THE source for JPEG2000

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Corporate Overview

- Founded in 1986
- Roots in wavelet mathematics, data compression and telecom modulation
- In 1993, focused efforts on telecom and image compression products
- IPO in 1996 raised $36M
- 140 employees
Business Model

- Aware develops and licenses telecom and compression technology
  - Software packages
  - System models
  - Reference designs
Aware Compression Achievements

- First to commercialize wavelet compression
- Early hardware implementation of wavelet compression
- Contributed to development of WSQ fingerprint compression standard
- Co-developed ADV601 wavelet video chip with Analog Devices
- Participation in JPEG2000 Standard Development
- Strong Patent Portfolio
## Aware Compression Products

<table>
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<tr>
<th>Standards based products</th>
<th>Proprietary products</th>
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<tr>
<td>JPEG2000</td>
<td>Accupress: wavelet based still image codec</td>
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<tr>
<td>WSQ: FBI fingerprint compression</td>
<td>Motionwavelets: video codec</td>
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<td>AccuPrint</td>
<td>Seispact: seismic data compression</td>
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<td>NISTPack</td>
<td>AccuFace: specialized facial compression</td>
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<td>CJISWeb</td>
<td>AccuRad: medical images</td>
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Products available as DLL’s, ActiveX controls, SDK’s, and plug-ins for web browsers and Adobe Photoshop.
Wavelet Scalar Quantization (WSQ)

- A non proprietary standard defined by the FBI
- Based on a class of compression algorithms called wavelets
- Wavelet compression does not introduce the block artifact inherent in JPEG compression
- Wavelet compression enables more robust visual and automatic recognition of fingerprint images
JPEG versus WSQ

JPEG compressed: note block artifacts
WSQ compressed

FBI stipulates WSQ as a requirement for compression. All states, AFIS and live scan vendors follow suit.
Aware Experience Relevant to NIMA

- Extensive Involvement with the Federal Government
- US DOJ Digital Fingerprint Systems- IAFIS, Booking Stations, Latent Print Work Stations
- All use Standard Compliant Software components by Aware
  - Image compression (fingerprints, mug shots, scanned documents)
  - Compliant File Formatting
  - FBI Certified ten-print card printing
Aware & JPEG2000

- Active contributor to standard
  - US & International meetings
  - contributed several compliance test images (part IV)
- Optimized JPEG2000 software implementation
  - Based on extensive experience providing commercial wavelet-based compression solutions
- Expertise on best practices to deploy JPEG2000
- Roadmap to provide value-added layers
  - Enhanced viewers, profiles, example code, DSP implementations, C Model
Professionally Developed JPEG2000 API

- COTS product design is based on years of commercial experience
- Emphasis on...
  - ease of use and debug
  - ease of portability
  - memory to memory compression/decompression
  - file conversion
  - thread safe and optimized
  - tools and “value add” options
  - continual maintenance and support
The Aware Professional API

- All libraries written in ANSI C
  - API source code can easily be compiled for different operating systems
  - C++ wrappers can be built by user
- Java Classes available
- Object based design
The Aware “Image Object”

JPEG 2000
JP2
BMP
JPEG
Targa
TIFF
PPM

JPEG 2000 LIBRARY
ENCODER
DECODER
TRANSCODER

Input Image Info
Input Image Options
Output Image Options
The Aware J2K library provides full support for this profile:
- 1k square tiles, 5 levels of transform, layer progressive with at least 19 layers, etc.

Each NIMA encode parameter can be set individually or via one high level function.

We provide a working demo with source code:

The “Tile From Disk” Demo
- encodes large images from disk to memory
- provides decode/display by resolution and quality
Aware J2K NIMA profile viewer (1)

- Is Designed to support encode/decode and display of large tiled images
- For compression: Reads TIF or BMP files in tiles from disk, compresses, writes to memory
- For decompression/viewing
  - Reads entire NIMA J2K file into memory
  - Images encoded by quality (first), resolution (second)
  - Lowest resolution displayed first, quality layers decoded incrementally
  - Only decodes what is necessary for display
Aware J2K NIMA profile viewer (2)

Display (cont.)

- mouse or keyboard control to decode higher resolutions and to decode (view) different quality layers
- pan/scroll bars to display all parts of the image
NIMA Profile Decode - Resolution to fit window

10K x 10K image
NIMA Profile Decode - Higher resolution
NIMA Profile Decode – Higher resolution
NIMA Profile
decode each tile by quality layers

8K x 6K, 24 bit image
NIMA Profile
Progressive Display, 1K x1K tile, Layer 1 of 19
NIMA Profile
Progressive Display, 1K x1K tile, all 19 layers
/* initialize the JPEG 2000 image object */
    retval = aw_j2k_create(&j2k_object);

/* Read in the input image */
    input_file_name = "sample_image.bmp";
    retval = aw_j2k_set_input_image_file(j2k_object, input_file_name);

/* Request a JPEG 2000 format for the output */
    retval = aw_j2k_set_output_type(j2k_object, AW_J2K_FORMAT_J2K);
/* Set the Compression parameters using the NIMA profile option */

aw_j2k_set_output_j2k_profile(j2k_object,
    AW_J2K_PROFILE_NIMALOSSLESS);

/* Request the output image */

output_file_name = "sample_image.j2k";
retval = aw_j2k_get_output_image_file(j2k_object,
    output_file_name);
NIMA PROFILE
How to use the Aware JPEG200 API (3)

Optionally…. Each encoding option can be set separately

Examples:

/* set number of layers to 19 */
aw_j2k_set_output_j2k_layers(j2k_object, 19);

/* set the tile size to 1024 x 1024 */
aw_j2k_set_output_j2k_tile_size(j2k_object, 1024, 1024);
AWARE & JPEG2000- Embedded

- Ports to DSP’s provided as requested

- Aware C Model is designed to provide platform independent, modularized, commented source code to facilitate ports to DSPs or other embedded devices

- Includes test vectors- Each functional block of the J2K algorithm can be compiled, run, tested
Aware & JPEG2000 - Wireless
Aware & JPEG2000- Wireless

- Pocket PC Plugin and API
- JPEG2000 is ideal
  - small file sizes, layered file format, error resilience

  Aware provides a fully functional progressive decoder for the PocketPC devices
Aware & Web Based Imaging Solutions-

*CJIS Web* for biometric image database
*FrameWave Web* for medical image database
JPEG2000 Browser Plugin

Magnify Tool Enabled in Browser
The Value of Aware to NIMA

- All J2K software developed and written by Aware engineers and mathematicians
- All US based code development
- No university based development or code ownership (important for support and maintenance)
- No cross-licensing of code from third parties
- All code written in ANSI C - facilitates ease of porting
Aware’s Value to NIMA

- 16 years of experience in wavelet compression, including ASICs and MMX-optimized software
- Active participation in the standards body
- Aware is profitable, stable, long term supplier
- Reduced risk and faster time-to-market
- Can provide implementations tailored to specific application requirements
- Full maintenance and support by a team of professional engineers