**BMP.html**

<!DOCTYPE html>

<html>

<style>

#topinfo{

background: transparent;

width: 100%;

float: top;

}

h1 {text-align: center;}

div {text-align: center;}

table {border: 1px solid black;}

th, td {

border: 1px solid black;

padding: 8px;

text-align: center;

}

button {

background-color: black;

color: white;

padding: 14px 20px;

margin: 8px 0;

border: none;

cursor: pointer;

width: 10%;

}

</style>

<script>

function greeting() {

var question;

var answer = ["yes", "no"];

do {

question = prompt("Have you heard of Bitmap (BMP) file? (yes/no)");

} while (!answer.includes(question.toLowerCase()));

document.getElementById("message").innerHTML = "Since you have answered " + question + ", let's learn more about how BMP images are compressed using Run-Length Encoding!";

}

</script>

<head>

<title>Lossless- Bitmap (BMP) </title>

</head>

<body onload = "greeting ();">

<div id="topinfo">

<h1>CS1102 - Course Project - 2023/2024 Semester B</h1>

<h4>Different image compression algorithams</h4>

<p>

<table>

<tr>

<td>Chan Yue Ting (57276040)</td>

<td>Lau Foo Kiu (56616932)</td>

<td>Pan Ching Man (56623253)</td>

<td>Yau Kam Chau (57850287)</td>

<td>Yau Wing Yan (56611870)</td>

</tr>

</table>

</p>

<hr/>

</div>

<span class = "s1"><div id = "message"></div></span>

<h1> Lossless Compression - Bitmap(BMP) Image </h1>

<hr size="2" width="40%" color="black">

<br/>

<h3> What is BMP file format?</h3>

<li>BMP format is an uncompressed raster file designed to display high-quality images on Microsoft Windows OS and store printable photos.</li>

<li>Image files are composed of either pixel or vector (geometric) data that are rasterized to pixels when displayed in a vector graphic display.</li>

<li>The pixels that constitute an image are ordered as a grid (columns and rows),each pixel consists of numbers

representing magnitudes of brightness and color.</li>

</br>

<h3> Pros and Cons of BMP files</h3>

<table>

<tr>

<th><b> Pros </b></th>

<th><b> Cons </b></th>

</tr>

<tr>

<td> Device-independent: Can be stored and display across multiple devices without quality degrading </td>

<td> Large file size: Difficult for image sharing, website usage or hardrive storing </td>

</tr>

<tr>

<td> Highly versatile: Can handle multiple color depths, profiles, and alpha channels </td>

<td> Color range limitation: BMP can only contain RGB images </td>

</tr>

</table>

<h3> BMP file compression algorithm : <u>Run-Length Encoding (RLE)</u> </h3>

</br>

</h2> <u>Definition</u></body>

<li> Run-Length Encoding (RLE) is a data compression algorithm that is supported by most bitmap file formats including BMP. </li>

<h3> Pros and Cons of BMP files</h3>

<table>

<tr>

<th> Pros </th>

<th> Cons </th>

</tr>

<tr>

<td> Multiple data types: RLE is suited for compressing any type of data regardless of its information content.</td>

<td> Limitations on compression: RLE algorithms cannot achieve the high compression ratios of the more advanced compression methods</td>

</tr>

<tr>

<td> Easy and quick to use: RLE is easy to implement and quick to execute, for complex compression algorithms or uncompression image data, RLE is a good alternative</td>

<td> Result depends on the content of data: the content of the data will affect the compression ratio achieved by RLE </td>

</tr>

</table>

<h3> How does the Run-Length Algorithm work? </h3>

</br>

<p>RLE works by reducing the physical size of a repeating string of characters</p>

<p>This repeating string, called a <u>run</u>, is typically encoded into two bytes. The first byte

represents the number of characters in the run and is called the run count. The second byte is the value of the character in the run, which is in the range of 0 to 255, and is called the run value. </p>

<h4>Run-Length Coding processing method: </h4>

<IMG SRC="Run-Length Coding.gif" width="40%" >

<h4> Example of compression of BMP files using Run-Length Encoding: </h4>

<IMG SRC="RLE Compression Example.jpg " width="40%" >

<h4> More about Run-length encoding: </h4>

<table>

<tr>

<th> Run-length encoding variants </th>

<th> Basic run-length encoding flow </th>

<th> 9-4: Bit-, byte-, and pixel-level RLE schemes </th>

</tr>

<tr>

<td> <IMG SRC="RLE Encoding Varients.png" width="100%" ></td>

<td> <IMG SRC="RLE Encoding flow.png" width="100%" ></td>

<td> <IMG SRC="RLE level scheme.png" width="100%" > </td>

</tr>

</table>

<a href="#top">

<button>Back to top</button>

</a>

</body>

</html>

**RAW.html**

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<title>Lossless- RAW </title>

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<h4>Different image compression algorithms</h4>

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<h1> Lossless Compression - RAW Image </h1>

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<h3> What is RAW file format? </h3>

<li>RAW files contain uncompressed and unprocessed image data captured by digital camera or scanner's sensors. </li>

<li>Among the raster file types, RAW file stores the largest amount of detail which facilitates editing, compressing, and converting RAW files into other formats. </li>

</br>

<h3> Pros and Cons of RAW files</h3>

<table>

<tr>

<th> Pros </th>

<th> Cons </th>

</tr>

<tr>

<td> Images with great details and wide color range: RAW images contain most detail and multiple colors.</td>

<td> Format Compatibility: Unstandradised raw files create situations where software can't read files from certain cameras. </td>

</tr>

<td> Greater control on image adjustment and conversion: Allows multiple adjustments including image brightness, contrast, and gamma correction. It also allows the merging of RAW files to form HDR or panoramic images.</td>

<td> Large file size: The size of RAW images can require both additional camera and computer storage space </td>

</tr>

<tr>

<td> Possibility of Image conversion: RAW images can possibly merge to form HDR or panoramic images for editing. </td>

<td> Long workflow: Large file size causing longer time to process RAW files. </td>

Due to the larger file sizes, conversions and having at least two files for each image (the original RAW and converted raster file), it can take longer to work with RAW files.</td>

</tr>

</table>

</br>

<h3> Pros and Cons of RAW files</h3>

<h3> Learn more about <u> Uncompressed RAW image </u> and <u> Lossless RAW Compression </u> </h3>

<h4>Uncompressed RAW image</h4>

<li> Data are all preserved without compression.</li>

<li> There is no impact on image quality, which provides flexibility in manipulating various aspects of the image with minimized quality loss. Aspects manipulation including brightness, color, sharpness, and noise reduction. </li>

<h4> Lossless RAW Compression</h4>

<li> Allows image size reduction without compromising on image quality</li>

<li> Process by post-processing software and decompressed similarly with ZIP file.</li>

<li> After file decompression, images are expanded back to their original size.</li>

<li> Ideal choice for RAW image compression since data are fully preserved with fewer storage spaces.</li>

<h3> How big are the differences between an uncompressed RAW image and a Lossless RAW image? </h3>

<IMG SRC="RAW image compression.jpg" width="40%" >

<h3> Examples of Post-processing software </h3>

<li> Adobe Photoshop</li>

<li> Adobe Lightroom</li>

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**Lossless comparison**

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</div>

</br>

<script>

var color = new Array("black", "brown");

var no = 0;

function load(obj){

theobj = obj;

setInterval("change(theobj)",1100);

}

function change(obj){

if (no >= color.length) no = 0;

obj.style.color = color[no];

no++;

}

</script>

</head>

<body onLoad="load(text)">

<span id=text style="font-size:30pt;font-weight:bold;">

Lossless image compression comparison </span>

</script>

</br>

<h3>Lossless compression Algorithm </h3>

<li> Lossless compression is a technique to compress an image without data loss.</li>

<li> It enables images to take up less space and there is a discernible loss in picture quality </li>

<li> It is known as reversible compression which data files are restored and rebuilt in their original form after decompression. </li>

</br>

<table>

<tr>

<th> </th>

<th> PNG </th>

<th> GIF </th>

<th> BMP </th>

<th> Lossless RAW </th>

</tr>

<tr>

<td><b> Compression Algorithm</b></td>

<td>DEFLATE</td>

<td>Encoding</td>

<td>Run-Length Encoding </td>

<td> Processed by Post-processing software </td>

<tr>

<td> <b> Color range</b> </td>

<td> Full 24-bit color (8 bits per channel) and an alpha channel ( level of transparency between 0 (fully transparent) and 255 (fully opaque).) </td>

<td> 256 colors per image and single transparent color </td>

<td> 8-bit (256 colours) and 24-bit (16 million colours) </td>

<td> No fixed color range </td>

</tr>

<td> <b> File size after file compression </b></td>

<td> Large </td>

<td> Small </td>

<td> Large </td>

<td> Large </td>

</tr>

<td> <b> Image quality after file compression </b></td>

<td> High </td>

<td> Low </td>

<td> High </td>

<td> High </td>

</tr>

</table>

</br>

<h3> Lossless compression using Run-length Encoding and DFTBA </h3>

<div>

<IMG SRC="Lossless gif.gif" width="40%" >

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