Image Processing through JavaScript

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Abstract: Images are everywhere on the internet, making them an essential content of web page therefore it would be very useful to have the image processing technique within/on the web page itself. In this paper, a novel method is presented to implement the image processing technique at browser’s end. The image processing is conducted through JavaScript using various features of Web Component, comprising of Canvas and JavaScript Classes pertaining to image.

Keywords: Image processing implementation on browser

1. Introduction

Images are everywhere, our surrounding, our devices and our mind. Images have become an integral part of our life, life without images is unthinkable. What is an image? It is an artefact that depicts visual representation, a 2 dimensional picture. We are in technology revolution; new things come up on daily basis. Internet is part of this revolution where contents and information are uploaded at large number and accessible to all. Web content constitutes of many things, but most important of them is textual and image representation. Image being an essential content of the web page therefore it would be very useful to have image processing technique on web.

Web application or web site containing the web page can be 2 tier, 3 tier or n tier. If 2 tier than client (browser) and server entities are involved, if 3 or n tier then database comes into picture. One way to implement the image processing is on the server side, the server components can process the images easily. In order to do that the image should be transferred on the server through the network call causing excessive utilization of network and server resources. Another way of implementing the image processing would be on the client side that is browser. In order to process the image on browsers, the technique must be compatible with the browsers. As we all know JavaScript is an integral part of web technology, available on all modern browsers, providing the dynamic functionality to web page. If the technique is developed in JavaScript, the image can be processed efficiently on browsers.

2. Image Representation in Webpage

2.1 HTML <img>

The <img> tag contains an image in an HTML page.

2.2 Image (JavaScript Class)

Used for creating the instance of image.

It accepts two optional parameters: Image ([unsigned long width, unsigned long height])

Returns an HTML Image Element instance just as document.createElement ('img') would.

2.3 HTML5 Canvas (Supported on all the modern browsers)

The HTML <canvas> element is used to draw graphics, on the fly, via scripting (JavaScript). The <canvas> element is only a container for graphics. JavaScript is used to draw the graphics.

3. Method and Implementation

The image processing consists of 3 phases.

3.1 Load Image and Canvas

Select the desired image and store it within <img> tag or as an instance of Image Object (JavaScript Class). In order to store the image as an instance, use FileReader Class.

To work with pixel it is very important to understand what pixel comprises of. Each pixel contains 4 channels, RGB (Red, Green and Blue) are 3 channels while the fourth one is alpha channel. The values in RGB channel range from 0 to 255 whereas value in alpha channel range between 0 to 1. The RGB channels are responsible for colour and alpha channel is responsible for transparency.

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To play with the image, the image replica must be stored as an instance of Image Object and later imprinted within a <canvas> tag that acts as a container of the modified image. In order to print the image to canvas use ‘ctx’ and JavaScript functions of Canvas.

ctx = canvas.getContext('2d');
ctx.drawImage(img, 0, 0, canvas.width, canvas.height);// img represents Image Object

3.2 Choose Algorithm and Manipulate

Choose the desired image processing algorithm to be applied on the image. Define components to perform the image manipulation process compatible with the browser, if you wish to provide control to the user. The image processing formula is applied on the pixels within the image. The pixel value is extracted using the ‘ctx’ and Uint8ClampedArray.
var imageData = ctx.getImageData ( 0 , 0 , canvas.width ,
canvas.height );

var pixelData = imageData.data
// represents object containing image data

var uint8pixelData = new Uint8ClampedArray ( pixelData.length )
// array representing 8-bit unsigned integers clamped to 0-
255

The ‘uint8pixelData’ object can be used by conditional
statements and ‘pixelData’ can be used to manipulate image
values, but they point to the same address.

if ( uint8pixelData[i+j] > threshold // threshold can be any
input for eg: 200
 pixelData[i+j] = 255;
else
 pixelData[i+j] = 0;

The data within the ‘uint8pixelData’ array contains the 4
channels in linear fashion as depicted below. This data must
be handled properly to get the correct outcome.

--- Red (133) Green Blue Alpha --- Red Green Blue Alpha --- Red Green Blue Alpha ---

Pixel Pixel Pixel

3.3 Store Processed Image

After image processing algorithm has been applied on pixels
of the image, the modified pixels must be united and formed
as a modified image. It is possible to perform this task using
Canvas

ctx.putImageData(imageData, 0, 0); // Paint the new image in
Canvas

The implementation of the process is shown in screenshot
below. The image on the left hand side is modified image
and right hand side image is the original one.

Algorithm

![](Contrast Stretching)

Upper Threshold: 168
Lower Threshold: 73

To view the implementation, please visit
http://imagerefining.com

4. Conclusion

This paper represents the steps to process an image in
browser, hence image processing task can be handled on the
client side unless there exists some issues like security
concerns.

Using the same process, other tasks related to image can be
accomplished easily like sending image over the network,
copying image data, manipulating the image data to send
messages, etc.

References

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