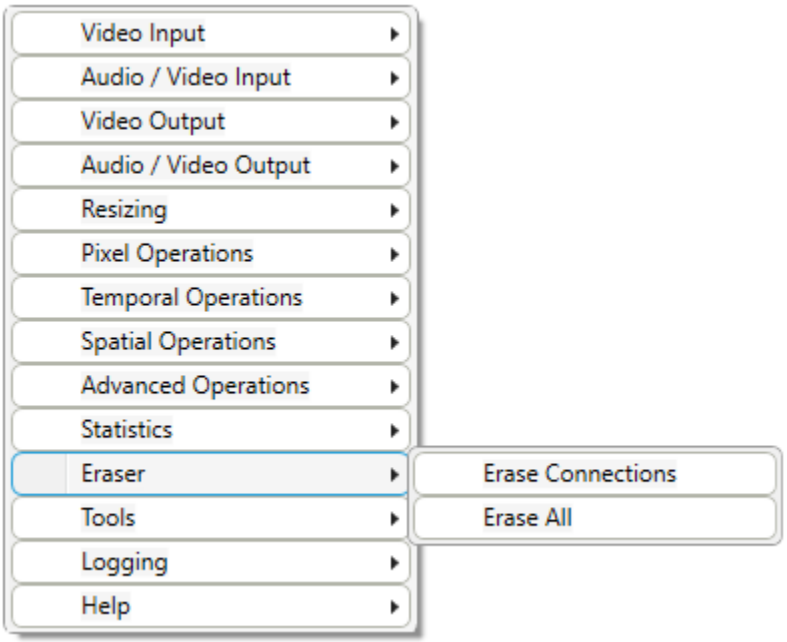


Figure 86 : Audio Spectrum Control with view expanded

The Audio Spectrum control will perform a real-time FFT on each audio frame and display the results as a spectrum.

Eraser Functions

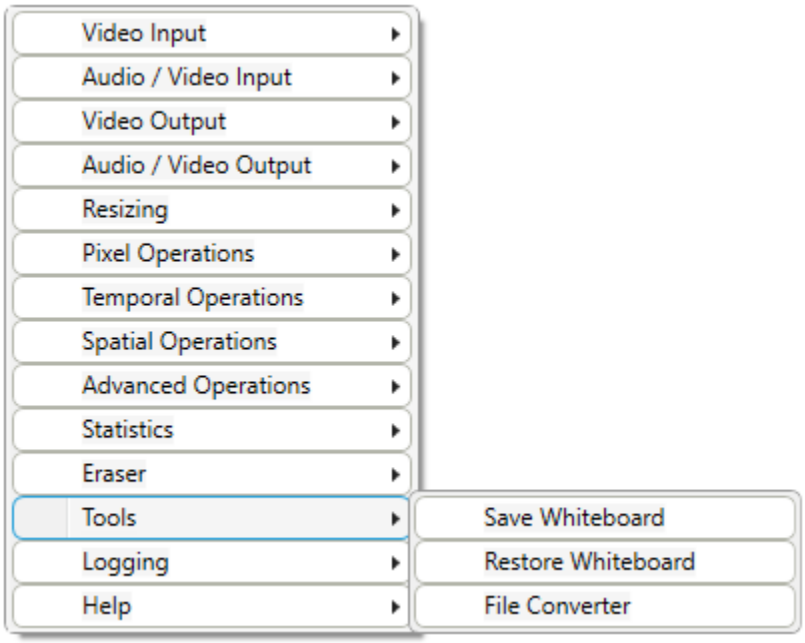


To remove a control and its connections the delete button on the control should be used.

Erase connections will just erase all connection on the whiteboard and leave the controls in place.

Erase all will clear the whiteboard and return it to its original blank state.

Tools



Save and Restore Whiteboard

Save and Restore Whiteboard will allow the user to save the current state of the Whiteboard to an XML file and restore this state at a later time.

Saved whiteboards can be published to allow more complex algorithms to be delivered. These will be described in the Imageing Whiteboard 2.0 Cookbook.

File Converter

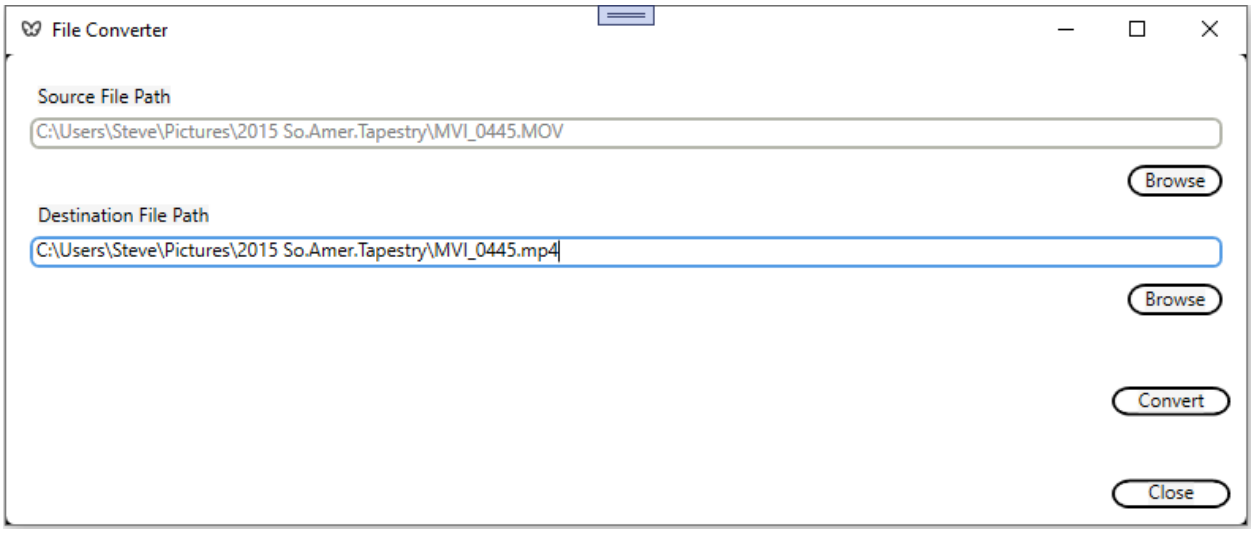
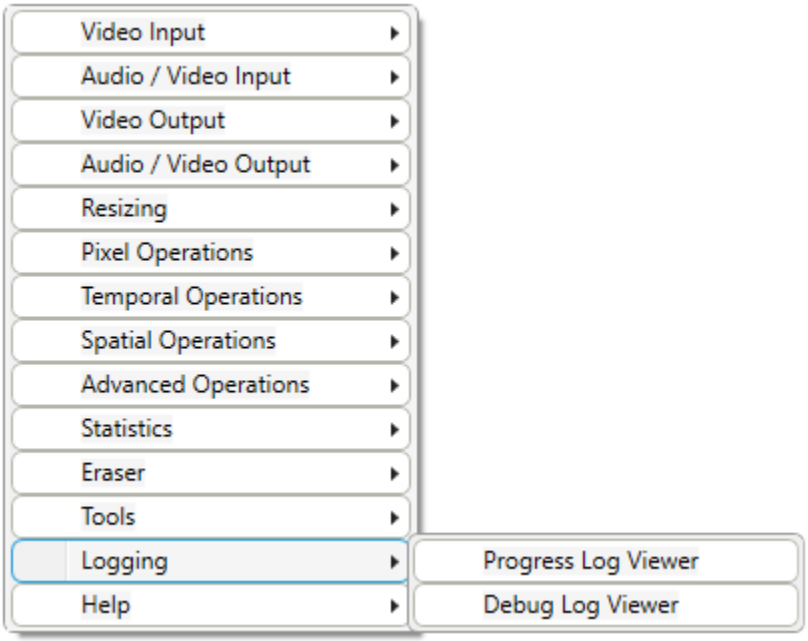


Figure 87 : Converting mov to mp4

The file converter is provided for convenience. It will convert the source file to the destination file performing any format conversion necessary. File types are determined by the file extensions.

Logging Functions



Debug Logging

Figure 88 : Debug Logging Dialog

Log Viewer will launch the log viewer to display debug logging. Debug logging is always enabled.

Progress Logging

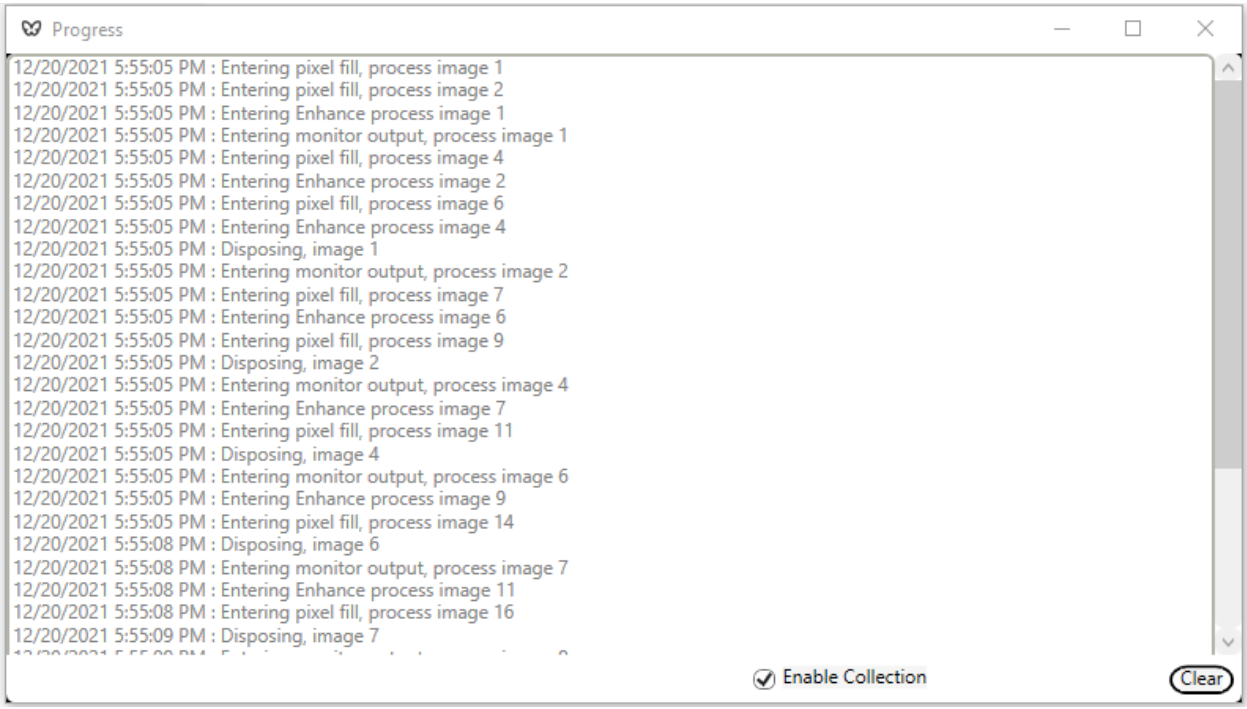
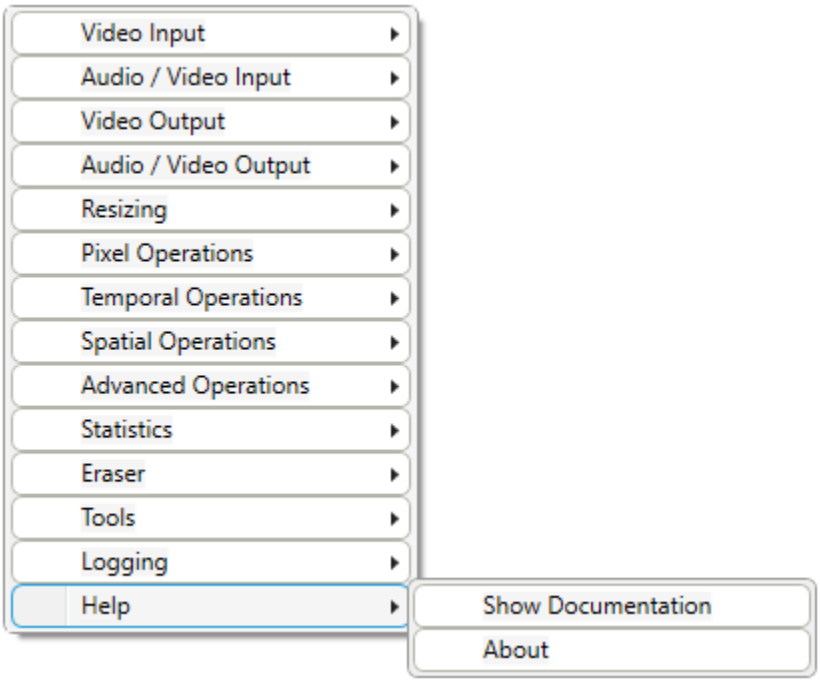


Figure 89 : Progress Logging Dialog

Progress logging has its own window. Because progress logging can be very verbose the enable collection checkbox is off by default. Logging will begin when the check box is checked.

Help Functions



Show documentation will launch this document.

About will show a dialog with the version and other information.

Performance

Real-time image processing has historically (1970s – 1990s) been performed by specialized hardware https://en.wikipedia.org/wiki/Datacube_Inc. Real-time performance was guaranteed by using as much hardware as was required for a given algorithm, for example if your algorithm required a convolution, you would add a convolver to the hardware. Always there were people predicting that one day soon a PC would be powerful enough to match the performance of pipelined hardware. In 2018 is this true yet? Part of the motivation for this project was to find out.

There has been some partial success. Temporal operations require real-time as they require processing to be performed on successive frames; these work well with lower resolution images. Even image warping runs real-time at low resolutions. The limitations are not so much the processing required, certainly with modern multi-core processors, floating point performance is adequate for most algorithms. The issue is with memory, once local memory is used virtual memory has to be employed. The other issue is that as your algorithm increases in complexity you cannot add more hardware. FFT filtering does not run real-time, but, even with pipeline processors FFTs never did run real time.

Compromises

The Imaging Whiteboard handles performance issues in various ways, depending on the input used.

Image file, and test patterns are single shot and are not required to run real-time.

Video Files are usually of too high a resolution to run real-time. The Video Input control will read the file as fast as possible and all frames will be processed.

Camera Input cannot be slowed so here frames that cannot be processed will be dropped.

What helps?

More memory is the most useful enhancement. The machine used for development had 32GB.

A SSD (solid state drive) is useful, performance on a Surface one seems better than on a more powerful desktop with a hard drive.

Use lower resolution, if possible, how low depends on your hardware.

Contact

If you have any questions, suggestions, or feedback email steve@sound-analysis.com