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UNIVERSITY OF SCIENCE

FACULTY OF INFORMATION TECHNOLOGY

USER GUIDE

Individual Lab 1



Computer Vision

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1 Introduction

The project is the implementation of several image manipulations using C++ including:

- Convert a color image to the gray image
- Change the brightness/contrast of an image
- Filter an image using Average, Median and Gaussian filter
- Edge detection using Sobel and Laplacian filter

2 Installation and set up

- Install OpenCV library
- Set up environment variables
- Configure project
 - Open project's *Properties*, add *Include Directories* and *Library Directories* as well as lib file.
 - Copy *opencv_world341d.dll* to the Debug folder containing the exe file.

3 Running program

3.1 Command line

3.1.1 Convert color image to grayscale

$\langle Executable\ file \rangle$ -rgb2gray $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$

where

- *-rgb2gray*: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image

3.1.2 Change image brightness

$\langle Executable\ file \rangle$ -brightness $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$ $\langle C \rangle$

where

- *-brightness*: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image
- *C*: the brightness factor (integer). Postive value will result in brighter image while negative value will lead to darker image.

3.1.3 Change image contrast

$\langle Executable\ file \rangle$ -contrast $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$ $\langle C \rangle$

where

- *-contrast*: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image
- *C*: the contrast factor (float). Value greater than 1 will enhance image contrast while value between 0 and 1 will lower image's contrast.

3.1.4 Filter image using Average filter

$\langle Executable\ file \rangle$ -avg $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$ $\langle k \rangle$

where

- *-avg*: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image
- *k*: the filter kernel size (integer). The program only takes in odd value from 3 as valid kernel size. Larger kernels result in more extensive averaging or blurring of pixel values, leading to a smoother appearance in the image.

3.1.5 Filter image using Median filter

$\langle Executable\ file \rangle$ -med $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$ $\langle k \rangle$

where

- *-med*: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image
- *k*: the filter kernel size (integer). The program only takes in odd value from 3 as valid kernel size. Larger kernels result in more extensive averaging or blurring of pixel values, leading to a smoother appearance in the image.

3.1.6 Filter image using Gaussian filter

$\langle Executable\ file \rangle$ -gau $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$ $\langle k \rangle$

where

- -gau: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image
- *k*: the filter kernel size (integer). The program only takes in odd value from 3 as valid kernel size. Larger kernels result in more extensive averaging or blurring of pixel values, leading to a smoother appearance in the image.

3.1.7 Image edge detection using 3x3 Sobel kernel

$\langle Executable\ file \rangle$ -sobel $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$

where

- -sobel: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image

3.1.8 Image edge detection using 3x3 Laplace kernel

$\langle Executable\ file \rangle$ -laplace $\langle InputFilePath \rangle$ $\langle OutputFilePath \rangle$

where

- -laplace: command for the function
- *InputFilePath*: the path of input file/ image
- *OutputFilePath*: the path of output file/ image

3.2 Call the program

- Run the program once to create exe file. (Assuming that the *opencv_world341d.dll* has been copied to the project)
- The executable file is located in the debug file after the project run once.
- In the *Debug* folder, right click and choose *Open in Terminal*.
- After open the Terminal, enter the desired command line from the list of given command line with the *Executable file* is named *21127730*.
- If there is no error, the input and output image will be shown. After that, press Enter to close the images and save the output. If save successfully, there will be a notification on where the image is saved.

3.3 Sample process

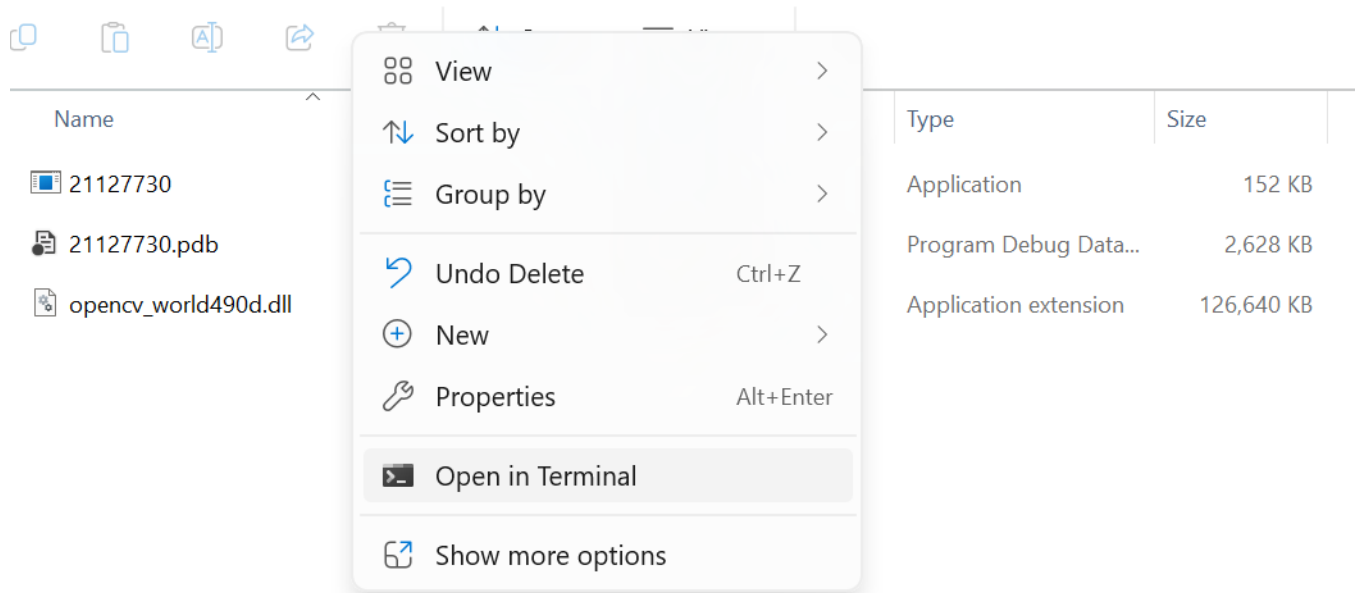


Figure 1: Open Terminal

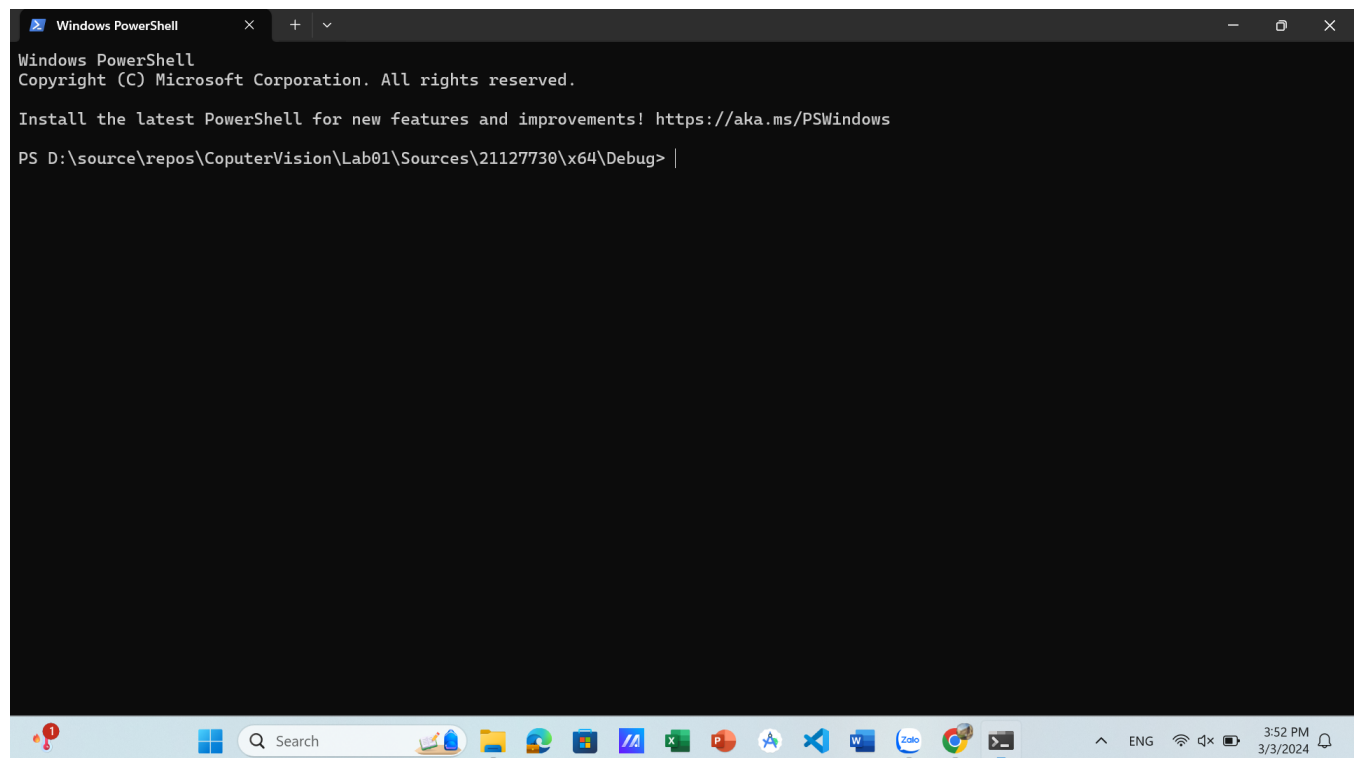


Figure 2: Terminal screen

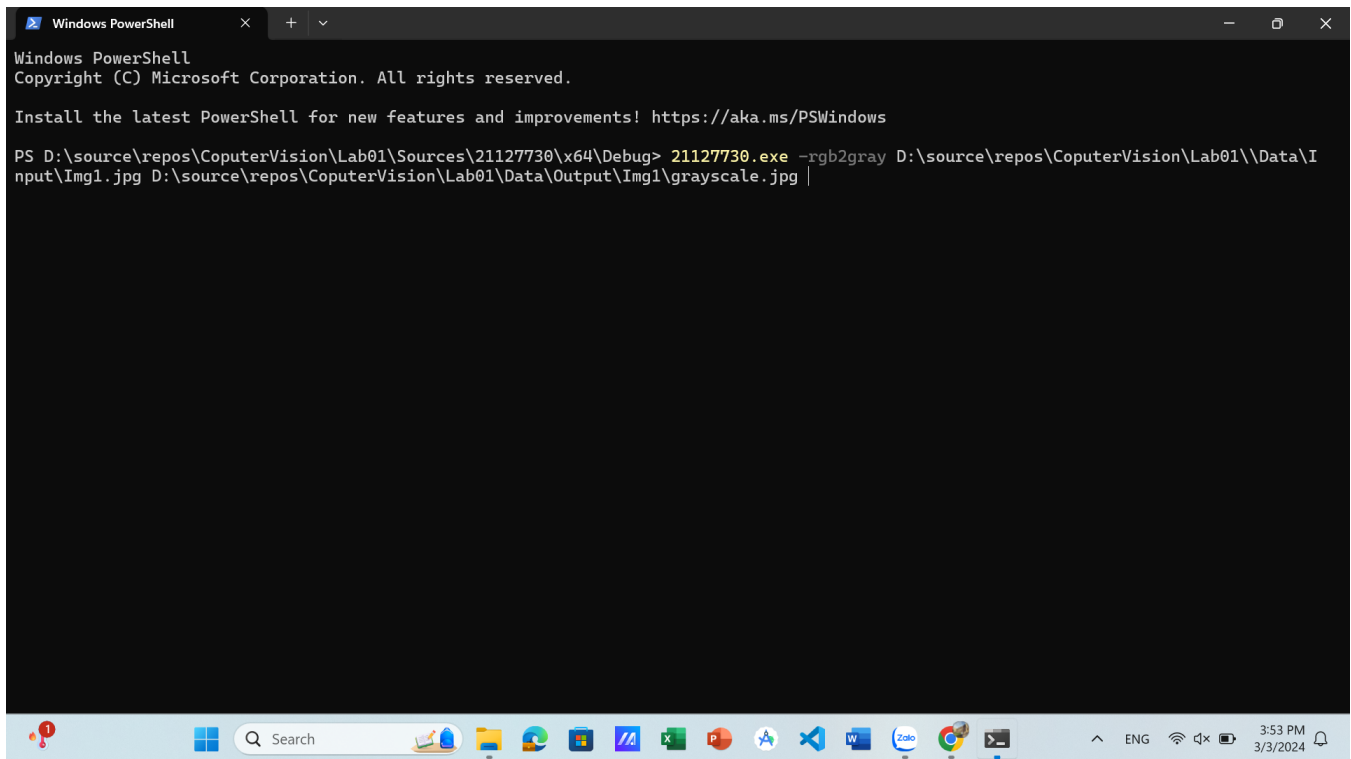


Figure 3: Enter the command line (convert to grayscale image)

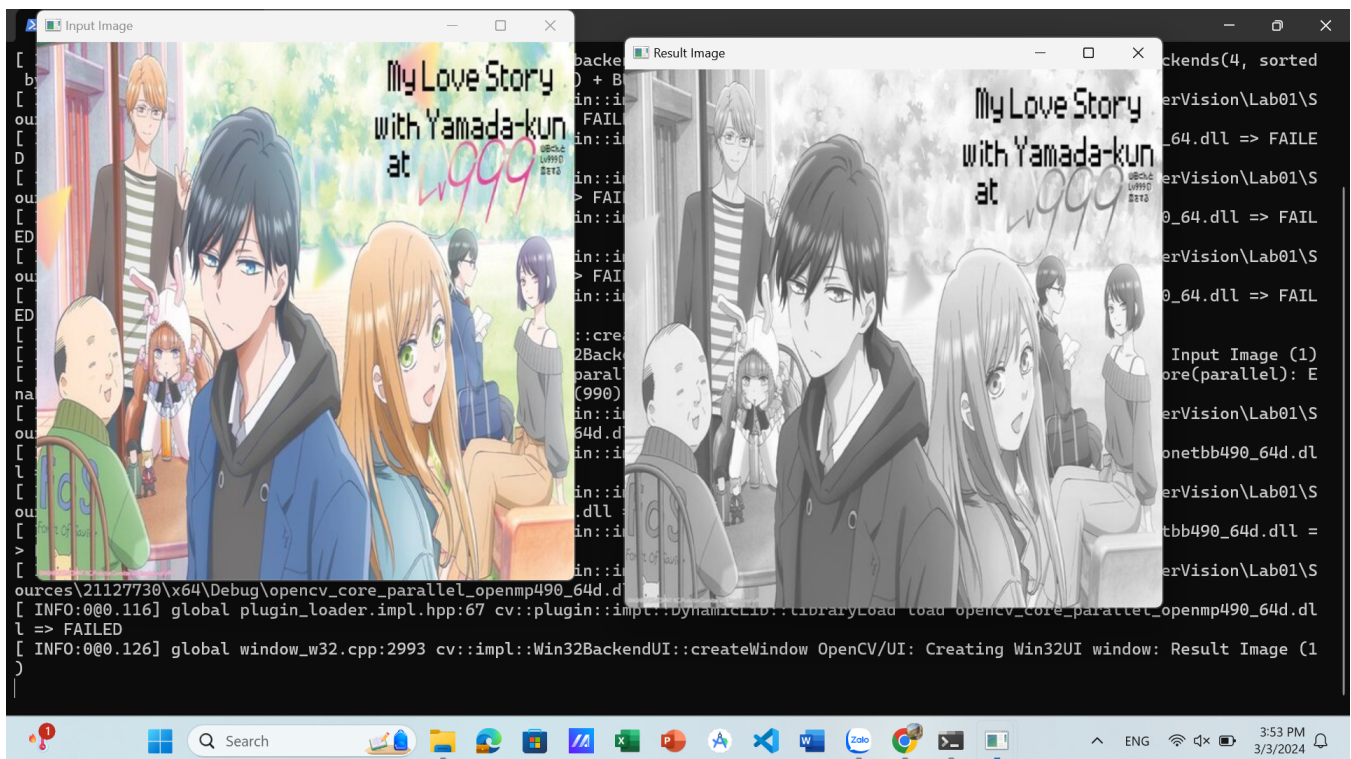
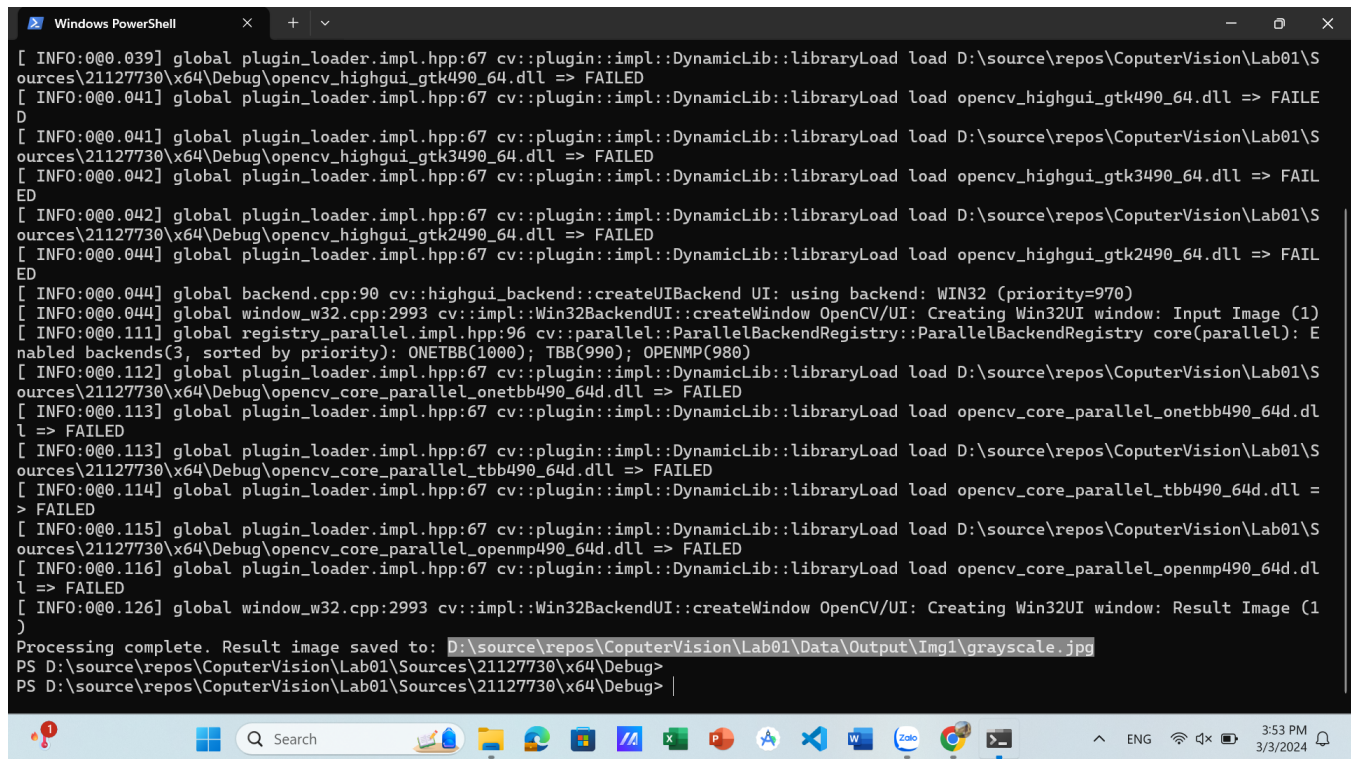


Figure 4: Input and Output image after process



```
Windows PowerShell
[ INFO:000.039] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load D:\source\repos\CoputerVision\Lab01\S
ources\21127730\x64\Debug\opencv_highgui_gtk490_64.dll => FAILED
[ INFO:000.041] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load opencv_highgui_gtk490_64.dll => FAILE
D
[ INFO:000.041] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load D:\source\repos\CoputerVision\Lab01\S
ources\21127730\x64\Debug\opencv_highgui_gtk3490_64.dll => FAILED
[ INFO:000.042] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load opencv_highgui_gtk3490_64.dll => FAIL
ED
[ INFO:000.042] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load D:\source\repos\CoputerVision\Lab01\S
ources\21127730\x64\Debug\opencv_highgui_gtk2490_64.dll => FAILED
[ INFO:000.044] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load opencv_highgui_gtk2490_64.dll => FAIL
ED
[ INFO:000.044] global backend.cpp:90 cv::highgui_backend::createUIBackend UI: using backend: WIN32 (priority=970)
[ INFO:000.044] global window_w32.cpp:2993 cv::impl::Win32BackendUI::createWindow OpenCV/UI: Creating Win32UI window: Input Image (1)
[ INFO:000.111] global registry_parallel.impl.hpp:96 cv::parallel::ParallelBackendRegistry::ParallelBackendRegistry core(parallel): E
nabled backends(3, sorted by priority): ONETBB(1000); TBB(990); OPENMP(980)
[ INFO:000.112] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load D:\source\repos\CoputerVision\Lab01\S
ources\21127730\x64\Debug\opencv_core_parallel_onetbb490_64d.dll => FAILED
[ INFO:000.113] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load opencv_core_parallel_onetbb490_64d.dl
l => FAILED
[ INFO:000.113] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load D:\source\repos\CoputerVision\Lab01\S
ources\21127730\x64\Debug\opencv_core_parallel_tbb490_64d.dll => FAILED
[ INFO:000.114] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load opencv_core_parallel_tbb490_64d.dll =
> FAILED
[ INFO:000.115] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load D:\source\repos\CoputerVision\Lab01\S
ources\21127730\x64\Debug\opencv_core_parallel_openmp490_64d.dll => FAILED
[ INFO:000.116] global plugin_loader.impl.hpp:67 cv::plugin::impl::DynamicLib::libraryLoad load opencv_core_parallel_openmp490_64d.dl
l => FAILED
[ INFO:000.126] global window_w32.cpp:2993 cv::impl::Win32BackendUI::createWindow OpenCV/UI: Creating Win32UI window: Result Image (1
)
Processing complete. Result image saved to: D:\source\repos\CoputerVision\Lab01\Data\Output\Img1\grayscale.jpg
PS D:\source\repos\CoputerVision\Lab01\Sources\21127730\x64\Debug>
PS D:\source\repos\CoputerVision\Lab01\Sources\21127730\x64\Debug>
```

Figure 5: Output image saved successfully to the path