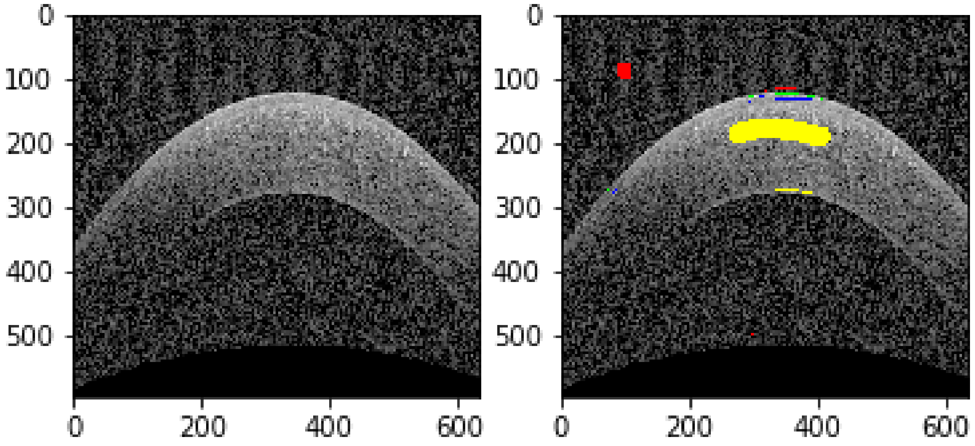
ex01_solution-Copy1

October 26, 2017

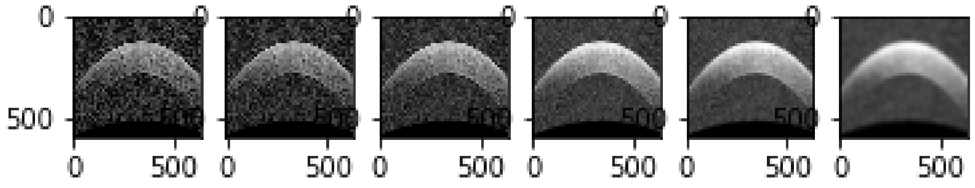
```
In [1]: import scipy.ndimage
        import cv2
        import numpy as np
        import skimage.color
        import skimage.feature
        import sklearn.ensemble

        %matplotlib inline
        import matplotlib.pyplot as plt
```

```
In [2]: train = cv2.imread("oct2.png")
        label = np.load('labels3.npy').squeeze()
        train_label = cv2.imread("label_newnew.png")
        train_gray = skimage.color.rgb2gray(train)

        test = cv2.imread("oct3.png")
        #test = cv2.imread("test.png")
        test = skimage.color.rgb2gray(test)

        train_label = train.copy()


        for lbl, color in enumerate([(255,0,0), (0,255,0), (0,0,255), (255,255,0)]):
            mask = label == lbl
            train_label[mask] = color

        f = plt.figure()
        ax_left = f.add_subplot(121)
        ax_right = f.add_subplot(122)
        ax_left.imshow(train)
        ax_right.imshow(train_label)
```

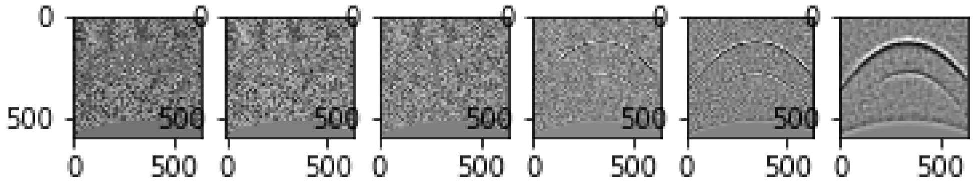
```
Out[2]: <matplotlib.image.AxesImage at 0x7fc9f863dfd0>
```



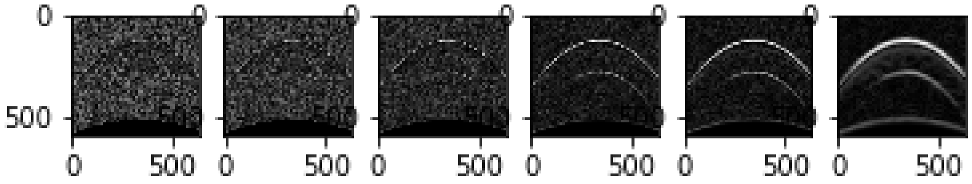
```
In [176]: filters = []

          f = plt.figure()
          sigmas = [0.7, 1, 1.6, 3.5, 5, 10]
          for i, sigma in enumerate(sigmas):
              res = scipy.ndimage.gaussian_filter(train_gray, sigma=sigma)
              ax = f.add_subplot(1, len(sigmas), i+1)
              ax.imshow(res, cmap='gray')
              filters.append(res)
```



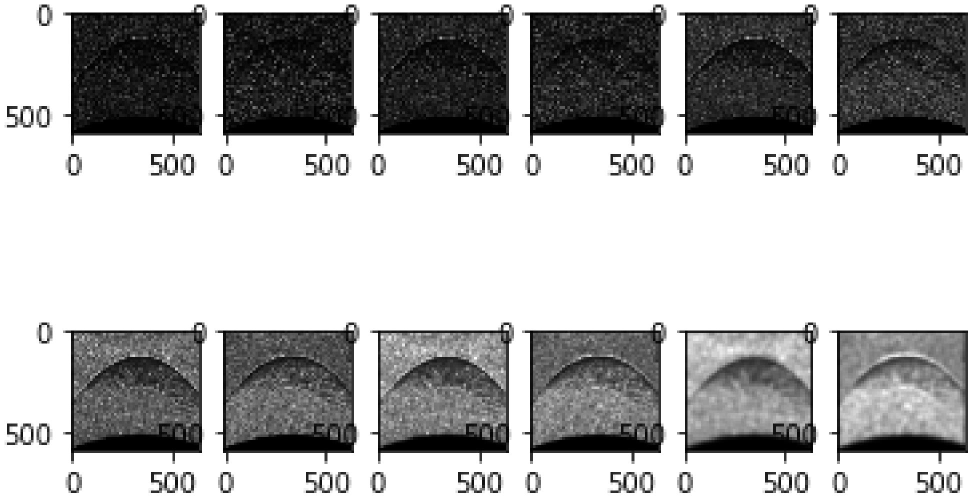
```
In [177]: f = plt.figure()
          for i, sigma in enumerate(sigmas):
              res = scipy.ndimage.gaussian_laplace(train_gray, sigma=sigma)
              ax = f.add_subplot(1, len(sigmas), i+1)
              ax.imshow(res, cmap='gray')
              filters.append(res)
```



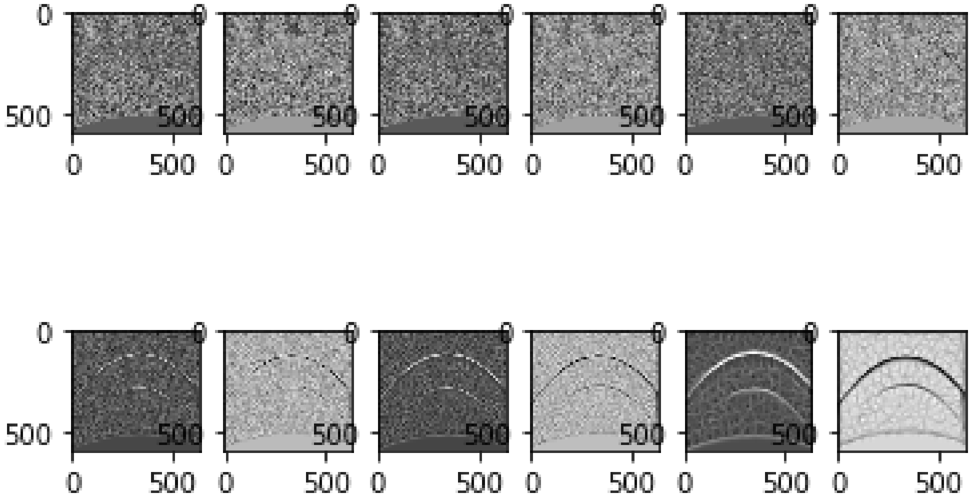
```
In [178]: f = plt.figure()
          for i, sigma in enumerate(sigmas):
              res = scipy.ndimage.gaussian_gradient_magnitude(train_gray, sigma=sigma)
              ax = f.add_subplot(1, len(sigmas), i+1)
              ax.imshow(res, cmap='gray')
              filters.append(res)
```



```
In [179]: f = plt.figure()
          for i, sigma in enumerate(sigmas):
              a,b = skimage.feature.structure_tensor_eigvals(*skimage.feature.structure_tensor(t
              ax0 = f.add_subplot(2, len(sigmas), 2*i+1)
              ax1 = f.add_subplot(2, len(sigmas), 2*i+2)
              ax0.imshow(a, cmap='gray')
              ax1.imshow(b, cmap='gray')
              filters.append(a)
              filters.append(b)
```



```
In [180]: f = plt.figure()
          for i, sigma in enumerate(sigmas):
              a,b = skimage.feature.hessian_matrix_eigvals(*skimage.feature.hessian_matrix(train
              ax0 = f.add_subplot(2, len(sigmas), 2*i+1)
              ax1 = f.add_subplot(2, len(sigmas), 2*i+2)
              ax0.imshow(a, cmap='gray')
              ax1.imshow(b, cmap='gray')
              filters.append(a)
              filters.append(b)
```



```
In [181]: filters = np.array(filters)
          print(filters.shape)
          mask = np.logical_not(np.isnan(label))
          train_X = filters[:,mask].T
          train_Y = label[np.logical_not(np.isnan(label))]

          #train_label = train_label[:,:,0].reshape((-1))
          print(train_X.shape)
          print(train_Y.shape)
```

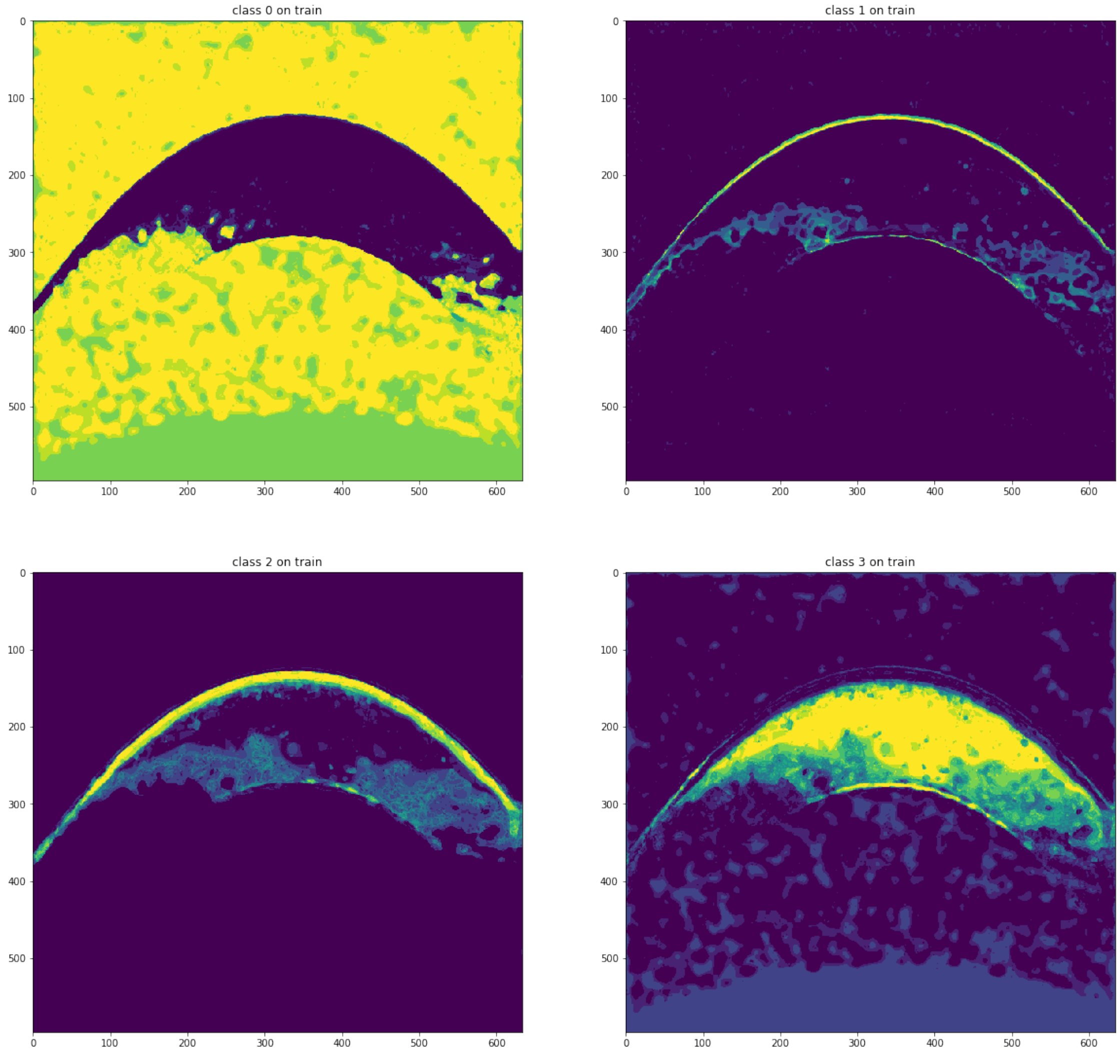
```
(42, 596, 634)
(6255, 42)
(6255,)
```

```
In [182]: rf = sklearn.ensemble.RandomForestClassifier(n_estimators=10)
          rf.fit(train_X, train_Y)
```

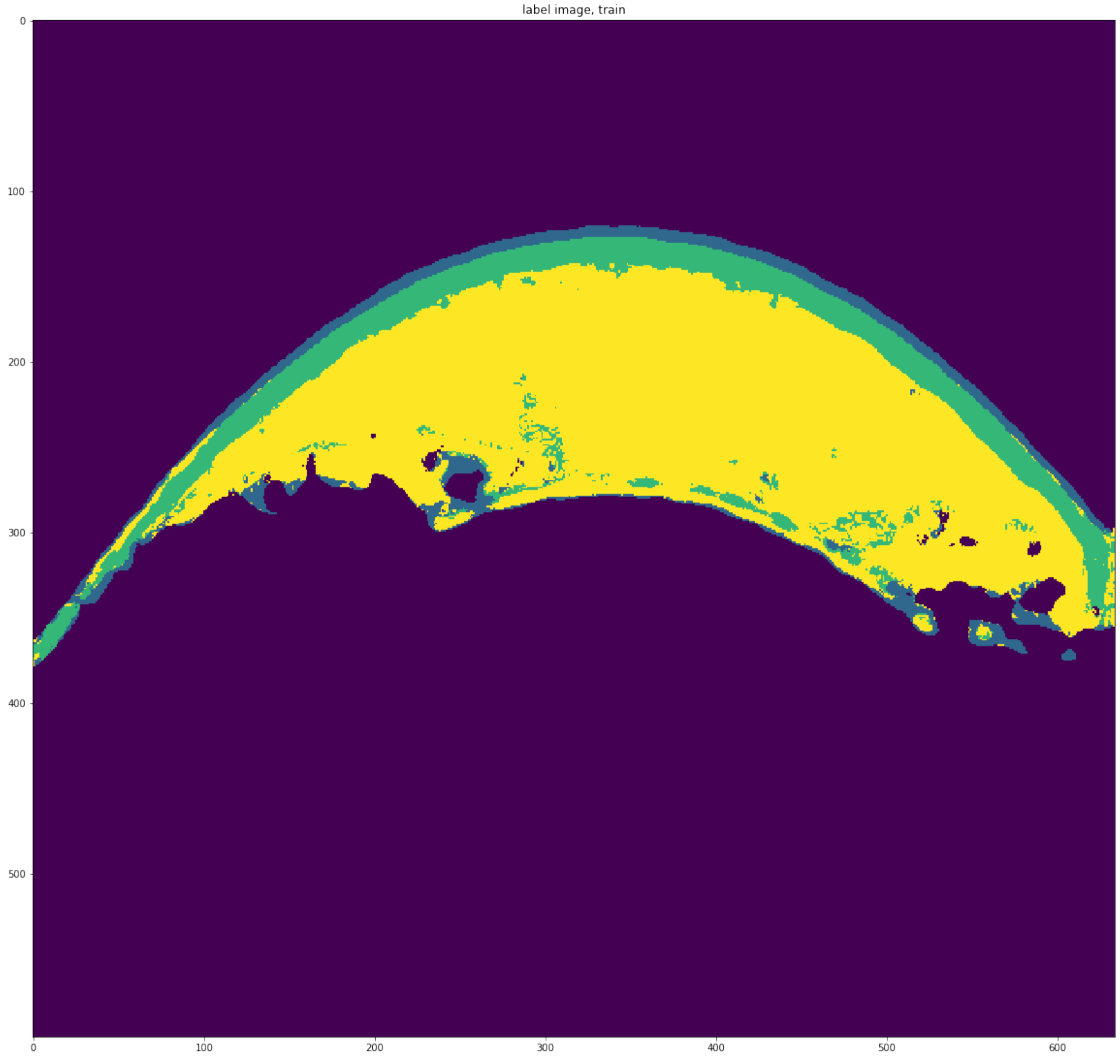
```
Out[182]: RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
                      max_depth=None, max_features='auto', max_leaf_nodes=None,
                      min_impurity_decrease=0.0, min_impurity_split=None,
                      min_samples_leaf=1, min_samples_split=2,
                      min_weight_fraction_leaf=0.0, n_estimators=10, n_jobs=1,
                      oob_score=False, random_state=None, verbose=0,
                      warm_start=False)
```

```
In [183]: pred0 = rf.predict_proba(filters.reshape((filters.shape[0], -1)).T)
          pred0 = pred0.reshape(train_gray.shape+(-1,))
```

```
In [184]: f = plt.figure()
          for i_class in range(pred0.shape[-1]):
              ax = f.add_subplot(4, 2, i_class+1)
              ax.imshow(pred0[:,:,i_class])
              ax.set_title(f"class {i_class} on train")
          f.set_size_inches(20,40)
```



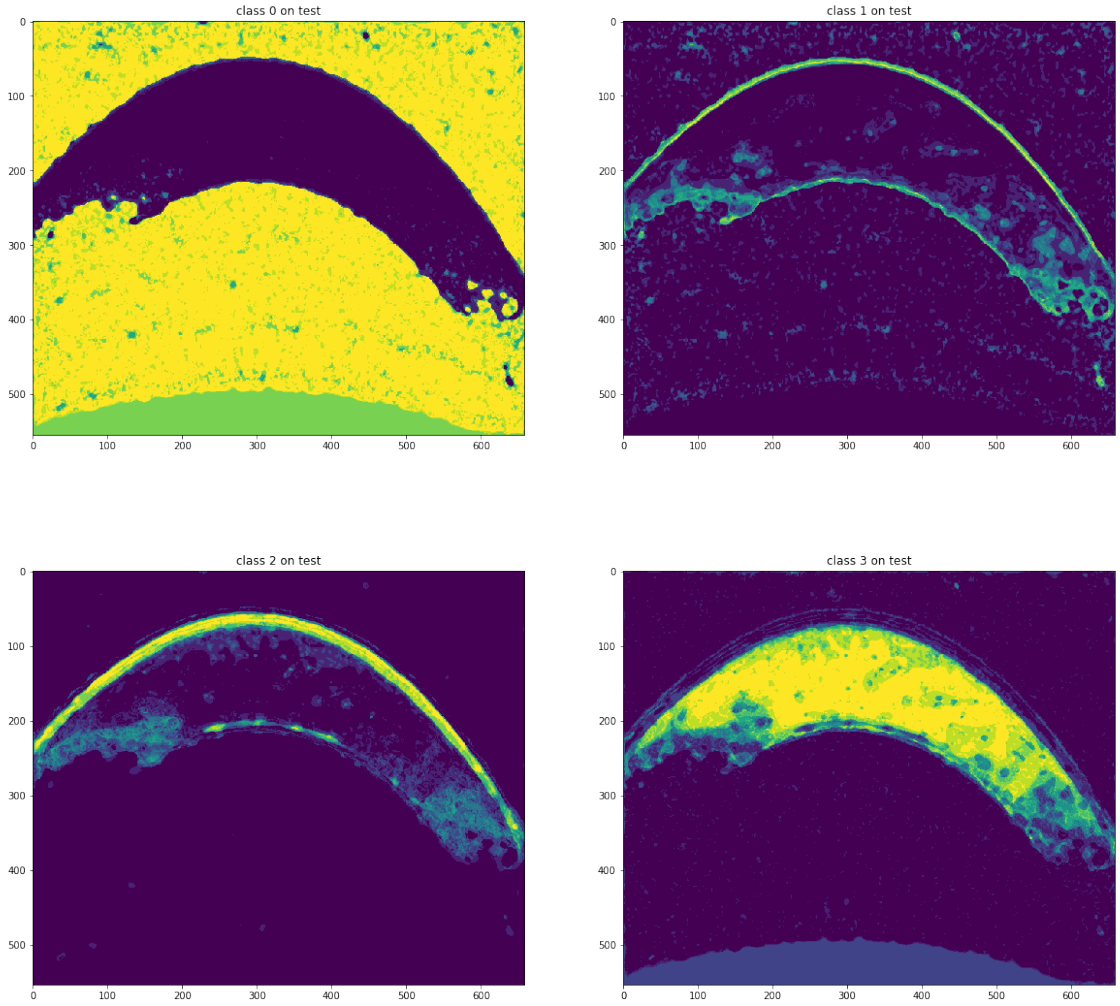
```
In [185]: pred_full = np.argmax(pred0, axis=2)
          f = plt.figure()
          ax = f.add_subplot(111)
          ax.imshow(pred_full)
          ax.set_title("label image, train")
          f.set_size_inches(20,40)
```



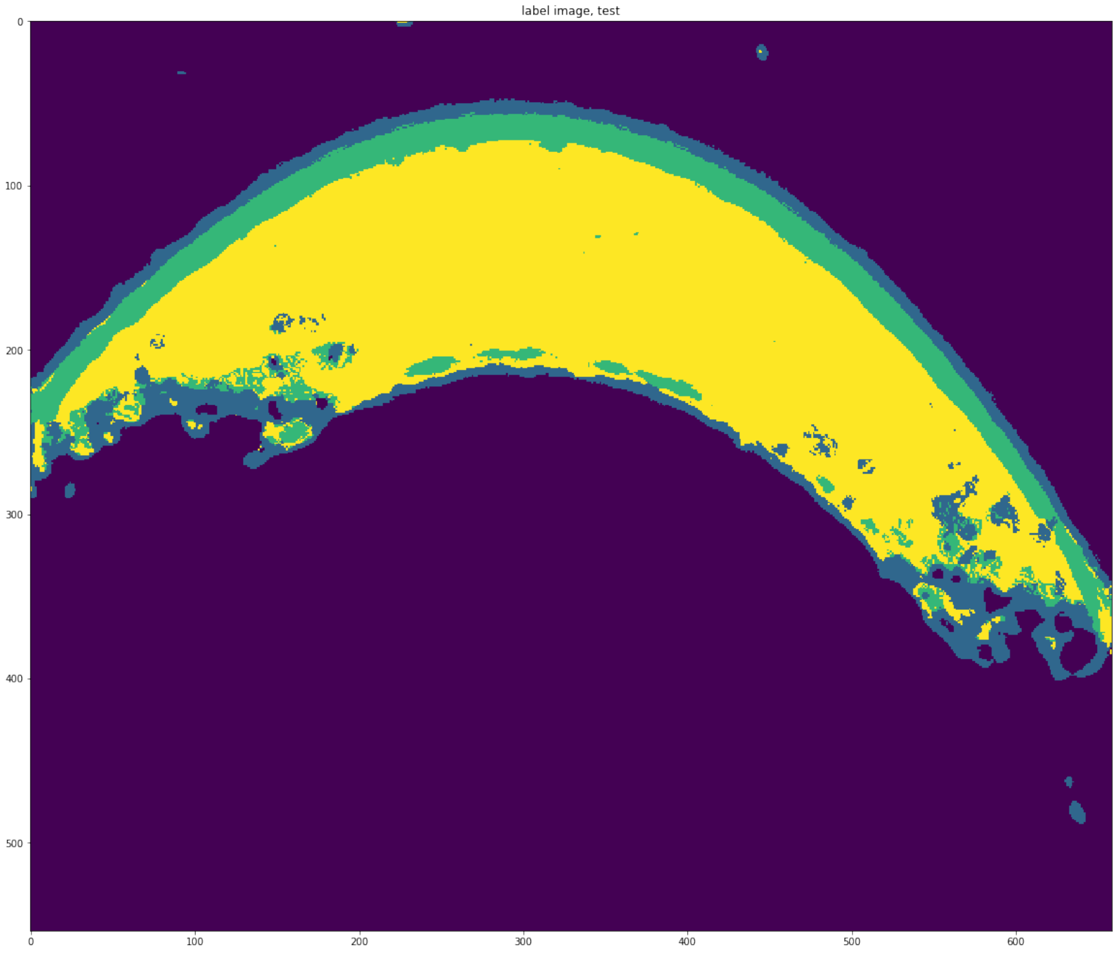
```
In [186]: test_filters = []
          for i, sigma in enumerate(sigmas):
              res = scipy.ndimage.gaussian_filter(test, sigma=sigma)
              test_filters.append(res)
          for i, sigma in enumerate(sigmas):
              res = scipy.ndimage.gaussian_laplace(test, sigma=sigma)
              test_filters.append(res)
          for i, sigma in enumerate(sigmas):
              res = scipy.ndimage.gaussian_gradient_magnitude(test, sigma=sigma)
              test_filters.append(res)
          for i, sigma in enumerate(sigmas):
              a,b = skimage.feature.structure_tensor_eigvals(*skimage.feature.structure_tensor(t
              test_filters.append(a)
              test_filters.append(b)
          for i, sigma in enumerate(sigmas):
              a,b = skimage.feature.hessian_matrix_eigvals(*skimage.feature.hessian_matrix(test,
              test_filters.append(a)
              test_filters.append(b)
```

```
In [187]: test_filters = np.array(test_filters)
          pred = rf.predict_proba(test_filters.reshape((test_filters.shape[0], -1)).T)
          pred = pred.reshape(test.shape+(-1,))
```

```
In [188]: f = plt.figure()
          for i_class in range(pred.shape[-1]):
              ax = f.add_subplot(4, 2, i_class+1)
              ax.imshow(pred[:,:,i_class])
              ax.set_title(f"class {i_class} on test")
          f.set_size_inches(20,40)
```



```
In [189]: pred_full = np.argmax(pred, axis=2)
          f = plt.figure()
          ax = f.add_subplot(111)
          ax.imshow(pred_full)
          ax.set_title("label image, test")
          f.set_size_inches(20,40)
```


label image, test
0
100
200
300
400
500
0
100
200
300
400
500
600