Introduction to image processing

February 22, 2025

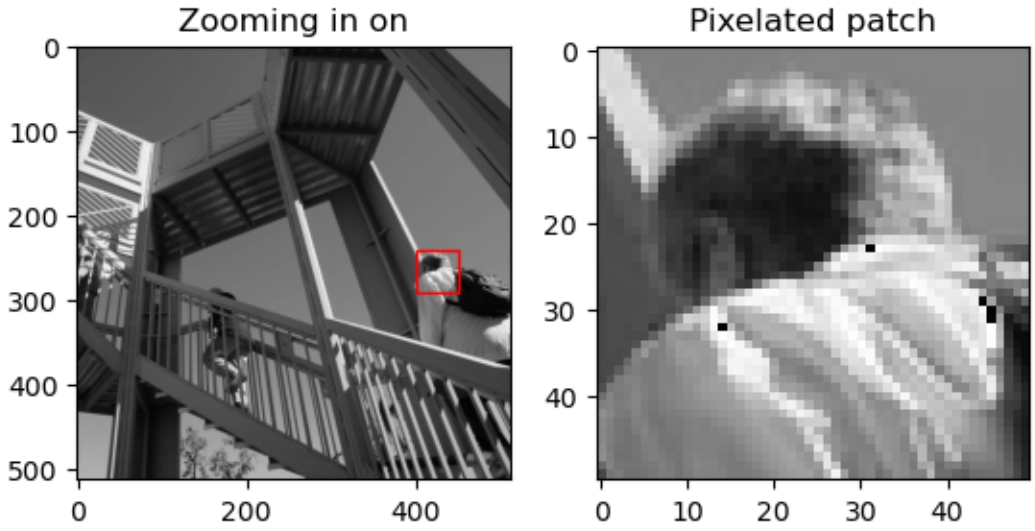
1 Introduction to Image Processing

[41]:
```
# importing required libraries
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.patches as patches
import scipy.datasets as datasets
```

1.0.1 Process Gray Scale image to view pixel matrix

[42]:
```
ascent_image = datasets.ascent()
plt.axis("off")
plt.imshow(ascent_image, cmap="gray")
plt.show()
```

[43]:
```
figure = plt.figure(1)
plt.subplot(1, 2, 1)
plt.imshow(ascent_image, cmap="gray")
ax = plt.gca()
rect_patch = patches.Rectangle(
    (400, 240), 50, 50, linewidth=1, edgecolor="r", facecolor="none"
)
ax.add_patch(rect_patch)
ax.set_title("Zooming in on")

# zoomed in patch
plt.subplot(1, 2, 2)
plt.imshow(ascent_image[240:290, 400:450], cmap="gray")
ax = plt.gca()
ax.set_title("Pixelated patch")
plt.show()
```



1.1 Process color image to view pixel matrix

[44]:
```
face = datasets.face()

# details of the face image
print(f"The face image has shape {face.shape}")
print(f"The face image has type {face.dtype}")
print(f"The face image has a maximum value of {face.max()}")
print(f"The face image has a minimum value of {face.min()}")
```

```
The face image has shape (768, 1024, 3)
The face image has type uint8
The face image has a maximum value of 255
The face image has a minimum value of 0
```

[45]:
```
# plot the face image
plt.imshow(face)
plt.axis("off")
ax = plt.gca()
ax.set_title("Original RGB image")
plt.show()
```

[46]:
```
# extract the red channel
red_channel = face[:, :, 0]
# extract the green channel
green_channel = face[:, :, 1]
# extract the blue channel
blue_channel = face[:, :, 2]

zeromap = np.zeros_like(red_channel)
```

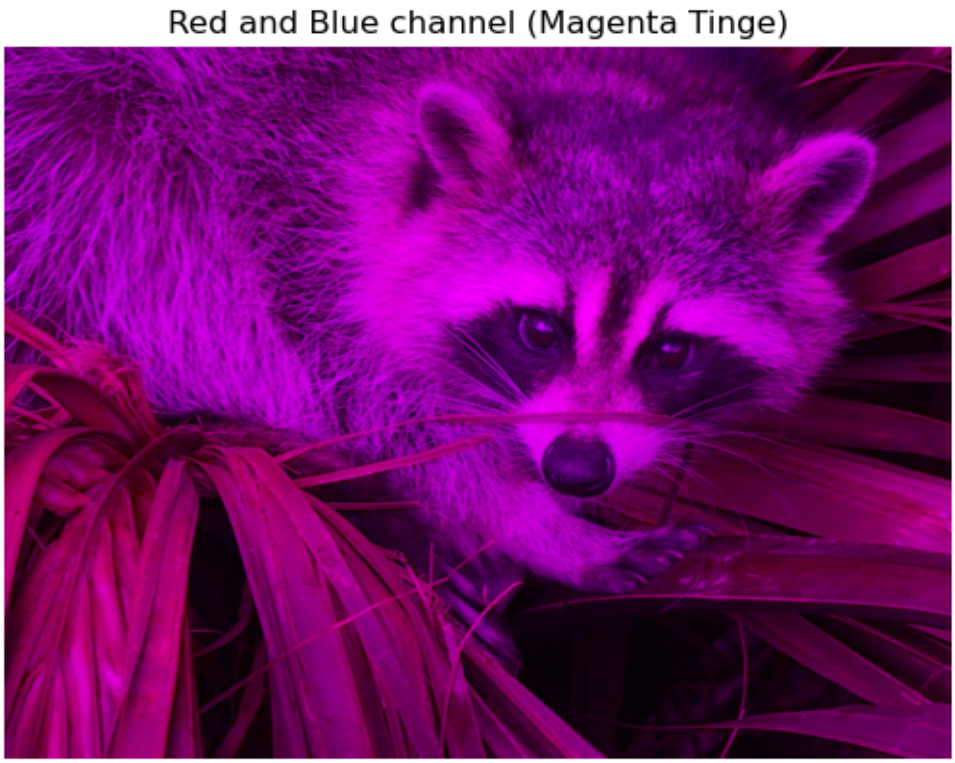
[47]:
```
# plot the red channel
figure = plt.figure(3)
plt.imshow(red_channel, cmap="Reds")
plt.axis("off")
ax = plt.gca()
ax.set_title("Red channel")

# plot the green channel
figure = plt.figure(4)
plt.imshow(green_channel, cmap="Greens")
plt.axis("off")
ax = plt.gca()
ax.set_title("Green channel")

# plot the blue channel
figure = plt.figure(5)
plt.imshow(blue_channel, cmap="Blues")
plt.axis("off")
ax = plt.gca()
ax.set_title("Blue channel")

plt.show()
```

Green channel

Blue channel

[48]:
```
# plot the red and green channel
figure = plt.figure(6)
plt.axis("off")
red_green_channel = np.dstack((red_channel, green_channel, zeromap))
plt.imshow(red_green_channel)
ax = plt.gca()
ax.set_title("Red and Green channel (Yellow Tinge)")
plt.show()
```

[49]:
```
# plot the red and blue channel
figure = plt.figure(7)
plt.axis("off")
red_blue_channel = np.dstack((red_channel, zeromap, blue_channel))
plt.imshow(red_blue_channel)
ax = plt.gca()
ax.set_title("Red and Blue channel (Magenta Tinge)")
plt.show()
```



[50]:
```
# plot the green and blue channel
figure = plt.figure(8)
plt.axis("off")
green_blue_channel = np.dstack((zeromap, green_channel, blue_channel))
plt.imshow(green_blue_channel)
ax = plt.gca()
ax.set_title("Green and Blue channel (Cyan Tinge)")
plt.show()
```

Green and Blue channel (Cyan Tinge)