# NHI Deep Leison dataset

October 22, 2020

Deep Leison dataset link

The nhi deep leison dataset has the following files:

key_slices - example slices of images along with label

DL_info.csv - a file with the labels of all the images

images : They named each slice with the format “{patientindex}*{study index}*{series index}_{slice index}.png”, with the last underscore being / or  to indicate sub-folders. The images are stored in unsigned 16 bit. One should subtract 32768 from the pixel intensity to obtain the original Hounsfield unit (HU) values. We provide not only the key CT slice that contains the lesion annotation, but also its 3D context (30mm extra slices above and below the key slice).

```
In [116]: import os
          from PIL import Image
          import pandas as pd
          import cv2
          import imageio
          import os
          import zipfile
          import matplotlib.pyplot as plt
```

I ran the "DL_save_nifti.py" file to get the nii files from the images which are stored in unsigned 16 bit format, then I sliced the nii file as shown below.

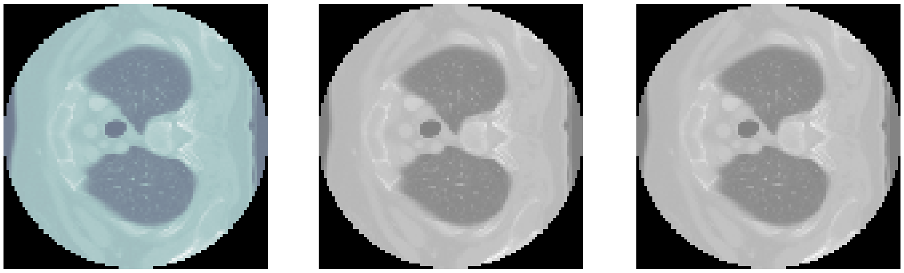
```
In [117]: vol = imageio.volread('000001_01_01_103-115.nii')
```

```
In [118]: vol.shape
```

```
Out[118]: (13, 512, 512)
```

Doubt : The dataset gives 16 bit files and the code to get the nii file out of it, it has labels for each sliced image file. The file ’000001_01_01_103-115.nii’ is made of thirteen 16 bit files( also has depth of 13 and we can get 13 slices of image out of it). So technically each slice should be of the same order and we should assign the labels to each slice respectively, but I am not really sure about it

```
In [119]: fig,axes = plt.subplots(nrows=1,ncols=3)
          axes[0].imshow(vol[0],cmap = "bone")
          axes[1].imshow(vol[0],cmap = "gray")
          axes[2].imshow(vol[0],cmap = "gray")
          #axes[3].imshow(vol[3],cmap = "gray")
          for ax in axes:
              ax.axis("off")
          plt.show()
```



```
In [120]: for ii in range(1,10):
              if ii == 9: # To take the 9th slice and compare it with the '000001_01_01_109.png'

                  im = vol[ii,:,:]
                  imageio.imwrite("sliced_image_000001_01_01_109.jpg",im)

                  print("image shape",im.shape)
```

```
Lossy conversion from int16 to uint8. Range [-3024, 830]. Convert image to uint8 prior to saving
```

```
image shape (512, 512)
```

I saved the sliced image as "sliced_image_000001_01_01_109.jpg" which corresponds to the slice image example shown Section **??** which was taken from the file key_slices present in the dataset

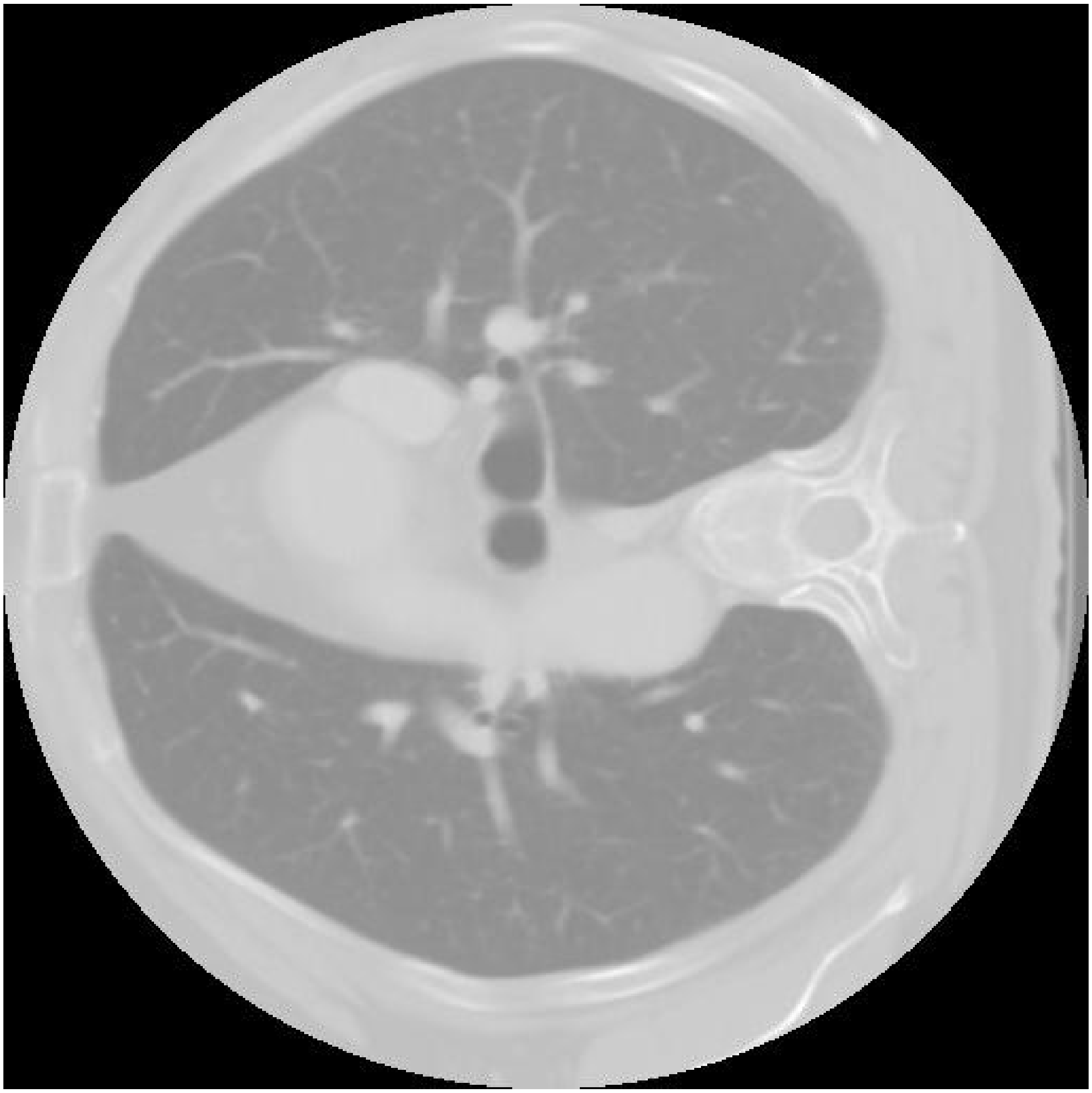
```
In [121]: k = 'sliced_image_000001_01_01_109.jpg'
```

```
In [122]: im = Image.open(k)
          imt = cv2.imread(k)
          imt.shape
```

```
Out[122]: (512, 512, 3)
```

```
In [123]: im
```

```
Out[123]:
```



```
In [124]: im.info
```

```
Out[124]: {'jfif': 257, 'jfif_version': (1, 1), 'jfif_unit': 0, 'jfif_density': (1, 1)}
```

I tried to change the resolution of image and save it as "test_600.png"

```
In [125]: im.save("test-600.jpg", dpi=(10,10))
          #im.show()
```

```
In [126]: im = Image.open('test-600.jpg')
          im.info
```

```
Out[126]: {'jfif': 257,
           'jfif_version': (1, 1),
           'dpi': (10, 10),
           'jfif_unit': 1,
           'jfif_density': (10, 10)}
```

### 0.0.1 I am even able to increase the dpi, is it the correct way to change the resolution of image?

```
In [127]: im.size
```

```
Out[127]: (512, 512)
```

I tried to get the bounding box co-ordinates of the image ’000001_01_01_109.png’

```
In [128]: df = pd.read_csv("DL_info (1).csv")
          df.head()
```

```
Out[128]:               File_name  Patient_index  Study_index  Series_ID  \
          0  000001_01_01_109.png              1            1          1
          1  000001_02_01_014.png              1            2          1
          2  000001_02_01_017.png              1            2          1
          3  000001_03_01_088.png              1            3          1
          4  000001_04_01_017.png              1            4          1

             Key_slice_index                            Measurement_coordinates  \
          0              109  233.537, 95.0204, 234.057, 106.977, 231.169, 1...
          1               14  224.826, 289.296, 224.016, 305.294, 222.396, 2...
          2               17  272.323, 320.763, 246.522, 263.371, 234.412, 3...
          3               88  257.759, 157.618, 260.018, 133.524, 251.735, 1...
          4               17  304.019, 230.585, 292.217, 211.789, 304.456, 2...

                                   Bounding_boxes Lesion_diameters_Pixel_  \
          0  226.169, 90.0204, 241.252, 111.977        11.9677, 5.10387
          1  217.396, 284.296, 233.978, 310.294         16.019, 6.61971
          2  229.412, 258.371, 285.221, 325.763        62.9245, 48.9929
          3  246.735, 128.524, 270.288, 162.618        24.1998, 13.6123
          4  287.217, 206.789, 309.456, 235.585         22.1937, 9.8065

               Normalized_lesion_location  Coarse_lesion_type  Possibly_noisy  \
          0   0.44666, 0.283794, 0.434454                   3               0
          1  0.431015, 0.485238, 0.340745                   3               0
          2  0.492691, 0.503106, 0.351754                   3               0
          3  0.498999, 0.278924, 0.452792                   3               0
          4   0.572678, 0.42336, 0.445674                   3               0

            Slice_range         Spacing_mm_px_ Image_size DICOM_windows Patient_gender  \
          0    103, 115  0.488281, 0.488281, 5   512, 512     -175, 275              F
          1       8, 23  0.314453, 0.314453, 5   512, 512     -175, 275              F
          2       8, 23  0.314453, 0.314453, 5   512, 512     -175, 275              F
          3     58, 118  0.732422, 0.732422, 1   512, 512     -175, 275              F
          4      11, 23  0.666016, 0.666016, 5   512, 512     -175, 275              F
```

```
   Patient_age  Train_Val_Test
0         62.0               3
1         72.0               3
2         72.0               3
3         73.0               3
4         73.0               3
```

```
In [129]: ks = list(df["File_name"])
```

```
In [130]: for i,j in enumerate(ks) :
              if j == k:
                  print(i)
```

```
In [131]: bounding_box = list(df["Bounding_boxes"])
          m = bounding_box[0]
```

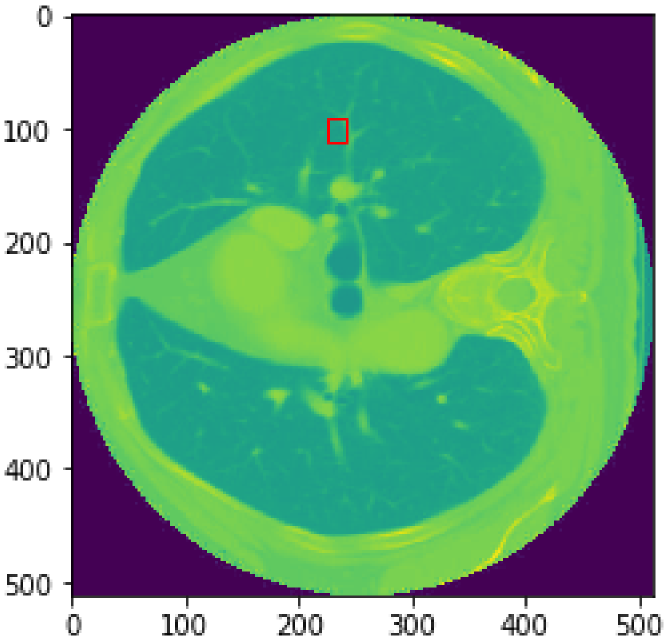
```
In [132]: j = m.split(",")
```

```
In [133]: hs = []
          for i in j:
              hs.append(float(i))
```

```
In [134]: hs #bounding box co-ordinates
```

```
Out[134]: [226.169, 90.0204, 241.252, 111.977]
```

```
In [135]: import matplotlib.pyplot as plt
          import matplotlib.patches as patches
          from PIL import Image
          import numpy as np

          im = np.array(Image.open('sliced_image_000001_01_01_109.jpg'), dtype=np.uint8)

          # Create figure and axes
          fig,ax = plt.subplots(1)

          # Display the image
          ax.imshow(im)

          # Create a Rectangle patch
          rect = patches.Rectangle((hs[0] , hs[1] ), hs[2]-hs[0] , hs[3] - hs[1] ,linewidth=1,ed
          #0.3087787109375, 0.34495019531250004, -0.26591523437500003, -0.252490234375
          # Add the patch to the Axes
          ax.add_patch(rect)
          plt.savefig("toot.png")
          plt.show()
          [226.169, 90.0204, 241.252, 111.977]
```



```
Out[135]: [226.169, 90.0204, 241.252, 111.977]
```

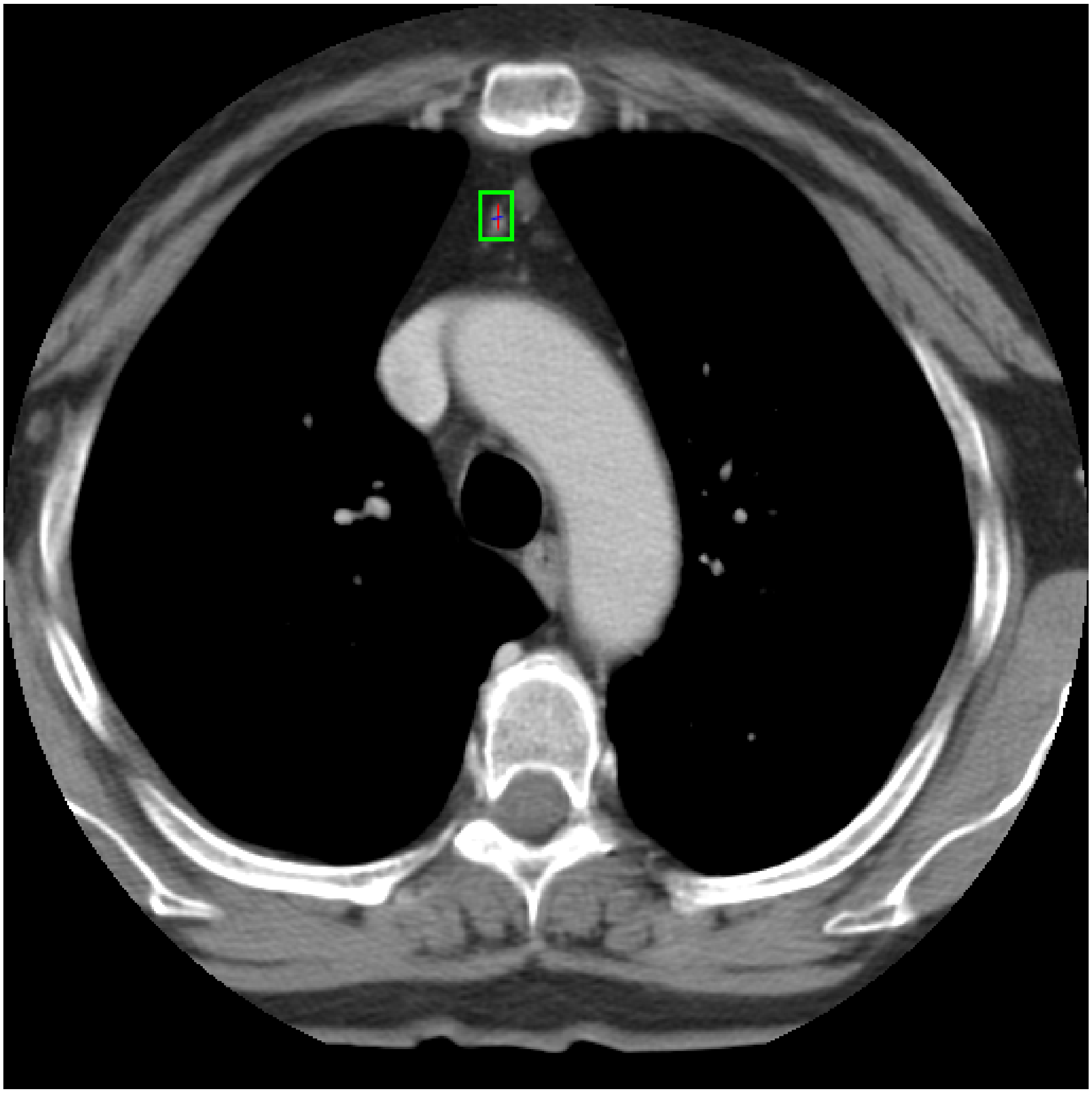
```
In [136]: im.shape
```

```
Out[136]: (512, 512)
```

The above plot is obtained from the sliced image

```
In [137]: #im = Image.open(k)

          imt = Image.open('000001_01_01_109.png')
          #imt.shape
          imt
```

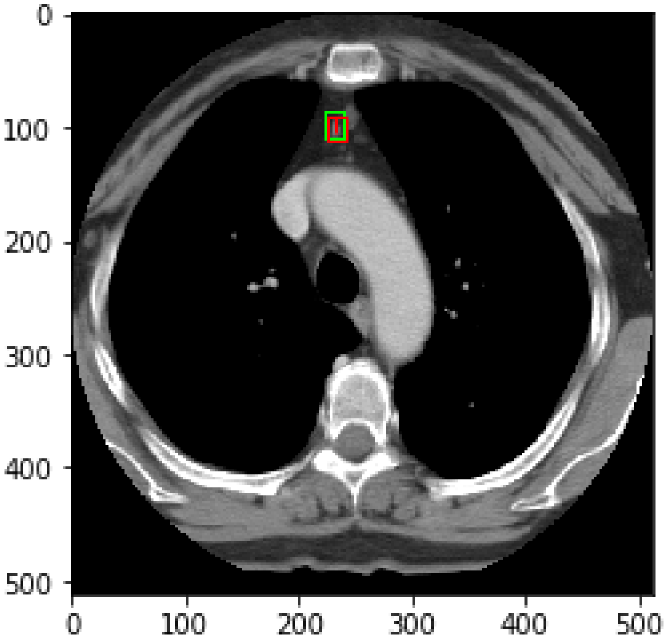
```
Out[137]:
```



The above image is taken from the file key_slice, which has example images.

```
In [138]: import matplotlib.pyplot as plt
          import matplotlib.patches as patches
          from PIL import Image
          import numpy as np

          im = np.array(Image.open('000001_01_01_109.png'), dtype=np.uint8)

          # Create figure and axes
          fig,ax = plt.subplots(1)

          # Display the image
          ax.imshow(im)
```

```
# Create a Rectangle patch
rect = patches.Rectangle((hs[0] , hs[1] ), hs[2]-hs[0] , hs[3] - hs[1] ,linewidth=1,ed
#0.3087787109375, 0.34495019531250004, -0.26591523437500003, -0.252490234375
# Add the patch to the Axes
ax.add_patch(rect)

plt.show()
#[226.169, 90.0204, 241.252, 111.977]
```



The above plot has green bounding box which is already in the image, and red bounding box based on the label provided