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# ARCHAEOLOGICAL IMAGE ENHANCEMENT USING HISTOGRAM

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**Abstract**
Archaeology studies the story of man's past through his materials remains. The word archaeology comes from the Greek word Archaios – Ancient or Arche – beginning and logos-theory or science .According to one definition, "Archaeology is essentially a method of reconstructing the past from the surviving traces of former societies". It is a branch of learning that is concerned with the material vestiges of man, "everything made by human beings from simple tools to complex machine from the earliest temples and tombs to palaces. In olden days archaeologists will capture the photos through the camera and they will develop the photos in a photo storage room. In the last twenty five years, a school of archaeologists led by Leuis Binford and David Clark has been strongly championing the cause of archaeology as a scientific discipline. This approach goes under the name "New Archaeology". Archaeology is undergoing profound transition from interpretation of images displayed on photo to reading images on high-resolution computer screen. As this new era emerges, archaeologists are also starting to see traditional photo delivery replaced by electronic transfer of digital file, and photo storage rooms replaced by archives of computer files. Histogram comes in. It is a simple graph that displays where all of the brightness levels contained in the scene are found, from the darkest to the brightest. These values are arrayed across the bottom of the graph from left (darkest) to right (brightest).

## 1. Introduction

In the long term, the fabrication of visual impressions that do not reflect reality - up to and including so-called "virtual reality" - may have even further-reaching consequences. Films like *A* Bug's Life or Jurassic Park are well-known examples of the use of model-based, digital image generation to create a purely imagined "reality". The economical potential of visually intriguing computer games cannot be underestimated. In a more practical context, similar techniques may be used in flight simulations for pilot training, as well as in planning tasks in archeological research. A simple and compact image enhancement system for archaeology materials like Coins, Epigraph and Sculpture the images are scanned and changed into different computer image format such as .tiff (Tagged Image File Format), .png (Portable Network Graphics), .gif (Graphical Interchange Format) . In the different image format .tiff and .gif the image color quality is lost and in the .png format the image color is retained. Edges are detected by adjusting the intensity level.

The impact of the computer age and it applies to archaeology as well. The ability of the computer to handle massive amounts of materials more rapidly and dependably than any other system is obvious. It is especially necessary for artifact analysis of site with large number of finds, because it allow the control, indexing and storage of large number of information. The computer also interprets the quantitative and qualitative patterning. Enhancing the images through the computer system is useful to identify the minute pictures and information inside the coins, epigraph, sculpture and any other archaeological images. The reflection, or mirror image and shadow of lights can be eliminated.

## 2. Image Enhancement Schemes

Image enhancement refers to accentuation, or sharpening , of images features such as edge , boundaries ,or contrast to make a graphic display more useful for display and analysis. The enhancement process does not increase the inherent information content in the data. that they can be detected easily. Image enhancement includes gray level and contrast manipulation, noise reduction , edge crispening and sharpening, filtering, interpolation and magnification, pseudocoloring , and so on. The greatest difficulty in image enhancement is quantifying the criterion for enhancement. Therefore, large number of image enhancement technique are empirical and acquire interactive procedures to obtain satisfactory results. However , image Enhancement remains a very important topic because of its usefulness in virtually all image processing application. Some of If a process is then it is clear that only one application of the process is necessary to achieve the maximum ``enhancement" possible. This could be seen as signifying efficient design. The common image enhancement techniques. In point operation -Contrast stretching – low contrast images occur due to poor or non uniform light, Noise clipping, Window slicing and Histogram Modeling. There is an optimal order in which these adjustments should be applied. Because any enhancement you make will have an impact on the previous ones they should be applied in a logical order so as to accumulate the effects properly:

1. A Color balance adjustment should be applied first because of its effect on saturation and contrast.
2. Apply a Brightness and Contrast enhancement next.
3. Lastly adjust the Saturation

The histogram of an image represent the relative frequency of occurrence of various gray level in the image. Histogram-modeling techniques, modify an image so that histogram has a desired shape. This is useful in stretching the low-contrast level of images with narrow histograms. Histogram modeling has found to be a powerful technique for image enhancement.

## 3. Histogram

### 3.1 Definition

The histogram of an image represents the relative frequency of occurrence of the various gray levels in the images. A Histogram display bar graph format measurement of data distributed by categories. Histogram modeling has been found to be a powerful technique for image enhancement.

### 3.2 Histogram Equalization of Grayscale Image

Consider a discrete gray scale ($x$) and let $n_i$ be the number of occurrences of gray level $i$. The probability of an occurrence of a pixel of level $i$ in the image is

$$\mathrm{p_x(i) = \ p(x = i) = \frac{ni}{n}, 0 \leq i} < L$$

$L$ being the total number of gray levels in the image, $n$ being the total number of pixels in the image, and $p_x(i)$ being in fact the image's histogram for pixel value i, normalized to (0,1).

Let us also define the cumulative distribution function corresponding to $p_x$ as

$$cdf_x(i) = \sum_{j=0}^{i} p_x(j)$$

This is also the images accumulated normalized histogram.

We would like to create a transformation of the form $y = T(x)$ to produce a new image $\{y\}$, with a flat histogram. Such an image would have a liberalized CDF across the value range, i.e.

$$cdf_y(i) = iK$$

for some constant $K$. The properties of the CDF allow us to perform such a transform Inverse distribution function, it is defined as

$$cdf_y(y') = cdf_y\big(T(k)\big) = cdf_x(k)$$

where $k$ is in the range (0,L). Notice that T maps the levels into the range (0,1), since we used a normalized histogram of {x}. In order to map the values back into their original range, the following simple transformation needs to be applied on the result

$$y' = y.\,(\max\{x\} - \min\{x\}) + \min\{x\}$$

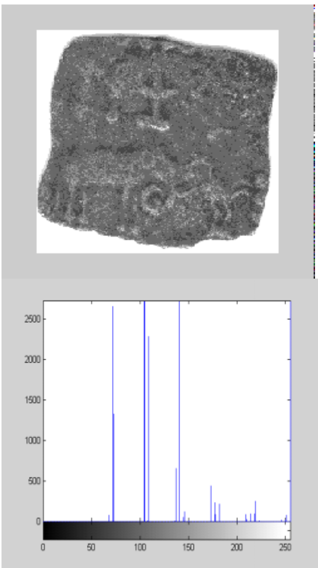


Figure:1 Original Image with Histogram

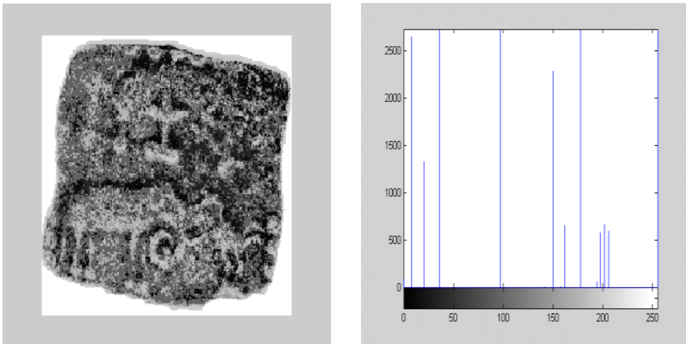


Figure:2 Coin Enhanced by Histogram Equalization

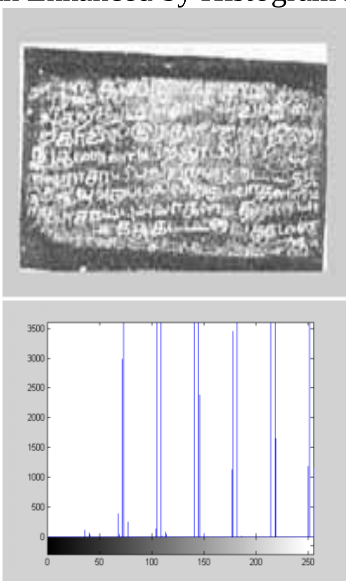

Figure: 3 Original Epigraph with Histogram

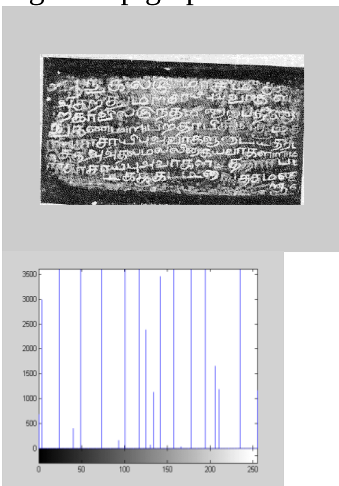

Figure: 3 Epigraph Enhanced by Histogram Equalization

## 4. Histogram equalization of color images

A color histogram of an image represents the distribution of the composition of colors in the image. It shows different types of colors appeared and the number of pixels in each type of the colors appeared. The relation between a color histogram and a luminance histogram is that a color histogram can be also expressed as “Three Color Histograms”, each of which shows the brightness distribution of each individual Red/Green/Blue color channel.

The above describes histogram equalization on a grayscale image. However it can also be used on color images by applying the same method separately to the Red, Green and Blue components of the RGB color values of the image. However, applying the same method on the Red, Green, and Blue components of an RGB image may yield dramatic changes in the image's color balance since the relative distributions of the color channels change as a result of applying the algorithm. However, if the image is first converted to another color space, Lab color space, or HSL/HSV color space in particular, then the algorithm can be applied to the luminance or value channel without resulting in changes to the hue and saturation of the image. There are several histogram equalization methods in 3D space. Trahanias and Venetsanopoulos applied histogram equalization in 3D color space. However, it results in “whitening” where the probability of bright pixels are higher than that of dark ones. Han et al. proposed to use a new cdf defined by the iso-luminance plane, which results in uniform gray distribution.

## 5. Conclusion

Despite rapid progress in enhancing images and computer performance for image enhancement in archaeological study, Histogram equalization is proved to be a successful algorithm in this techniques, Original images are enhanced and compared with Histogram equalization and the graphical representation shows the difference between the original image and enhanced image.

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