MistyTakeDepth

January 27, 2020

[1]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

[2]:
```
#Check pandas version to make sure 0.25.1 and the worksheet is working
pd.__version__
```

[2]:
```
'0.25.1'
```

[3]:
```
%matplotlib inline
```

How to use this worksheet

1.Point Misty at something interesting

There needs to be different levels of depth or something interesting in the frame.

2.Get Depth Data

The data is pulled in using either Misty API Explorer or Postman.
GET http://<your Misty robots IP address>/api/cameras/depth

The data should be in json format:

```
{
    "result": {
        "height": 240,
        "image": [ "NaN", ...],
        "width": 320
    },
    "status": "Success"
}
```

3. Save the data as a .json file

4. Read in the data by changing the script below to reference your file

5. Run each of the cells in order

6. If Desired: Take a fisheye picture and compare

[4]:
```
# Read in a json file

#depth = pd.read_json('../coderepo/<your file name here>.json')
data = pd.read_json('../coderepo/BB8_HW.json')

#Transpose the DataFrame to get the column labels to contain height width, and image
dataT = data.T

print(" The height and width should be (240, 320):", dataT['height'].result, dataT['width'].result);
dataT
```

```
 The height and width should be (240, 320): 240 320
```

[4]:

	height	image	width
result	240	[NaN, NaN, NaN, NaN, NaN, NaN, NaN, NaN, NaN, ...	320
status	Success	Success	Success

[5]:
```
#Next Extract the Image Data - all 76800 values
sf = dataT['image'].result;

#Turn the result into a DataFrame
depth = pd.DataFrame(sf);

#Rename the volumn values
depth.rename(columns={0:'Values'}, inplace=True);


#Check to see the count of NaN values in the Image - Count all NaN's
NaN_cnt = (depth.Values == 'NaN').sum();

# Calculate the coverage of the data
coverage = round(((76800-NaN_cnt)/76800)*100,2) #percent of non-NaN "good" values
print("Depth point coverage is: ", coverage, "%");


 # Subject to change - it does work with 40%, but less than that risk divide by zeros
if coverage < 50:
    print("Data not so good - you may not have valid data in all cells")
    print("You may have problems running the rest of the cells")
```

```
Depth point coverage is:  41.88 %
Data not so good - you may not have valid data in all cells
You may have problems running the rest of the cells
```

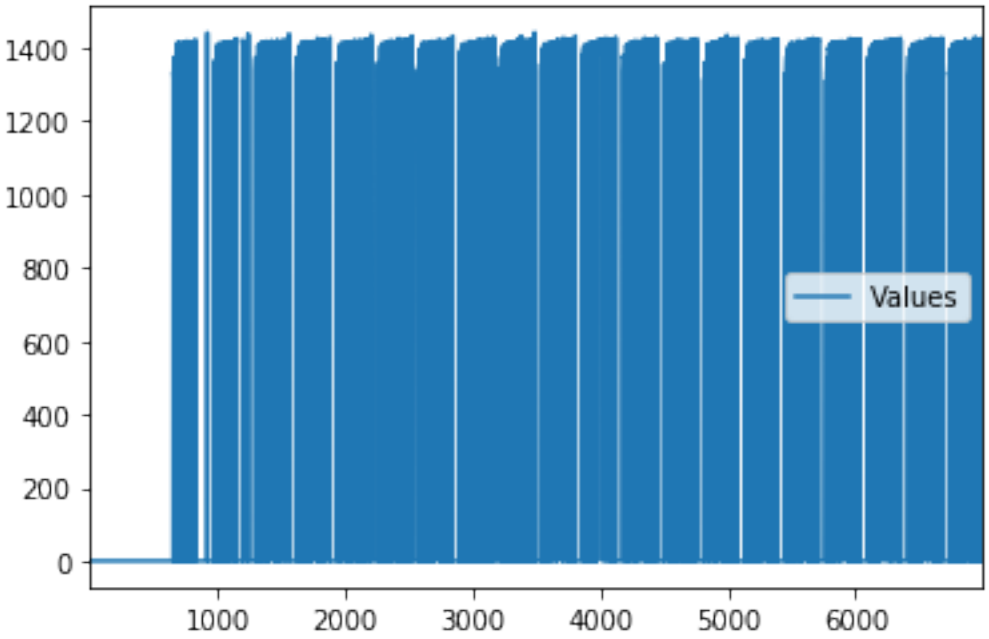
[6]:
```
#Look at depth Dataframe before moving on
depth.describe()
```

[6]:
```
        Values
count    76800
unique    4695
top        NaN
freq     44636
```

[7]:
```
#replace all of the NaN values with 0
fo = depth.replace('NaN',0)
fo
```

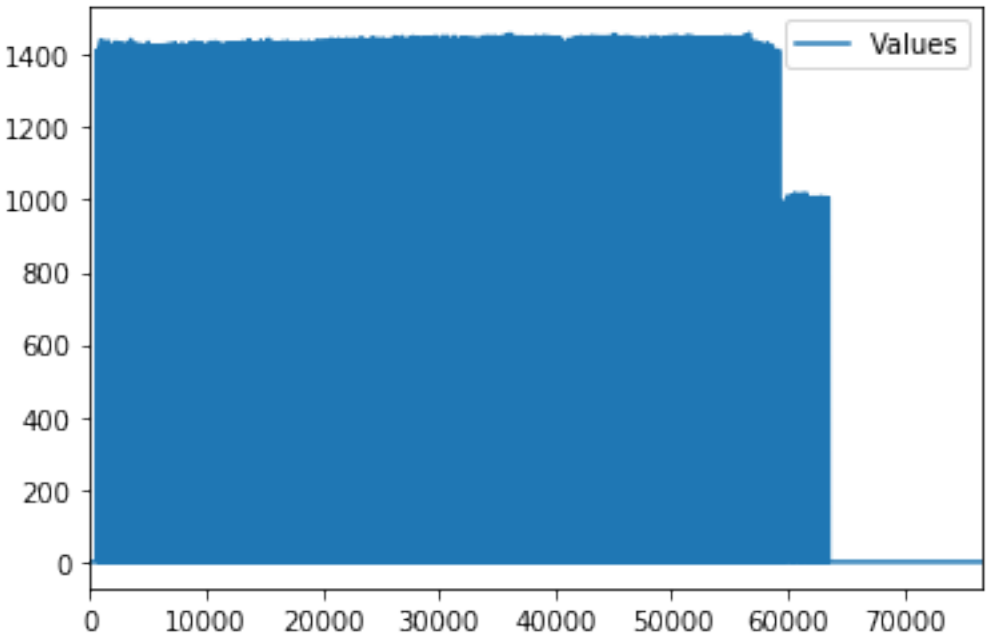
[7]:
```
        Values
0          0.0
1          0.0
2          0.0
3          0.0
4          0.0
...        ...
76795      0.0
76796      0.0
76797      0.0
76798      0.0
76799      0.0

[76800 rows x 1 columns]
```

[8]:
```
#Plot first 7000 points - can change this to look at other regions
fo_small = fo[1:7000]
fo_small.plot();
```



[9]:
```
fo.plot()
type(fo)
```

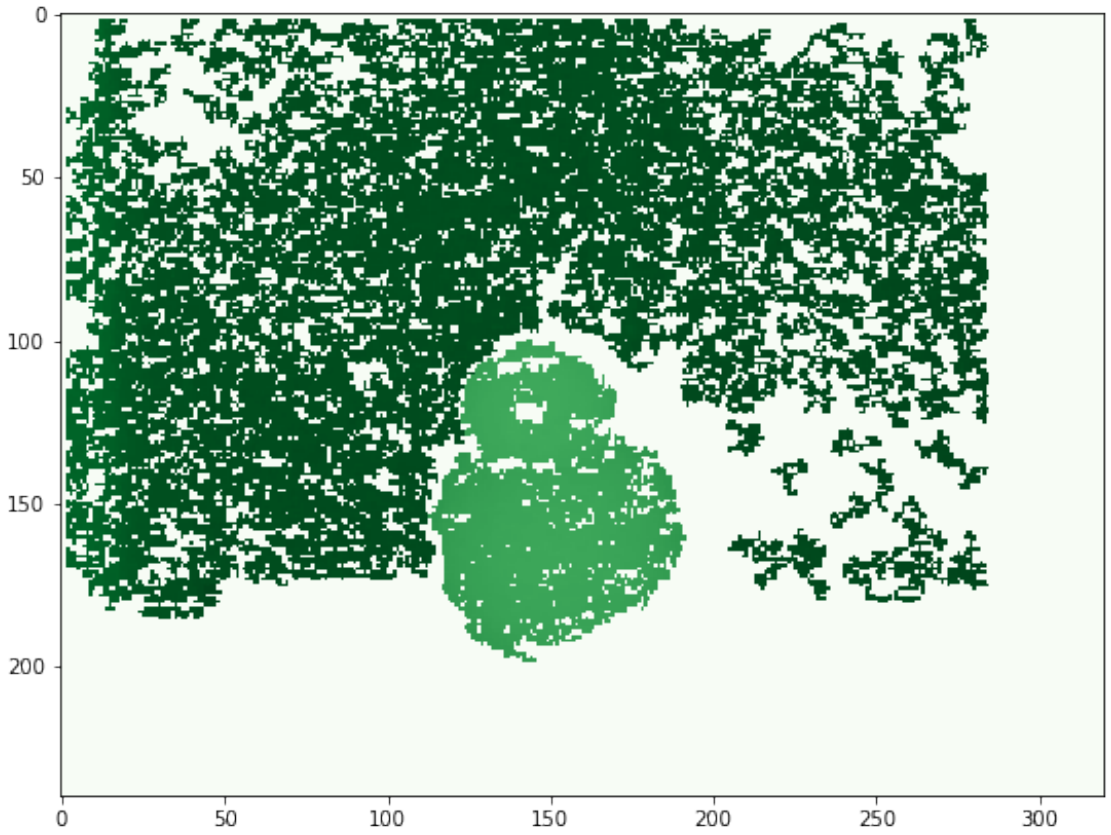
[9]: pandas.core.frame.DataFrame



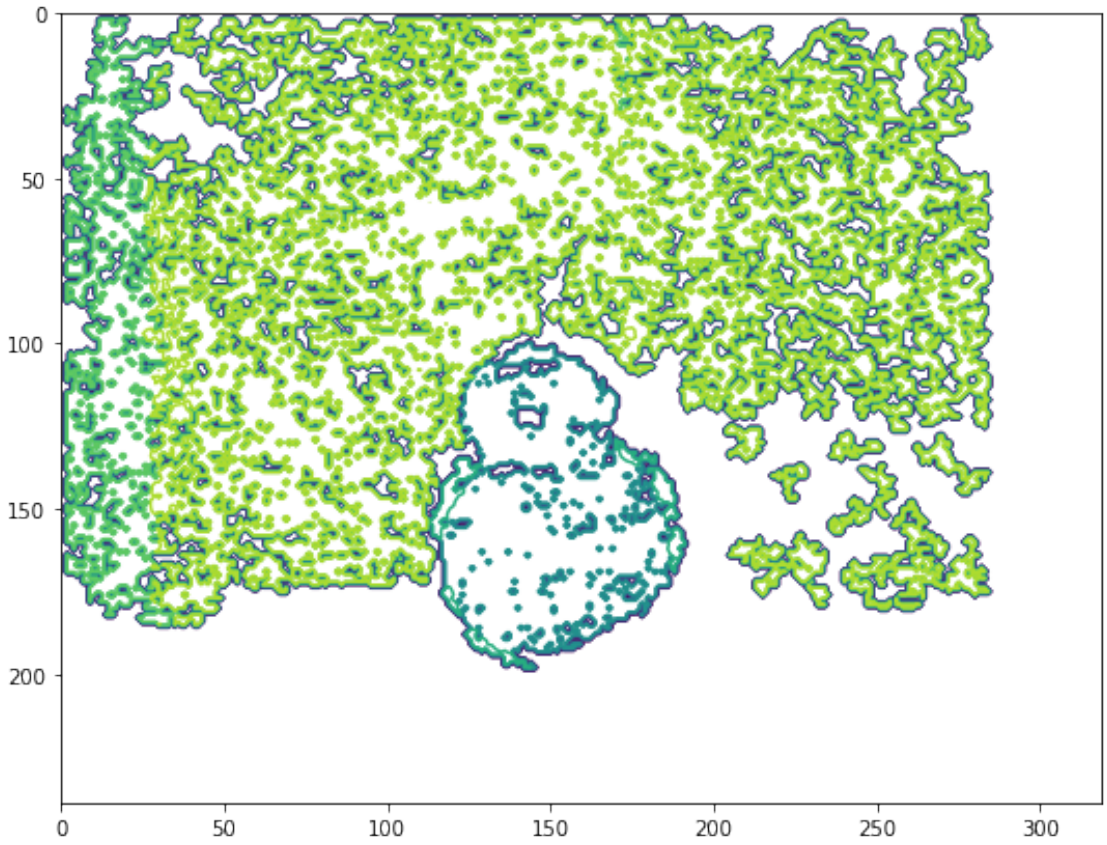
[10]:
```
#Reshape the array
data = np.array(fo).reshape((240,320))
data.shape
```

[10]:
```
(240, 320)
```

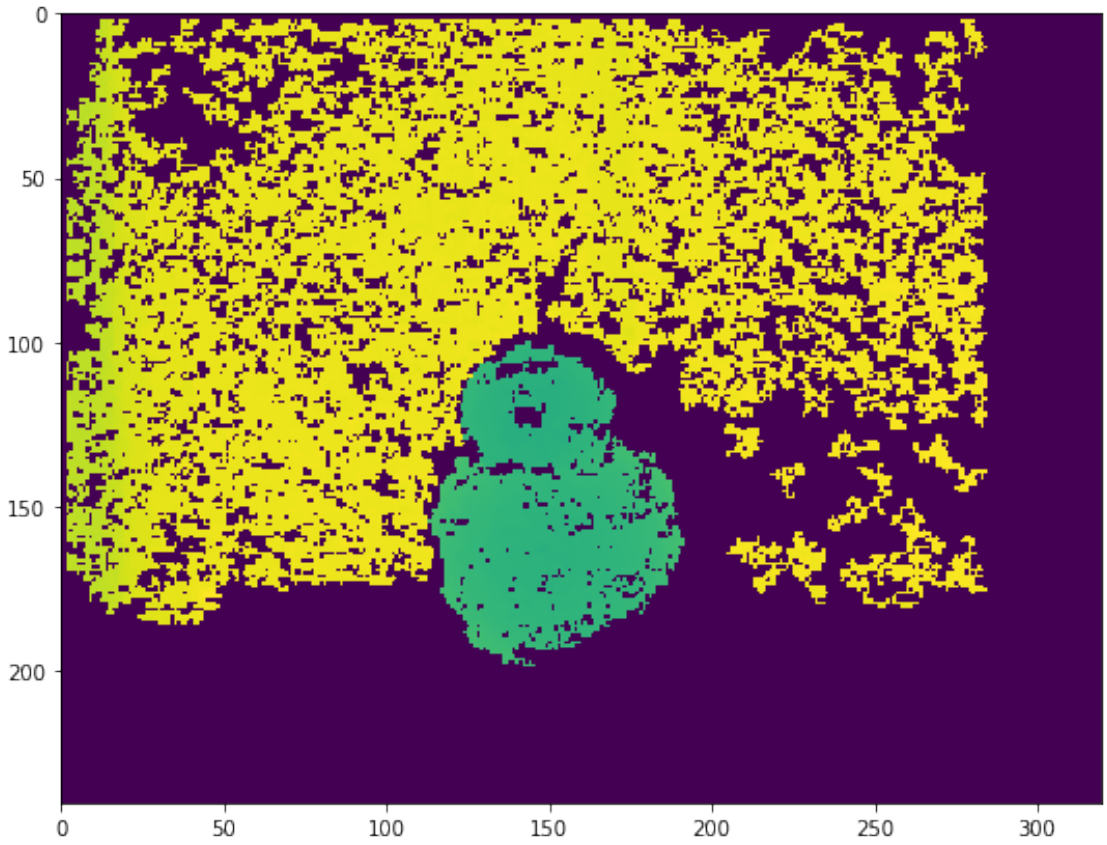
[11]:
```
#Plot the data

plt.rcParams['figure.figsize'] = [12, 7]

#plt.imshow(data, cmap=plt.get_cmap('gray'));
plt.imshow(data, cmap=plt.get_cmap('Greens'));
```



[12]:
```
# Try different ways of plotting
plt.rcParams['figure.figsize'] = [9, 7]
plt.contour(data)
plt.gca().invert_yaxis() #need to rotate or flip it so that 0 is at the top
```



[13]:
```
plt.rcParams['figure.figsize'] = [9, 7]
plt.pcolormesh(data)
plt.gca().invert_yaxis()
```



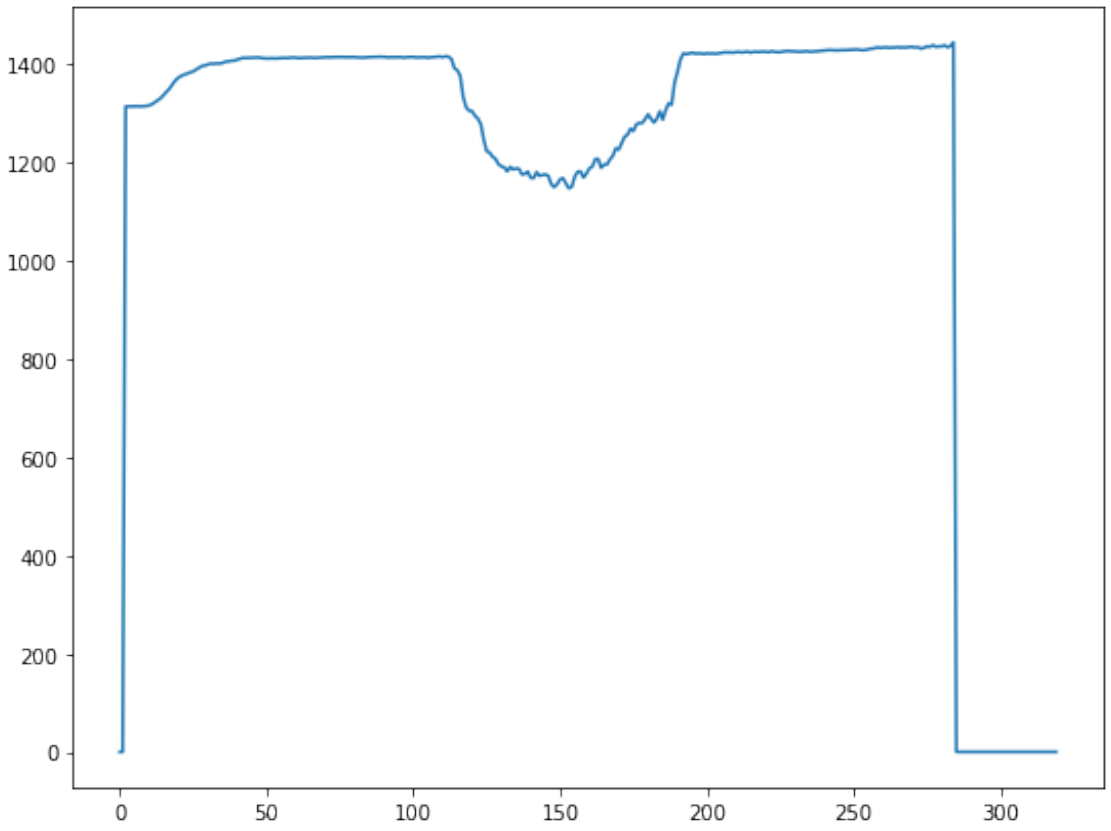
[14]:
```
#Create the column arrays for the sum results to be stored in
#There are 320 columns so create zero arrays of length 320

colDepthSum = np.empty(320)
colDepthCount = np.empty(320)
columnDepth = np.empty(320)

for i in range(320):
    colDepthSum[i]=0
    colDepthCount[i]=0
    columnDepth[i]=0
```

[15]:
```
# This takes each of the 320 columns and iterates the number or rows. Each␣
 ↪column is averaged into a single depth
# The data input is fo, which has all of the NaN's removed (see above)

depthSum = 0;         #sum total of all depth points
depthCount = 0;       #count of all non-zero points
tempDepth = 0;        #temporary variable for holding value
```

```
for i in range(76800): #76800 is the number of array points returned from the␣
 ↪depth picture
    if fo.Values[i] != 0:
        tempDepth = fo.Values[i]    #don't really need this step
        depthCount = depthCount +1
        depthSum = depthSum + tempDepth

        indes=i%320 #There are 320 colums - find correct column by remainder of␣
 ↪position index

        colDepthSum[indes] = colDepthSum[indes] + fo.Values[i]
        colDepthCount[indes] = colDepthCount[indes] + 1


print("number of non-zero values:", depthCount, 'which is', round(depthCount/
 ↪76800*100,1) ,'% coverage')
print("average overall depth:", round(depthSum/depthCount,4))
```

```
number of non-zero values: 32164 which is 41.9 % coverage
average overall depth: 1346.175
```

[43]:
```
#In here - calculate the average depth for each of the 320 columns

#Imagine looking at what Misty "sees" from top view  - looking down on Misty's␣
 ↪head

for i in range(320):
    if colDepthCount[i] !=0:
        columnDepth[i] = colDepthSum[i]/colDepthCount[i]


plt.plot(columnDepth)
plt.show()
```



[17]:
```
#OK, now onto a depth map with fewer array positions. Try 12, and then plot␣
 ↪these.

#use different variables from above.

#want to have 3 rows of 4 squares. So there are 12 total. Each "block" is 80x80␣
 ↪= 6400 measurements

#looks like this:
# TFL - TNL - TNR - TFR
# MFL - MNL - MNR - MFR
# BFL - BNL - BNR - BFR

TFL = 0 #TopFarLeft - 1
TNL = 0
MFL = 0
MNL = 0
BFL = 0
BNL = 0
TFR = 0  #TopFarRight - 4
```

```
TNR = 0
MFR = 0
MNR = 0
BFR = 0 #BottomFarRight - 12
BNR = 0

TFL_cnt = 0 #TopFarLeft - 1
TNL_cnt = 0
MFL_cnt = 0
MNL_cnt = 0
BFL_cnt = 0
BNL_cnt = 0
TFR_cnt = 0  #TopFarRight - 4
TNR_cnt = 0
MFR_cnt = 0
MNR_cnt = 0
BFR_cnt = 0 #BottomFarRight - 12
BNR_cnt = 0

TFL_sum = 0 #TopFarLeft - 1
TNL_sum = 0
MFL_sum = 0
MNL_sum = 0
BFL_sum = 0
BNL_sum = 0
TFR_sum = 0  #TopFarRight - 4
TNR_sum = 0
MFR_sum = 0
MNR_sum = 0
BFR_sum = 0 #BottomFarRight - 12
BNR_sum = 0


depthSum = 0;         #sum total of all depth points
depthCount = 0;       #count of all non-zero points

for i in range(76800): #76800 is the number of array points returned from the␣
 ↪depth picture
    if fo.Values[i] != 0:
        depthCount = depthCount + 1
        depthSum = depthSum + fo.Values[i]

        indes=i%320 #There are 320 colums - find correct column by remainder of␣
 ↪position index

        if indes <= 80: #Check column for the Far Left FL variables
            if i <= 25600: #check row - top third of rows are all less than 25600
```

```
            #put values in the Top Far Left
            TFL_sum = TFL_sum + fo.Values[i]
            TFL_cnt = TFL_cnt + 1

        elif i <= 51200: #put in the Middle Far Left
            MFL_sum = MFL_sum + fo.Values[i]
            MFL_cnt = MFL_cnt + 1

        else: #put in the Bottom Far Left
            BFL_sum = BFL_sum + fo.Values[i]
            BFL_cnt = BFL_cnt + 1

    elif indes <=160: #Check column for the Near Left NL variables
        if i <= 25600: #check row - top third rows are all less than 25600
            #put in the Top Bins
            #print("this")
            TNL_sum = TNL_sum + fo.Values[i]
            TNL_cnt = TNL_cnt + 1

        elif i <= 51200: #put in the Middle Bins
            MNL_sum = MNL_sum + fo.Values[i]
            MNL_cnt = MNL_cnt + 1

        else: #put in the Bottom Bins
            BNL_sum = BNL_sum + fo.Values[i]
            BNL_cnt = BNL_cnt + 1

    elif indes <=240: #Check column for the Near Right NR variables
        if i <= 25600: #check row - top third rows are all less than 25600
            #put in the Top Bins
            #print("this")
            TNR_sum = TNR_sum + fo.Values[i]
            TNR_cnt = TNR_cnt + 1

        elif i <= 51200: #put in the Middle Bins
            MNR_sum = MNR_sum + fo.Values[i]
            MNR_cnt = MNR_cnt + 1

        else: #put in the Bottom Bins
            BNR_sum = BNR_sum + fo.Values[i]
            BNR_cnt = BNR_cnt + 1

    else: #This is the far right column, everything from column 240 to 320
        if i <= 25600: #check row - top third rows are all less than 25600
            #put in the Top Bins
            #print("this")
            TFR_sum = TFR_sum + fo.Values[i]
```

```
                TFR_cnt = TFR_cnt + 1

            elif i <= 51200: #put in the Middle Bins
                MFR_sum = MFR_sum + fo.Values[i]
                MFR_cnt = MFR_cnt + 1

            else: #put in the Bottom Bins
                BFR_sum = BFR_sum + fo.Values[i]
                BFR_cnt = BFR_cnt + 1


print("number of valid measurements:", depthCount)
print("average overall depth:", depthSum/depthCount)


coverage = round((depthCount/76800)*100,2); #percent of non-NaN values
print("depth point coverage is: ", coverage, "%")
```

```
number of valid measurements: 32164
average overall depth: 1346.1749900200505
depth point coverage is:  41.88 %
```

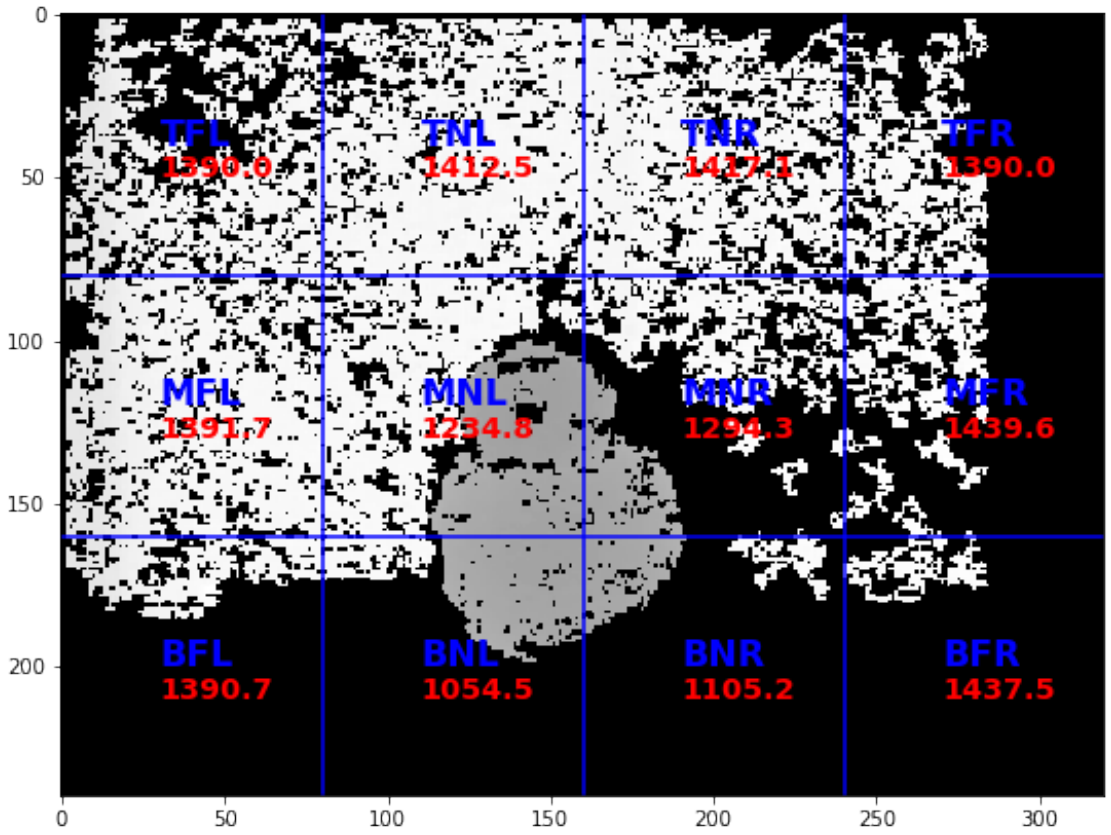
[18]:
```
#Leftmost Column - FarLeft
TFL = round(TFL_sum/TFL_cnt, 2)
MFL = round(MFL_sum/MFL_cnt, 2)
BFL = round(BFL_sum/BFL_cnt, 2)

#Next Column - NearLeft
TNL = round(TNL_sum/TNL_cnt, 2)
MNL = round(MNL_sum/MNL_cnt, 2)
BNL = round(BNL_sum/BNL_cnt, 2)

#Next Column - NearRight
TNR = round(TNR_sum/TNR_cnt, 2)
MNR = round(MNR_sum/MNR_cnt, 2)
BNR = round(BNR_sum/BNR_cnt, 2)

#RightMost Column - FarRight
TFR = round(TFR_sum/TFR_cnt, 2)
MFR = round(MFR_sum/MFR_cnt, 2)
BFR = round(BFR_sum/BFR_cnt, 2)


TakeDepth12pts = [TFL, TNL, TNR, TFL, MFL, MNL, MNR, MFR, BFL, BNL, BNR, BFR]
print("The 12 points array:")
```

```
print(TakeDepth12pts)
```

```
The 12 points array:
[1389.97, 1412.45, 1417.13, 1389.97, 1391.74, 1234.75, 1294.3, 1439.56, 1390.68,
1054.53, 1105.23, 1437.53]
```

[21]:
```
# Re-plot the entire DepthPicture (with points) and inlay lines
# that show the positions of consolidated points, and the depth
# level of each of the 12 points

plt.rcParams['figure.figsize'] = [12, 7]
plt.imshow(data, cmap=plt.get_cmap('gray'));
#plt.imshow(data, cmap=plt.get_cmap('Greens'));

#plot horizontal lines
plt.plot([0, 319], [80, 80], 'b');
plt.plot([0, 319], [160, 160], 'b');

#plot vertical lines
plt.plot([80, 80], [0, 239], 'b');
plt.plot([160, 160], [0, 239], 'b');
plt.plot([240, 240], [0, 239], 'b');

plt.annotate('TFL', xy=(30, 40), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('TNL', xy=(110, 40), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('TNR', xy=(190, 40), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('TFR', xy=(270, 40), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');

plt.annotate('%.1f'%(TakeDepth12pts[0]), xy=(30, 50), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[1]), xy=(110, 50), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[2]), xy=(190, 50), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[3]), xy=(270, 50), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');

plt.annotate('MFL', xy=(30, 120), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('MNL', xy=(110, 120), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
```

```
plt.annotate('MNR', xy=(190, 120), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('MFR', xy=(270, 120), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');

plt.annotate('%.1f'%(TakeDepth12pts[4]), xy=(30, 130), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[5]), xy=(110, 130), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[6]), xy=(190, 130), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[7]), xy=(270, 130), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');

plt.annotate('BFL', xy=(30, 200), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('BNL', xy=(110, 200), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('BNR', xy=(190, 200), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');
plt.annotate('BFR', xy=(270, 200), c='b', fontsize = 'xx-large', fontweight =␣
 ↪'bold');

plt.annotate('%.1f'%(TakeDepth12pts[8]), xy=(30, 210), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[9]), xy=(110, 210), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[10]), xy=(190, 210), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
plt.annotate('%.1f'%(TakeDepth12pts[11]), xy=(270, 210), c='r', fontsize =␣
 ↪'x-large', fontweight = 'bold');
```



[23]:
```
# The numbers in the plot above are sometimes hard to read
# show the total depth points array - these are the red numbers above
tdp = np.array(TakeDepth12pts).reshape((3,4))
tdp
```

[23]:
```
array([[1389.97, 1412.45, 1417.13, 1389.97],
       [1391.74, 1234.75, 1294.3 , 1439.56],
       [1390.68, 1054.53, 1105.23, 1437.53]])
```

[ ]:
```
#End - The End result is the above 12-point array
```