recyclebot

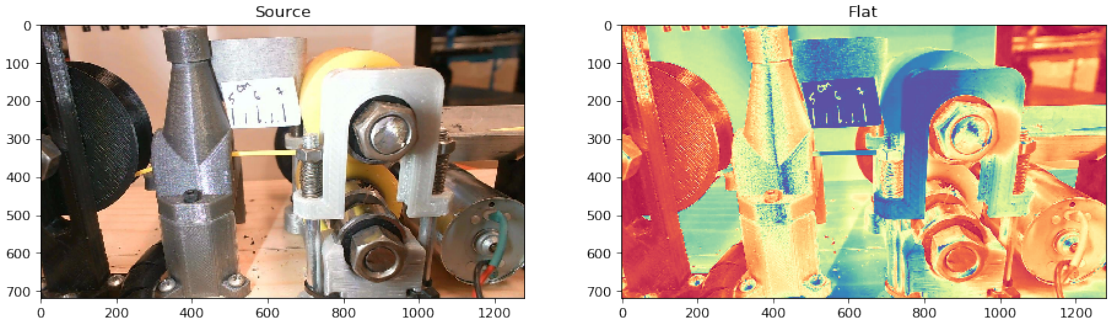
May 26, 2019

0.1 Measure Filament Diameter

```
In [1]: # RecycleBot

        import os
        import sys
        import cv2
        import numpy as np
        from matplotlib import pyplot as plt
        import matplotlib.image as mpimg
        from mpl_toolkits.mplot3d import Axes3D

        import pandas as pd
        import seaborn as sns
        from skimage import io, transform

        %matplotlib inline
        plt.ion()   # interactive mode
```

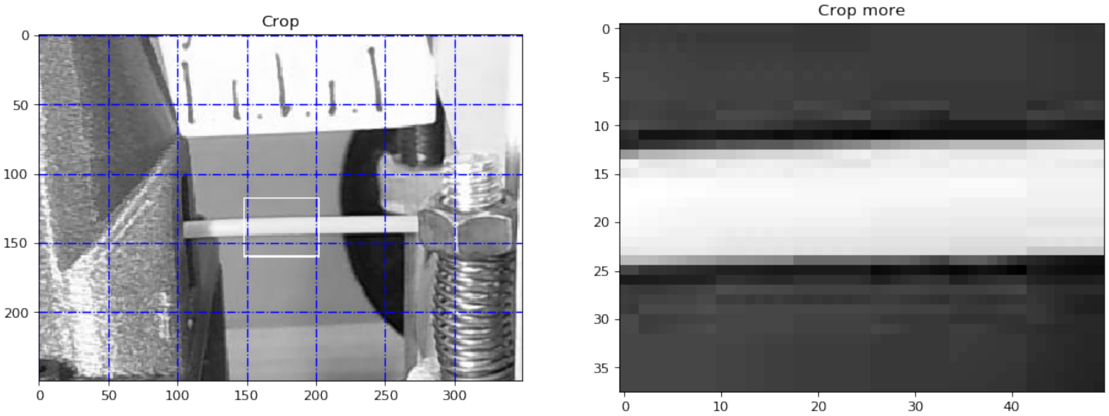
0.1.1 1. Get the image

```
In [2]: #img_src = mpimg.imread('pic.jpg')

        img_bgr = cv2.imread("pic.jpg")
        img_rgb = cv2.cvtColor(img_bgr, cv2.COLOR_BGR2RGB)
        gray = cv2.cvtColor(img_rgb, cv2.COLOR_BGR2GRAY)

        fig = plt.figure(figsize=(14, 14), dpi=80)
        plt.subplot(1, 2, 1)
        plt.imshow(img_rgb)
        plt.title('Source')
        plt.subplot(1, 2, 2)
        plt.imshow(gray,cmap=plt.cm.Spectral, alpha=1)
        plt.title('Flat')
        plt.show()
```

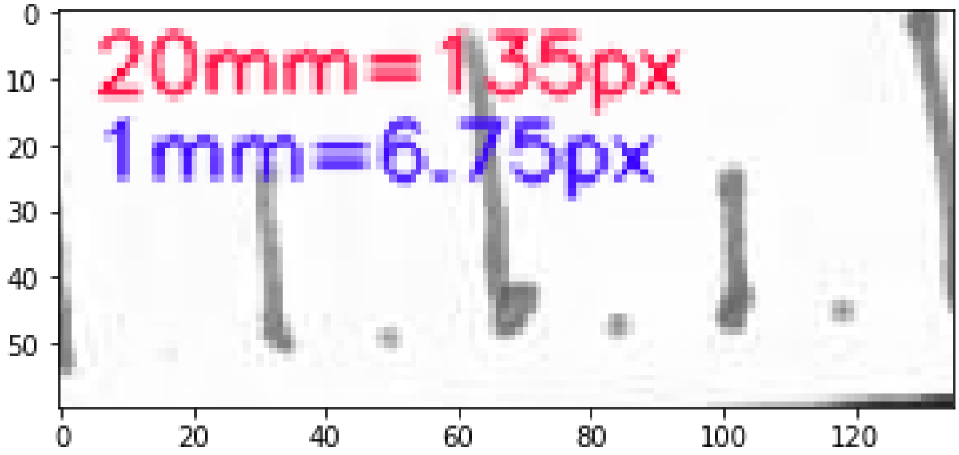


0.1.2 2. Crop the Region of Interest

```
In [3]: y = 200
        x = 400
        h = 250
        w = 350

        crop_img = gray[y:y+h, x:x+w]


        crop_more = crop_img[120:158, 150:200]

        cv2.rectangle(crop_img,(148,118),(202,160),(255,255,255),1)

        fig = plt.figure(figsize=(14, 14), dpi=80)
        plt.subplot(1, 2, 1)
        plt.imshow(crop_img,cmap=plt.cm.gray)
        plt.grid(color='b', linestyle='-.', linewidth=1)
        plt.title('Crop')
        plt.subplot(1, 2, 2)
        plt.imshow(crop_more,cmap=plt.cm.gray)
        plt.title('Crop more')
        plt.show()
```



In [4]:
```
# Check the scale
crop_scale = crop_img[10:70, 110:245]
crop_scale = cv2.cvtColor(crop_scale, cv2.COLOR_GRAY2RGB)
cv2.putText(crop_scale,'20mm=135px',(5,12),cv2.FONT_HERSHEY_SIMPLEX,0.4,(255,0,55),1,cv
cv2.putText(crop_scale,'1mm=6.75px',(5,25),cv2.FONT_HERSHEY_SIMPLEX,0.4,(55,0,255),1,cv

imgplot = plt.imshow(crop_scale,cmap=plt.cm.gray)

mm2pix_scale = 135/20
```

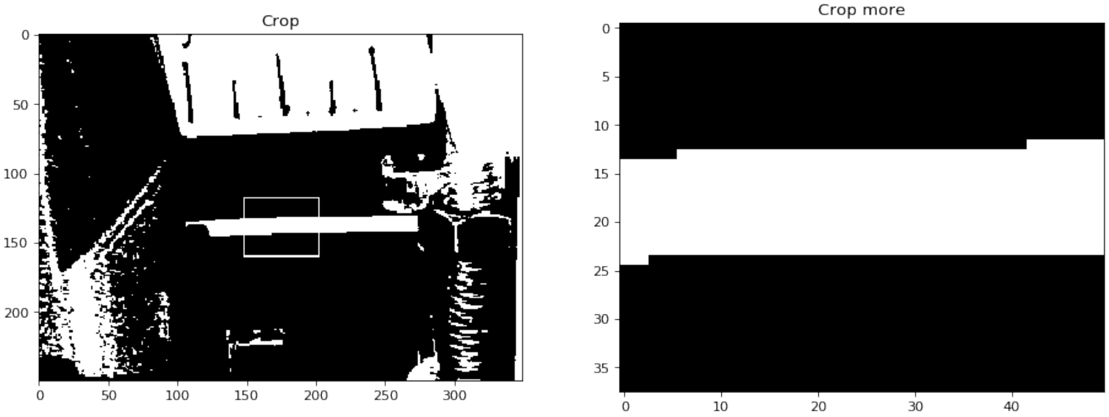


In [5]:
```
135/20
```

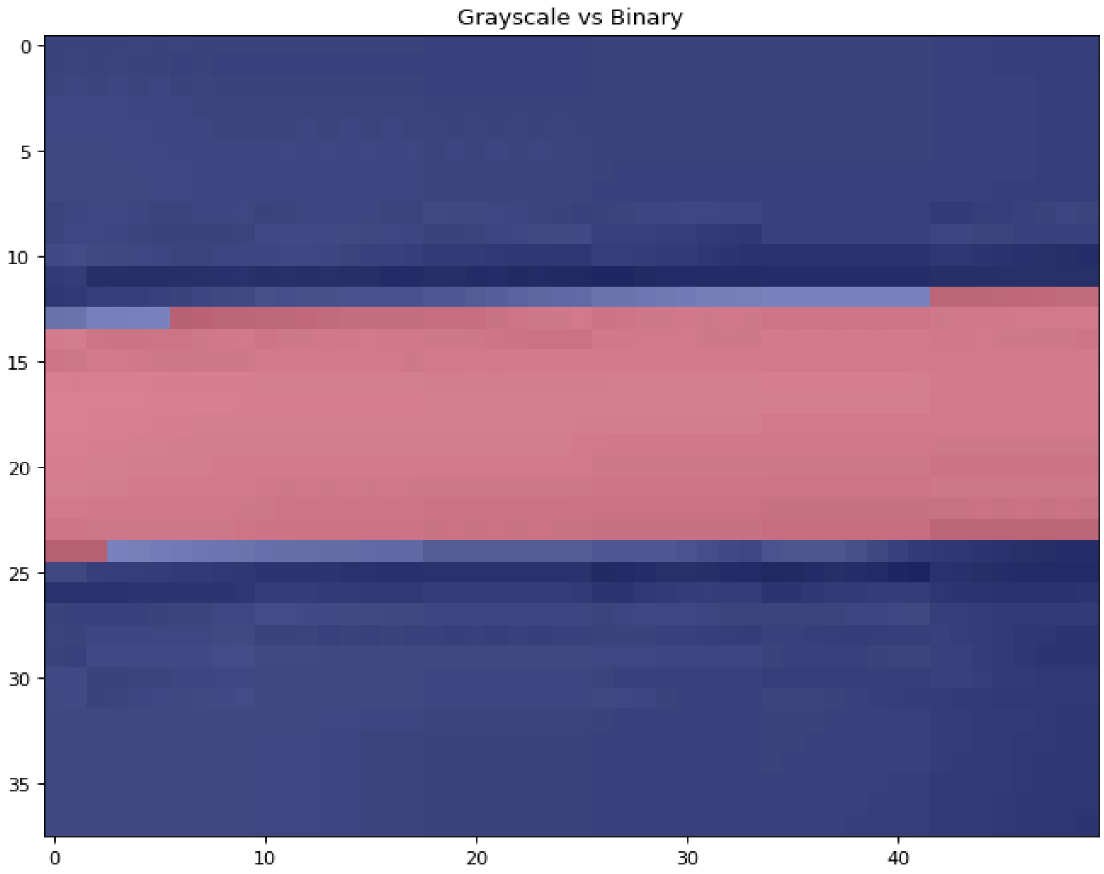
Out[5]:
```
6.75
```

0.1.3 3. Binarize ROI

In [6]:
```
#retval_crop1, threshold_crop1 = cv2.threshold(crop_img, 210, 255, cv2.THRESH_BINARY)
retval_crop1, threshold_crop1 = cv2.threshold(crop_img, 210, 255, cv2.THRESH_BINARY+cv2
retval_crop2, threshold_crop2 = cv2.threshold(crop_more, 210, 255, cv2.THRESH_BINARY)

#retval2,threshold2 = cv2.threshold(crop_more,125,255,cv2.THRESH_BINARY+cv2.THRESH_OTS

#imgplot = plt.imshow(threshold)


fig = plt.figure(figsize=(14, 14), dpi=80)
plt.subplot(1, 2, 1)
plt.imshow(threshold_crop1,cmap=plt.cm.gray)
plt.title('Crop')
plt.subplot(1, 2, 2)
plt.imshow(threshold_crop2,cmap=plt.cm.gray)
plt.title('Crop more')
plt.show()
```

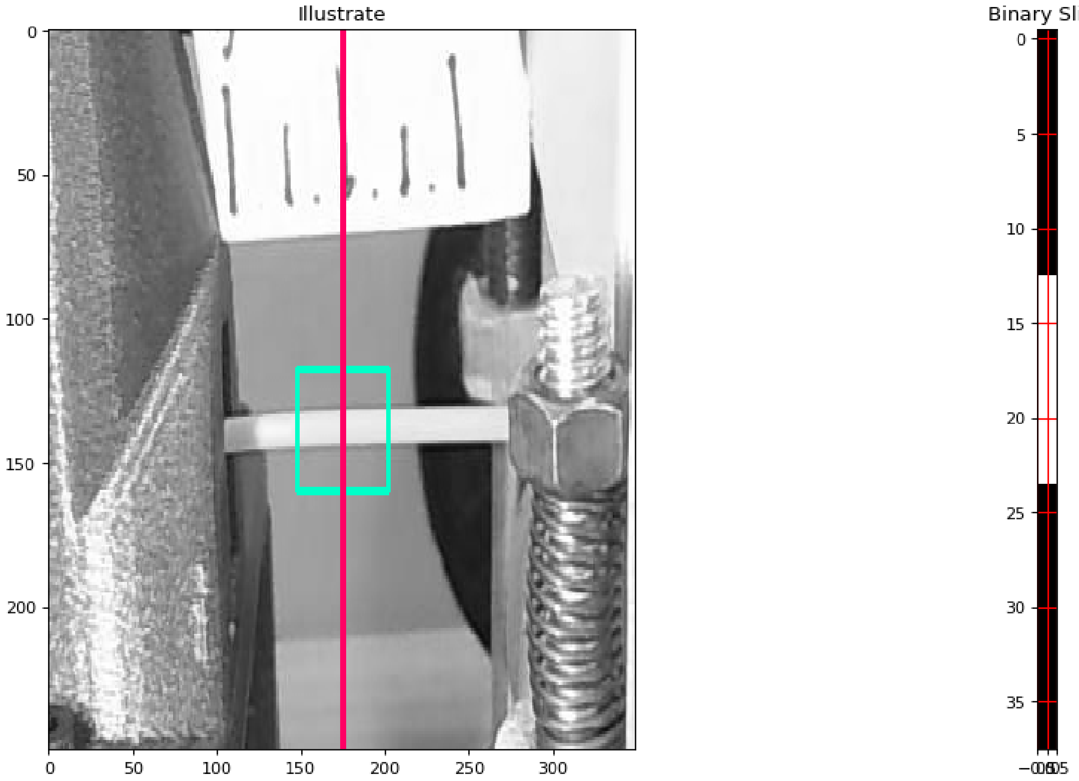


In [7]:
```
# Check matching
fig = plt.figure(figsize=(10, 10), dpi=80)
plt.imshow(crop_more, cmap=plt.cm.gray, alpha=1)
plt.imshow(threshold_crop2, cmap=plt.cm.coolwarm, alpha=0.5)
plt.title('Grayscale vs Binary')
plt.show()
```



0.1.4 4. Slice a single_pixel array

```
In [8]: illustrate = cv2.cvtColor(crop_img, cv2.COLOR_GRAY2RGB)
        cv2.rectangle(illustrate,(148,118),(202,160),(0,255,200),2)
        cv2.line(illustrate,(175,0),(175,250),(255,0,100),2)

        bin_slice = threshold_crop2[:,20:21]

        fig = plt.figure(figsize=(14, 8), dpi=80)

        plt.subplot(1, 2, 1)
        plt.imshow(illustrate,aspect="auto")
        plt.title('Illustrate')
        plt.subplot(1, 2, 2)
        plt.imshow(bin_slice,cmap=plt.cm.gray,aspect="equal")
        plt.grid(color='r', linestyle='-', linewidth=1)
        plt.title('Binary Slice')
        plt.show()

        bin_slice.shape
```



```
Out[8]: (38, 1)
```

0.1.5 5. Calculate Filament Diameter

```
In [9]: #bin_slice

        px_d = np.count_nonzero(bin_slice) # number of nonzero elements
        px_d # number of white pixel in the cross section

        # add 1 pixel as a calibration coeffitient
        px_d = px_d + 1

        mm_d = px_d/mm2pix_scale # calculate diameter in mm, based on our pixel/mm ration
        mm_d # calculated diameter of filament

        print(mm_d)
        print('filament diameter is {} mm'.format(np.round(mm_d,3)))
```

```
1.7777777777777777
filament diameter is 1.778 mm
```

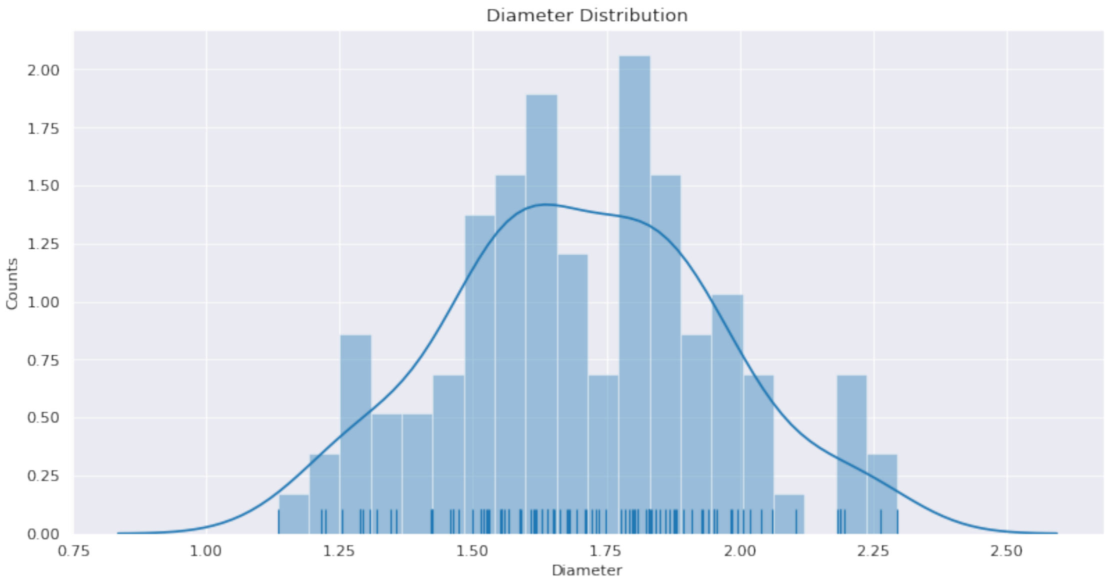
0.1.6 6. Calculate Diameter Distribution

```
In [10]: # When you have real measurements, substitute 'Darray' with
         # an array of measured data

         Darray = np.zeros(100)

         for i in range(len(Darray)):
             Darray[i] = np.random.normal(1.75,0.25)
```

```
In [11]: len(Darray)
```

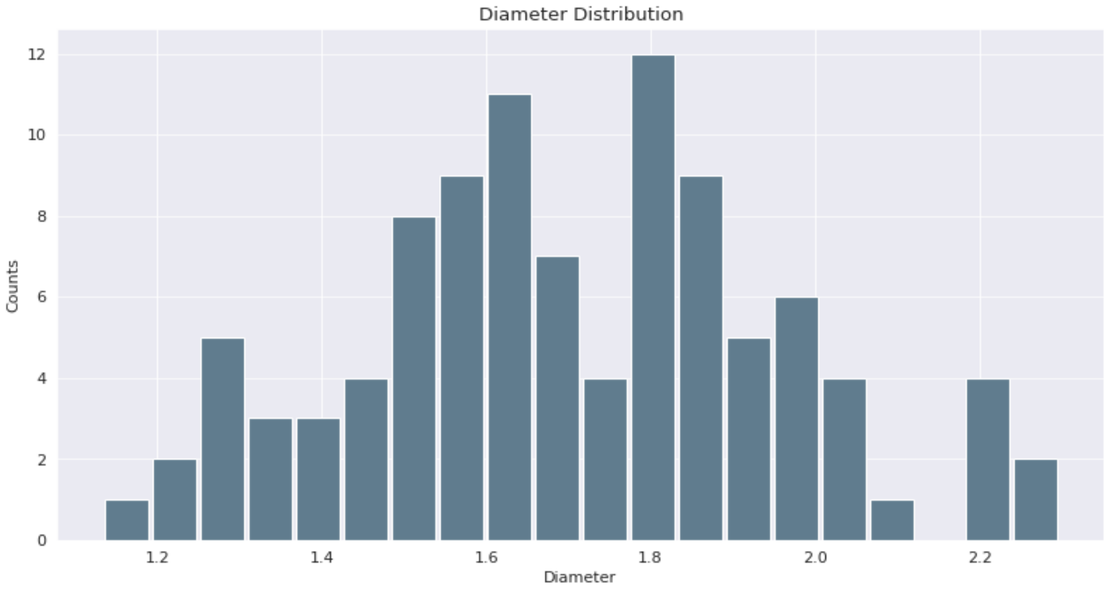
```
Out[11]: 100
```

```
In [12]: # plot histogram with 'seaborn'
         fig = plt.figure(figsize=(12, 6), dpi=80)

         sns.set_style('darkgrid')
         sns.distplot(Darray, bins=20, hist=True, kde=True, rug=True)
         plt.title('Diameter Distribution')
         plt.xlabel('Diameter')
         plt.ylabel('Counts')
         plt.grid(axis='y', alpha=0.75)
         plt.show()
```



```
In [13]: # or plot histogram with pandas

         size, scale = 1000, 10
```

```
commutes = pd.Series(Darray)

fig = plt.figure(figsize=(12, 6), dpi=80)
commutes.plot.hist(grid=True, bins=20, rwidth=0.9,
                   color='#607c8e')
plt.title('Diameter Distribution')
plt.xlabel('Diameter')
plt.ylabel('Counts')
plt.grid(axis='y', alpha=0.75)
plt.show()
```



```
In [ ]:
```