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CT404

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Assignment 2: Image Processing & Analysis

1 A Morphological Image Processing Pipeline for Medical Images

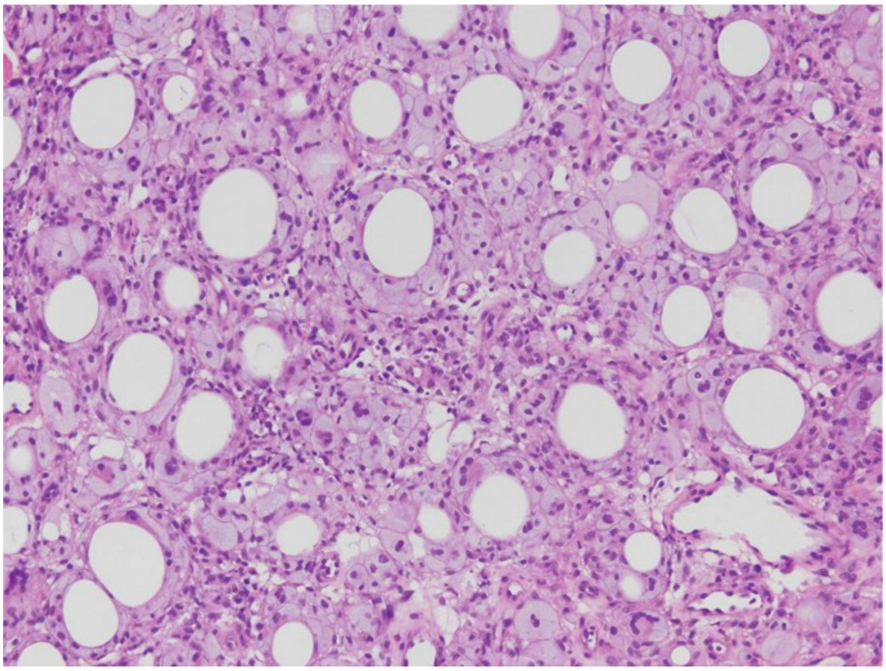


Figure 1: Original Skin Biopsy Image

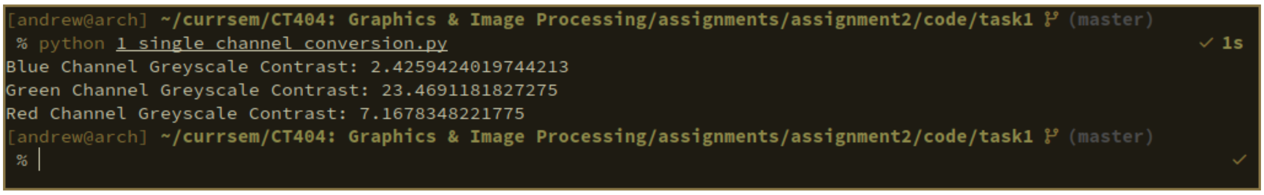
1.1 Conversion to A Single-Channel Image

```
# Task 1: A Morphological image processing pipeline for medical images
# Task 1.1: Conversion to a single channel image
import cv2

# read in original image (in BGR format)
image = cv2.imread("../../Task1.jpg")

# convert to greyscale
greyscale = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
cv2.imwrite("./output/greyscale.jpg", greyscale)

# convert to blue channel only
b_channel = image.copy()
b_channel[:, :, 1] = 0
b_channel[:, :, 2] = 0
cv2.imwrite("./output/b_channel.jpg", b_channel)

# convert blue channel to greyscale
b_channel_greyscale = cv2.cvtColor(b_channel, cv2.COLOR_BGR2GRAY)
b_channel_greyscale_contrast = b_channel_greyscale.std()
cv2.imwrite("./output/b_channel_greyscale.jpg", b_channel_greyscale)

# convert to green channel only
g_channel = image.copy()
g_channel[:, :, 0] = 0
```

```python
g_channel[:, :, 2] = 0
cv2.imwrite("./output/g_channel.jpg", g_channel)

# convert green channel to greyscale
g_channel_greyscale = cv2.cvtColor(g_channel, cv2.COLOR_BGR2GRAY)
g_channel_greyscale_contrast = g_channel_greyscale.std()
cv2.imwrite("./output/g_channel_greyscale.jpg", g_channel_greyscale)

# convert to red channel only
r_channel = image.copy()
r_channel[:, :, 0] = 0
r_channel[:, :, 1] = 0
cv2.imwrite("./output/r_channel.jpg", r_channel)

# convert red channel to greyscale
r_channel_greyscale = cv2.cvtColor(r_channel, cv2.COLOR_BGR2GRAY)
r_channel_greyscale_contrast = r_channel_greyscale.std()
cv2.imwrite("./output/r_channel_greyscale.jpg", g_channel_greyscale)

# assess objectively which allows most contrast
print("Blue Channel Greyscale Contrast: "  + str(b_channel_greyscale_contrast))
print("Green Channel Greyscale Contrast: " + str(g_channel_greyscale_contrast))
print("Red Channel Greyscale Contrast: "   + str(r_channel_greyscale_contrast))
```

Listing 1: `1_single_channel_conversion.py`

Since the image has predominant hues of pink-purple, we would expect the green-channel-only image to be the one that yields the highest contrast, as pink & purple colours are made up primarily by the blue & red channels: the dominance of these channels results in little variance in intensity within these channels, and therefore green will have the highest intensity variance. This is proven true by the text output of the above code, where the standard deviation of the greyscale image based off the green channel alone is by far the highest:



```
[andrew@arch] ~/currsem/CT404: Graphics & Image Processing/assignments/assignment2/code/task1 (master)
 % python 1_single_channel_conversion.py                                                          ✓ 1s
Blue Channel Greyscale Contrast: 2.4259424019744213
Green Channel Greyscale Contrast: 23.4691181827275
Red Channel Greyscale Contrast: 7.1678348221775
[andrew@arch] ~/currsem/CT404: Graphics & Image Processing/assignments/assignment2/code/task1 (master)
 % |                                                                                                 ✓
```

Figure 2: Output of `1_single_channel_conversion.py`

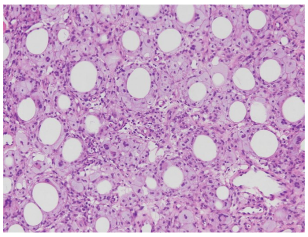


Figure 3: Original image

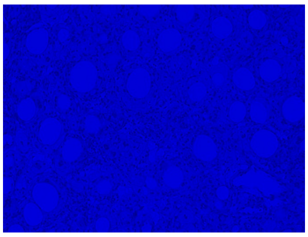


Figure 5: B-Channel

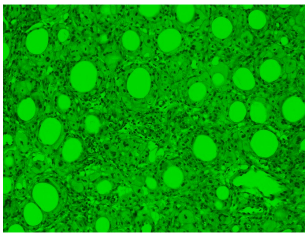


Figure 7: G-Channel

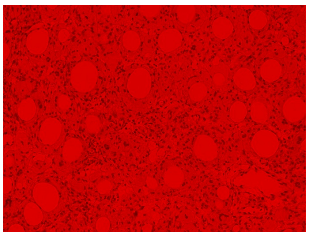


Figure 9: R-Channel

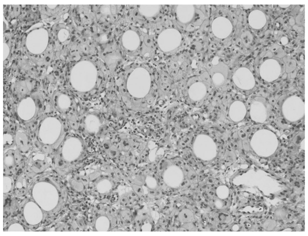


Figure 4: Greyscale original

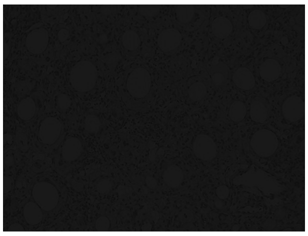


Figure 6: B-Greyscale

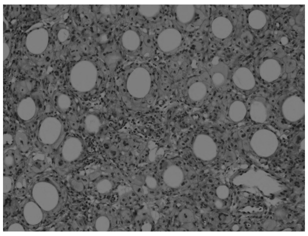


Figure 8: G-Greyscale

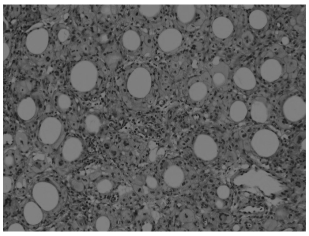


Figure 10: R-Greyscale

My selected single-channel image is the greyscale version of the green-channel-only image, as it yields the greatest contrast:

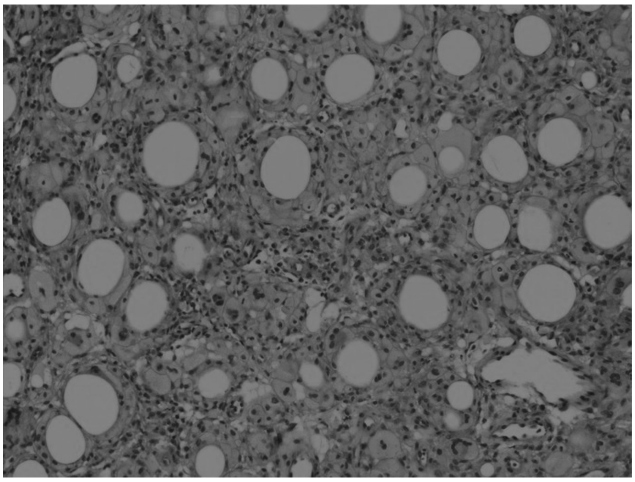


Figure 11: Selected single-channel image: greyscale green-channel-only

1.2 Image Enhancement