Module EE565  
Medical Imaging and Visualization Assignment #2  
3D Rendering Technique

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Part 1

Update the maximum intensity projection program so that it implements transparent voxel rendering using ?



1. Call method getSliceAsBufferedImage() from MaximumIntensityProjection().

Which will return a Buffered image.

**public** **class** MaximumIntensityProjection **extends** JFrame{

**public** MaximumIntensityProjection() {

Volume volume = **new** Volume("Stanford-CT\_Head.vol");

BufferedImage bufferedImage = volume.getSliceAsBufferedImage();

JFrame frame = **new** JFrame();

frame.setLayout(**new** BorderLayout());

JLabel label = **new** JLabel(**new** ImageIcon(bufferedImage));

frame.add(label);

frame.pack();

frame.setDefaultCloseOperation(JFrame.*EXIT\_ON\_CLOSE*);

frame.setVisible(**true**);

}

**public** **static** **void** main(String args[]) {

**new** MaximumIntensityProjection();

}

}

1. Inside getSliceAsBufferedImage() get the the following image “stannford-CT\_Head.vol” data:

**int** volumeWidth = volume.getWidth(); // Width

**int** volumeHeight = volume.getHeight(); //Height

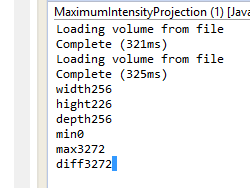
**int** volumeDepth = volume.getDepth(); //Depth

Range range = getRange();

**int** min = range.getMinimum(); // Minimum Voxel color = 0

**int** max = range.getMaximum(); //Maximum Voxel color = 3272

**int** diff = max - min; //Difference 3272



// create a buffered image with this data

BufferedImage image = **new** BufferedImage(volumeWidth, volumeHeight, BufferedImage.*TYPE\_INT\_ARGB*);

// initialize variables

**float** C\_out = 0.0f; // initialize to black (0.0)

// Enter the volume rendering loop

**for**(**int** x=0; x<volumeWidth; x++){

**for**(**int** y=0; y<volumeHeight; y++){

C\_in = 0.0f; // initialize to 0.0 the color coming into the voxel that is furthest from the view plane is black (0.0)

**for** (**int** z=0; z<volumeDepth; z++) // Render from front of head to back

**// for**(**int** z=volumeDepth-1; z>=0; z--) // come from Back of head furthest from plane. This process starts at the voxel that is furthest from the view plane

{

**int** voxel = getVoxel(x, y, z);

**int** grey = ((voxel - min) \* 255) /diff //C value

**float** alpha = grey/255.0f; //255.0 (white);

C\_out = C\_in\*(1.0f - alpha) + grey\*alpha; // ray casting formula e.g. -> Cin = 0,C = 255,alpha = 0.8.

C\_in = C\_out; // C\_in is now the value of C\_out going through the loop

}

**int** grey = (**int**)C\_out; //cast to int for pixel formula

**int** pixel = 0xff000000 | (grey << 16) | (grey << 8) | grey;

image.setRGB(x,volumeHeight-1-y, pixel); // use volumeHeight-1 else upside down

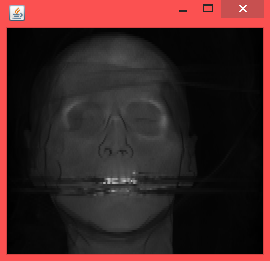
}

}

**return** image;

}

Output:



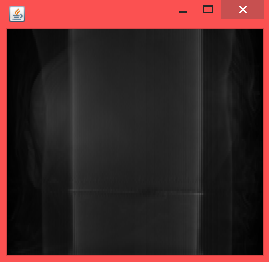
Part 2

Generate transparent voxel renderings of the patient’s head from the left, right and back

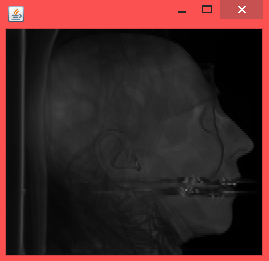
To generate different views then set the Z depth for loop as follows:

Back Head View:

**for**(**int** z=volumeDepth-1; z>=0; z--) // come from Back of head furthest from plane. This process starts at the voxel that is furthest from the view plane



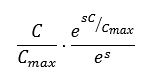
Rightside Head View:



**int** voxel = getVoxel(z, y, x); // Change around axis for side view

Part 3:

For the front view only, generate transparent voxel renderings where the value for



and s is varied from 1 to 8 in steps of 1?

The **java.lang.Math.exp(float a)**returns Euler's number e raised to the power of a float value. This method returns the value es, where *e* is the base of the natural logarithms.

So first get the es

Set up a variable so can change value s.

S = 0.0;

Next get es -> Euler's number = (float)Math.*exp*(S);

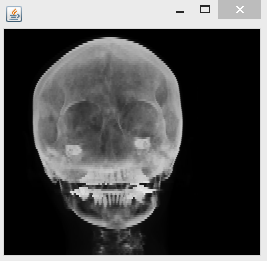
Calculation to get new alpha value:

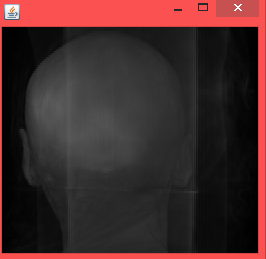
alpha = (**float**) (alpha \* Math.*exp*(s\*alpha)/eulersNum);

then just put in value from 1-8 into S variable.

Here are the following results with the corresponding s value;

S = 8.oof: S= 1.00f:





CODE for Question 3:

// initialize variables

**float** C\_out = 0.0f;

**float** s = 7.00f; //adjust as needed

**float** eulersNum = (**float**)Math.*exp*(s);

// Enter the volume rendering loop

**for**(**int** x=0; x<volumeWidth; x++)

**for**(**int** y=0; y<volumeHeight; y++){

**float** C\_in = 0.0f;

// for(int z=0; z<volumeDepth; z++) //view from front

**for**(**int** z=volumeDepth-1; z>=0; z--) // come from Back of head furtest from plane

{

**int** voxel = getVoxel(x, y, z);

**int** grey = ((voxel - min) \* 255);

**float** alpha = grey/255.0f;

alpha = (**float**) (alpha \* Math.*exp*(s\*alpha)/eulersNum); //Question 3

C\_out = C\_in\*(1.0f - alpha) + grey\*alpha;

C\_in = C\_out;

}

**int** grey = (**int**)C\_out;

**int** pixel = 0xff000000 | (grey << 16) | (grey << 8) | grey;

image.setRGB(x,volumeHeight-y-1, pixel);

}

Keywords: [Click here to add keywords.]

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| Column Head | Column Head | Column Head | Column Head | Column Head |
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| Row Head | 123 | 123 | 123 | 123 |
| Row Head | 456 | 456 | 456 | 456 |
| Row Head | 789 | 789 | 789 | 789 |

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