MANIPAL
ACADEMY of HIGHER EDUCATION
*(Institution of Eminence Deemed to be University)*

# Tool Development for Medical Images

**Mini-Project Report**

*submitted to*

Manipal School of Information Sciences, MAHE, Manipal


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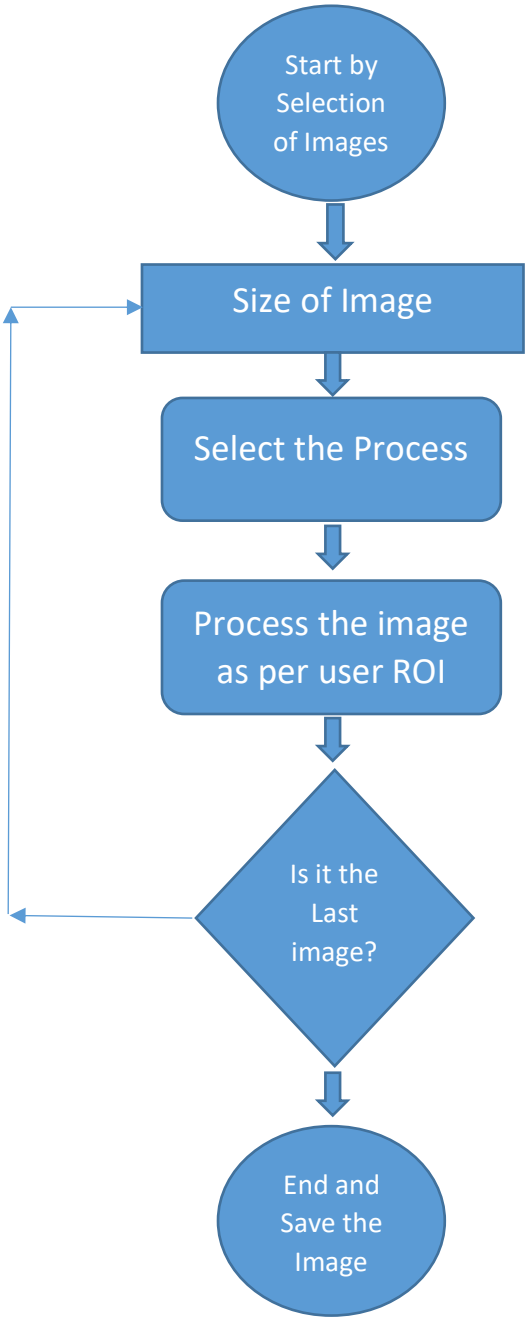
MANIPAL SCHOOL OF INFORMATION SCIENCES
MANIPAL
*(A constituent unit of MAHE, Manipal)*

## 1. Objectives:

- Processing the images based on Region of Interest (ROI).
- Analysis of medical images under the common platform.

## 2. Block Diagram/Flowchart




## 3. Applications

- Useful in medical field
- Useful for pathologist to identify the prognosis of cancer based on region of Interest
- Development of model for any medical images for researchers.
- Processing the image becomes easy

# Introduction:

By developing the tool we aim to help the medical fraternity to be able to identify and process stained medical images easily for the purpose of treating patients.

**Images:**

An image is a visual representation of something. It can be two-dimensional, three-dimensional, or somehow used in visual system to convey information.

Standard digital image file formats include the following:

**JPEG:**

JPEG (pronounced JAY-peg) is a graphic image file produced according to the Joint Photographic Experts Group standard. This group of experts develop and maintain standards for a suite of compression algorithms for computer image files. JPEGs usually have a .jpg file extension.

**GIF**

GIF (pronounced JIF by many, including its designer, and pronounced GIF with a hard G by others) stands for Graphics Interchange Format. GIFs use a two-dimensional (2D) raster data type and are binarily encoded. GIF files usually have the .gif extension.

GIF89a is an animated GIF image format. The primary benefit of this format is the ability to create and play an animated image on a webpage. A twirling icon, a banner with a hand that waves or letters that magically get larger are examples of animated GIFs. GIF89a can also be specified for interlaced GIF presentations.

## What is image processing?

Image processing describes the process of digitally transforming an image and executing specific operations to obtain useful information from it. Image processing systems often treat images as 2D signals when applying some predetermined signal processing approaches.

Types of image processing include the following:

- pattern recognition to measure various patterns around objects in an image;
- recognition to detect or differentiate objects within an image;
- retrieval to browse or search an extensive image database for an image like the original image;

**sharpening and restoration:** to create an enhanced image from the original image; and **visualization:** to identify objects not visible in an image.

**Pixel:**
pixel is the smallest addressable element in a raster image, or the smallest addressable element in an all-points addressable display device, so it is the smallest controllable element of a picture represented on the screen.

**Colour:**
The property possessed by an object of producing different sensations on the eye as a result of the way it reflects or emits light.

**Histopathological images** - the diagnosis and study of diseases of the tissues and involves examining tissues and/or cells under a microscope.

**Region Of Interest (ROI)**: Region of interest takes very important role in medical images. The size of the tumour cells varies. The stained cells processed under microscope for further processing to diagnose the stages of cancer. The cell size various tumour to tumour. The images accessed under microscope with magnification of 10x, 20x, 40x. The manually accessed image size May 1600x1200, 1400x1200 based on the lens and camera attached to the microscope. The size image further divided into 100x100, 512x512 to process through model. Using this image ROI is considered based on size of nuclei.

**Why computer aided diagnostic system improves accuracy?**

For the pathologist identifying the region of interest is difficult due to the size of the nuclei. There is a chance of human error for the nuclei which may not be region of interest,
So, the computer aided system helps human to read the image with less error for the colour pixels of the pathology images also the various deep learning architecture models helps to process these images, gives better accuracy.

**Why is machine learning required?**

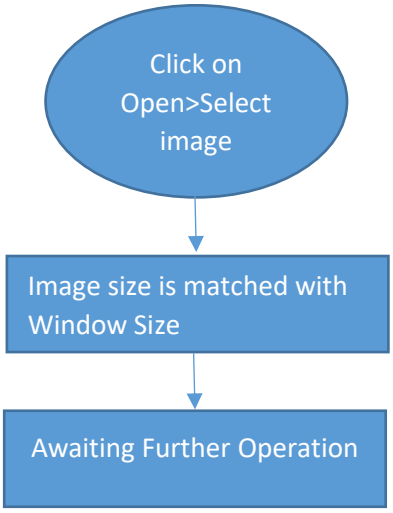
As per World health Organisation (WHO) every year 18% of the people in the world death occurs due to cancer. The processing of stained tumour cells images is difficult for pathologist, the diagnostic and treatment of cancer patient makes very important role based on number of cells identified. The pathologist cannot be so accurate to count the number of cells , the machine learning algorithms are advanced , the various models makes human life easier by processing thousands of image per second.

Medical Image Tool:

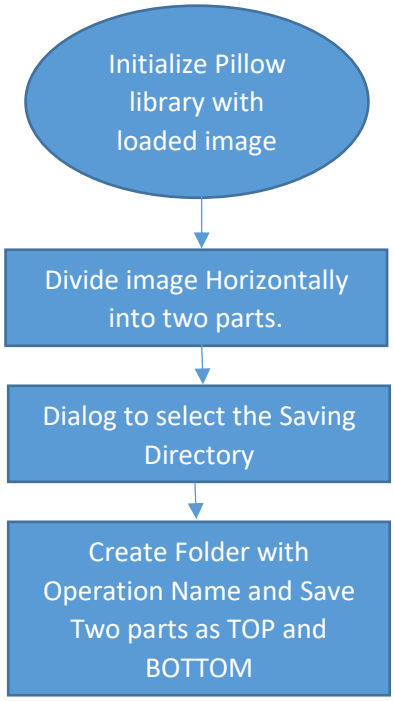
The Medical image tool will have seven functions in its 1st iteration, The seven functions are listed below.

1. Open
2. Horizontal Slicing
3. Vertical Slicing
4. 2x2 slicing
5. 4x4 slicing
6. 8x8 slicing
7. 1 Point ROI
8. 2 Point ROI

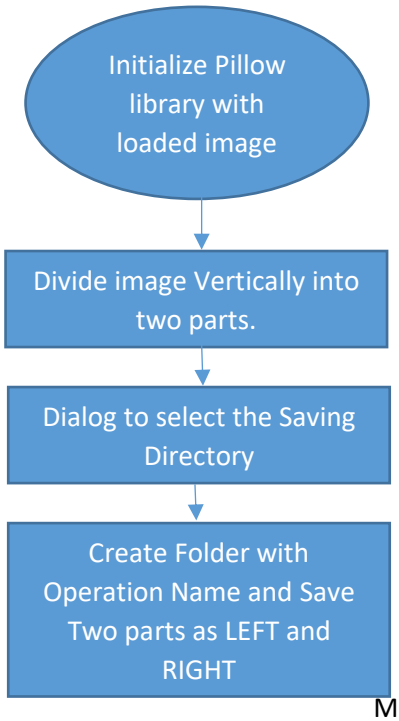
1) Open:
   This function is used for opening the image and loading it onto the application window.



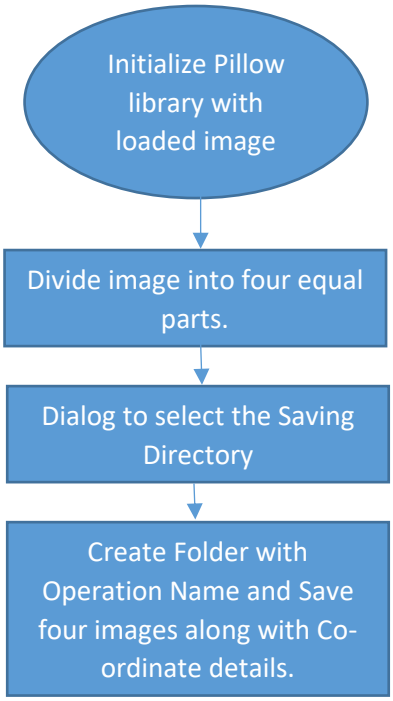
2) Horizontal Slicing:
This function is used for slicing the loaded image horizontally and saved as Top and Bottom.



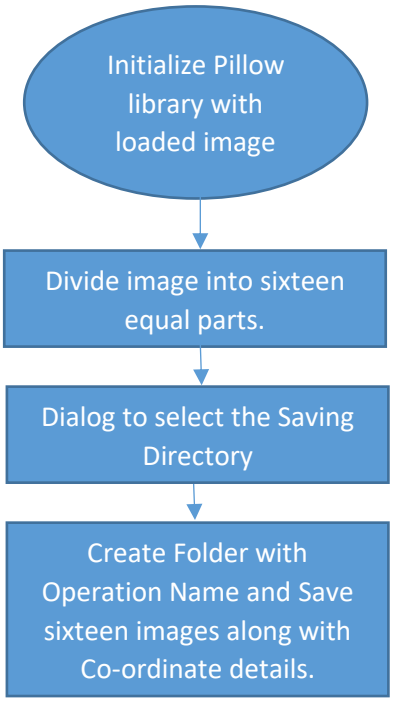

3) Vertical Slicing:
This function is used for slicing the loaded image vertically and saved as Left and Right.



4) 2x2 Slicing:
This function is used for slicing loaded image to four equal images.

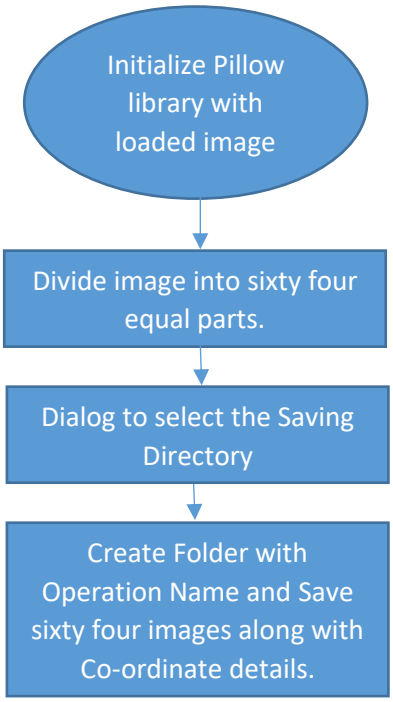



5) 4x4 Slicing:
This function is used for slicing loaded images to 16 equal parts.



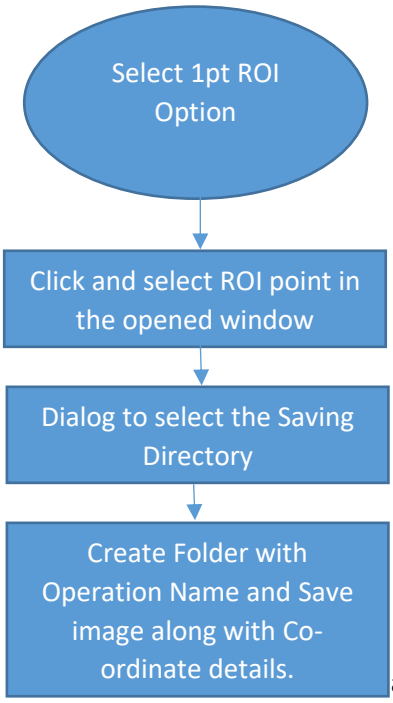
6) 8x8 Slicing:

This function is used for slicing loaded images to 64 equal parts.

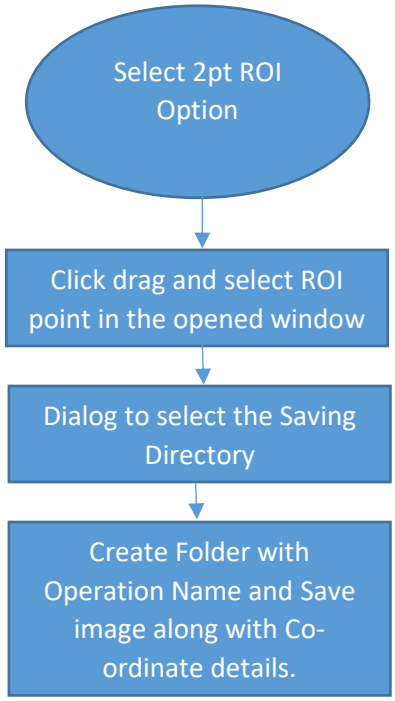



7)1 Point ROI (Region of Interest):

Select a point on the window to select region of interest, it will save 100px around the clicked point.



8) 2 Point ROI (Region of Interest):
This function will open a new window where we have to drag and select region of interest and click enter to save ROI image.




## Graphical User interface (GUI)

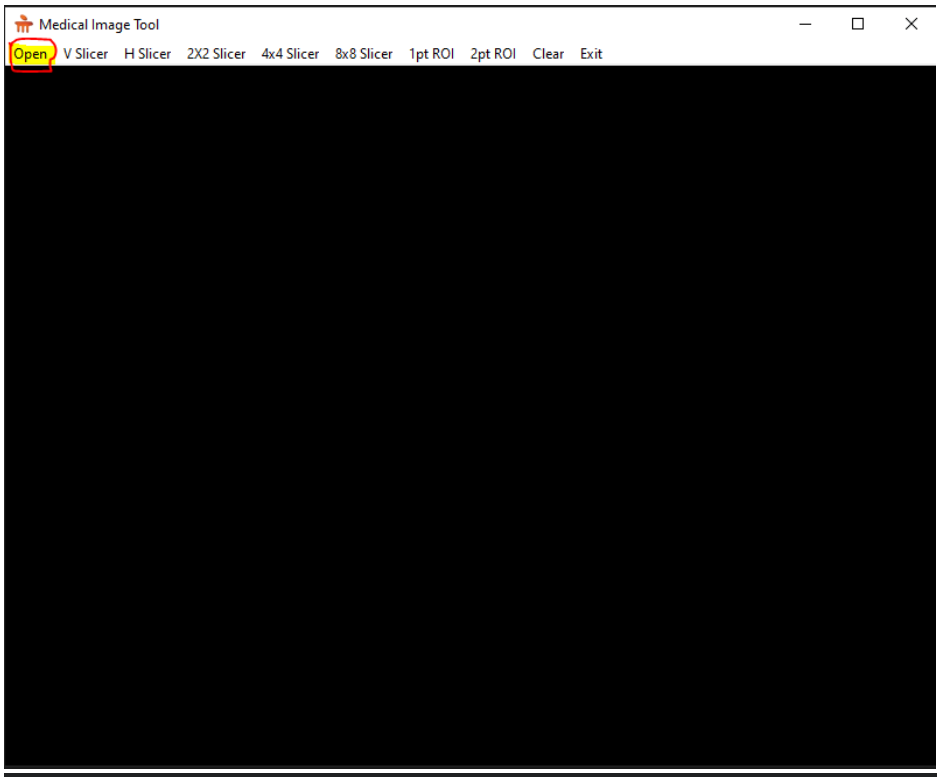
graphical user interface, is a form of user interface that allows users to interact with electronic devices through graphical icons and audio indicator such as primary notation, instead of text-based UIs, typed command labels or text navigation. GUIs were introduced in reaction to the perceived steep learning curve of CLIs (command-line interfaces), which require commands to be typed on a computer keyboard.

The actions in a GUI are usually performed through direct manipulation of the graphical elements. Beyond computers, GUIs are used in many handheld mobile devices such as MP3 players, portable media players, gaming devices, smartphones and smaller household, office and industrial controls. The term GUI tends not to be applied to other lower-display resolution types of interfaces, such as video games (where HUD (head-up display) is preferred), or not including flat screens like volumetric displays because the term is restricted to the scope of 2D display screens able to describe generic information, in the tradition of the computer science research at the Xerox Palo Alto Research Centre.

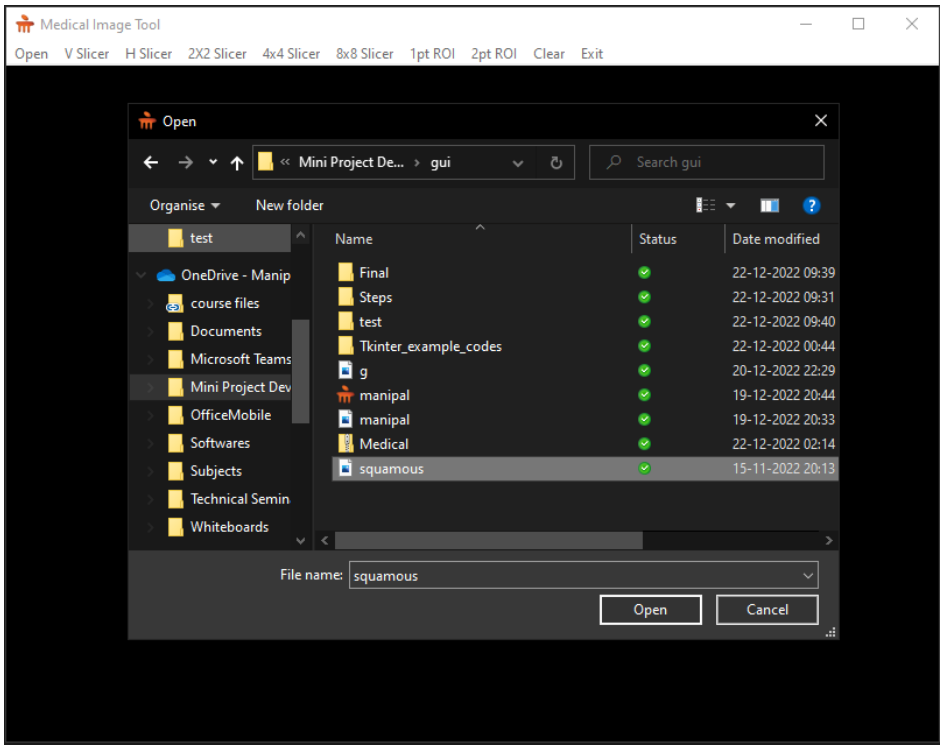
## Steps in Medical tool to perform the 7 operations on the image:

### 1. Open Function in the application to load images

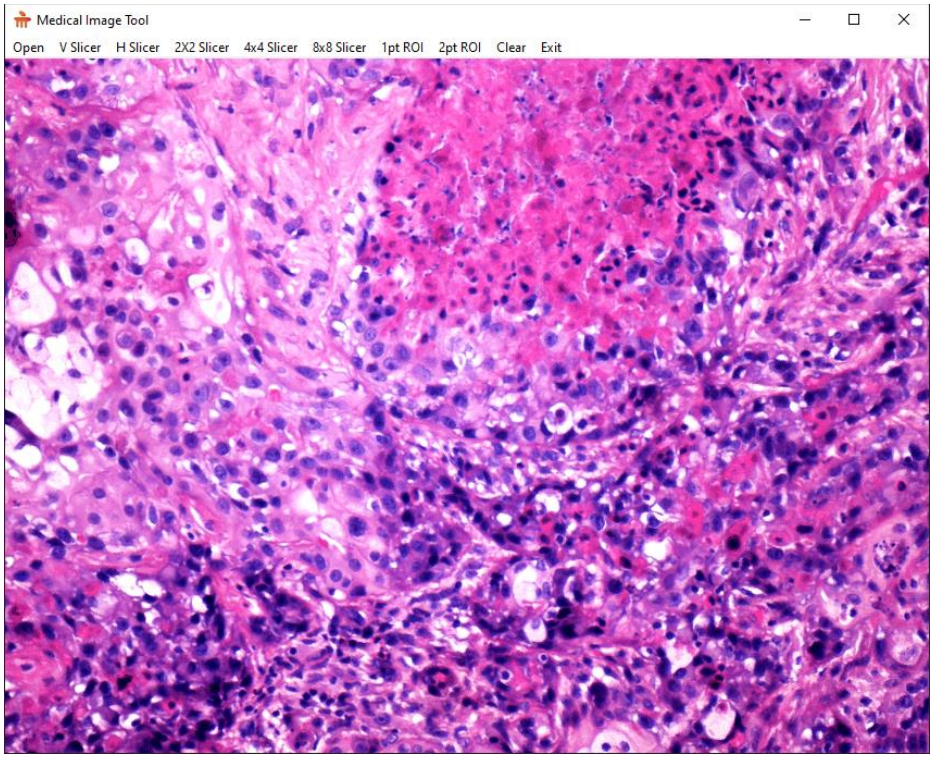
Step1




Step 2

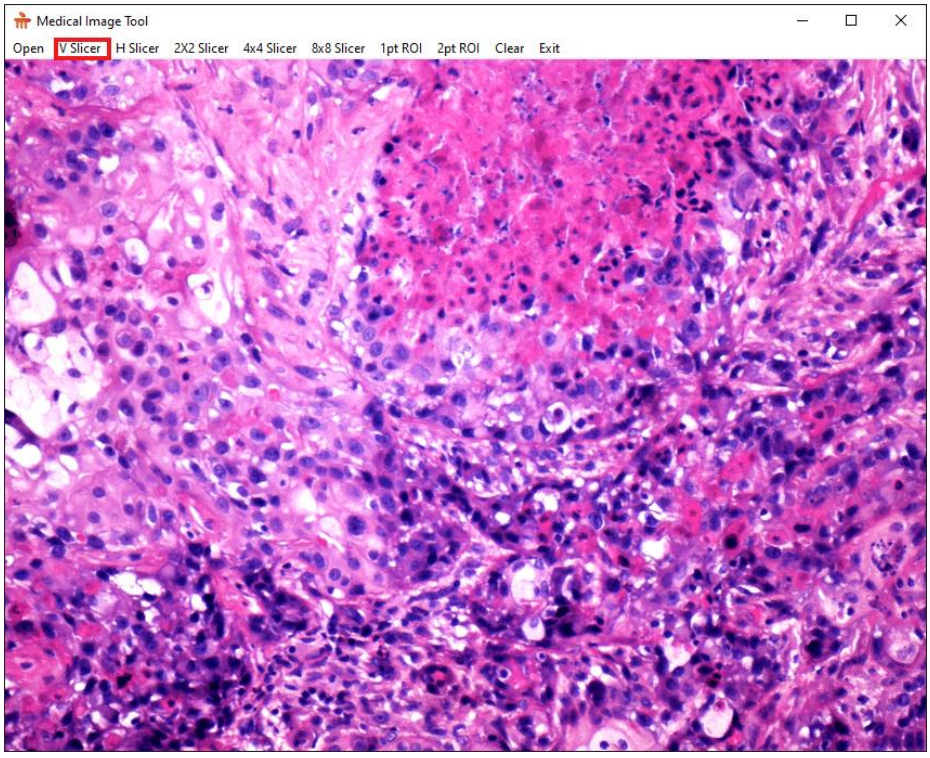


Step 3

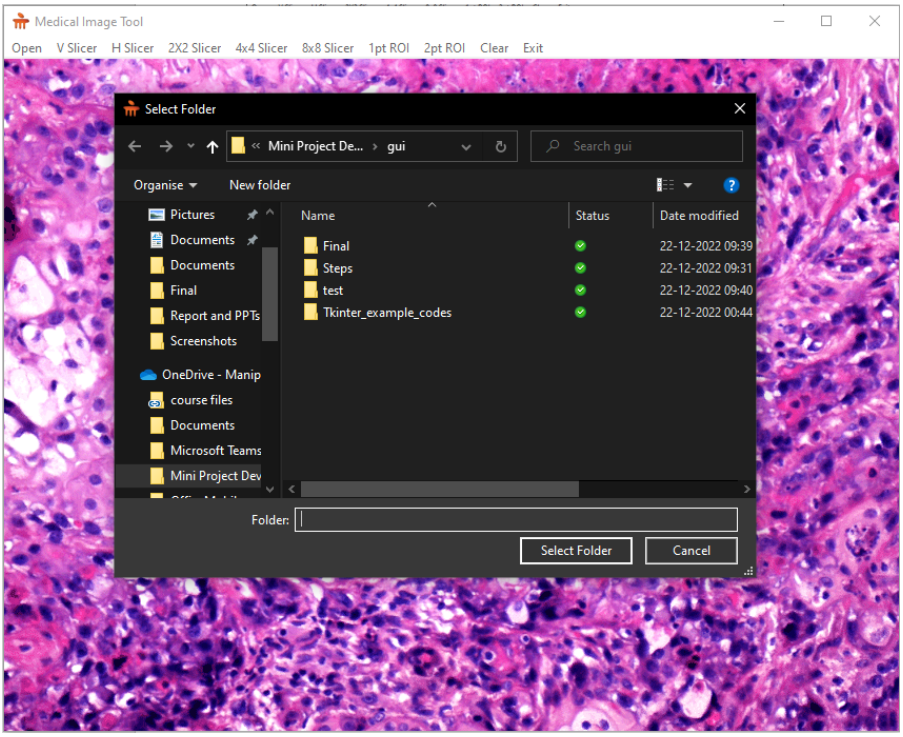



## 2. Vertical Image Slicing operation

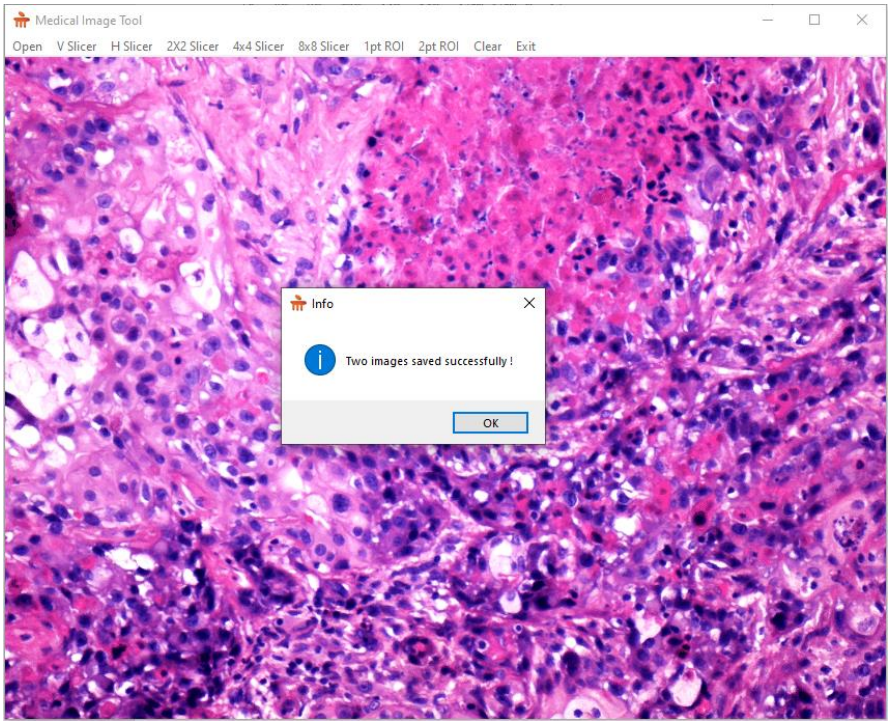
Step 1



Step 2

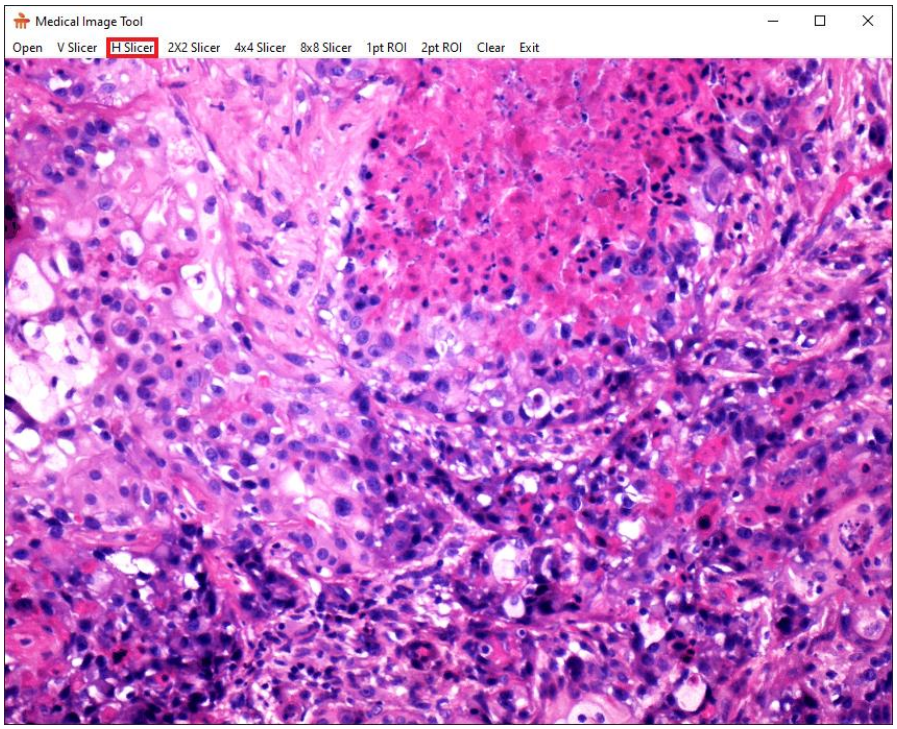

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Select Folder
Mini Project De... › gui
Search gui
Organise
New folder
Pictures
Documents
Documents
Final
Report and PPTs
Screenshots
OneDrive - Manip
course files
Documents
Microsoft Teams
Mini Project Dev
Name
Status
Date modified
Final
22-12-2022 09:39
Steps
22-12-2022 09:31
test
22-12-2022 09:40
Tkinter_example_codes
22-12-2022 00:44
Folder:
Select Folder
Cancel

Step 3:

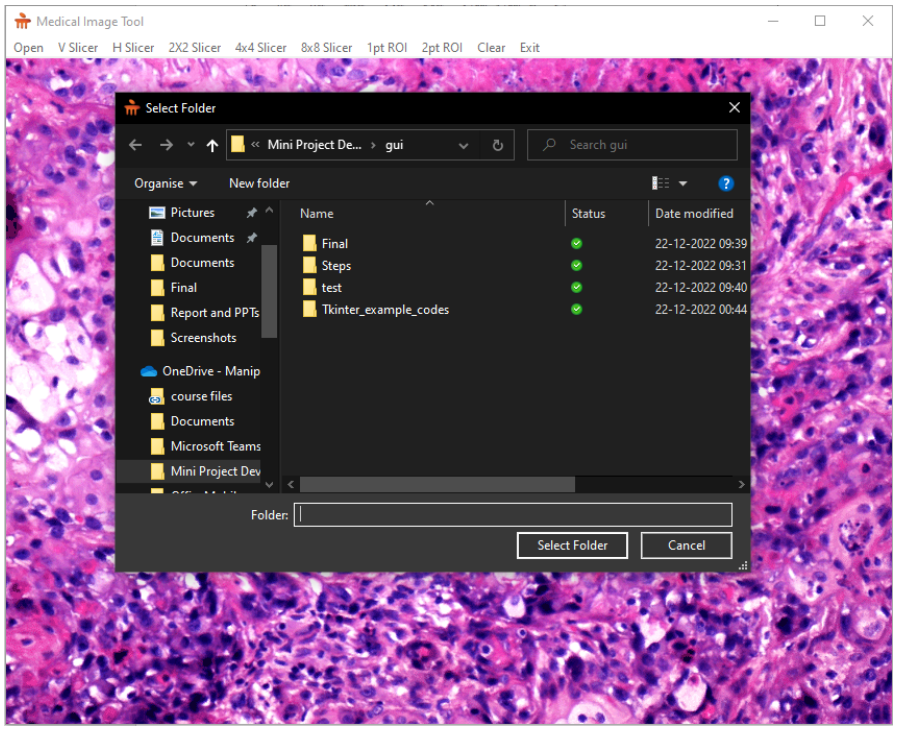

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Info
Two images saved successfully !
OK

## 3. Horizontal Image Slicing operation

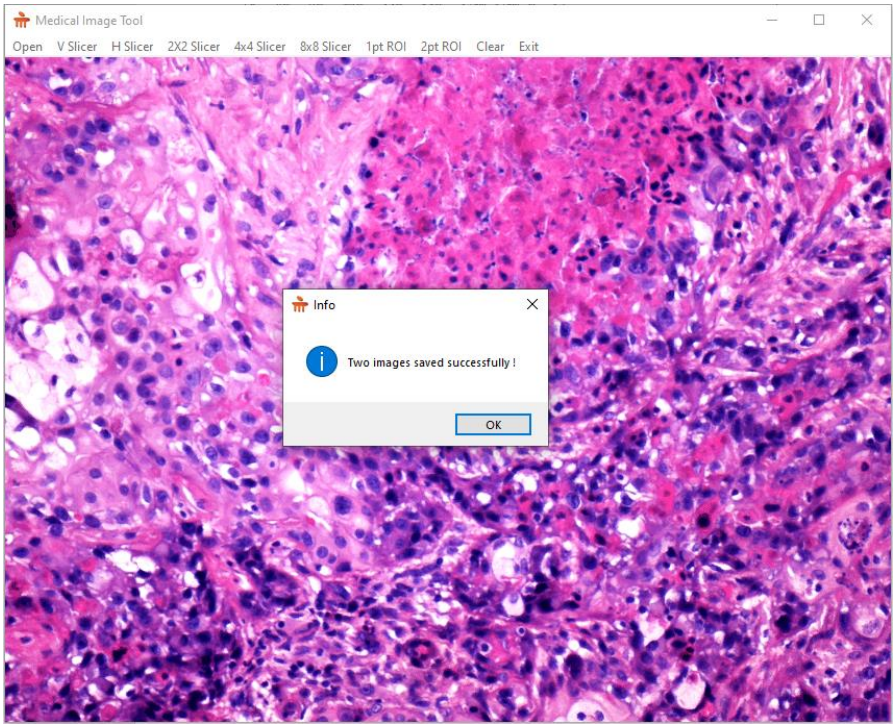
Step 1:




Step 2:

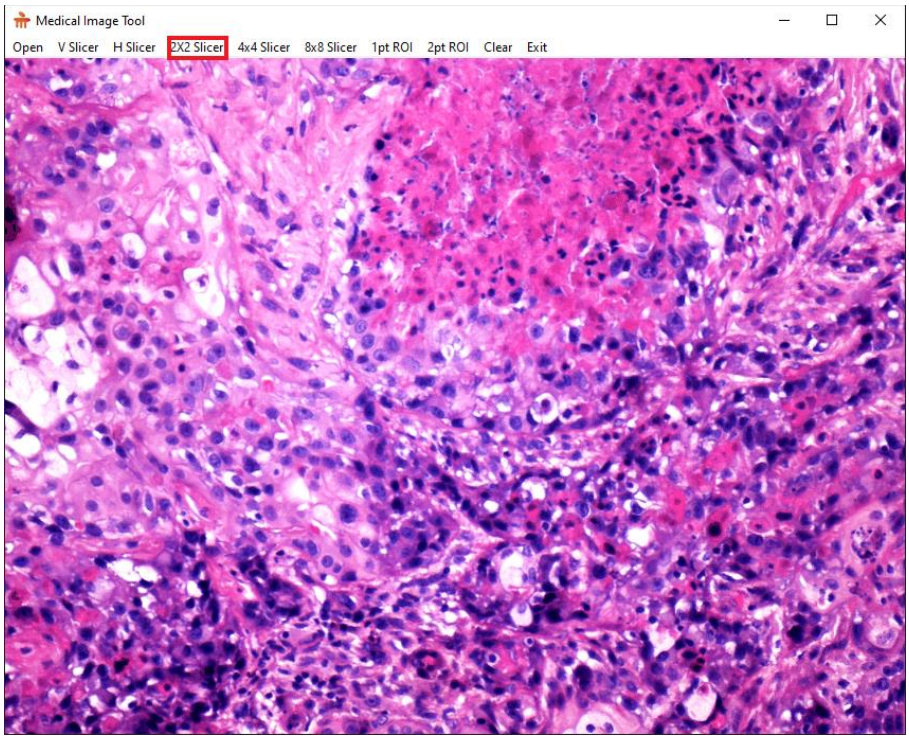


Step 3:

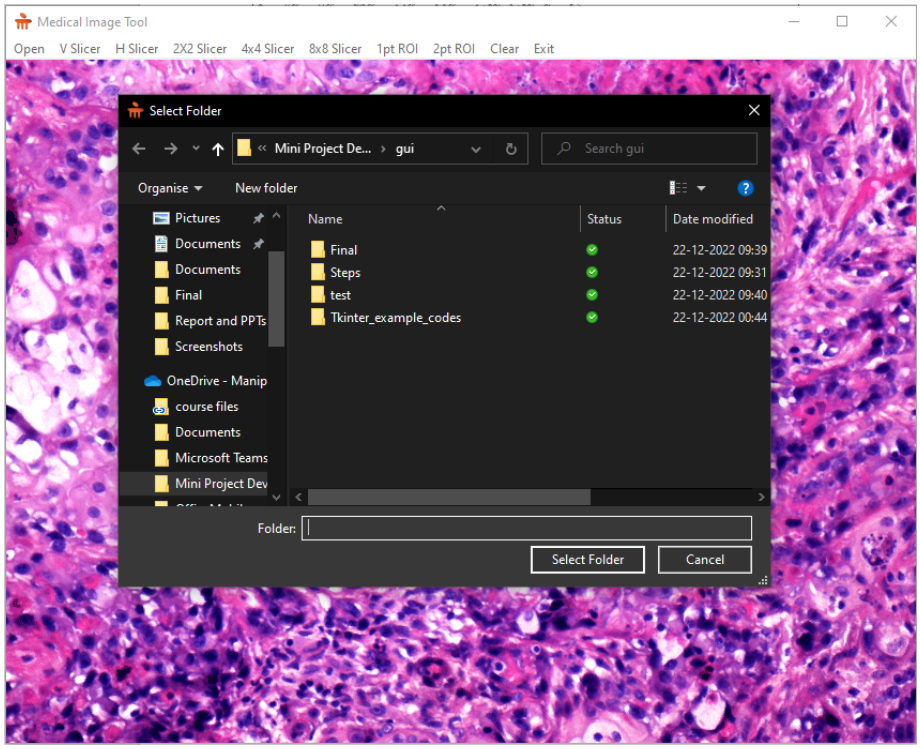



## 4. 2x2 Image Slicing operation

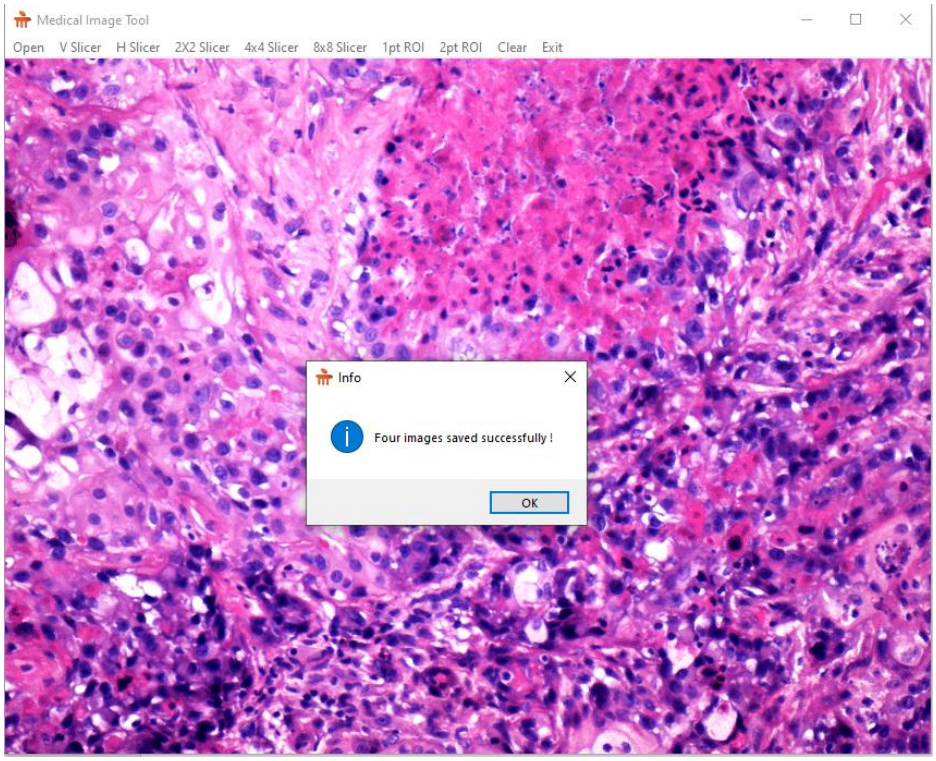
Step 1:



Step 2:

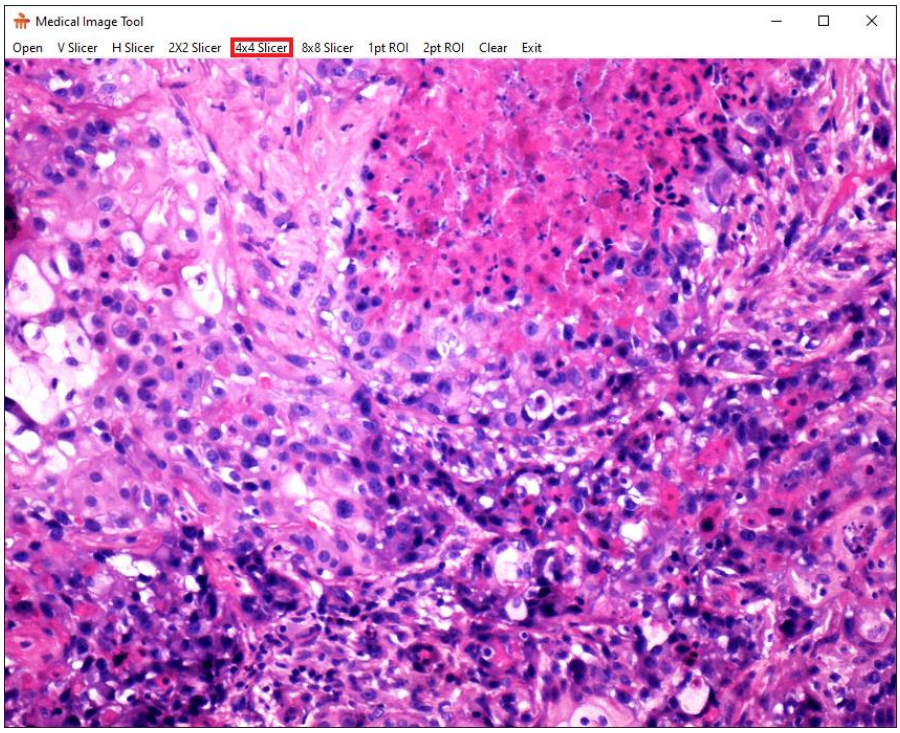

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Select Folder
Mini Project De... › gui
Search gui
Organise
New folder
Pictures
Documents
Documents
Final
Report and PPTs
Screenshots
OneDrive - Manip
course files
Documents
Microsoft Teams
Mini Project Dev
Name
Status
Date modified
Final
22-12-2022 09:39
Steps
22-12-2022 09:31
test
22-12-2022 09:40
Tkinter_example_codes
22-12-2022 00:44
Folder:
Select Folder
Cancel

Step 3:

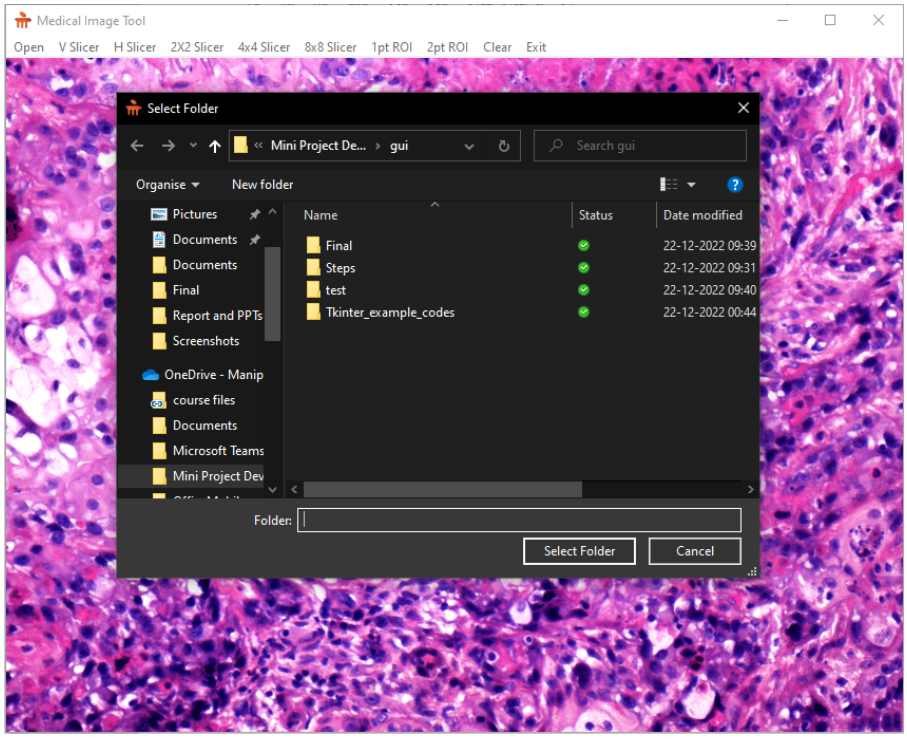

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Info
Four images saved successfully !
OK

## 5. 4x4 Image Slicing operation

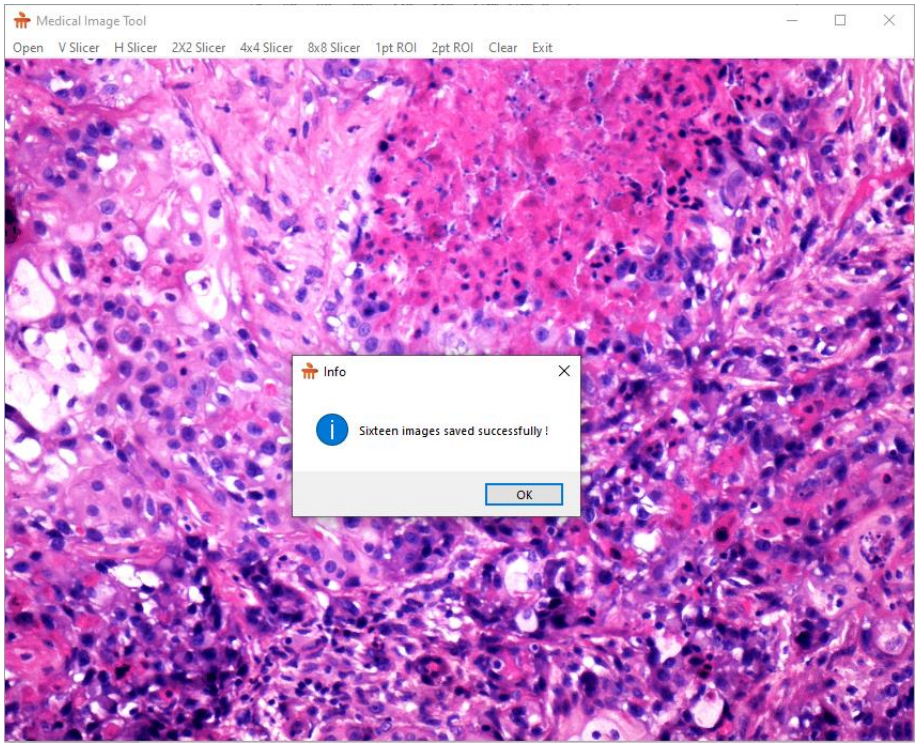
Step1:




Step 2:

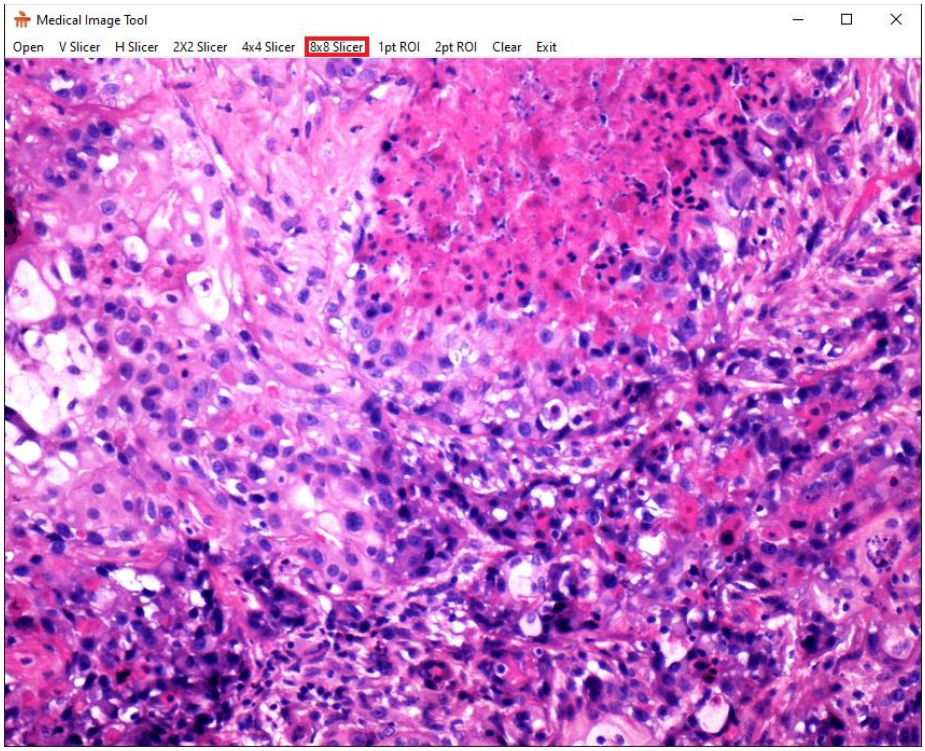


Step 3:

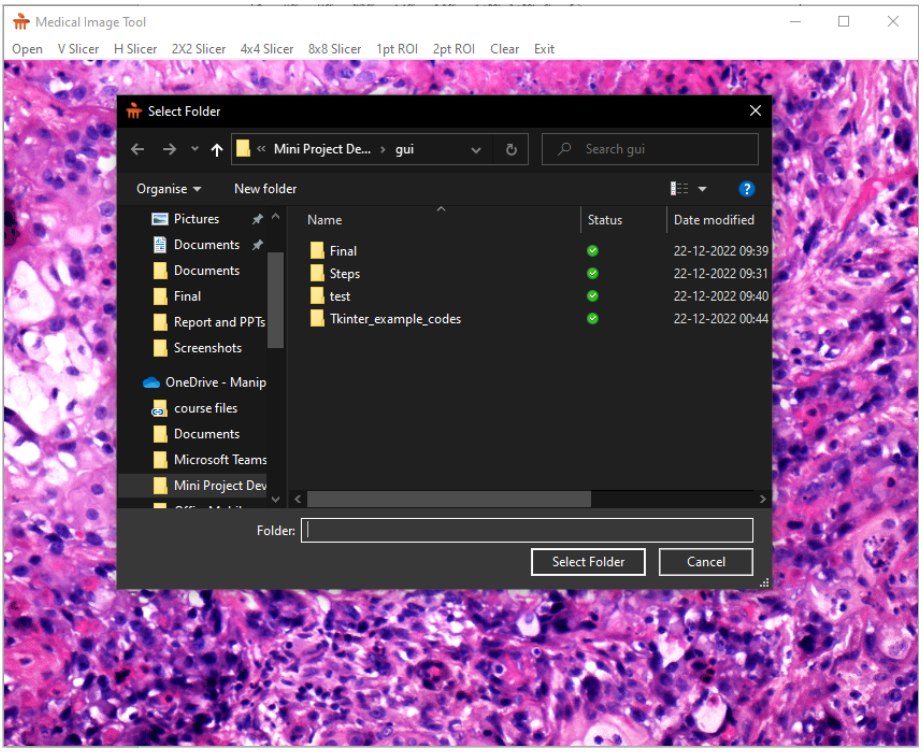



## 6. 8x8 Image Slicing operation

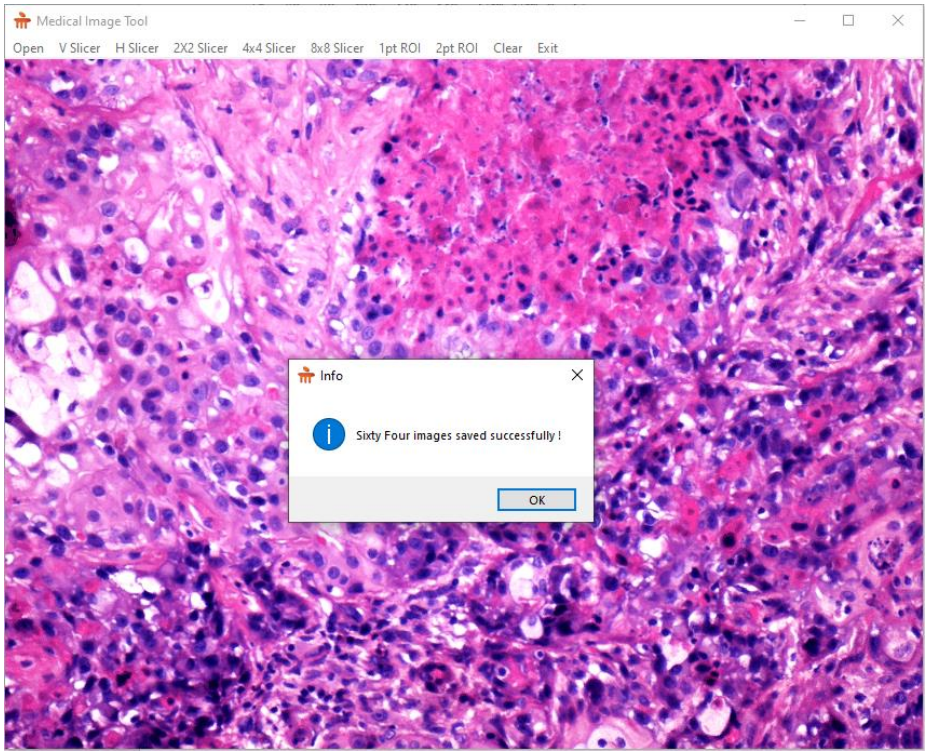
Step 1:



Step 2:

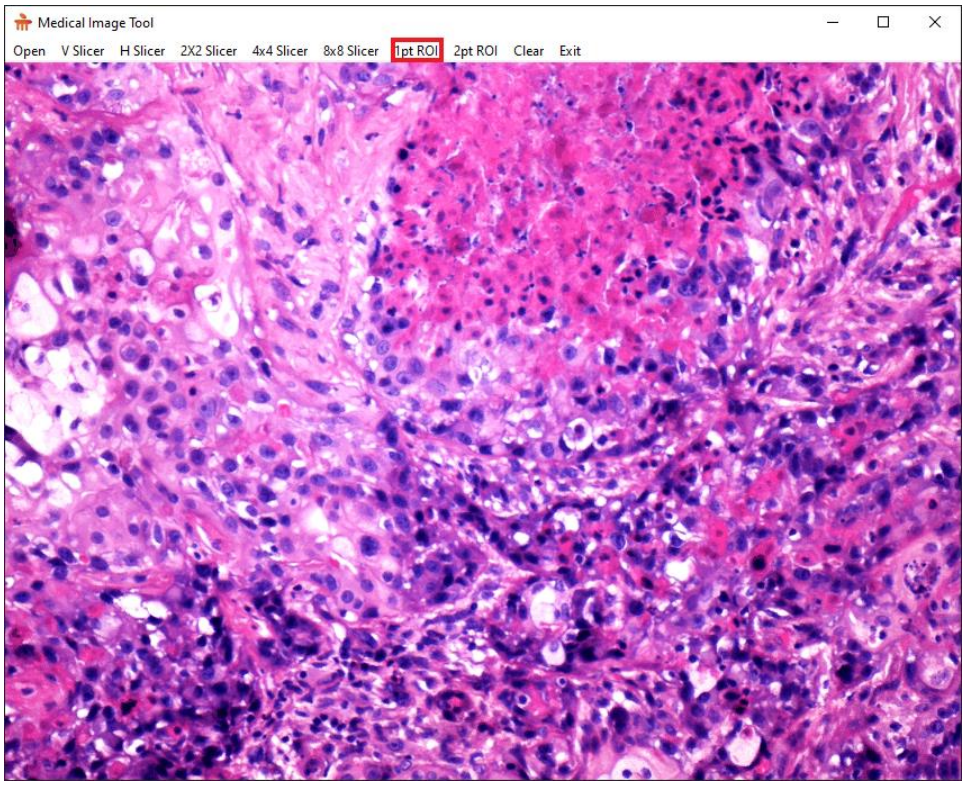

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Select Folder
Mini Project De... › gui
Search gui
Organise
New folder
Pictures
Documents
Documents
Final
Report and PPTs
Screenshots
OneDrive - Manip
course files
Documents
Microsoft Teams
Mini Project Dev
Name
Status
Date modified
Final
22-12-2022 09:39
Steps
22-12-2022 09:31
test
22-12-2022 09:40
Tkinter_example_codes
22-12-2022 00:44
Folder:
Select Folder
Cancel

Step 3:

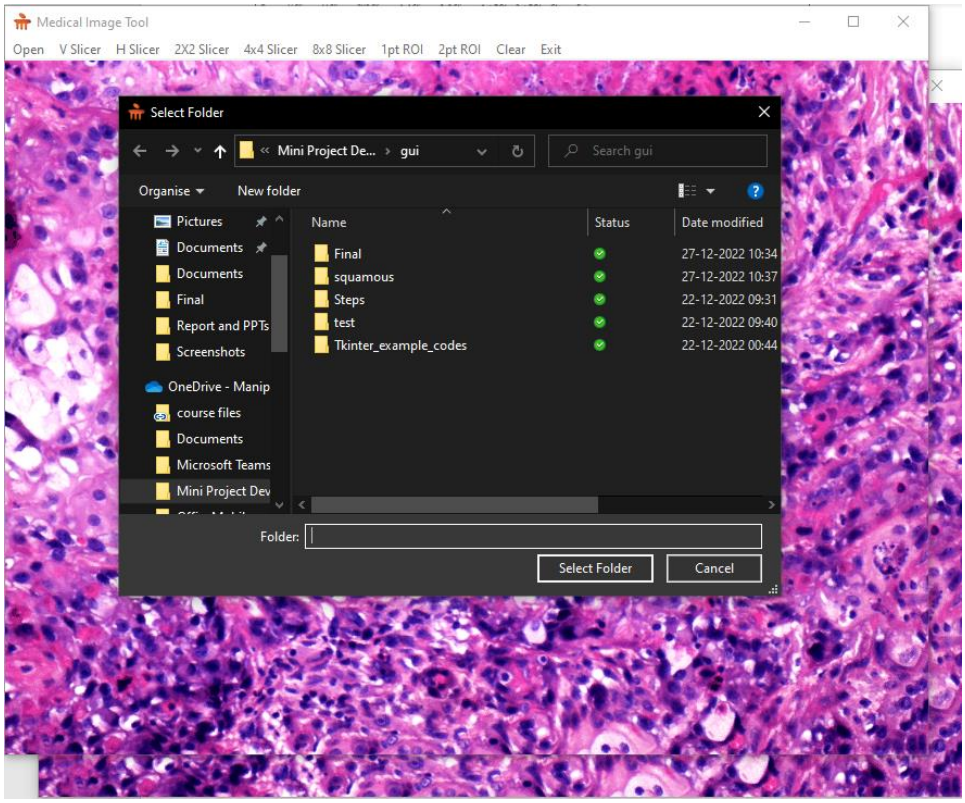

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Info
Sixty Four images saved successfully !
OK

## 7. 1 point ROI image Slicing Operation

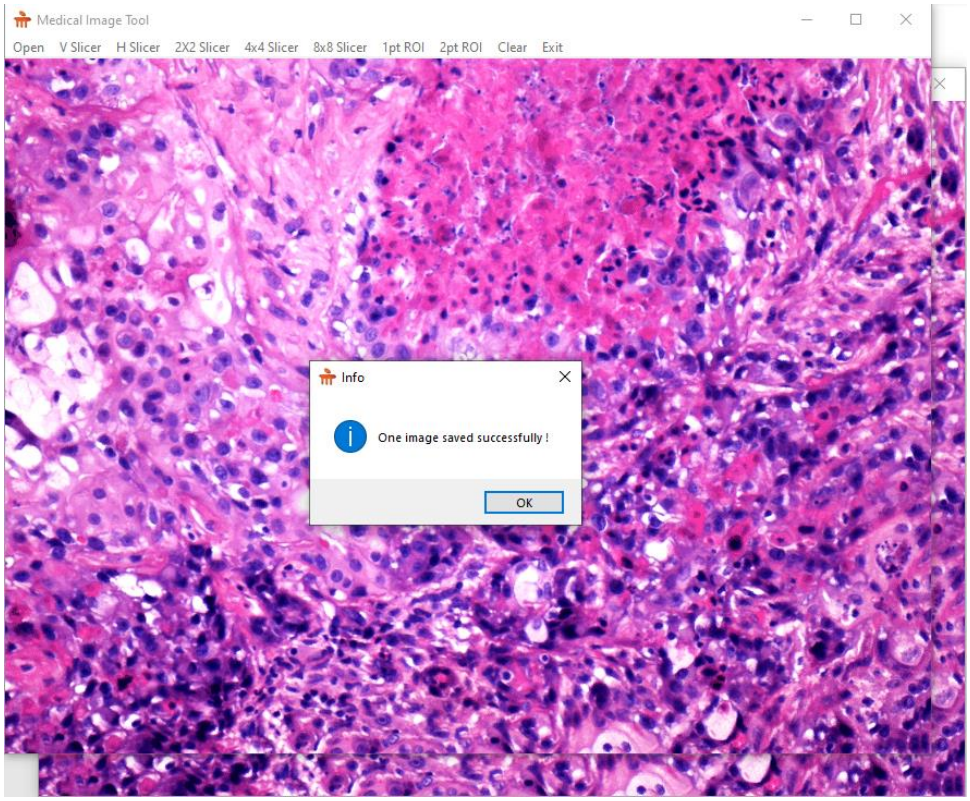
Step 1:




Step 2:

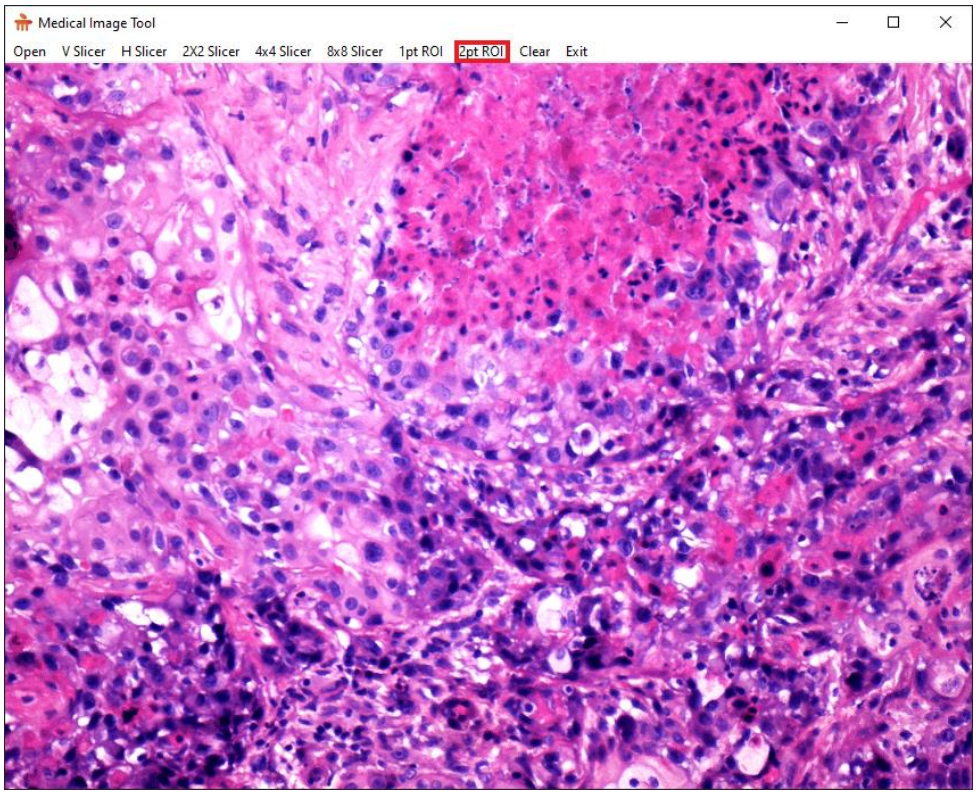


Step 3:

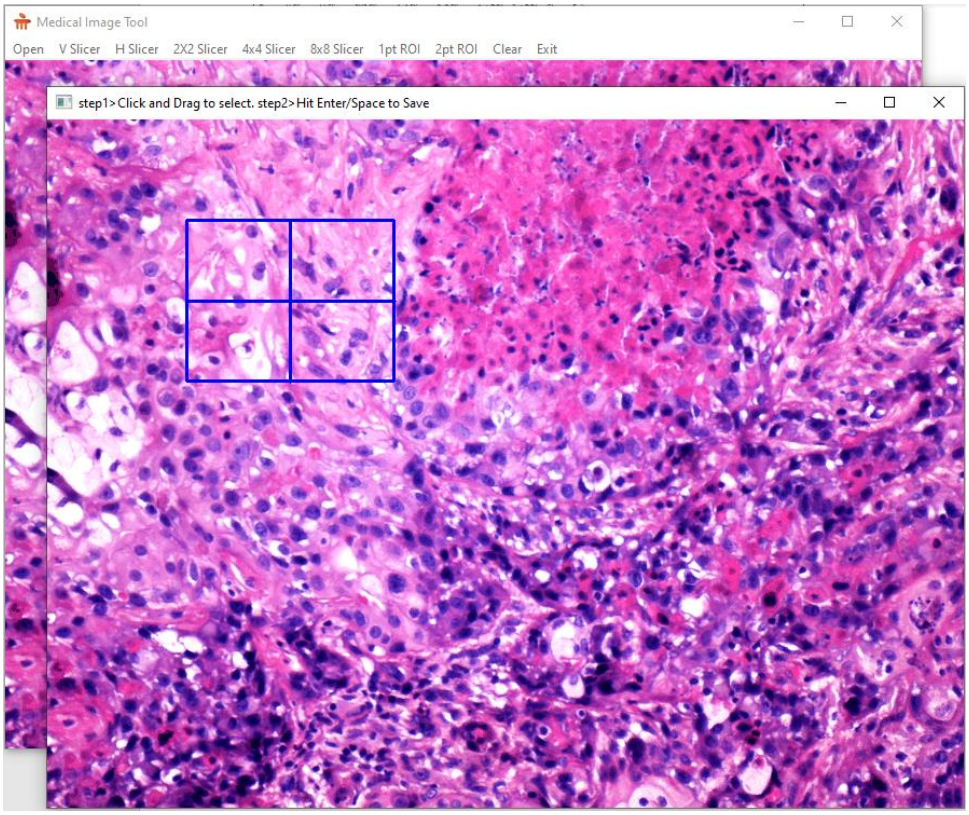



## 8. 2 point ROI image Slicing Operation

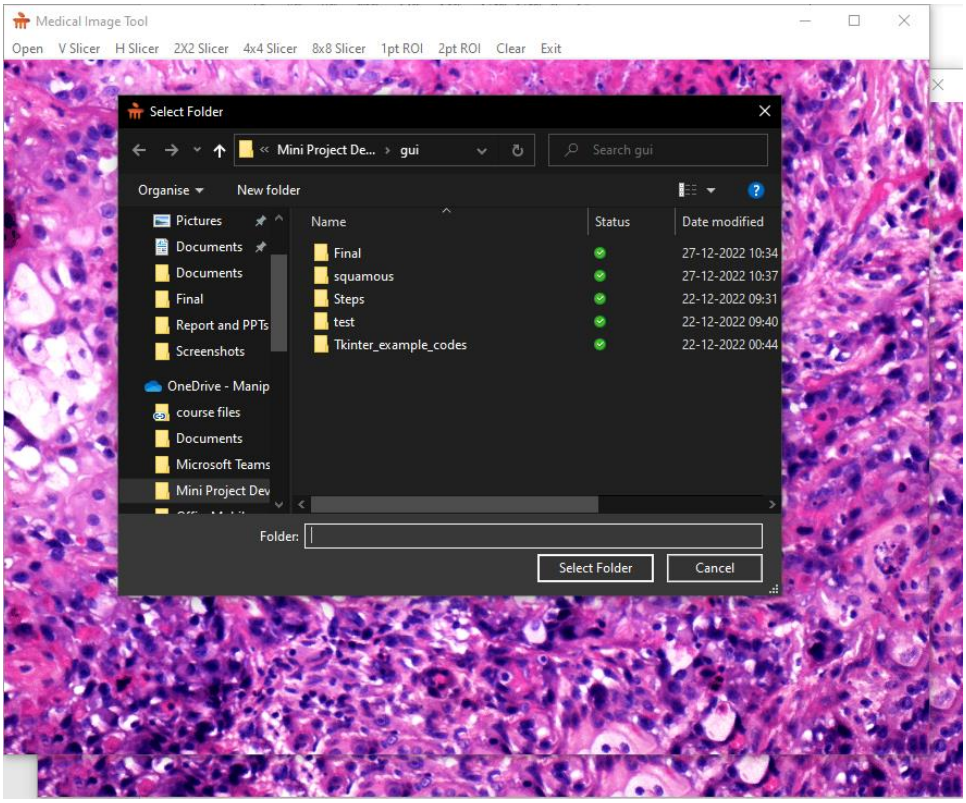
Step 1:



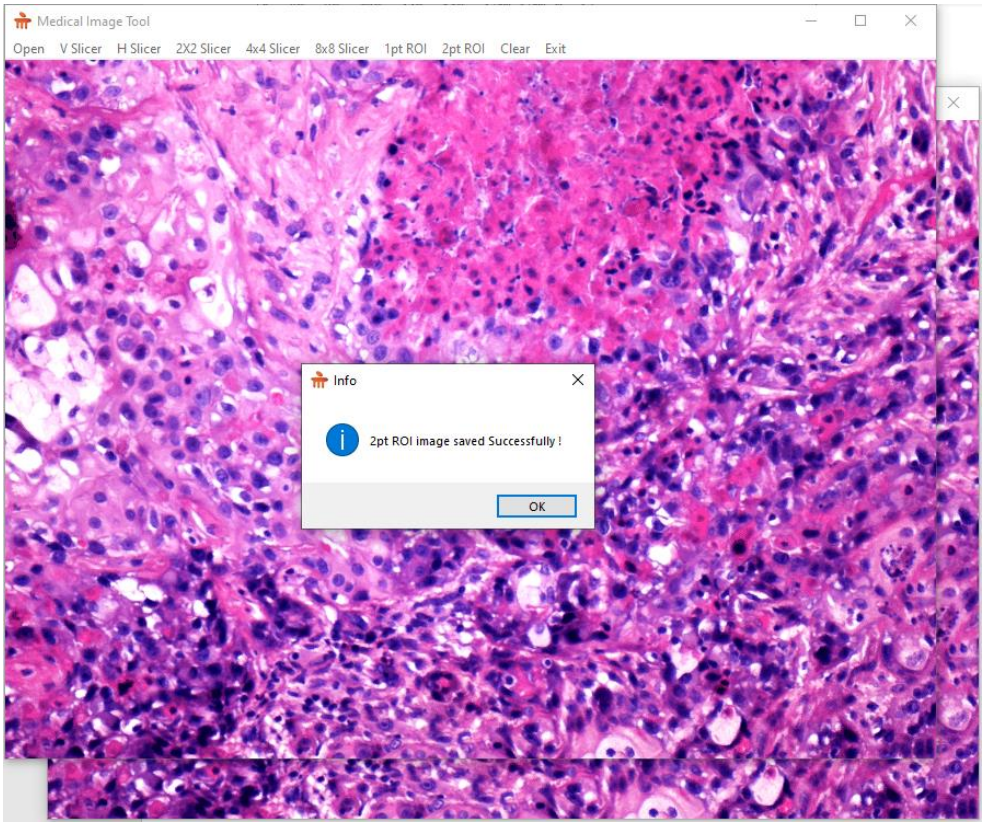
Step 2:


Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
step1>Click and Drag to select. step2>Hit Enter/Space to Save

Step 3:

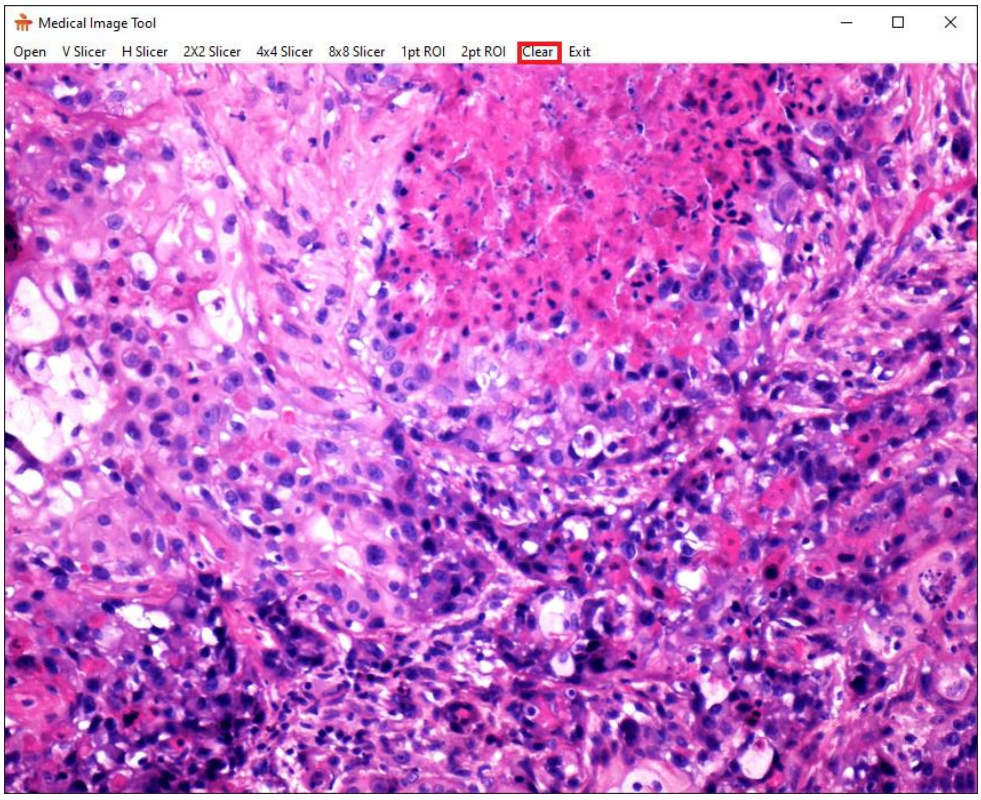

Medical Image Tool
Open V Slicer H Slicer 2X2 Slicer 4x4 Slicer 8x8 Slicer 1pt ROI 2pt ROI Clear Exit
Select Folder
Mini Project De... › gui
Search gui
Organise
New folder
Pictures
Documents
Documents
Final
Report and PPTs
Screenshots
OneDrive - Manip
course files
Documents
Microsoft Teams
Mini Project Dev
Name
Status
Date modified
Final 27-12-2022 10:34
squamous 27-12-2022 10:37
Steps 22-12-2022 09:31
test 22-12-2022 09:40
Tkinter_example_codes 22-12-2022 00:44
Folder:
Select Folder
Cancel

Step 4:

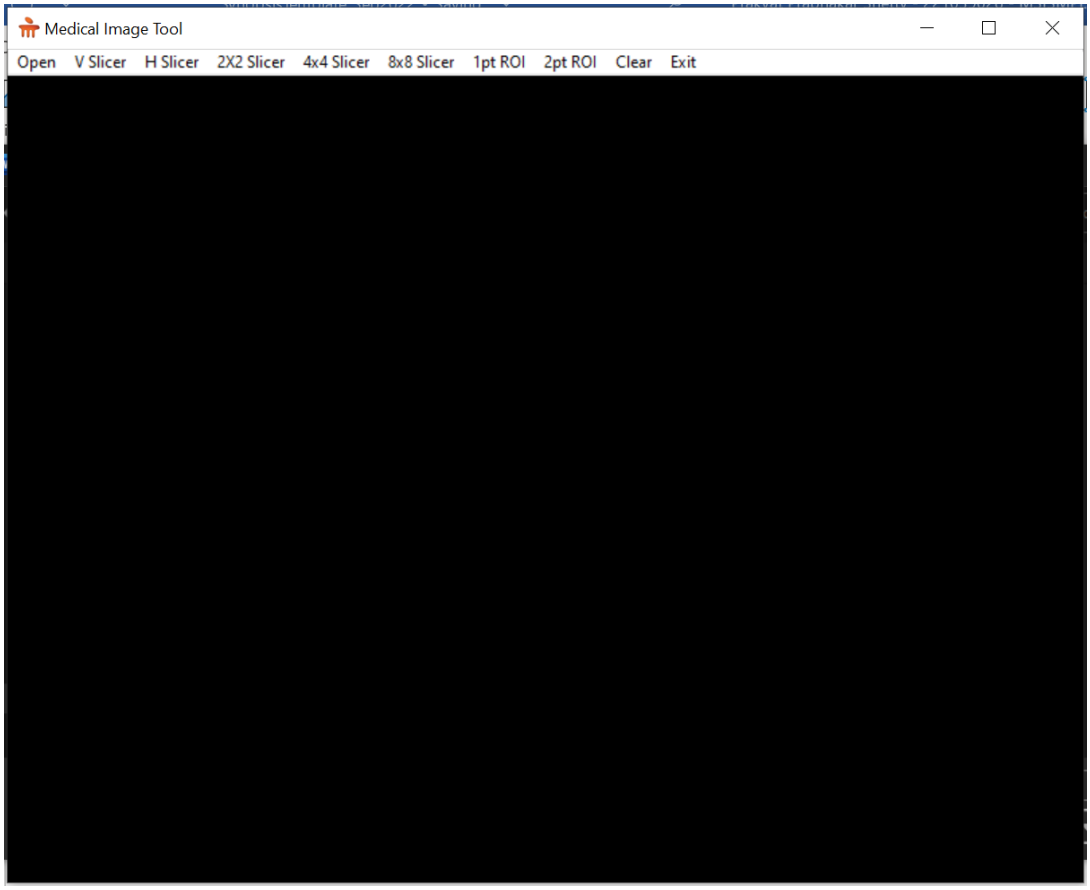



## 9. Clear the window

Step 1:



Step 2:




## Future Scope:

Further the project can be incorporated with deep learning to perform both slicing and analysis of image in a single tool instead of using multiple tools for the same purpose.

The number of tools for enhancing the images can be added such as normalization of image and adding halftone to image as per researcher requirements.

The GUI can be redesigned based on user feedback.

## References:


1) https://www.geeksforgeeks.org/python-opencv-selectroi-function/
2) https://docs.opencv.org/3.4/js_basic_ops_roi.html
3) https://stackoverflow.com/questions/5953373/how-to-split-image-into-multiple-pieces-in-python
4) https://www.geeksforgeeks.org/crop-image-with-opencv-python/
5) https://docs.python.org/3/library/tk.html
6) https://pillow.readthedocs.io/en/stable/
7) https://www.cancer.gov/publications/dictionaries/cancer-terms/def/squamous-cell
8) https://www.mdanderson.org/content/mda/en/cancerwise/2022/11/squamous-cell-carcinomas--8-things-to-know-about-the--cancer-of-the-surfaces/jcr:content/blog/adaptiveimage.resize.1296.0.high.jpg/1669646541583.jpg