The Open Microscopy Environment (OMERO) For Marine Organism Imaging*

Extended Abstract†

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ABSTRACT

Many biologists face the struggle of not being able to secure the data that they many want. Along with that they find it as a challenge to share images as well. With the financial stand point they are not able to purchase certain microscopes in order to search for their data so this is where OMERO comes in. OMERO is an open source meaning its free and biologists do not have to worry about spending money.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability;

KEYWORDS

OMERO, Paraview, ImageJ, Visualization

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1 INTRODUCTION

OMERO [1] is defined as a software that "handles all your images in a secure central repository. You can view, organize, analyze, and share your data from anywhere you have Internet access. Work with your images from a desktop app (Windows, Mac or Linux), from the web or from 3rd party software. Over 140 image file formats supported, including all major microscope formats."[1] The OMERO software is mostly used for storing tons of data and imaging. The current challenge biologists face is that they do not have a standard way to interact and analyze microscopy data without a software license with the specific microscope company, with an example such as .lif from Leica microscope. Paraview is known for "an open-source, multi-platform data analysis and visualization application. Paraview users can quickly build visualizations to analyze their data using qualitative and quantitative techniques. The data exploration can be done interactively in 3D or programmatically using ParaviewâĂŹs batch processing capabilities."[2] Paraview analyzes datasets using memory computer resources. While using Paraview their is also a Python shell that can be used in order to get images from OMERO. ImageJ "is a public domain, Java-based image processing program developed at the National Institutes of Health. ImageJ was designed with an open architecture that provides extensibility via Java plugins and recordable macros. Custom acquisition, analysis and processing plugins can be developed using ImageJ's built-in editor and a Java compiler."[3] OMERO also has a plugin for ImageJ. ImageJ can read the Meta data specific to the microscopy data. Metadata is just information in a photo of some sort. An example of data from a picture can perhaps be the pixels from that particular photo.

2 METHODOLOGY

2.1 Setup of OMERO

In order to have OMERO [4] run properly a Linux computer had to be used. With the program running on the Linux computer the user was able to access the interface off of a windows computer once the IP address was connected to OMERO. On the OMERO "Getting Started" link it shows the step by step process on how to setup OMERO on the windows computer. The important thing to

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¶The secretary disavows any knowledge of this author's actions.
‖The secretary disavows any knowledge of this author's actions.
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[1]https://www.openmicroscopy.org/site/products/omero
[2]https://www.paraview.org/
[3]https://en.wikipedia.org/wiki/ImageJ

Figure 1: A process of how each of the softwares connect to one another.

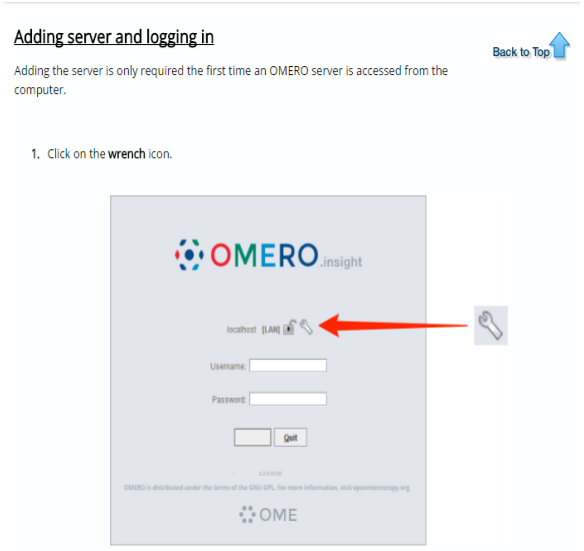

Figure 2: A process of how each of the softwares connect to one another.

remember to do is to connect the server from the Linux computer to the windows computer.

2.2 Setup of Paraview

On the paraview [2] homepage the user would go to the top right of the screen and click on the "Download" tab. Their are three different operating systems this software can be downloaded on whether it is Windows 64-bit, Linux 64-bit, or Mac OS X. Once the operating

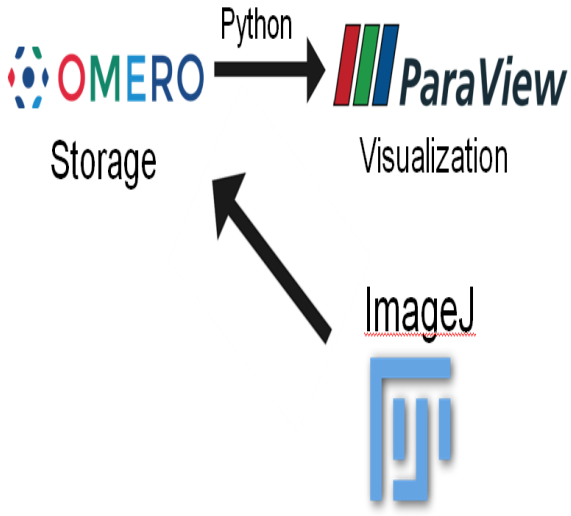

Figure 3: A process of how each of the softwares connect to one another.

system is chosen then the user would click download that is located beneath "File to Download". When that is completed the user would be able to access the program from either the start menu or by clicking on the folder and opening up the application.

2.3 Setup of ImageJ

OMERO has a plugin for ImageJ [3]. Once the data is collected from OMERO the data can be exported into raw data so the image can display in paraview. The three softwares connected basically work in a triangle. To get ImageJ download the user would go to the OMERO website and downloads. If the user scrolls down they will see "ImageJ/Fiji" under OMERO plugin downloads and continue on by extracting the file.

2.4 Data Conversion

With the data that was given they were stored as ".lif" files. After using the .lif files it was determined that by the files being saved in that format it would be difficult to be able to visualize them. Another format that we used was known as a .tif file. Once all the data that was going to be used had been collected the goal was to convert those files into .tif and begin to go through a process so that they can be visualized.

The data that was received dealt with the image of Salmon Lice. It was collected through the viewing from a microscope and all done on the same channel. The task was to attempt to get the image to a part where an individual would be able to visualize the image in 3D.

2.5 Visualization

With the image being saved as a .tif file running it under ImageJ was a success. Before any image was able to be visualized it had to be imported first onto Imagej through an image sequence. Once that

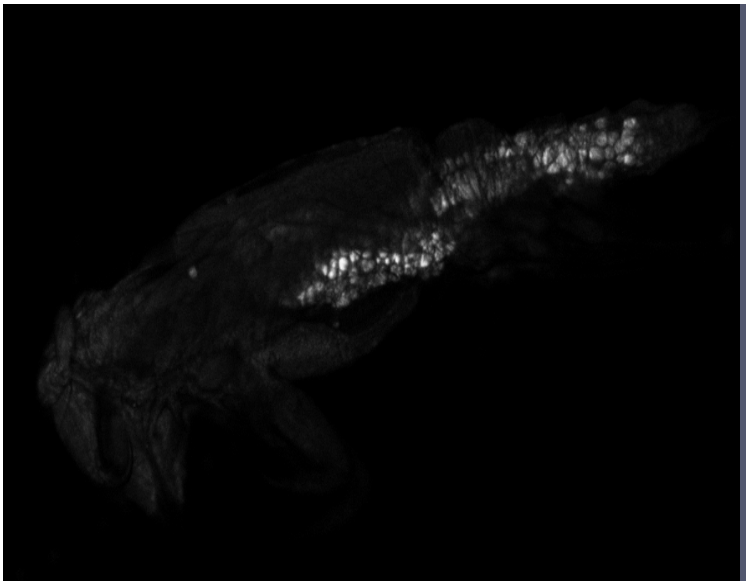

Figure 4: Salmon Lice that had been collected.

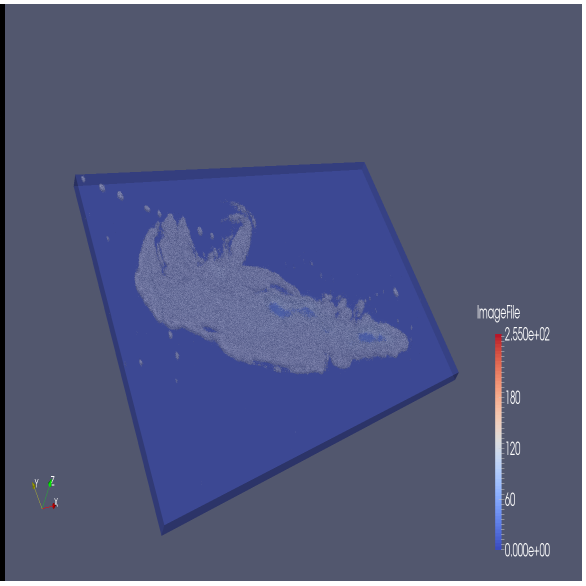

Figure 5: Visualized image of Salmon Lice

was completed the user had to gain the info from that specific image which contained the width, height, and the depth which should be noted down along with the "Bits per pixel". This information is located on the "Image" and "Show Info" tab. This information is important when the user is trying to use it on the next interface to get the image display in 3D. Next, the user would save this image as "Raw Data", meaning it would be saved as a .raw file. Once it is saved as a .raw file then that is when the user would transition over to paraview where they can continue to work with the image. Once in paraview the user would open file and select the data that was saved as .raw. Earlier it stated that the width, height, and the depth of the image should be noted down. This information would be noted down in the "Data Extent portion of the interface. Only on the right side of that specific column should be used. Whatever number was given in the width, height, and depth should be inserted in the Data Extent column one number less so for example the number "41" given for the width would be entered in the Data Extent as "40". Another thing that the user will have to focus on is "Data Scalar Type" This portion is determined by the "Bits per pixel" which is also located in the "Image" and "Show Info" tab of ImageJ. Now that all of that information has been entered the user would then click apply which with then display a 3D image. The image that is shown would be a surfaced image but most would prefer a volumed image and it can be changed to that as well by going to the top of paraview and where it states "Surface" click that tab and change it to volume.

3 RESULTS

After hours of messing around with images that were displayed on different channels of a microscope an image was finally able to be shown. The image that was visualized was Salmon Lice which is shown in the figure below. OMERO is used by many biologists across the world. For the simple fact that open microscopy helps a lot of biologists due to financial reasons most of them do not have the money to afford some microscopes to use. OMERO comes to the rescue because biologists are able to share their data with other scientists who may find the data useful or amusing. In order to visualize the images from OMERO, Paraview and ImageJ would be beneficial to most.

4 CONCLUSION

After weeks of research OMERO is very beneficial for most biologists. Without OMERO they would not be able to view or access other peoples data and viewing their interest of others. In connection to OMERO, Paraview and ImageJ work together in order to visualize the image that was able to be displayed. The users faced many challenges before OMERO had come into the picture. They would have to go through paying microscopes meaning they are losing a lot of money to try and get this data while OMERO is online and they are able to get the data.

5 FUTURE WORKS

For future works people plan to assist Dr. Mounts lab to have a central location of storage using OMERO. OMERO is beneficial to him as well. Along with that people in the lab would want to enhance scientific communication. Lastly exchange between different groups and management within the lab.

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