ImageSegmentationLung

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0.0.1 Image Segmentation using OpenCV (Watershed Algorithm)

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1. **Using watershed Algorithm**

   Steps :

   1. Otsu's binarization - Find threshold - See Fig. 1.1
   2. Sure foreground - erode (removes boundary pixels) - See Fig 1.2
   3. Sure background - dilate (increases object boundary to background) - See Fig. 1.3

   Basic Idea: Change image to an image, where catchment basins are the objects you want to segment/identify.

In [71]:
```
# import necessary modules
import numpy as np
import cv2, matplotlib.pyplot as plt
%matplotlib inline
```

In [72]:
```
# read image and show
img = cv2.imread('lung_cancer.jpeg') # in BGR mode
# convert to RGB mode
img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)

plt.axis('off')
plt.imshow(img)
```

Out[72]:
```
<matplotlib.image.AxesImage at 0x7fa70299f3c8>
```

Step 1 : Calculating Otsu's binarization (pixel value is either 0 or 1)

```
if(pixel_value > threshold):
    pixel_value = 1
else:
    pixel_value = 0
```

```
In [73]: # performing otsu's binarization
         # convert to gray scale first
         gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
         ret, thresh = cv2.threshold(gray, 0, 255, cv2.THRESH_BINARY_INV + cv2.THRESH_OTSU)
         print("Threshold limit: " + str(ret))

         plt.axis('off')
         plt.imshow(thresh, cmap = 'gray')
```

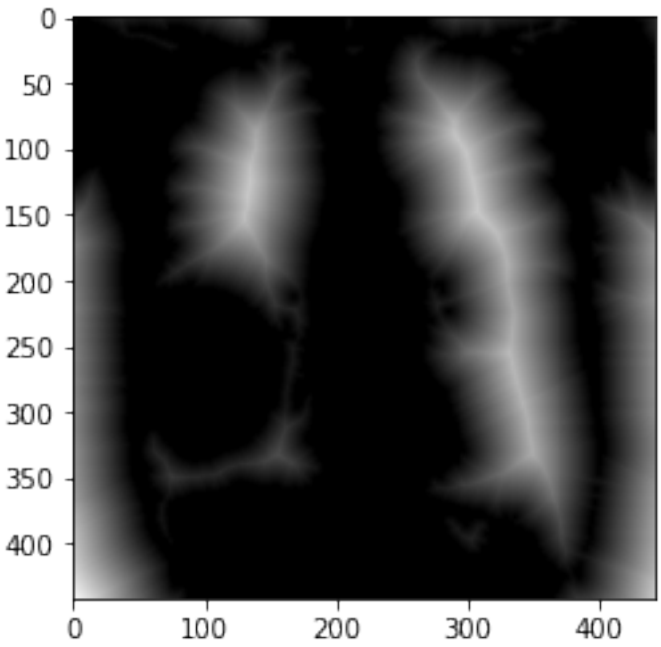
```
Threshold limit: 94.0
```

```
Out[73]: <matplotlib.image.AxesImage at 0x7fa7029744e0>
```

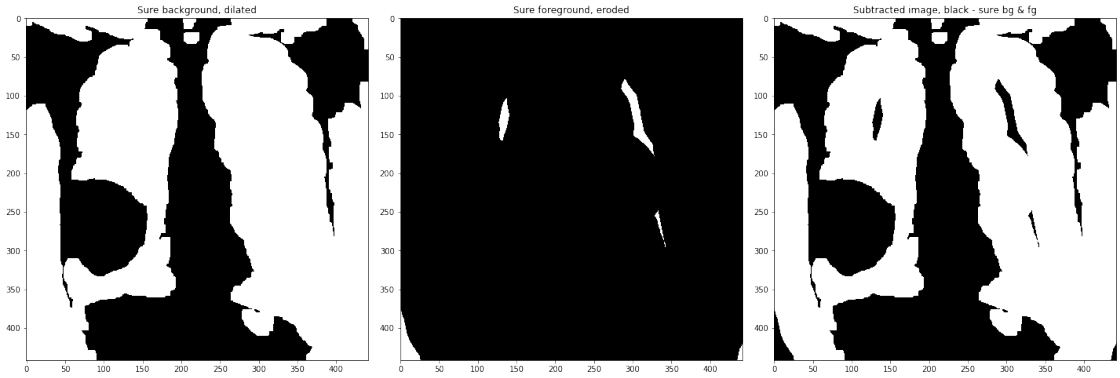
In [74]:
```
# noise removal
kernel = np.ones((3, 3), np.uint8)
opening = cv2.morphologyEx(thresh, cv2.MORPH_OPEN, kernel, iterations = 2)

# sure background area
sure_bg = cv2.dilate(opening, kernel, iterations = 3)

# sure foreground area
dist_transform = cv2.distanceTransform(opening,cv2.DIST_L2,5)
ret, sure_fg = cv2.threshold(dist_transform,0.7*dist_transform.max(),255,0)

# Finding unknown region
sure_fg = np.uint8(sure_fg)
unknown = cv2.subtract(sure_bg,sure_fg)
```

In [75]:
```
plt.imshow(dist_transform, cmap = 'gray')
```

Out[75]:
```
<matplotlib.image.AxesImage at 0x7fa7028c1978>
```



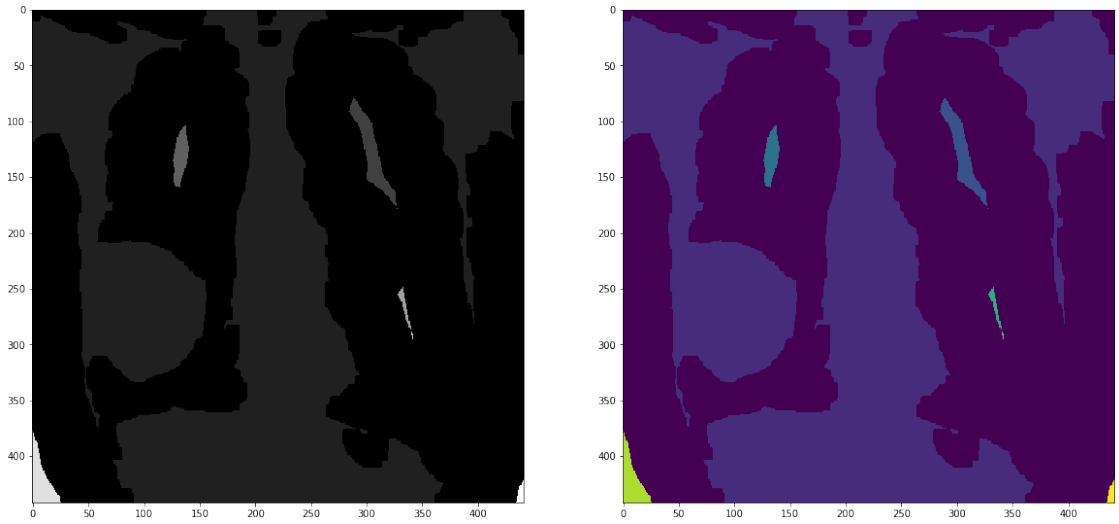
In [76]:
```
fig = plt.figure(figsize = (20, 10)) # to change figsize
plt.subplot(131)
plt.imshow(sure_bg, cmap = 'gray')
plt.title('Sure background, dilated')

plt.subplot(132)
plt.imshow(sure_fg, cmap = 'gray')
plt.title('Sure foreground, eroded')

plt.subplot(133)
plt.imshow(unknown, cmap = 'gray')
plt.title('Subtracted image, black - sure bg & fg')
plt.tight_layout()

# plt.subplots_adjust(wspace = 3)
# fine tuning
# f.subplots_adjust(wspace=3)
```



1. **First image above** - is **dilated image**, which increases the object region to background. **Whatever black, is surely background.**
2. **Second imge above** - we use **distance transform** (For connected coins) and then threshold it, to get the sure coins. **(white is sure fg here).**
3. **Third image above** - we subtract the results in first and second figures to get unknown area. **The white area is unknown area.**

Let's represent **sure background and sure foreground** with **positive integers** and **unknown** area with **0**. We use `cv2.connectedDots()` for this which sets background area to 0, we'll add one after this to make sure it does not remain 0 (as we want unknown area to be 0)

```
In [77]: ret, markers = cv2.connectedComponents(sure_fg)

         markers = markers + 1

         markers[unknown==255] = 0

         fig = plt.figure(figsize = (20, 10)) # to change figsize
         plt.subplot(121)
         plt.imshow(markers, cmap = 'gray')
         plt.subplot(122)
         plt.imshow(markers)

Out[77]: <matplotlib.image.AxesImage at 0x7fa702bb5e10>
```



```
In [78]: markers = cv2.watershed(img, markers)
         img[markers == -1] = [0, 255,0]

In [79]: plt.imshow(img)

Out[79]: <matplotlib.image.AxesImage at 0x7fa702bc13c8>
```