Digital Image Processing
Week 1 Assignment

SAI KUMAR MURARSHETTI
LEWIS ID: L30079224

Report

1. Detailed description of techniques:

Quantization:

- Sampling is the process of transforming a continuous image into a discrete image by determining a finite number of points from the original picture.
- In digital image processing, images are represented by a grid of pixels. Sampling helps to separate a picture by storing information at specific locations.
- The sampling rate determines the density of pixels in the captured picture. The greater sampling rate provides more information but requires more storage.

Sampling:

- Quantization involves providing a discrete value to each sample point. It is the technique of reducing the number of intensity levels or colours in a picture.
- Digital pictures constantly have a restricted number of intensity levels, therefore quantization helps in data reduction and image representation.
- The number of bits used to represent each pixel determines the number for various intensity levels.
- Greater bit depth provides smoother slopes, but lower bit depth can cause obvious information loss, particularly in areas with slight intensity changes.

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2. Design of the Algorithms:

During **Quantization** the below code is used for the different samples to produce the output.

While using the below code we need to provide various input images samples it will convert them into the discrete image by making a bunch of pixels and also represent the output as original image and Quantized image.

```
import numpy as np
from skimage import data
from matplotlib import pyplot as plt
from google.colab import files

uploaded = files.upload()
image_path = next(iter(uploaded.keys()))
image = io.imread(image_path)
print("Original image:")
plt.imshow(image)
plt.show()
ratio = 130
for i in range(image.shape[0]):
    for j in range(image.shape[1]):
        for k in range(image.shape[2]):
            image[i][j][k] = int(image[i][j][k] / ratio) * ratio
print("Quantized image:")
plt.imshow(image)
plt.show()
```

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During **Sampling** the below code is used for the producing different samples.

By considering various input values at discrete steps from the continuous signal and produces several outputs by labelling original image and Sampling image.

```
import numpy as np
from skimage import data
from matplotlib import pyplot as plt
import imageio as img
uploaded = files.upload()
image_path = next(iter(uploaded.keys()))
image = io.imread(image_path)
print(image.shape)
print(type(image))
ratio=20
image1=np.zeros((int(image.shape[0]/ratio),
                 int(image.shape[1]/ratio),
                 image.shape[2]),dtype='float32')
for i in range(image1.shape[0]):
    for j in range(image1.shape[1]):
        for k in range(image1.shape[2]):
            delta=image[i*ratio:(i+1)*ratio,j*ratio:(j+1)*ratio,k]
            image1[i,j,k]=np.mean(delta)
plt.imshow(image1.astype('uint8'))
plt.show()
plt.imshow(image)
plt.show()
```

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3. Observed results for both algorithm techniques:

Sampling Results:

- The most noticeable outcome is a loss in image resolution. This may because deleting some of the pixels leading to a lower pixel density in the sampled image.
- Blur in the image compared to the before and after the sampling.
- The sampled image generally has a smaller file size than the original since it stores fewer pixel values.
- It may represent most important feature but here we can balance between reduction of data and visual clarity.

Quantization Results:

- Here I observed the Visual Quality of both Original and Sampled image it includes colour, accuracy, sharpness and overall appearance.
- The Distortion in the objects which include banding, colour changes and loss of specific details.
- Before quantization, the colours in a picture were perfectly but after quantization we can see distortion in the picture and loss of colours in the picture.
- Alternatively, between reduced file size and loss of image quality.