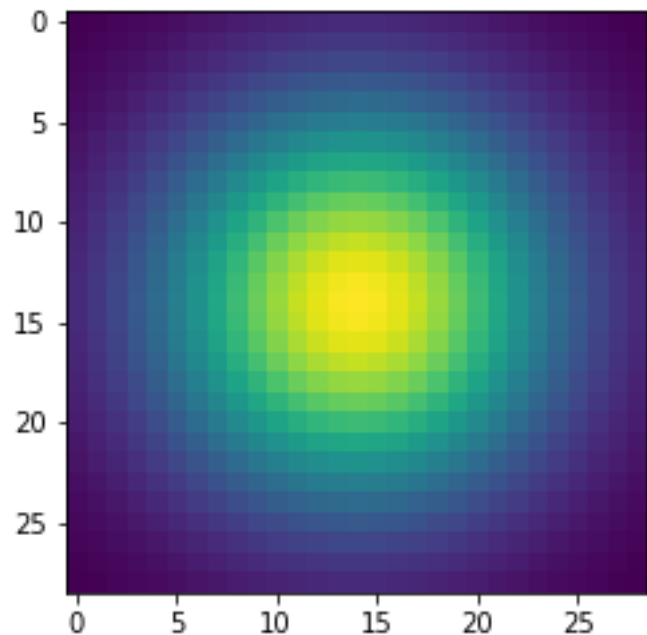


CS 4476 Project 1

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Part 1: Image filtering



First get the stats of the image and calculate the padding size. Then use `np.pad()` to pad the image. Finally use iteration to apply the filter to the image.

Part 1: Image filtering

Identity filter



Small blur with a box filter



Part 1: Image filtering

Sobel filter



Discrete Laplacian filter



Part 1: Hybrid images

Get high frequency part by applying filter to image2 and then subtracting the filtered content from the original image.

Get low frequency part by applying filter to image1.

The hybrid image is made from adding the low frequency part to the high frequency part and clip the pixels.

Cat + Dog



Cutoff frequency: 7

Part 1: Hybrid images

Motorcycle + Bicycle



Cutoff frequency: 7

Plane + Bird



Cutoff frequency: 12

Part 1: Hybrid images

Einstein + Marilyn



Cutoff frequency: 4

Submarine + Fish



Cutoff frequency: 5

Part 2: Hybrid images with PyTorch

Cat + Dog



Motorcycle + Bicycle



Part 2: Hybrid images with PyTorch

Plane + Bird



Einstein + Marilyn



Part 2: Hybrid images with PyTorch

Submarine + Fish



Part 1 vs. Part 2

The runtime for Part 1 is 8.00 seconds and that for Part 2 is 2.23 seconds. Using pytorch to do the work is much more efficient.

Tests

```
(proj1) D:\GT\Fall 2019\CS 4476\proj1>pytest tests
===== test session starts =====
platform win32 -- Python 3.6.9, pytest-5.0.1, py-1.8.0, pluggy-0.12.0
rootdir: D:\GT\Fall 2019\CS 4476\proj1
collected 6 items

tests\unit_test.py ..... [100%]

===== 6 passed in 5.56 seconds =====
```

Conclusions

The cutoff frequency influences that how clear the low frequency image is in the hybrid image. A good cutoff frequency depends on the extent of difference in the colors of the images in one pair and the image order chosen to do low/high frequency operations.

Also, by swapping the images in each pair, I found that the pairs with low cutoff frequencies for original hybrid images should take in high cutoff frequencies to get a good hybrid image after swapping images in the pair.

Furthermore, using Pytorch to do the work is much faster since Pytorch provides faster access to the array elements.