APS360 Assignment 1

January 20, 2019

```
In [1]: def sum_of_squares(n):
            """Return the sum (1 + 2^2 + 3^2 + ... + n^2)

            Precondition: n > 0, type(n) == int

            >>> sum_of_squares(3)
            14
            >>> sum_of_squares(1)
            1
            """

            out = 0
            for i in range(1, n+1):
                out += i**2
            return out
```

```
In [2]: sum_of_squares(3)
```

```
Out[2]: 14
```

```
In [3]: sum_of_squares(1)
```

```
Out[3]: 1
```

```
In [4]: def word_lengths(sentence):
            """Return a list containing the length of each word in
            sentence.

            >>> word_lengths("welcome to APS360!")
            [7, 2, 7]
            >>> word_lengths("machine learning is so cool")
            [7, 8, 2, 2, 4]
            """

            out = []
            s = str.split(sentence)
            for w in s:
                out.append(len(w))
            return out
```

```
In [5]: word_lengths("welcome to APS360!")

Out[5]: [7, 2, 7]

In [6]: word_lengths("machine learning is so cool")

Out[6]: [7, 8, 2, 2, 4]

In [7]: import numpy as np

In [8]: matrix = None
        matrix = np.loadtxt('matrix.csv',delimiter=',')

In [9]: matrix

Out[9]: array([[1., 2., 3.],
               [4., 5., 6.],
               [7., 8., 9.]])

In [10]: vector = None
         vector = np.load('vector.npy')

In [11]: vector

Out[11]: array([[10],
                [20],
                [15]], dtype=int64)

In [12]: # plz ignore
         t = vector.shape
         print(t[0])
         print(t[1])

3
1


In [13]: def mat_x_vec(m,n):
             output = None

             output = []
             s = m.shape
             for i in range(0, s[0]):
                 e = 0
                 for j in range(0, s[1]):
                     #print("x" + str(i))
                     #print("y" + str(j))
                     e += m[i,j]*n[j,0]
                 output.append([e])
             return output
```

```
In [14]: output = mat_x_vec(matrix, vector)
         output

Out[14]: [[95.0], [230.0], [365.0]]

In [15]: np.savetxt('out_forloop.csv',output)

In [16]: output2 = None
         output2 = np.dot(matrix, vector)
         output2

Out[16]: array([[ 95.],
                [230.],
                [365.]])

In [17]: np.save('output_dot.npy',output2)

In [18]: output == output2

Out[18]: array([[ True],
                [ True],
                [ True]])

In [19]: class ElementwiseMultiply:
             def __init__(self, weight):
                 if len(weight.shape) == 1:
                     self.weight = weight
             def __call__(self, input):
                 if (self.weight.shape) == (input.shape):
                     return np.multiply(self.weight, input)
                 else:
                     return None

In [20]: class LeakyRelu:
             def __init__(self, alpha):
                 self.alpha = alpha
             def __call__(self, input):
                 if type(input) == np.ndarray:
                     output = input
                     output[output >= 0] = output[output >= 0]
                     output[output < 0] = self.alpha * output[output < 0]
                 return output

In [21]: class Compose:
             def __init__(self, layers):
                 self.layers = layers
             def __call__(self, input):
                 out = []
                 cur_in = input
                 for i in self.layers:
                     cur_out = i(cur_in)
                     #print(cur_out)
                     out.append(list(cur_out))
                     cur_in = cur_out
                 return out
```

```
In [22]: #copied from instructions
         class AddBias(object):
             def __init__(self, val):
                 self.val = val
             def __call__(self, input):
                 return self.val + input
```

```
In [23]: weight_1 = np.array([1, 2, 3, 4])
         weight_2 = np.array([-1, -2, -3, -4])
         bias_1 = 3
         bias_2 = -2
         alpha = 0.1

         elem_mult_1 = ElementwiseMultiply(weight_1)
         add_bias_1 = AddBias(bias_1)
         leaky_relu = LeakyRelu(alpha)
         elem_mult_2 = ElementwiseMultiply(weight_2)
         add_bias_2 = AddBias(bias_2)
         layers = Compose([elem_mult_1,
                           add_bias_1,
                           leaky_relu,
                           elem_mult_2,
                           add_bias_2,
                           leaky_relu])

         input = np.array([10, 5, -5, -10])
         print("Input: ", input)

         output = layers(input)
         print("Output:", output)
```

```
Input:  [ 10   5  -5 -10]
Output: [[10, 10, -15, -40], [13, 13, -12, -37], [13, 13, -1, -3], [-13, -26, 3, 12], [-15, -28
```

```
In [24]: #plz ignore
         t = np.array([1,2,3])
         t[t<2] = 2
         t
```

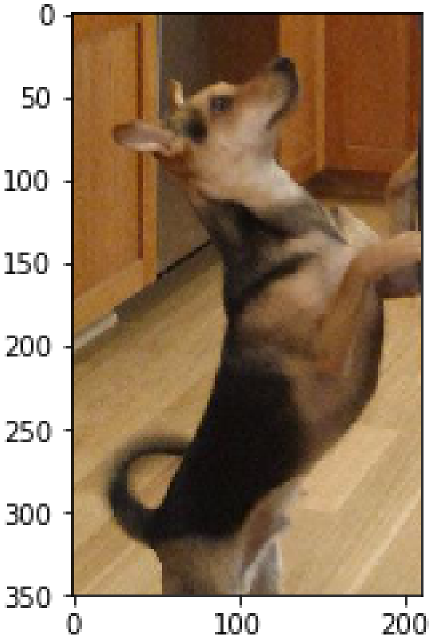
```
Out[24]: array([2, 2, 3])
```

```
In [25]: import matplotlib.pyplot as plt
```

```
In [26]: img = None
         img = plt.imread('dog_mochi.png')
```

```
In [27]: plt.imshow(img)
```

```
Out[27]: <matplotlib.image.AxesImage at 0x82fe160>
```

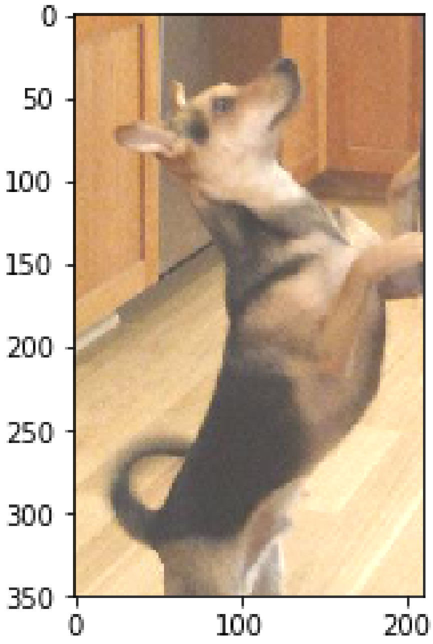


```
In [28]: img[50, 90]
```

```
Out[28]: array([0.36862746, 0.28235295, 0.1882353 , 1.        ], dtype=float32)
```

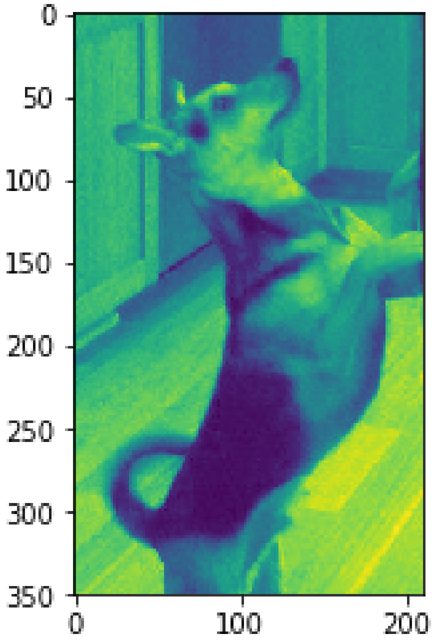
```
In [29]: img_add = None
         plt.imshow(np.clip(img+0.25,0,1))
```

```
Out[29]: <matplotlib.image.AxesImage at 0x84b0c50>
```



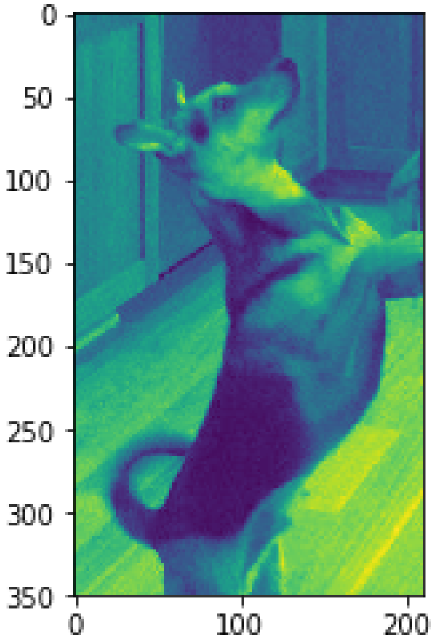
```
In [30]: img_r = np.array(img[:,:,0])
         plt.imshow(img_r)

Out[30]: <matplotlib.image.AxesImage at 0x850f828>
```



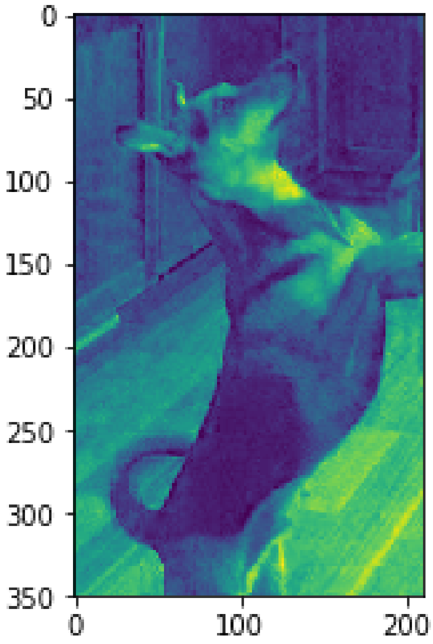
```
In [31]: img_g = np.array(img[:,:,1])
         plt.imshow(img_g)

Out[31]: <matplotlib.image.AxesImage at 0x8975f98>
```



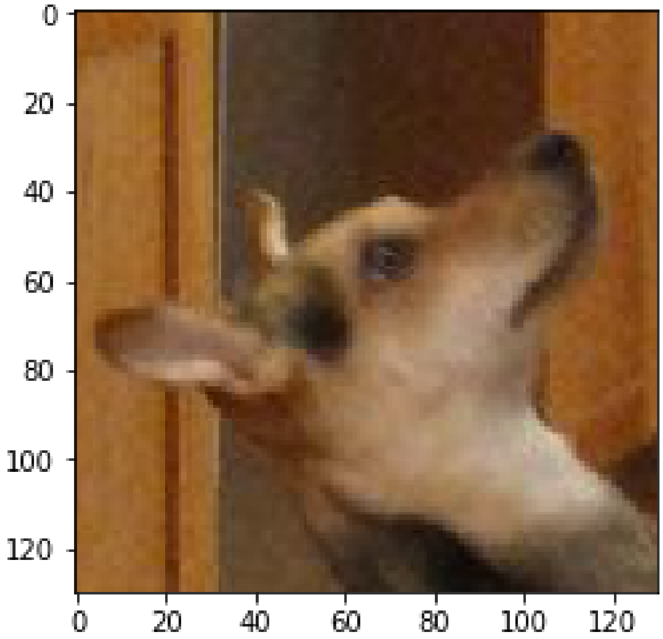
```
In [32]: img_b = np.array(img[:,:,2])
         plt.imshow(img_b)

Out[32]: <matplotlib.image.AxesImage at 0x89d3630>
```



```
In [33]: img_face = img[0:130,20:150]
         plt.imshow(img_face)

Out[33]: <matplotlib.image.AxesImage at 0x9388c50>
```



```
In [34]: plt.imsave('dog_name',img_face)

In [ ]:
```