



Analyzing Image Files for Modification

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Introduction

In this project we designed a program that detects intentional modifications in photographs. The availability of tools such as PhotoShop and Gimp has allowed people to easily create high quality, subtle changes to images. Automatic detection of "Photo shopped" images can be useful to anyone who is skeptical of the validity of media sources. Photoshopped images, as they pertain to the media, damage the integrity of the news source that uses them. Passing photoshopped images as truth results in a heavily biased opinion in an uninformed demographic. This program seeks to solve the problem of identifying which sources are trustworthy by providing the user with methods to determine whether an image has been modified.

Examples of Modified Images



General Method

Image file formats were broken down to better understand their structure. Most photographs are stored in the jpeg format which is a complex lossy format. The first method acquires the quantization table from the photo. The second method acquires the metadata from the photo and looks for inconsistencies. The third method performs an error level analysis comparison between the photo passed in and the same photo saved at a lower quality

Quantization Tables

When a picture is taken, it is saved using a complex algorithm. Part of this algorithm uses a table of values called a quantization table. Most cameras use preset tables in order to cut down the amount of time that it takes to save an image. When an image is modified in photo editing software like Photoshop, however, these tables are sometimes changed. We developed an algorithm to pull the quantization tables out of images to determine if an image has been modified.

```
2 1 1 1 1 1 2 1
1 1 2 2 2 2 2 4
3 2 2 2 2 5 4 4
3 4 6 5 6 6 6 5
6 6 6 7 9 8 6 7
9 7 6 6 8 11 8 9
10 10 10 10 10 6 8 11
12 11 10 12 9 10 10 10
```

Example of a
Quantization Table

Metadata

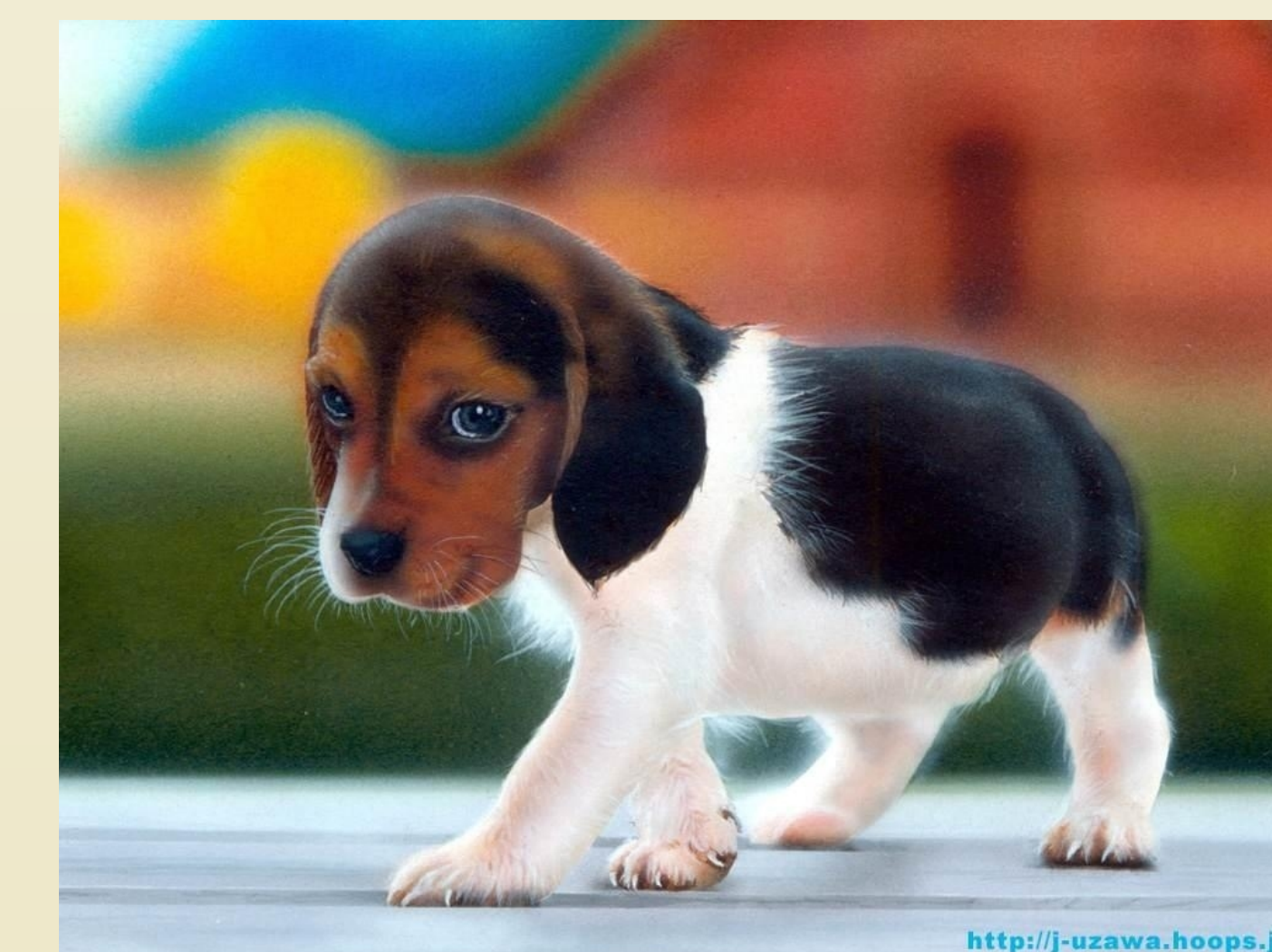
Metadata is data stored within the image file that gives details about the image that aren't readily apparent. Most of the details it gives are difficult to interpret without in-depth understanding of image files and computers. However, disparities are apparent in the metadata between images modified with different programs. Example of Metadata:

```
Format name: javax_imageio_1.0
<javax_imageio_1.0>
  <Chroma>
    <ColorSpaceType name="YCbCr"/>
    <NumChannels value="3"/>
  </Chroma>
  <Compression>
    <CompressionTypeName value="JPEG"/>
    <Lossless value="false"/>
    <NumProgressiveScans value="1"/>
  </Compression>
  <Dimension>
    <PixelAspectRatio value="1.0"/>
    <ImageOrientation value="normal"/>
    <HorizontalPixelSize value="0.35277778"/>
    <VerticalPixelSize value="0.35277778"/>
  </Dimension>
</javax_imageio_1.0>
```

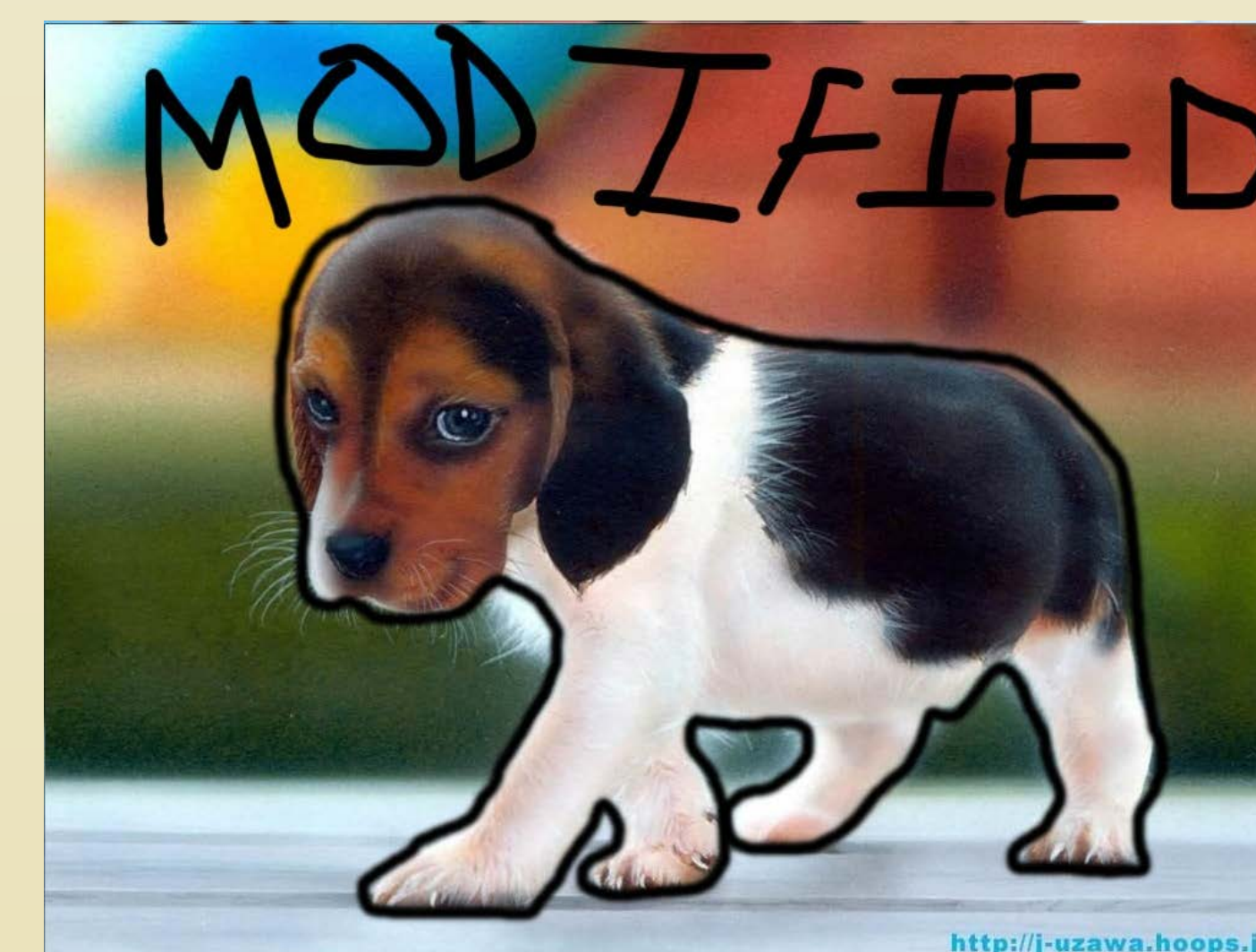
Error Level Analysis

Jpeg images are lossy. This means with every subsequent save, the quality of the image degrades. This means that pixel data is altered after every save. By subtracting the difference in color space between two different quality saves of the same image, we can see the information lost, and also some modifications.

Example Photos



Original Image



Modified Image



ELA Visual Difference
Comparison of Modified
image and another copy
saved at a lower quality

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