CS 4476 Fall 2025 PS1

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1.1 Use `numpy.random.rand` to return the roll of a six-sided die over N trials.

```
def prob_1_1(N):
    """
    Args: N: the number of trials.
    Returns: arr: array of rolls.
    """

    ### START CODE HERE ###
    arr=np.floor(6*np.random.rand(N))+1
    arr=arr.astype(int)
    ### END CODE HERE ###

    return arr
```

1.2 Let `y` be the vector: `y = np.array([11, 22, 33, 44, 55, 66])`. Use the reshape command to form a new matrix `z` that looks like this:
`[[11,22],[33,44],[55,66]]`

```
def prob_1_2(y):
    """
    Args: y: numpy array.
    Returns: z: numpy array of shape
    (new_size,2).
    """

    ### START CODE HERE ###
    z=y.reshape(3,2)
    ### END CODE HERE ###

    return z
```

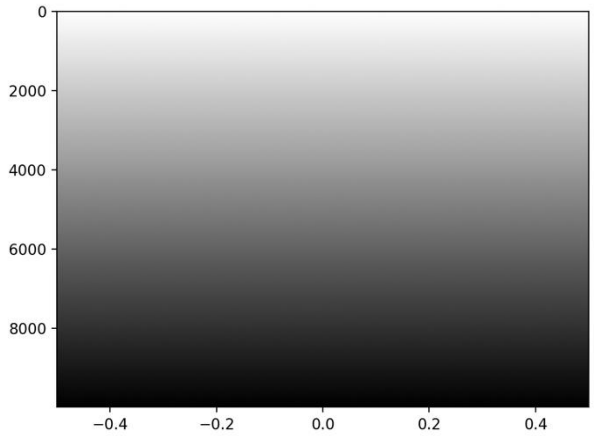
1.3 Use the `numpy.max` function to set x to the maximum value that occurs in z (above), and use the `numpy.where` function to set r to the row number (0-indexed) it occurs in and c to the column number (0-indexed) it occurs in. You may assume the maximum value is unique.

```
def prob_1_3(z):
    """
    Args: z: numpy array of shape
    (3,2).
    Returns: x: max value in z.
    r: row index of x.
    c: column index of x.
    """

    ### START CODE HERE ###
    x=np.max(z)
    r,c=np.where(z==x)
    r=int(r[0])
    c=int(c[0])
    ### END CODE HERE ###

    return (x, r, c)
```

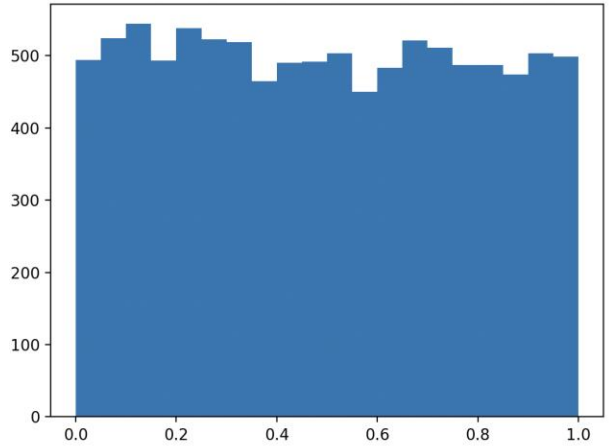
1.4 Let `v` be the vector: `v = np.array([1, 4, 7, 1, 2, 6, 8, 1, 9])`. Set a new variable `x` to be the number of 1's in the vector `v`.

```
def prob_1_4(v):
    """
    Args: v: numpy array.
    Returns: x: number of 1's in v.
    """

    ### START CODE HERE ###
    x=np.sum(v==1)
    ### END CODE HERE ###

    return x
```

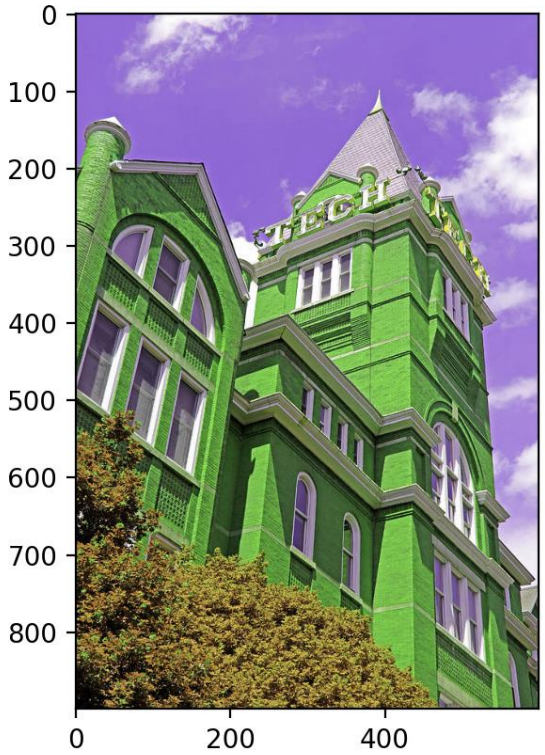
2.1 Plot all the intensities in `A`, sorted in decreasing value. Provide the plot in your answer sheet. (Note, in this case we don't care about the 2D structure of `A`, we only want to sort the list of all intensities.)



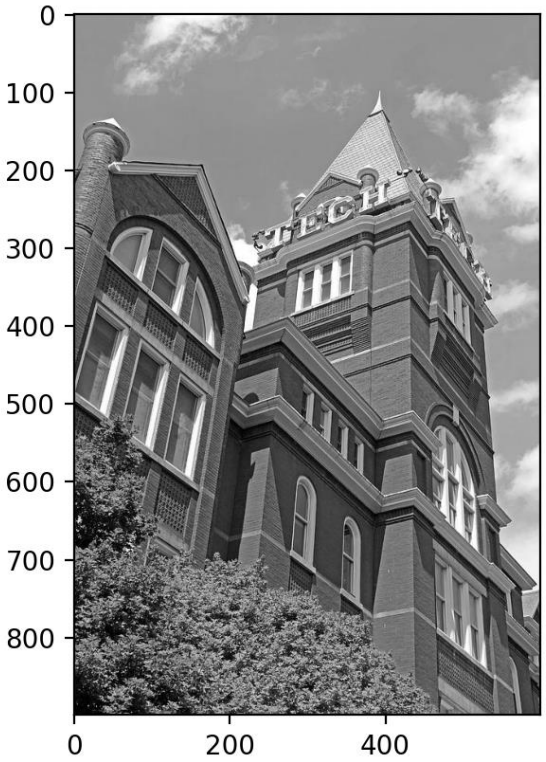
2.2 Display a histogram of A's intensities with 20 bins. Again, we do not care about the 2D structure. Provide the histogram in your answer sheet.



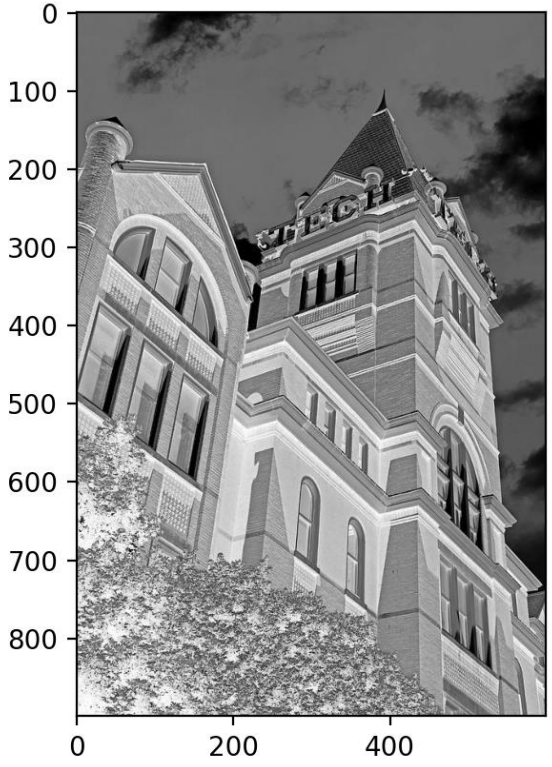
3.1 Display the color channel swapped image.



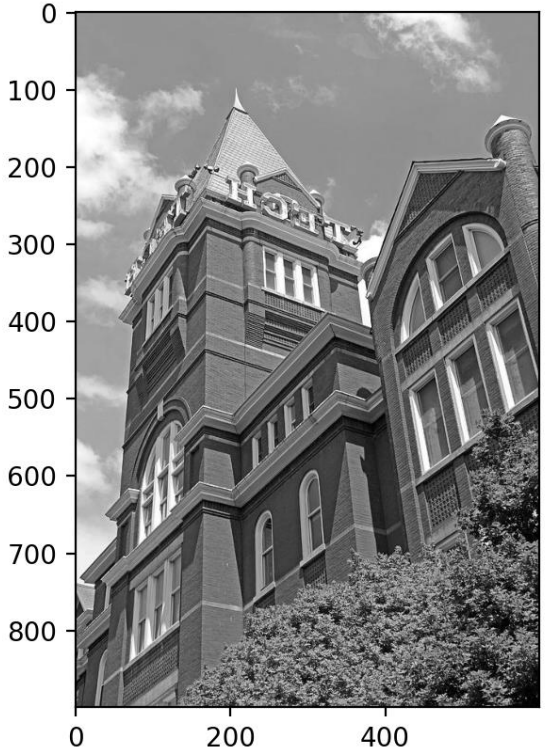
3.2. Display the grayscale image.



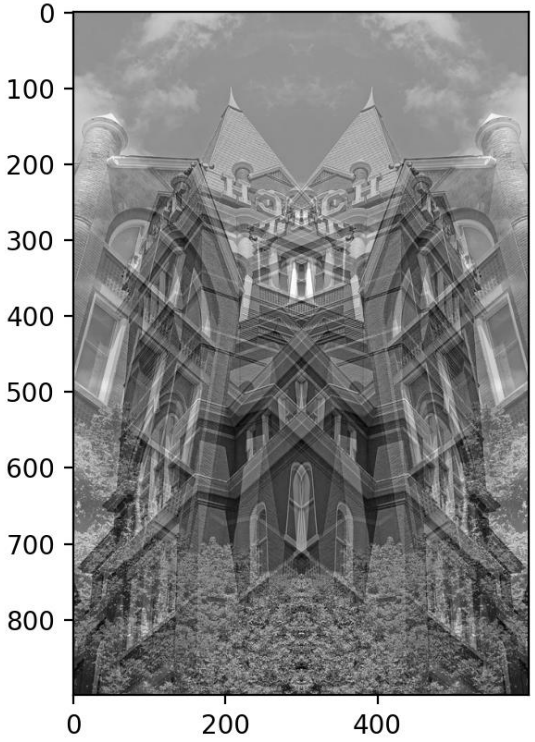
3.3 Display the negative image.



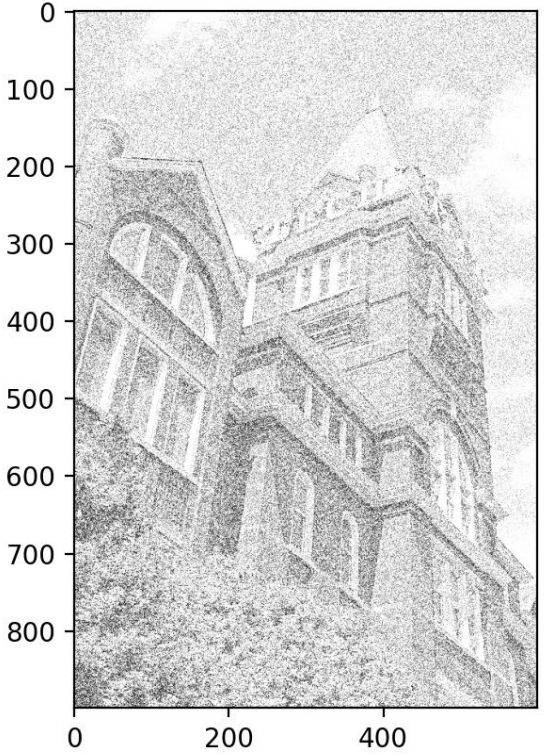
3.4 Display the mirror image.



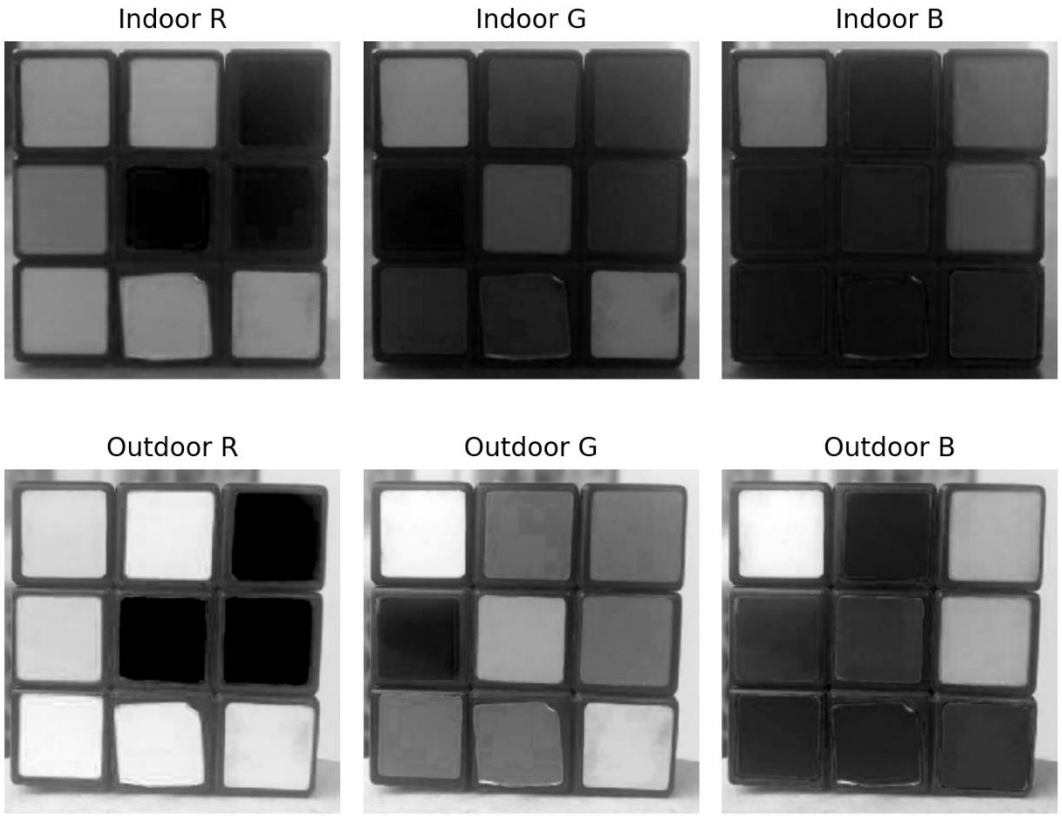
3.5 Display the averaged image.



3.6. Display the clipped image.



4.1. Load the images and plot their R, G, B channels separately as grayscale images using `plt.imshow()`



4.1.(contd) Then convert them into LAB color space and plot the three channels again.

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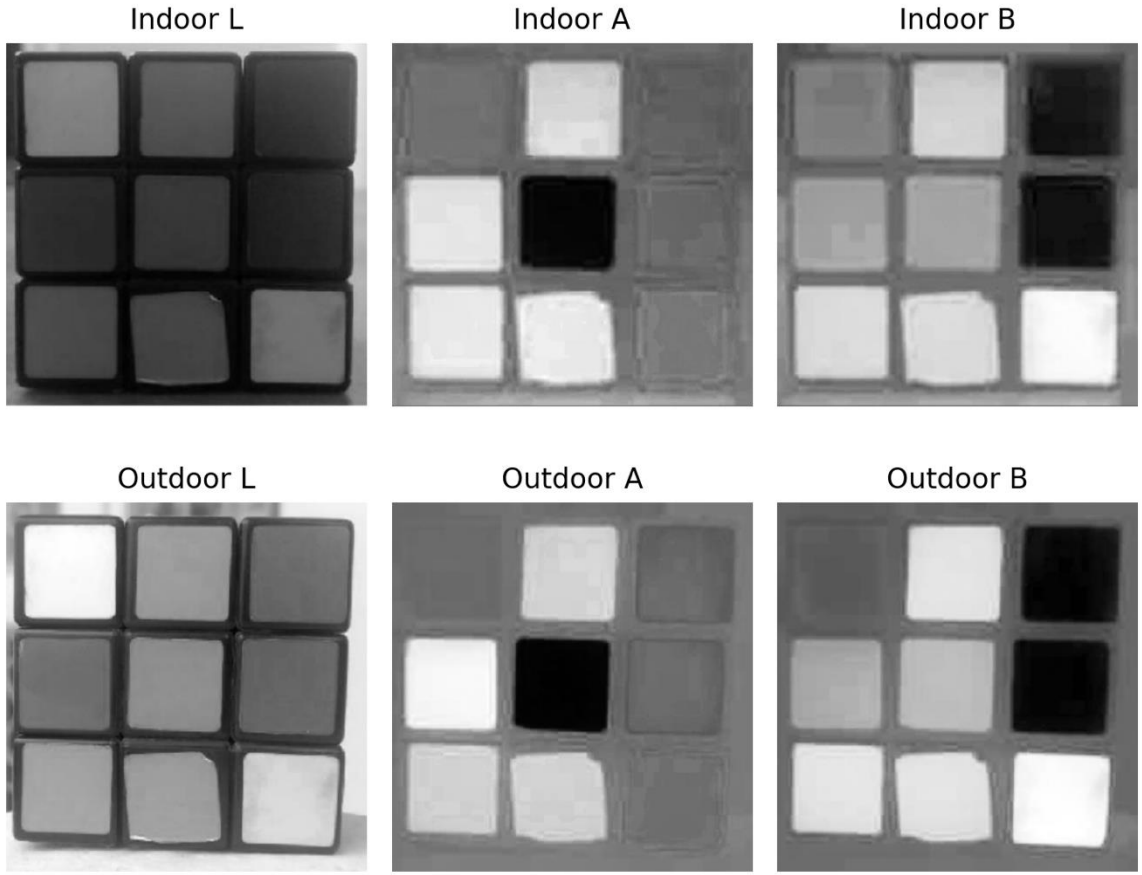

4.2. Convert the input image from RGB to HSV.

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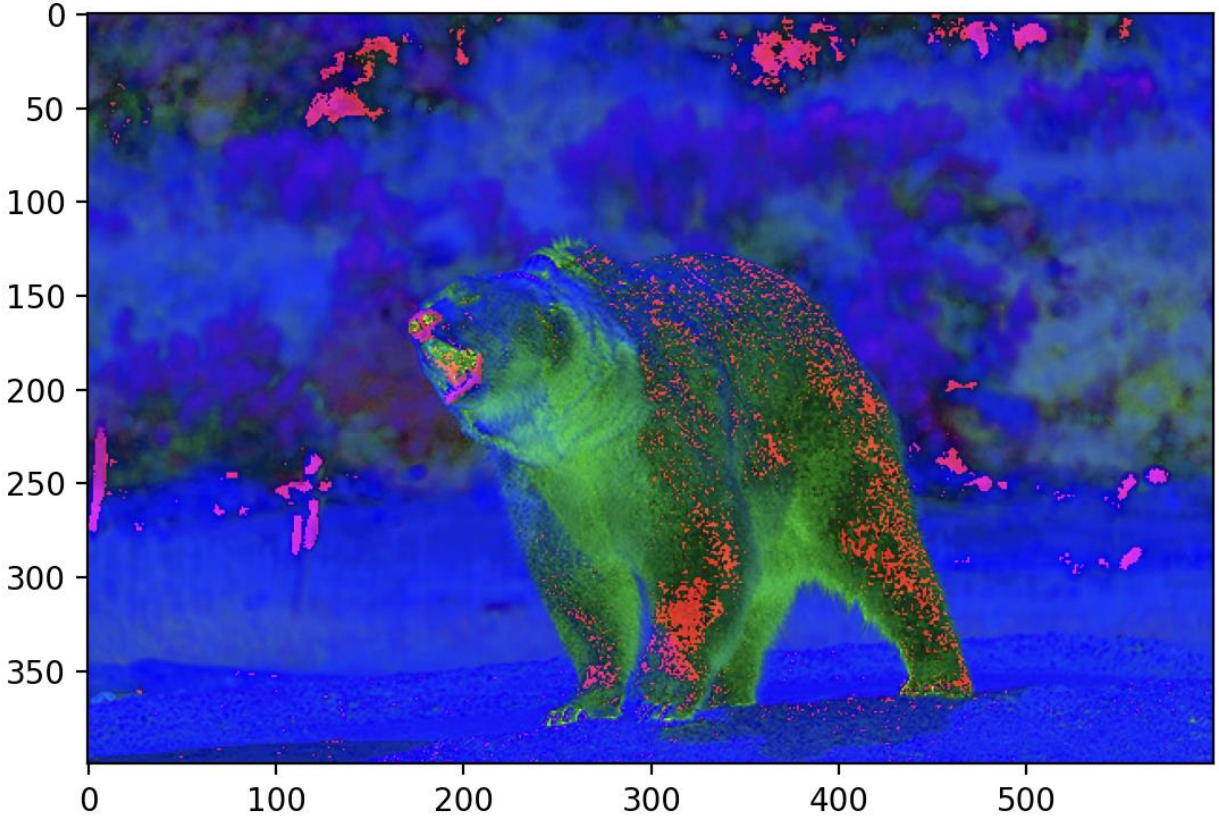

5.1 Display the cat image with the identity filter.

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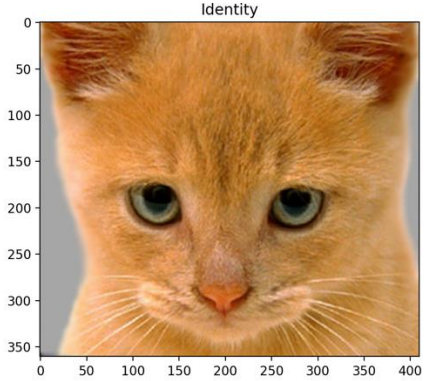

Display the cat image with the blur filter.

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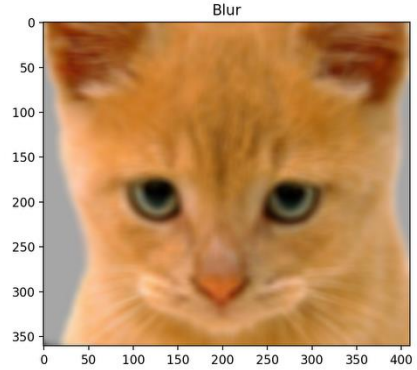
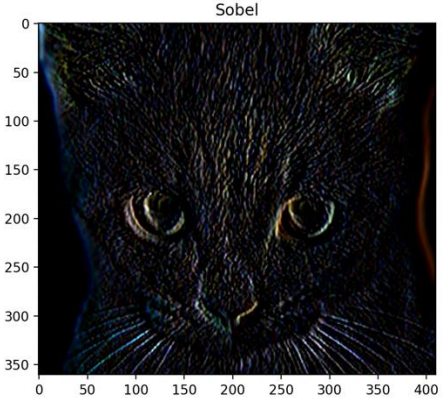


Display the cat image with the Sobel filter.

<



Display the cat image with the Laplacian filter.

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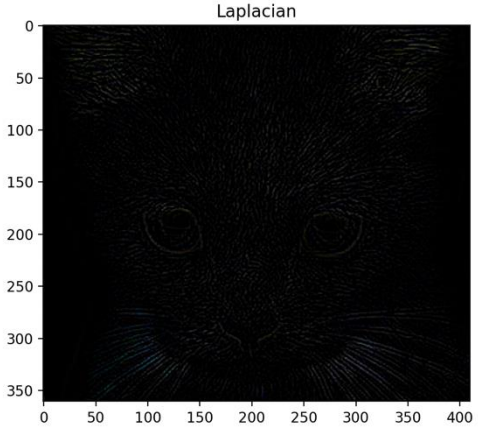
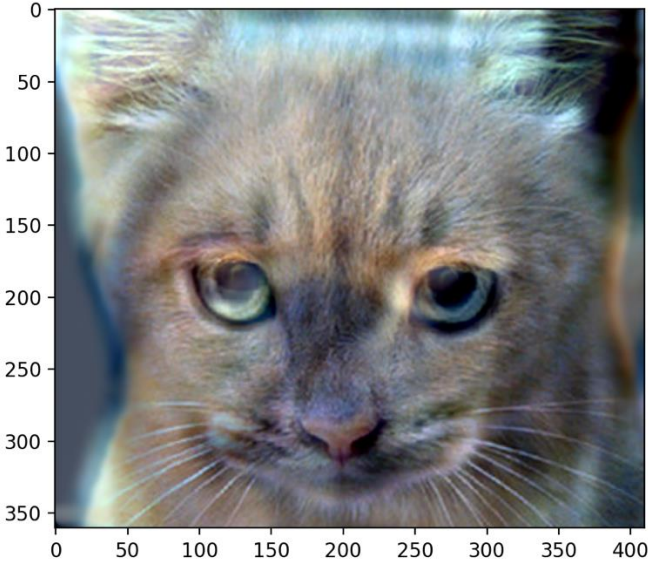


5.2 Display the hybrid image.



Display the multiscale hybrid image visualization.

<Insert plot here>