

Experiment of the Effect of Zooming on Image Sizes

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Abstract Using a fixed digital camera, pictures of various scenes were taken using different level of zoom. All the other variables were kept constant and only the zooming effect was analyzed. At the end of the day, the sequence of pictures was saved in the hard drive and the image sizes were analyzed. We conclude the zooming effect on the sizes of the images.

Keywords: zoom, image size, picture

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1. Introduction

Imagine a world without pictures. It will be quite dull and some cases impossible to understand as someone says, “A picture says a thousand words”. Nowadays images are everywhere- from newspapers to internet. In actuality, an image is nothing but consists of a lot of pixels [5]. For black and white pictures, each pixel contains a numerical value between 0 and 1 which represent its gray level – 0 being completely white and 1 being completely black.



Figure 1. Gray scale color for the value from 0 to 1

In the “Figure 1” above, we see the corresponding gray scale color for the value from 0 to 1 broken down into 10 pieces. For a color picture, each pixel contains a vector of length three, where the value represent the magnitude of red, green and blue. Here red, green and blue are the primary colors [3] from which all the other colors can be created.

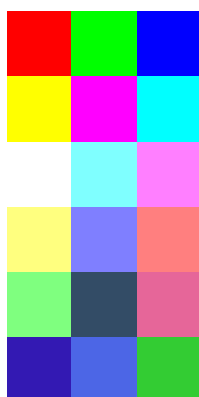


Figure 2. Color pixels for various values of RGB scale

In “Figure 2”, we see some examples of color pixels created for various values of RGB (Math is Fun, n.d.) scale. The exact numerical value of each pixel color value is given below. To learn more about it, please read (Rahman Z.), (White), (College, n.d.) [14] and (Center). For a very quick introduction, readers are referred to [8].

Col1	Col2	Col3
{1,0,0}	{0,1,0}	{0,0,1}
{1,1,0}	1,0,1}	{0,1,1}
{1,1,1}	{0.5,1,1}	{1,0.5,1}
{1,1,0.5}	{0.5,0.5,1}	{1,0.5,0.5}
{0.5,1,0.5}	{0.2,0.3,0.4}	{0.9,0.4,0.6}
{0.2,0.1,0.7}	{0.3,0.4,0.9}	{0.2,0.8,0.2}

The reader should compare Figure 2 with those values to have a feeling of RGB numerical value with the actual color. We use Mathematica software to do our experiment and also uses Microsoft excel to analyze our data. All the pictures were saved in JPEG (Group, n.d.) format to maintain the uniformity. The readers can use Mathematica (Purdue University, n.d.) software, a very powerful computer algebra system, to play around with images. More information on this software can be found on Wolfram website [16].

2. Experiment

The experiment consisted on taking pictures of different places, objects, or scenes with a digital camera using 5 level of various zoom. The digital camera we used had a 5X optical zoom length with a minimum focal length of 3.5mm, and the maximum focal length of 5.6mm (1X=3.5mm, 2X=4.0mm, 3X=4.5mm, 4X=5.0mm, 5X=5.6mm).

Every object or scenes have been photographed from a fixed place, from the same distance, without flash or other variable other than the zoom. We pictured 20 different scenes with the 5 different zoom options (100 pictures in total), and stored each scene pictures in a folder.

Each image's data has been store on a chart table with the corresponding zoom in order for us to compare. After getting all the data, we compared them and calculated the ratio [5].

$$Ratio = \frac{sizeofthezoomedimage}{sizeoforiginalimage}$$

With the help of excel, a graph was sketched based on de zoom type and the ratio. An average of all images of the same zoom was calculated.

$$Average = \frac{sumofallimagesizesperzoom}{numberofimagesperzoom}$$



Figure 3. Pictures with all zoom option and size chart

After calculating the average, a ratio of the average has been calculated. A graph have been sketched to illustrate the relation between zoom and the size of the picture (Figure 3).

3. Analyze Data

After analysis of each image from each scene, we found out that the size of the first image on which we didn't apply any zoom is the lowest. The size of the second image with the zoom 2X increased slightly in some scenes, and up to 1.3 times the size of the first image in others. The third and up images mostly followed the ratio a little more or less. It goes up as the zoom number increase forming a curve close to the square root function in some cases or a linear function in others. But most of the images ratio was not linear nor followed a special function. However, the overall average data showed an increase in the size very close to linear.

Furthermore, some of the image scenes didn't follow the rule. But if we give a closer look, the size re-increases in almost the same flow after it decreased. After close analysis, other factors like density of the object to photograph, the colors, and also the amount of element taken in count while the zoom is going over, can influence the image size too. After those factors are out of reach when zooming closer, the size re-increased at the same flow as it should be.

4. Observation

Overall, the size of images increases according to the zoom applied (Figure 4). But all the image scenes didn't have the same evolution in the size increase. A lot of natural factors like color, exposition, and light, have an influence on the size of the picture. Some of the scenes had a graph close to the graph of a square root function, and others seem to be close to a linear one's. However, the graph of the average size per zoom shows an almost linear function (Figure 5). But no matter what the graph looks like, the size of pictures with a greater zoom still increased most of the time.

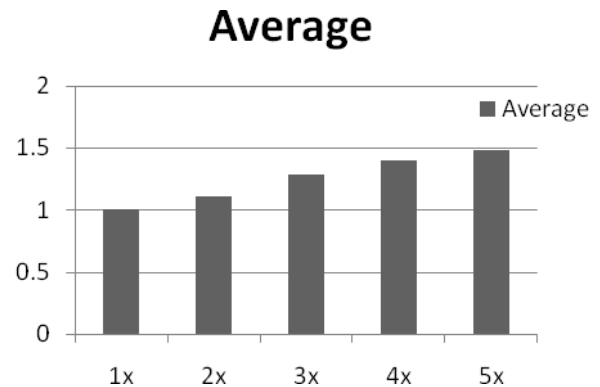


Figure 4. Graph of the average size of pictures per zoom

But there are some outliers: Some images don't follow the rule; like stated before, may be because of other factors like color and number of material in the picture. Some pictures have a lot of things when the zoom is out,

and when we zoom in it reduce the density. Reason why it can't follow necessarily.

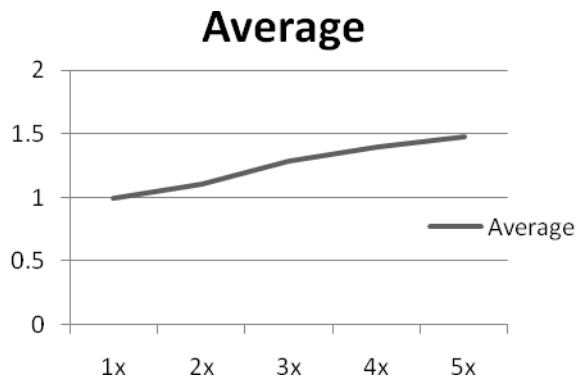


Figure 5. Linear graph of the average size of pictures per zoom

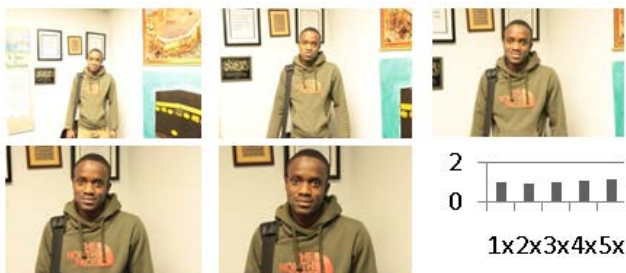


Figure 6. One of the outliers

In the Figure 6, the first picture had a lot of color and different object in the background. But as far as we zoom in, those objects are reduced and the image contains only the person and very few objects in the background. That caused the size of the second picture to decrease slightly. But, when it came to the point where only the person and less objects are present, the image size increased back again on the third and over. The graph shows the variation of the ratio based on the size of the first picture. One thing to point is the fact that the size of images 3, 4, and 5 increased gradually.

5. Conclusion

After analysis and observations, we could affirm that the zoom applied on a picture has an effect on its size. The more we zoom in a picture from the same point we took the first picture, the heavier the picture become. The scale of increase of the picture doesn't follow all the time the same equation. In average, the size of pictures increases almost linearly.

However, some pictures don't follow it because of different factors like color concentration, number of objects in the background susceptible of change while zooming. But it is to note that even if those pictures size decrease on a stage, the size starts increasing back as normal when there is no more interference.

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