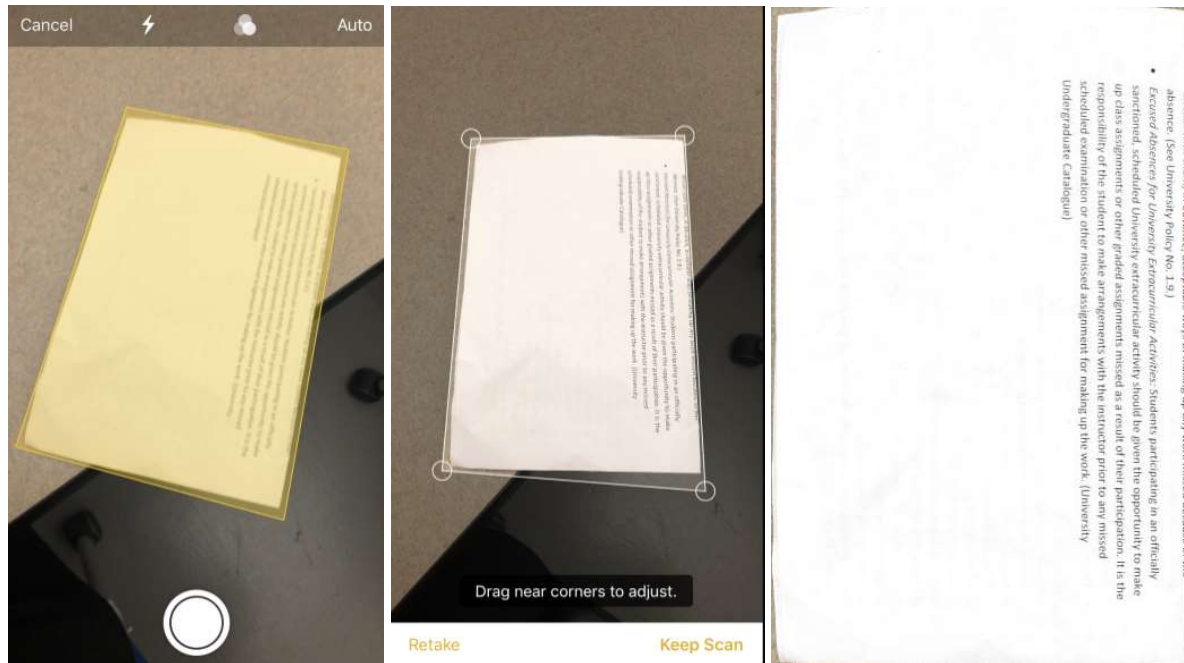


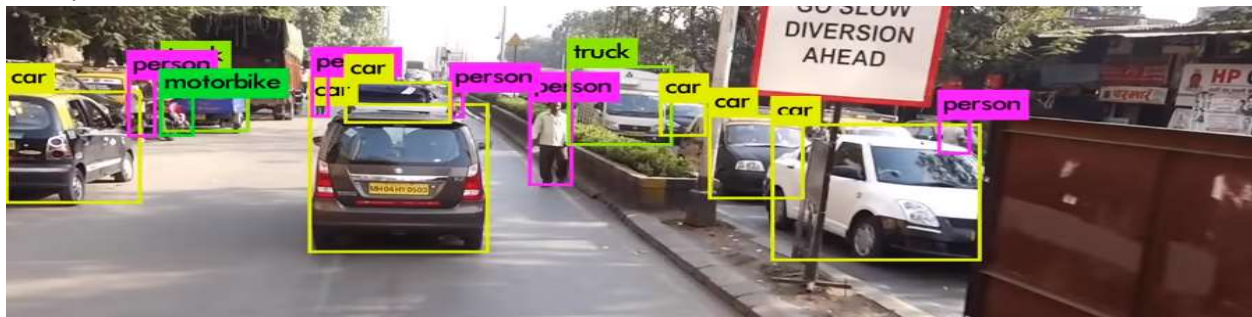
## 1. Applications of Computer Vision:

A common application I use every day is the iPhone PDF scanner to scan in my homework submissions to submit on canvas. This application scans the live video and attempts to detect edges by contrasting the brightness of the paper to the surrounding background. Then the application allows the user to fine tune the adjustment and finally the captured image is transformed into a standard rectangular matrix.



The second application of Computer Vision I found is used in combination with a deep neural network for object identification. It's called YOLO which stands for you only look once object identification. This algorithm splits the image into boxes and pushes each box into an already trained classifier neural network. The network then outputs a percentage certainty on if the given box contains a object the neural network recognizes. Then the algorithm tags the cluster of boxes that stand above a certain threshold of certainty.

Example in action:



Links to article and videos used:

[https://www.youtube.com/watch?v=4eIBisqx9\\_g](https://www.youtube.com/watch?v=4eIBisqx9_g) – actual tutorial I watched, contains previous methods of object identification

<https://pjreddie.com/darknet/yolo/> - referenced within the video

## 2. Using MATLAB

### 1. MATLAB Commands (type into MATLAB command window/prompt)

```
>> x = 1:18;  
>> y = randperm(18);
```

How is **y** different from **x**?

**Y** is a set of numbers 1 to 18 but in a random order while **X** is a set of numbers 1 to 18 steadily increasing by 1

### 2. MATLAB Commands

```
>> a = [1:2:50; 51:2:100];  
>> b = a(2,:)
```

How is **b** related to **a**? Does it correspond to a specific row or column of **a**?

**B** contains the 2<sup>nd</sup> row of **A**

### 3. MATLAB Commands

```
>> f = randn(100,1);  
>> ind = find( f > 0 );  
>> nc = numel( ind );  
>> g = f( ind );
```

What does **ind** contain? Does it tell you anything about which values of **f** are greater than zero (non-negative)?

**Ind** contains the locations of all positive numbers in data set **f**

What does the variable **nc** represent?

**nc** represents the size variable **ind**, basically it represents the number of values greater than zero in data set **f**.

What does the variable **g** represent? Does it contain any negative numbers?

**g** contains the actual positive values at the locations described by **ind**. It does not contain negative numbers

What is your best guess as to the purpose of the above MATLAB code fragment?

To find and extract the positive values of a data set and count of amount of positive values.

### 4. MATLAB Commands

```
>> x = 0.25 * ones (1,100);  
>> y = 0.25 * ones (100,1);
```

In what manner is the array **y** different from the array **x**?

**X** is a 1 x 100 matrix **Y** is a 100x1 matrix, **x** is just one row **y** is just one column

Image denoising:

What are the largest and smallest intensities in the original image?

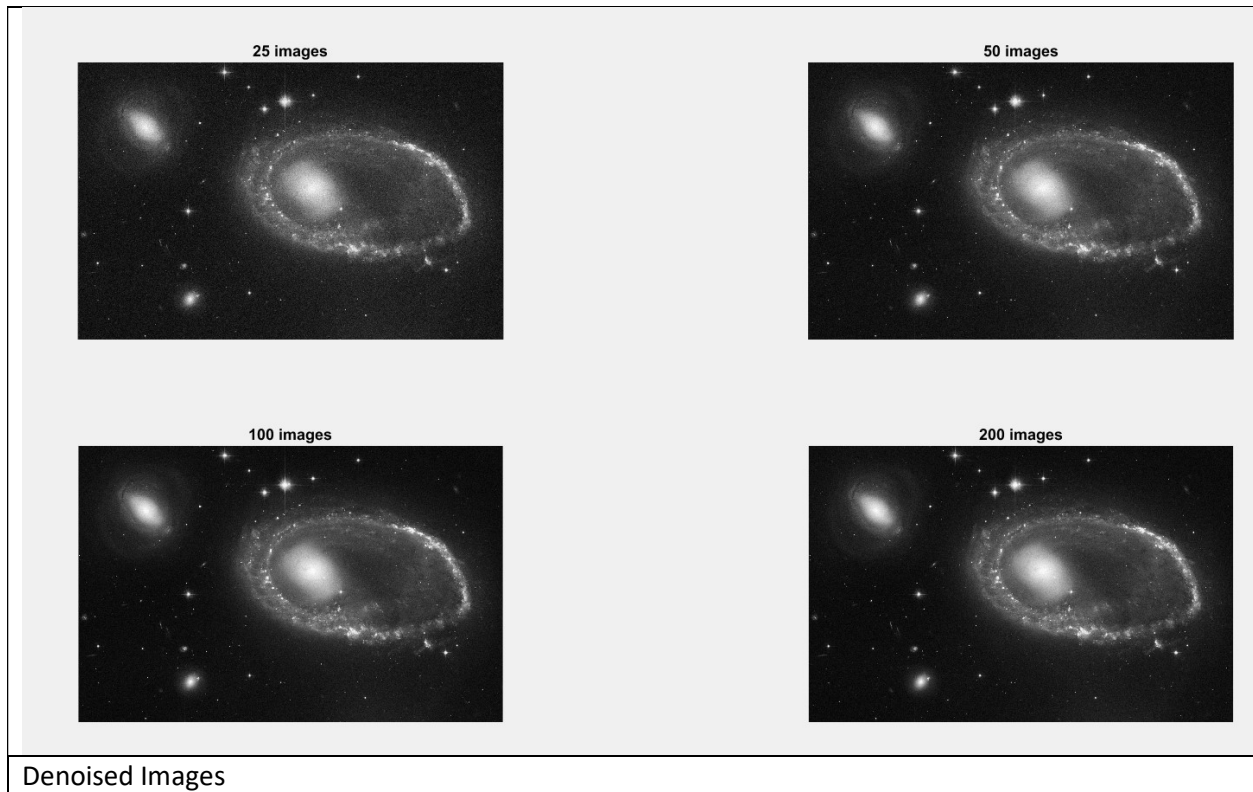
The largest and smallest intensities on the original image were 255 and 0 according to the Max and min functions.

What makes the noise Gaussian and white?

The noise that was added was considered gaussian and white because It was distributed across the size of the original image using the command `rand n`. It was then scaled by the standard deviation of sigma which in this case was 50.

Does the result of denoising improve with averaging more realizations/images? How does your answer compare with the MSE for each case?

Denoising did improve the realization of the images however according to the MSE for each case for cases of 25, 50 and 100, images the Error went down however for the case of 200 images the Error drastically spiked. Which indicates that after a certain point using more images averaged to denoise an image could actually be detrimental.





Original Image

## Image filtering Questions

Compare the original image with the filtered image to understand the effect of filtering for each filter. Comment on what you think the filter is doing to the letter  $\pi$ ?

Filter A seems to have no effect on the image whatsoever.

Filter B seems to have shifted the image on pixels to the left as there is now an addition of a black bar on the right side of the image as well as the red beam down the center is now closer to the right leg of the  $\pi$  in the image.

Filter C is like filter B except the image is shifted to the right and the black beam is on the left side of the image.

Filter D seems to have inverted some of the intensities of the image but the  $\pi$  shape is more defined and almost has a 3d pop out look to it. however there seems to be black beams around the  $\pi$  with one-pixel spot on the top right corner

Filter E seems to highlight the legs of the  $\pi$  in the image by inverting the image but the details of the horizontal bar is gone

Filter D also inverts the image like filter E however it seems to highlight the horizontal details while losing the vertical details which explains why the top bar is clearly visible while the legs have lost detail.

Filter GG seems to sharpen the edges of the image making some of the gray pixels on the edges disappear.

Explain the purpose of the MATLAB command subplot.

Subplot plots multiple plots on the same figure it allows us to compare and contrast multiple plots or images without cycling through many different figures.

Explain the purpose of the MATLAB command line used after each call to imshow in the code template included with the assignment.

The Line command seemed to generate the red and blue centering beams on each image so we can see if the image shifted left and right or up and down.