3D-MRI

March 28, 2022

[114]:
```
from PIL import Image
import numpy as np
import matplotlib.pyplot as plt

fast_20   = np.array(Image.open('fast_20.tif'))
fast_100  = np.array(Image.open('fast_100.tif'))
clear_30  = np.array(Image.open('clear_30.tif'))
clear_100 = np.array(Image.open('clear_100.tif'))
build_30  = np.array(Image.open('build_30.tif'))
build_100 = np.array(Image.open('build_100.tif'))
img_titles = ["SirayaTech Fast | 20% Infill",
              "SirayaTech Fast | 100% Infill",
              "SirayaTech Blu Clear (V2) | 30% Infill",
              "SirayaTech Blu Clear (V2) | 100% Infill",
              "SirayaTech Build | 30% Infill",
              "SirayaTech Build | 100% Infill"]
img_arr = [fast_20, fast_100, clear_30, clear_100, build_30, build_100]
#image_tiff.show() # opens the tiff image. this rainbow color tiff
```

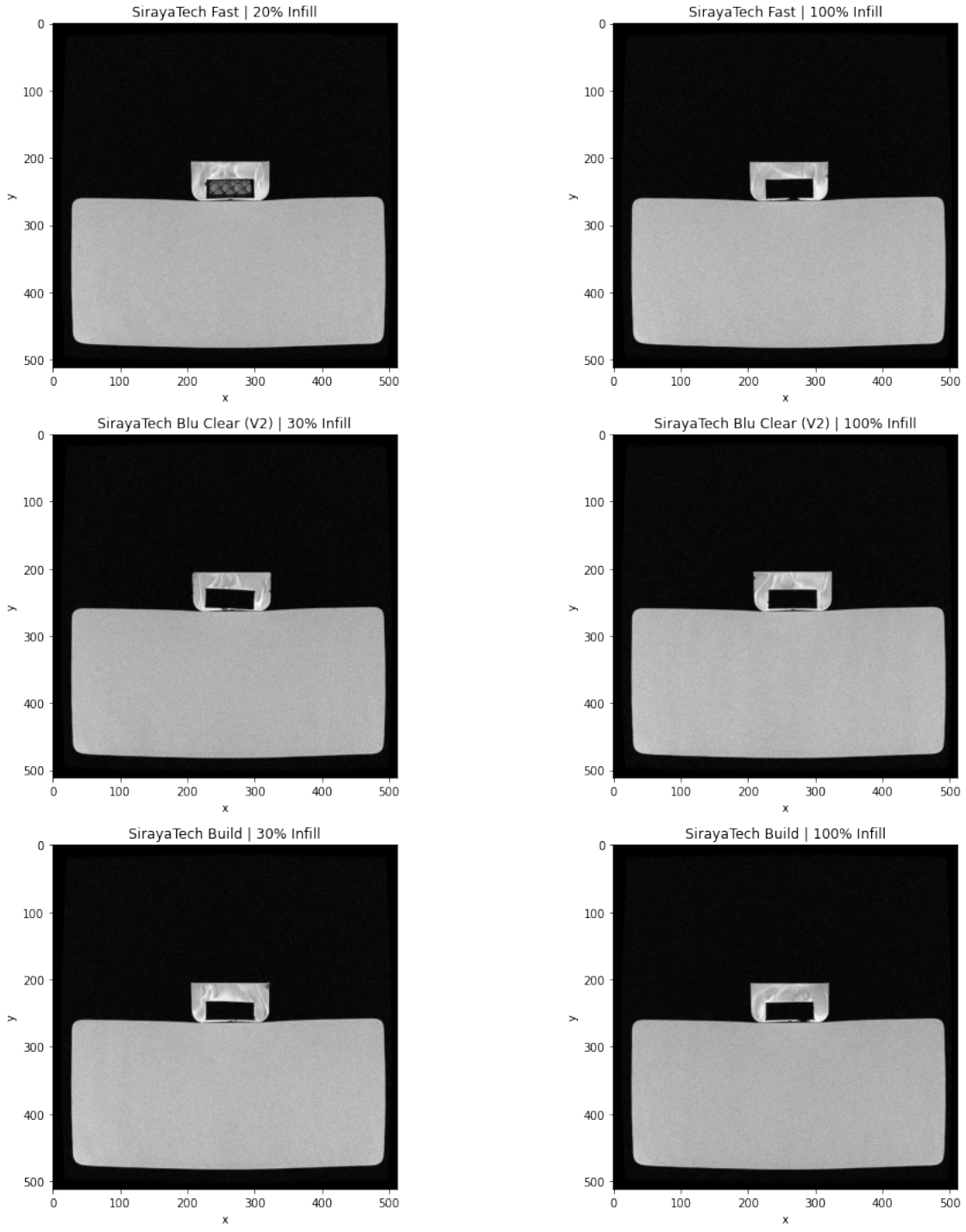
1 Dataset Overview

This data is derived from a series of scans made using UC Berkeley's 3T MRI scanner. The test objects being imaged were 50mm x 50mm x 20mm prisms of varying infill density. In this case of *SirayaTech Fast | 20% Infill*, the test object was hollowed with a geometric 3D-infill pattern.

Here are the images themselves.

[118]:
```
fig, axs = plt.subplots(nrows=3, ncols=2, figsize=(15, 15))
k = 0
for x in np.arange(3):
    for y in np.arange(2):
        axs[x, y].imshow(img_arr[k], cmap='gray')
        axs[x, y].set_title(img_titles[k])
        axs[x, y].set_xlabel('x')
        axs[x, y].set_ylabel('y')
        k += 1
```

```
plt.tight_layout()
plt.show()
```



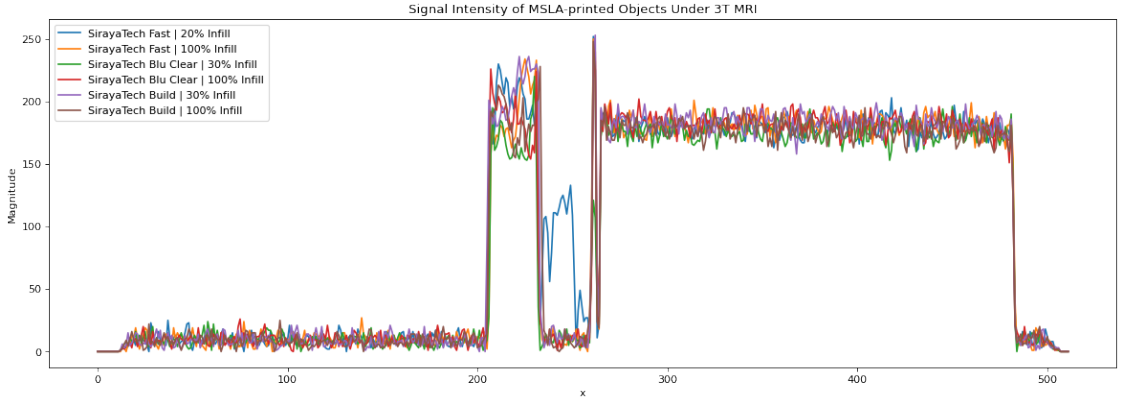
1.1 Loading the data

[34]:
```
fast_20_center = fast_20[:, 256]
fast_100_center = fast_100[:, 256]
clear_30_center = clear_30[:, 256]
clear_100_center = clear_100[:, 256]
build_30_center = build_30[:, 256]
build_100_center = build_100[:, 256]
```

1.2 Plotting all objects together

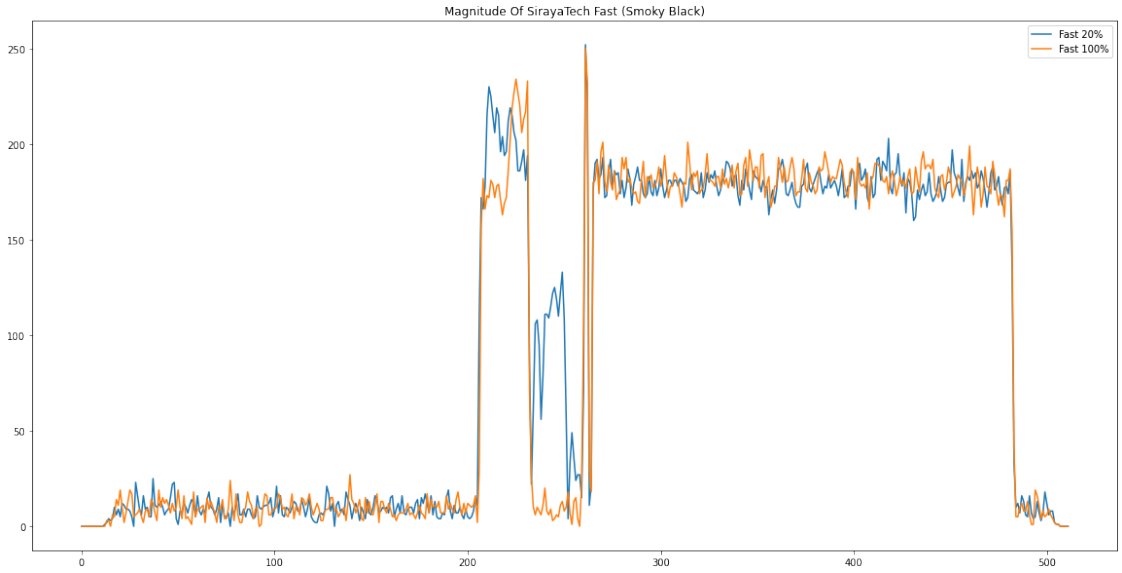
[80]:
```
from matplotlib.pyplot import figure
figure(figsize=(18, 6), dpi=80)

plt.plot(fast_20_center, label='SirayaTech Fast | 20% Infill')
plt.plot(fast_100_center, label='SirayaTech Fast | 100% Infill')
plt.plot(clear_30_center, label='SirayaTech Blu Clear | 30% Infill')
plt.plot(clear_100_center, label='SirayaTech Blu Clear | 100% Infill')
plt.plot(build_30_center, label='SirayaTech Build | 30% Infill')
plt.plot(build_100_center, label='SirayaTech Build | 100% Infill')
plt.ylabel('Magnitude')
plt.xlabel('x')
plt.legend()
plt.title("Signal Intensity of MSLA-printed Objects Under 3T MRI")
plt.savefig('combined_plot.png', dpi=100)
plt.show()
```



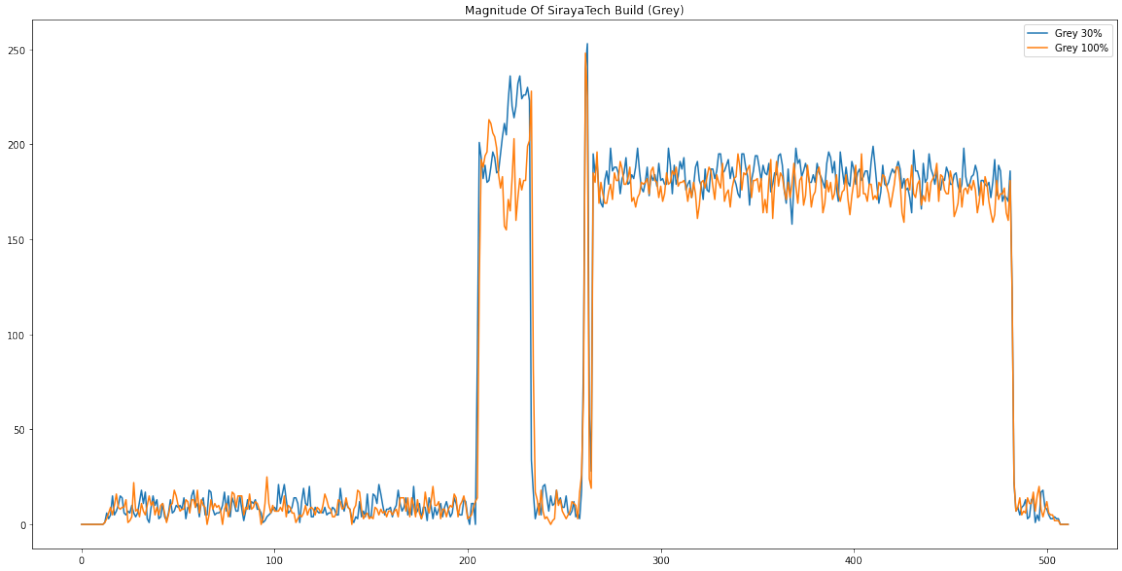
2 Intra-class Comparison: SirayaTech Fast

[57]:
```
# Plotting only Fast
fig, ax = plt.subplots(figsize=(20, 10))
plt.plot(fast_20_center, label = 'SirayaTech Fast 20%')
plt.plot(fast_100_center, label='SirayaTech Fast 100%')
plt.legend()
plt.title("Signal Intensity of SirayaTech Fast (Smoky Black)")
plt.show()
```



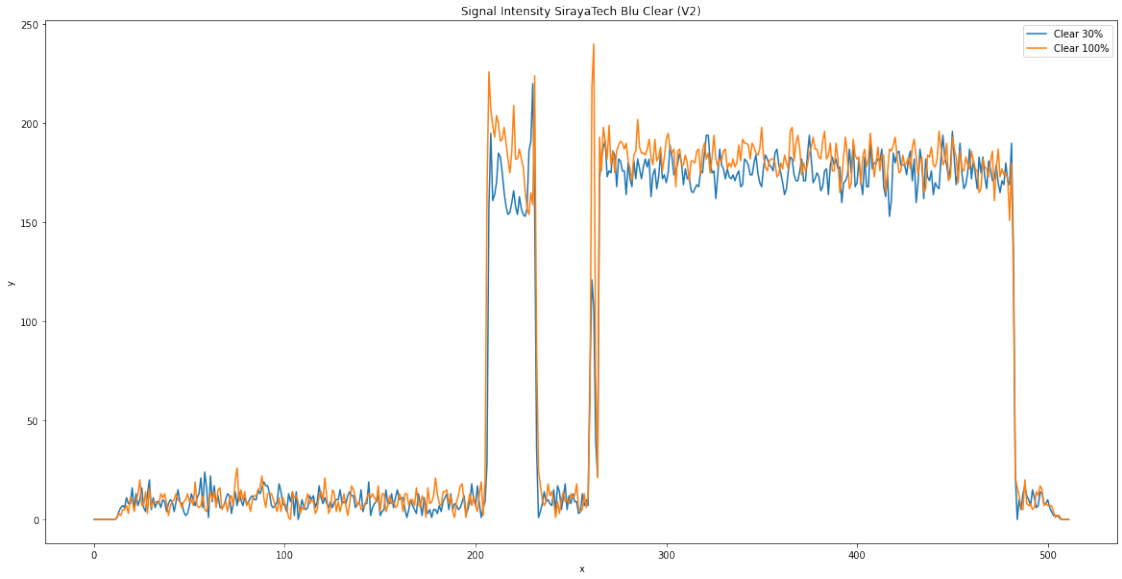
3 Intra-class Comparison: SirayaTech Build

[59]:
```
# Plotting only Fast
fig, ax = plt.subplots(figsize=(20, 10))
plt.plot(build_30_center, label = 'Grey 30%')
plt.plot(build_100_center, label='Grey 100%')
plt.legend()
plt.title("Signal Intensity of SirayaTech Build (Grey)")
plt.show()
```



4 Intra-class Comparison: SirayaTech Blu Clear (V2)

[81]:
```
# Plotting only Clear
fig, ax = plt.subplots(figsize=(20, 10))
plt.plot(clear_30_center, label = 'Clear 30%')
plt.plot(clear_100_center, label='Clear 100%')
plt.legend()
plt.xlabel('x')
plt.ylabel('y')
plt.title("Signal Intensity SirayaTech Blu Clear (V2)")
plt.show()
```


Signal Intensity SirayaTech Blu Clear (V2)
Clear 30%
Clear 100%
250
200
150
100
50
0
y
0
100
200
300
400
500
x

4.1 Analysis

[ ]: