Untitled

October 25, 2017

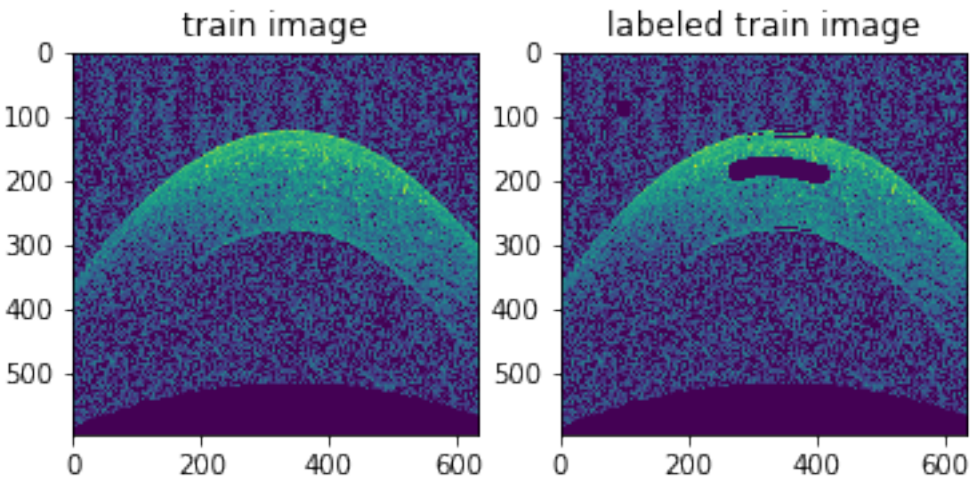
1 1 Random Forests

imports

```
In [1]: import numpy as np;
        from skimage import io
        from scipy.ndimage import gaussian_filter, gaussian_laplace, gaussian_gradient_magnitu
        import matplotlib.pyplot as plt;
        from copy import deepcopy
        from skimage.feature import structure_tensor, hessian_matrix, hessian_matrix_eigvals
```

1.1 1.1 Download and load the data

```
In [2]: #import labels
        labels = np.load('ex01_train_labels.npy')[:,:,0];
        #import pictures
        test_png = io.imread('ex01_test.png', as_grey=True);
        train_png = io.imread('ex01_train.png', as_grey=True);
        labeled_train_png = deepcopy(train_png);
        labeled_train_png[~np.isnan(labels)]=labels[~np.isnan(labels)];
        #plot side by side
        plt.figure(1);
        plt.subplot(121);
        plt.title('train image');
        plt.imshow(train_png);
        plt.subplot(122);
        plt.title('labeled train image');
        plt.imshow(labeled_train_png);
        plt.show();
```



1.2 1.2 Features

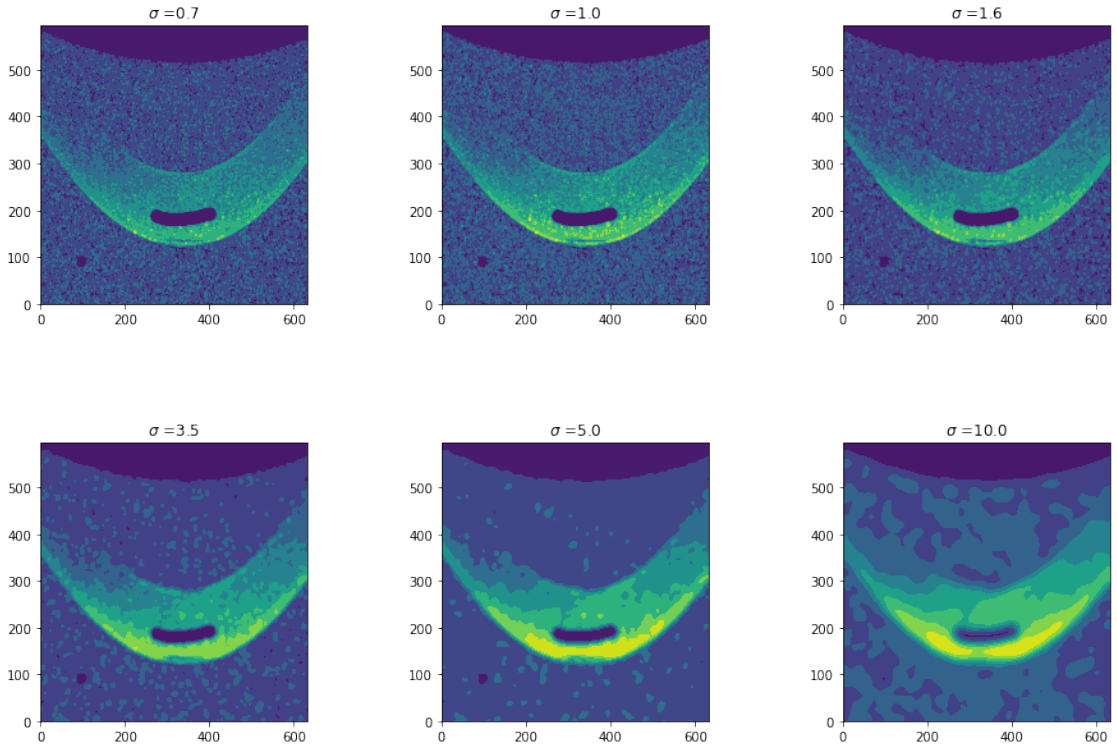
```
In [3]: sigma  = np.array([0.7,1,1.6,3.5,5,10])
```

1.2.1 Gaussian Filter

on train image

```
In [4]: plt.figure(2);
        fig, axs = plt.subplots(2,3, figsize=(15, 10));
        fig.subplots_adjust(hspace = 0.5, wspace=0.5);
        axs = axs.ravel()
        for i in range(len(sigma)):
            axs[i].contourf(gaussian_filter(labeled_train_png,sigma[i]))
            axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
        plt.show();
```

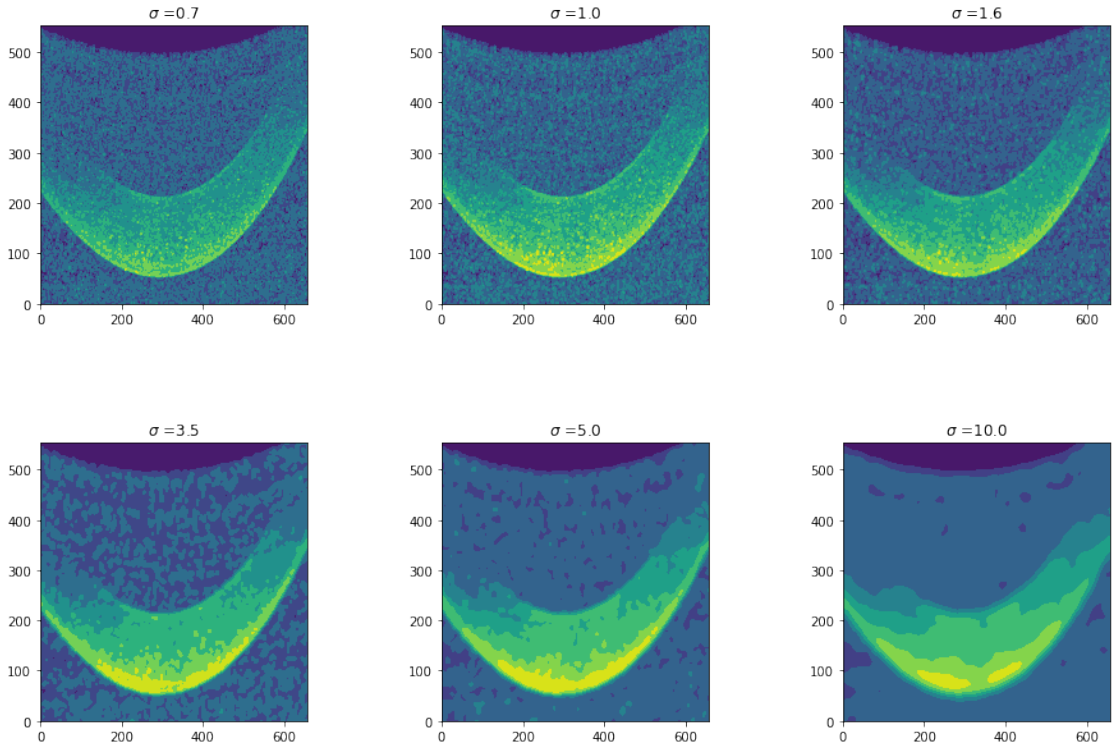
```
<matplotlib.figure.Figure at 0x189eed56cc0>
```



on test image

```
In [5]: plt.figure(3);
        fig, axs = plt.subplots(2,3, figsize=(15, 10));
        fig.subplots_adjust(hspace = 0.5, wspace=0.5);
        axs = axs.ravel()
        for i in range(len(sigma)):
            axs[i].contourf(gaussian_filter(test_png,sigma[i]))
            axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
        plt.show();
```

```
<matplotlib.figure.Figure at 0x189ef417c88>
```

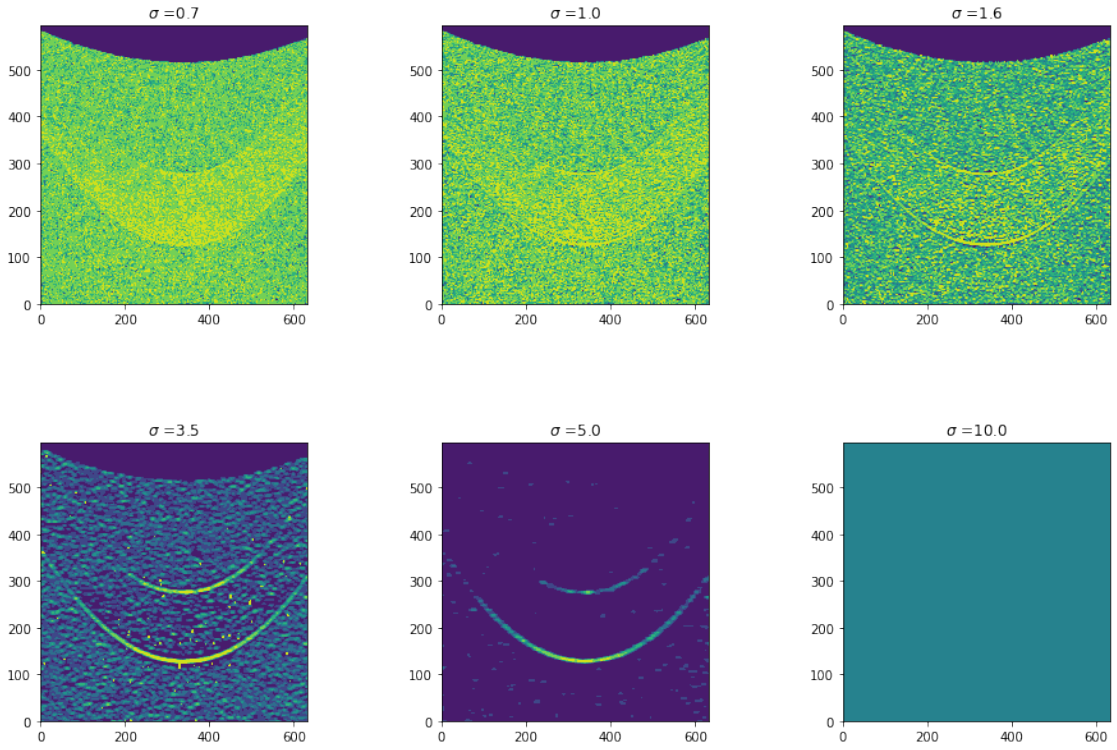


1.2.2 Gaussian-Laplace Filter

on train image

```
In [6]: plt.figure(4);
        fig, axs = plt.subplots(2,3, figsize=(15, 10));
        fig.subplots_adjust(hspace = 0.5, wspace=0.5);
        axs = axs.ravel()
        for i in range(len(sigma)):
            axs[i].contourf(gaussian_laplace(train_png,sigma[i]))
            axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
        plt.show();
```

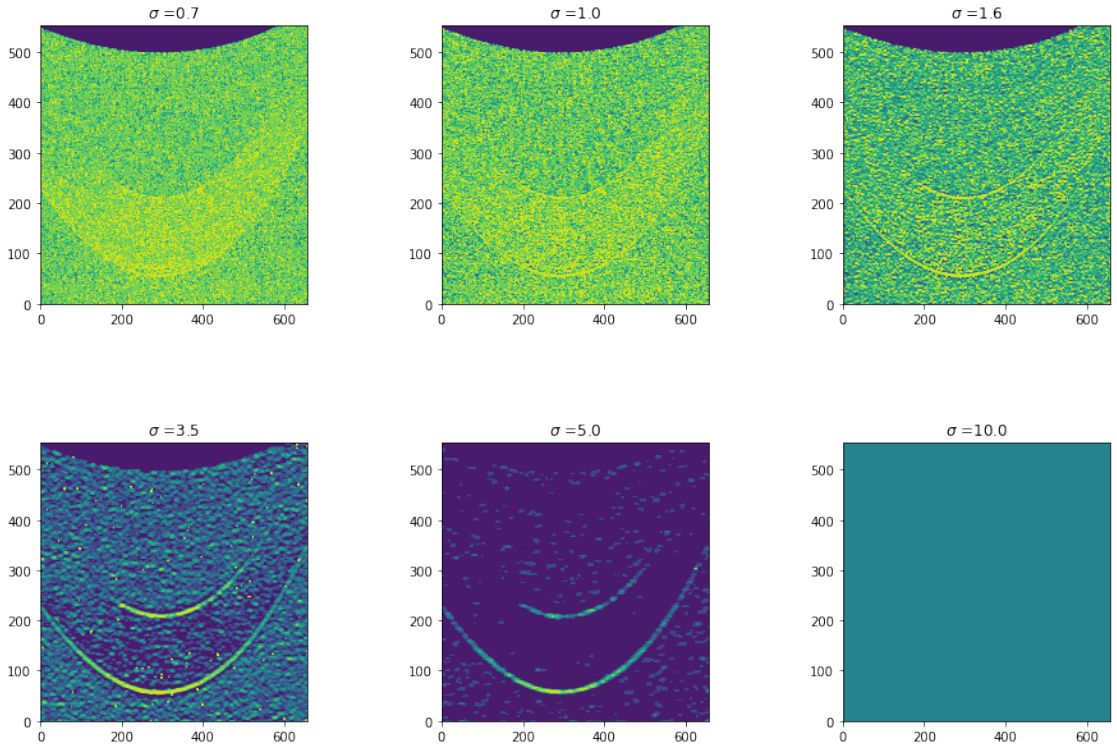
```
<matplotlib.figure.Figure at 0x189f13ea160>
```



on test image

```
In [7]: plt.figure(5);
        fig, axs = plt.subplots(2,3, figsize=(15, 10));
        fig.subplots_adjust(hspace = 0.5, wspace=0.5);
        axs = axs.ravel()
        for i in range(len(sigma)):
            axs[i].contourf(gaussian_laplace(test_png,sigma[i]))
            axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
        plt.show();
```

```
<matplotlib.figure.Figure at 0x189f1ea61d0>
```

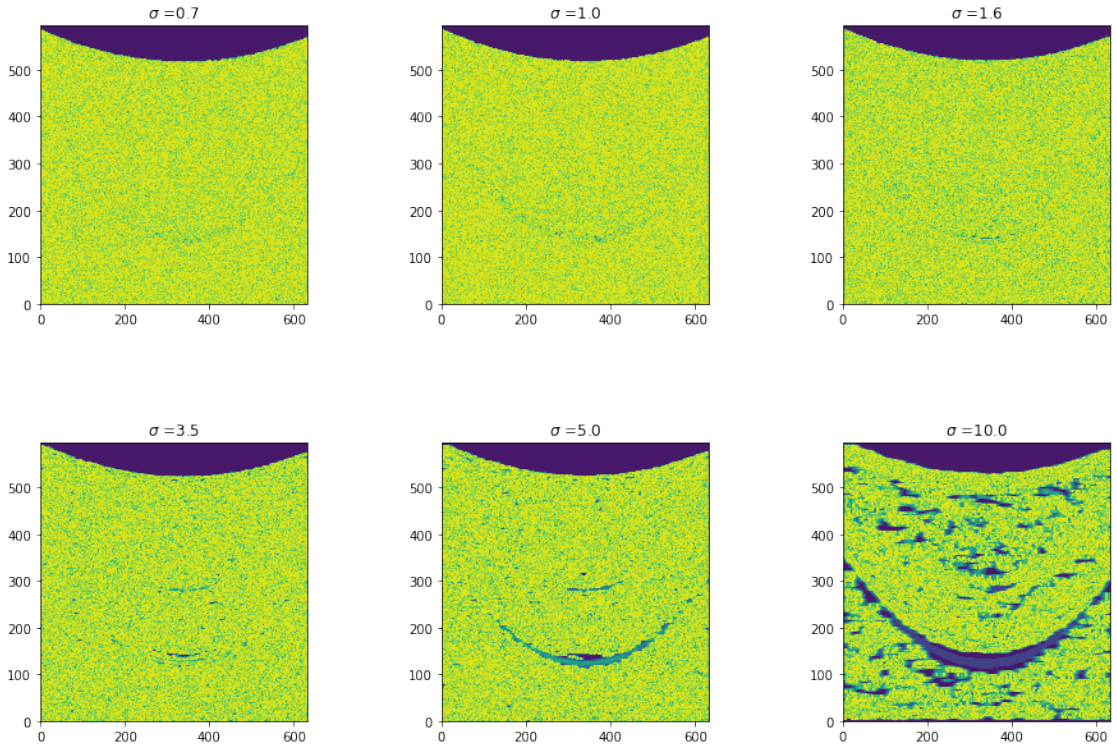


1.2.3 Gaussian Gradient Magnitude filter

on train image

```
In [8]: plt.figure(6);
        fig, axs = plt.subplots(2,3, figsize=(15, 10));
        fig.subplots_adjust(hspace = 0.5, wspace=0.5);
        axs = axs.ravel()
        for i in range(len(sigma)):
            axs[i].contourf(gaussian_gradient_magnitude(train_png,sigma[i]))
            axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
        plt.show();
```

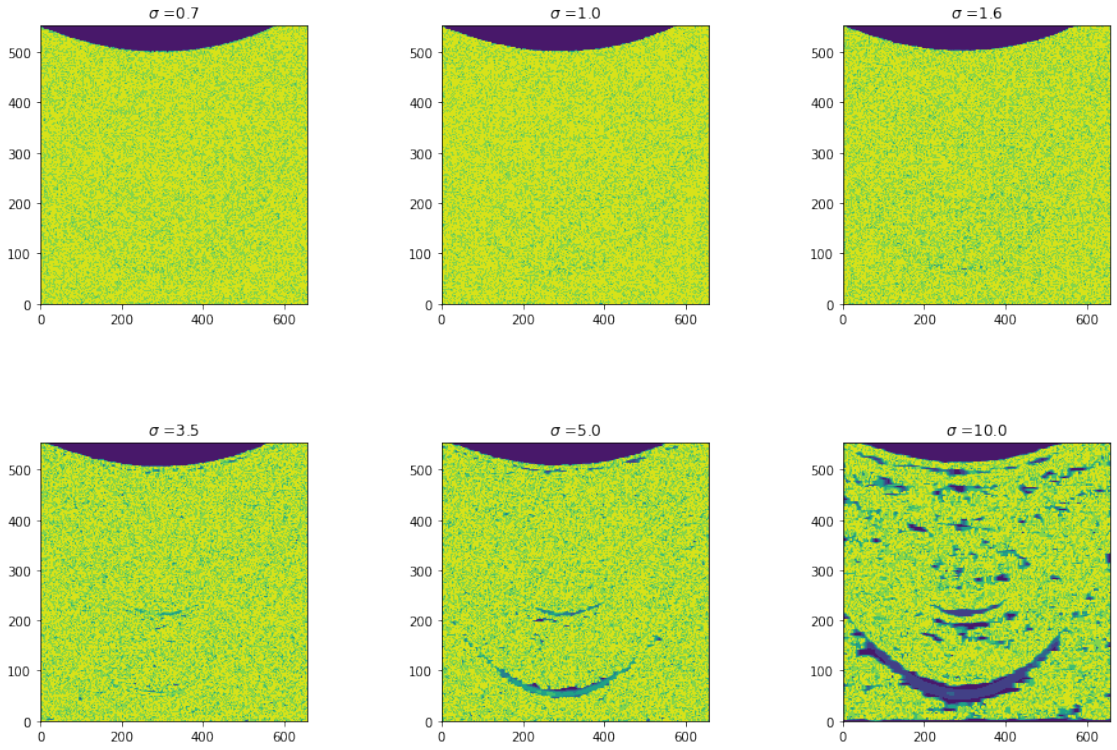
```
<matplotlib.figure.Figure at 0x18987cc4278>
```



on test image

```
In [9]: plt.figure(7);
        fig, axs = plt.subplots(2,3, figsize=(15, 10));
        fig.subplots_adjust(hspace = 0.5, wspace=0.5);
        axs = axs.ravel()
        for i in range(len(sigma)):
            axs[i].contourf(gaussian_gradient_magnitude(test_png,sigma[i]))
            axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
        plt.show();
```

```
<matplotlib.figure.Figure at 0x1898884d198>
```

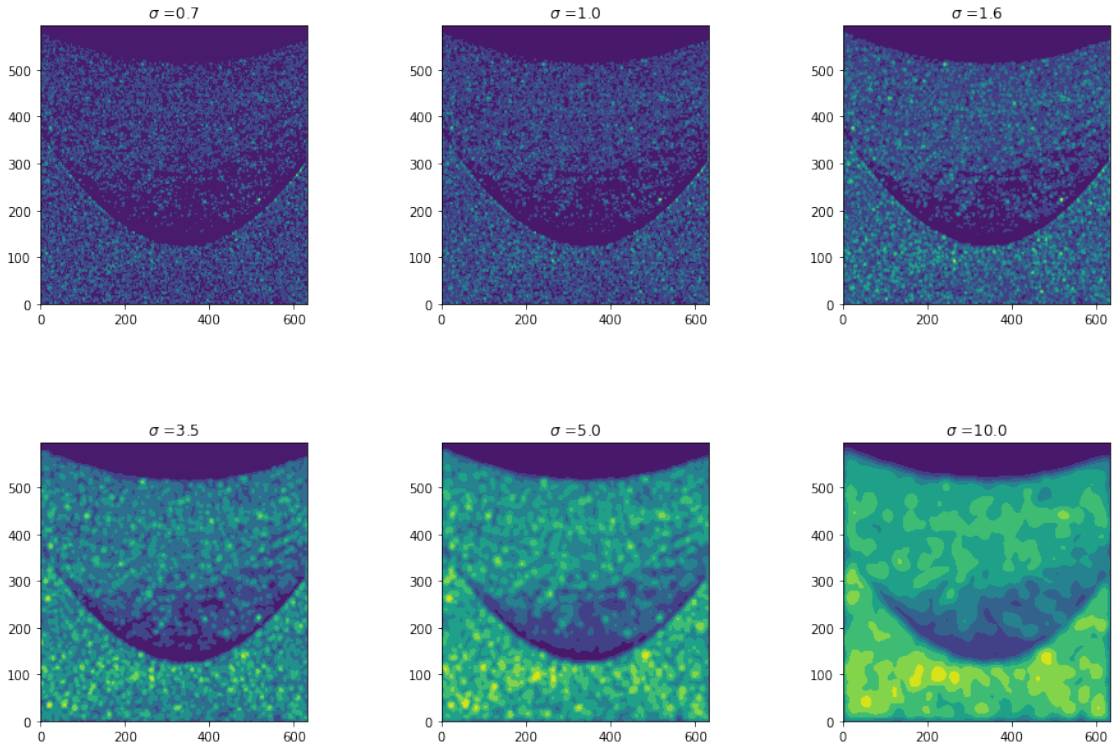


1.2.4 structure tensor

on train image

```
In [10]: plt.figure(8);
         fig, axs = plt.subplots(2,3, figsize=(15, 10));
         fig.subplots_adjust(hspace = 0.5, wspace=0.5);
         axs = axs.ravel()
         for i in range(len(sigma)):
             axs[i].contourf(structure_tensor(train_png,sigma[i])[0])
             axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
         plt.show();
```

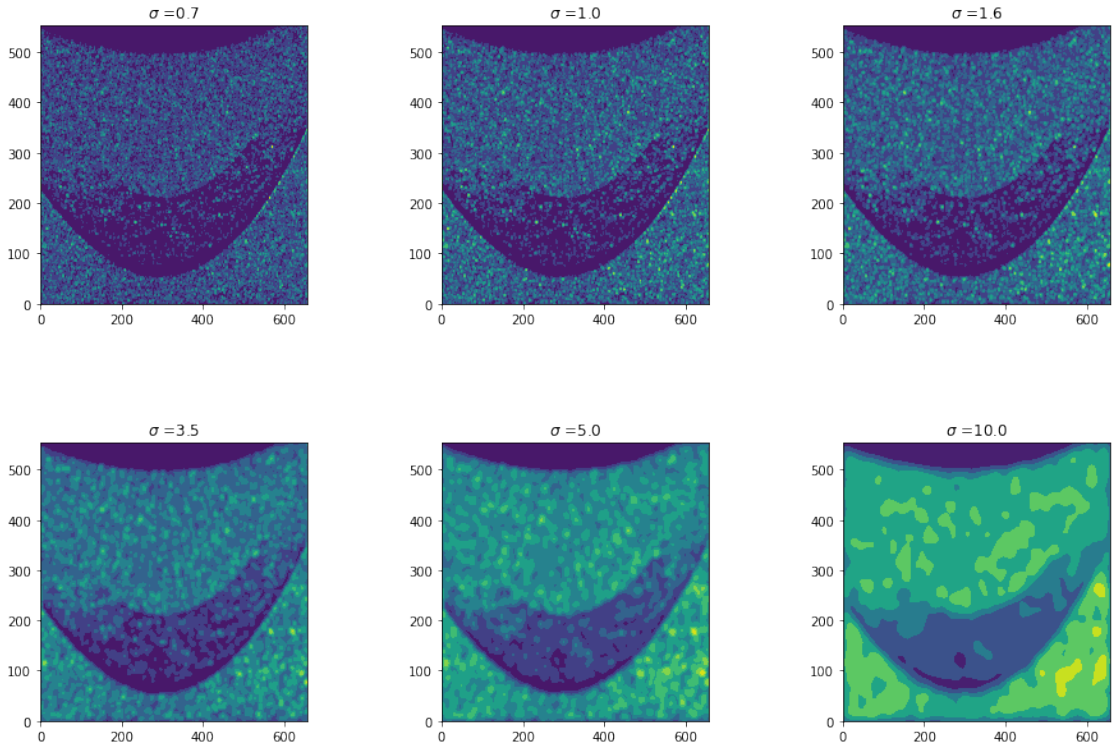
```
<matplotlib.figure.Figure at 0x18988503e10>
```



1.2.5 on test image

```
In [11]: plt.figure(9);
         fig, axs = plt.subplots(2,3, figsize=(15, 10));
         fig.subplots_adjust(hspace = 0.5, wspace=0.5);
         axs = axs.ravel()
         for i in range(len(sigma)):
             axs[i].contourf(structure_tensor(test_png,sigma[i])[0])
             axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
         plt.show();
```

```
<matplotlib.figure.Figure at 0x189a7d3bc18>
```

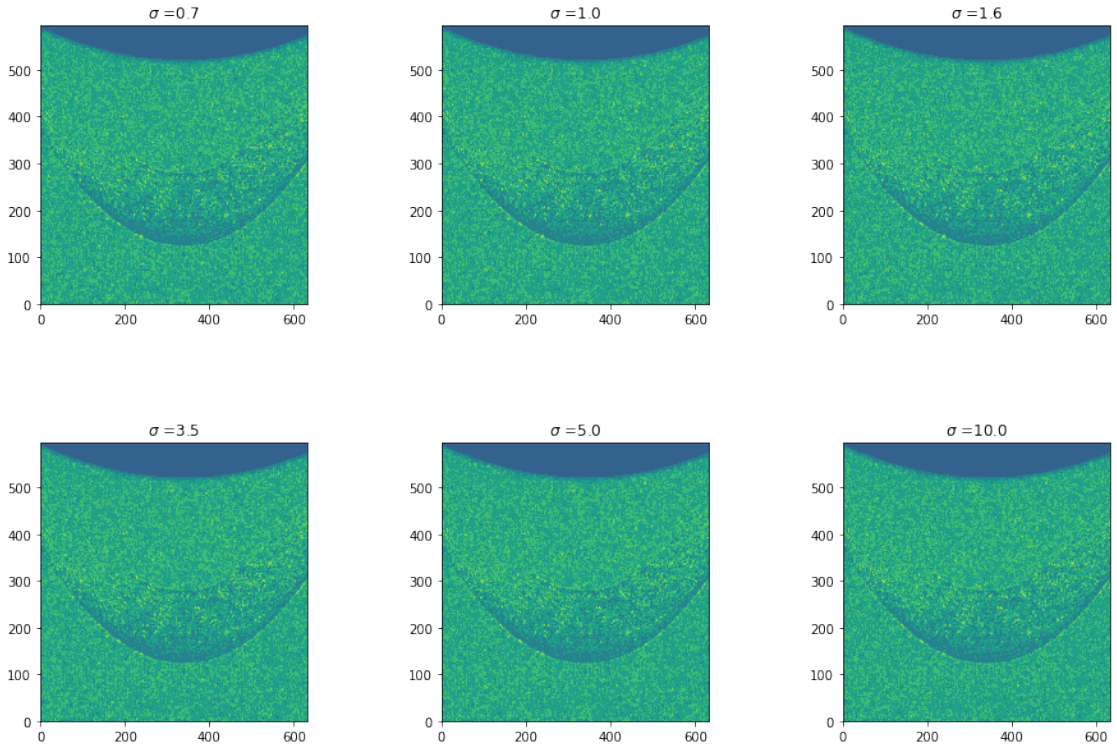


1.2.6 hessian eigenvalues

on train image

```
In [12]: plt.figure(10);
         fig, axs = plt.subplots(2,3, figsize=(15, 10));
         fig.subplots_adjust(hspace = 0.5, wspace=0.5);
         axs = axs.ravel()
         for i in range(len(sigma)):
             x,y,z = hessian_matrix(train_png, sigma=0.5, order='rc')
             axs[i].contourf(hessian_matrix_eigvals(x,y,z)[0])
             axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
         plt.show();
```

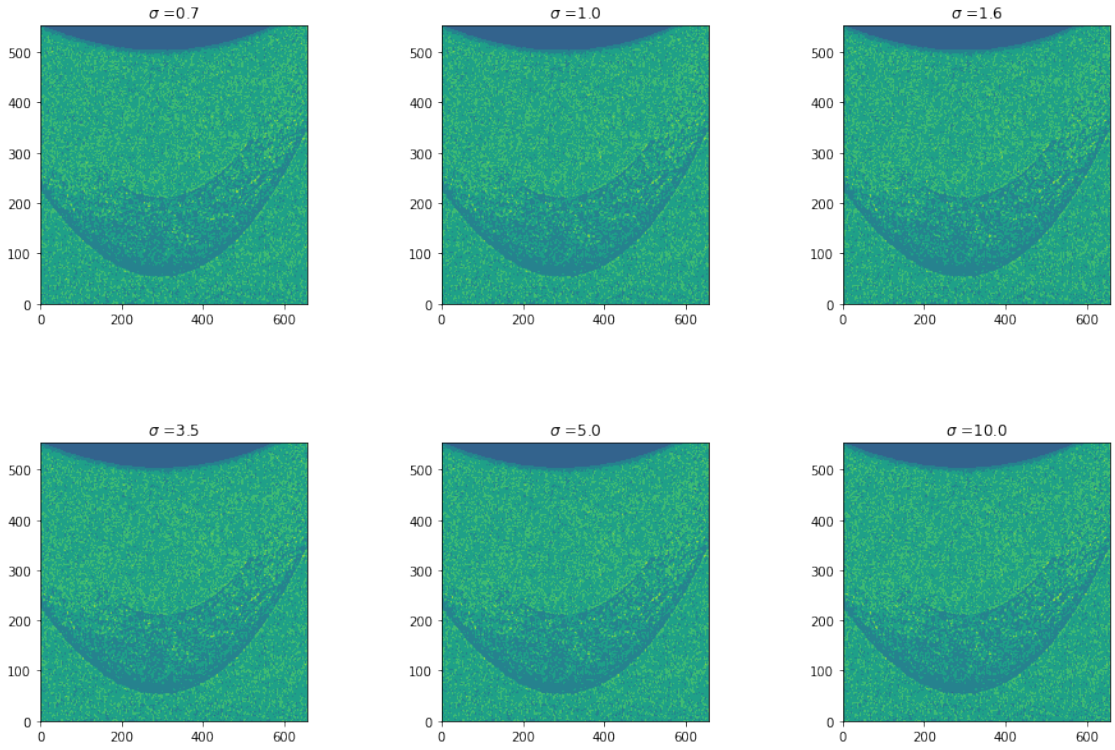
```
<matplotlib.figure.Figure at 0x189a7dcb2e8>
```



1.2.7 on test image

```
In [13]: plt.figure(11);
         fig, axs = plt.subplots(2,3, figsize=(15, 10));
         fig.subplots_adjust(hspace = 0.5, wspace=0.5);
         axs = axs.ravel()
         for i in range(len(sigma)):
             x,y,z = hessian_matrix(test_png, sigma=0.5, order='rc')
             axs[i].contourf(hessian_matrix_eigvals(x,y,z)[0])
             axs[i].set_title(r'$\sigma$ =%s'%(sigma[i]))
         plt.show();
```

```
<matplotlib.figure.Figure at 0x189f1e98390>
```


σ =0.7
σ =1.0
σ =1.6
σ =3.5
σ =5.0
σ =10.0
0
100
200
300
400
500
600