CONTENTS

New Features in LSIC V2.5:

New file format support:

- **8-bit grey BMP and TGA**
- **24-bit color TGA**

No pixel size constraint on the original image.

Support for incremental decompression.

You can check or uncheck on Option/Incremental display.

How to edit comments?

1. **Load a picture.**
2. **Click on Option/Edit Comments.**
3. **Compress the image.**
4. **Save to the disk. Comments will be saved as well.**
5. **When you load this compressed file, Click on Option/Edit Comments. You will see the comments.**

About the LSIC codec engine:

1. What does LSIC stand for?
2. What does codec stand for?
3. What environment does this program operate on?

1. **What does LSIC stand for?**

Lightning Strike Image Compressor.

2. What does codec stand for?

compressor - decompressor.

3. What environment does this compressor operate on?

LSIC V2.5 is a Win32 application. This program and the decompressor plug-in for Netscape will work on Windows 95/NT. Comparable LSIC codec engines are also available for the Mac, Unix, and Windows 3.1 environments.

About Compression:

1. What image file formats can be read and compressed?
2. Are there any requirements for image to be compressed?
3. How do I adjust compression parameters?
4. What is the meaning of the quality factor?
5. How do I compress an image?
6. What are the meanings of the different parameters under the Master Level option?
7. What is the meaning of the 8-bit Image and FS_Dithering settings?
8. How long should LSIC require to compress an image?

1. What format of image file can be read and compressed?

LSIC V2.5 can support PC formatted BMP (24 bit true color and 8 bit gray scale mode) files and TGA formated(24 bit true color and 8 bit gray scale) files.

2. Are there any requirements for image to be compressed?

LSIC V2.5 can compress any image size.

3. How do I adjust the compression parameters?

Go to the "Options" menu and choose "Easy Setup". After you set the Quality Factor value and select an image type such as Landscape, Faces, or Other, click on "Test". This will compress the image and provide a comparison with the uncompressed image. You can you these results to modify the Quality Factor value.

Changes to the specific compression parameters can be observed by examining the Master Level compression variables.

4. What is the meaning of the quality factor?

The quality factor is used to define a set of internal compression parameters. A high quality factor corresponds to a low compression ratio and results in a more appealing image.

5. How do I compress an image?

Open a bitmap file from the File menu, and choose "Compress or "Save" from the File menu once the compression parameters have been determined in either the Easy Setup or Master Level.

6. What are the meanings of the different parameters under the Master Level option?

A_Levels, B_Levels and C_Levels represent how many levels must be discarded after the wavelet transformation. Total_Levels stands for number of iterations in the wavelet transformation. Quantization Vector A, B and C are quantization settings for the A, B and C components repectively. The number of elements of each vector is equal to three times the Total Levels plus one. Threshold of vector gives threshold of image. The bigger the threshold is, the higher the resulting compression ratio will be. The number of elements associated with this vector is equal to the Total Levels plus one.

We recommend that you first become familiar with the compression results under the Easy Setup option and see how changes in the Quality Factor effect the compression parameters under the Master Level option. After some experimentation you will begin to get an intrinsic feel for how the different variable effect the overall compression ratio.

7. What is the meaning of the 8-bit Image and FS_Dithering settings?

If your display is 256 color then all true color images will be quantized to 256 colors. The FS_Dithering option allows LSIC to improve your image after the color quantization of the image.

8. How long should LSIC require to compress an image?

An uncompressed image file of 1.18 mb required 20 seconds to compress on a Dell Dimension XPS Pentium 90.

Software Support

You can email your technical questions to tsupport@infinop.com. We will try and get back to you in a reasonable amount of time. We will also post answers to frequent questions at www.infinop.com/html/tsupport_faq.html. If you require a more immediate response please contact Infinet Op directly at (817) 891-1538.

An Introduction to the Lightning Strike Wavelet Image Compression Technique

1. Image Compression

Image compression is now essential for many applications such as image transmission across the Internet. The information contained in the images must be compressed by extracting only the visible elements, which are then encoded. The fundamental goal of data compression is to reduce the bit rate for transmission or storage while maintaining acceptable fidelity or image quality. Compression is achieved according to the steps detailed below. It is important to note that these three steps are generic to any transform compression technique.

1) Transformation: Transforming the data, projecting it on a basis of functions. This step is lossless.
2) Quantization strategy: Mapping many input values into a smaller set of output values. This is a lossy step.
3) Error-free encoding: Encoding the quantized transform coefficients.

There are many choices in all of these three steps, which will impact the quality as well as the actual achieved compression ratio. We also point out that the last two steps have a very strong correlation with the transformation chosen in step 1. In other words, the actual transform selected in the first step plays the key roll in the overall success of the image compression.

2. Wavelet Based Transformation

The objective of any transform is to decorrelate the image pixels by projecting the original image on a basis of linear functions, and then we can use the coefficients of the transform as the means to store the image. The more carefully we choose the basis, the fewer coefficients we need to represent the image and this fact provides the possibility for image compression. Currently, there are two kinds of transformations which are frequently used. One is traditional Fourier analysis based method, such as discrete cosine transform (DCT), which is used in JPEG. The other one is a form of the wavelet transform. This is a relatively new approach which has just become popular in the recent past. The method we use is an adaptation of the wavelet approach.

The very name wavelet comes from the requirement that the basis function (the mother wavelet) should integrate to zero, "waving" above and below the x-axis. The diminutive connotation of wavelet suggests the function has to be well localized. Other requirements, such as requiring the wavelets to be orthornormal or symmetric, are technical and are needed to insure quick and easy calculation of the direct and inverse wavelet transform.

There are many kinds of wavelets. One can choose between smooth wavelets, compactly supported wavelets, wavelets with simple mathematical expressions, wavelets with simple associated filters, etc. Like the sine and cosines functions in the Fourier analysis, wavelets are used as basis functions in representing other functions.

There are some important differences between Fourier analysis and wavelets. Fourier basis functions are localized in frequency but not in time. Small frequency changes in the Fourier transform will produce changes everywhere in the time domain. Wavelets are local both in frequency/scale (via dilation) and in time (via translations). This localization is an advantage in many cases. For example, since many images have details at different scales and different positions, we can "look at" the image in different scales through the wavelet transform. It also allows us to deal with images locally.

Another important difference is the fact that many classes of signals or images can be represented by wavelets in a more compact way. For example, images with discontinuities and images with sharp spikes usually take substantially fewer wavelet basis functions than sine-cosine basis functions to achieve the same precision. This implies the wavelet-based method has potential to get a higher image compression ratio. Moreover as many have reported in the literature, for the same precision, the images that were reconstructed from wavelet coefficients look better than the images that were obtained using a cosine transform. This means that the wavelet scheme is closer to the human visual system

3. Conclusion

The wavelet-based image compression method provides higher image compression ratios, if we can take advantage of the mathematical structure of the wavelet transform coupled with the quantization and entropy encoder. The Lightning Strike product represents the very latest research available both in the literature as well as three years of in-house research. These efforts have produced the following results:
1) Process an image of any pixel dimension, not just a power of 2.
2) A much more tunable product according to the parameters of the transform.
3) Very large images can be compressed without edge effects.
4) A software only solution providing rapid compression and decompression times.

We are sure when you view the images compressed by Lightning Strike, you will agree that the bounds of compression have been redefined.