OTTAWA PC NEWS

Vol. 18 number 6 The newsletter of the Ottawa PC Users' Group June 2001

TECHNOLOGY DEVELOPMENTS

JPEG 2000 *by Dunc Petrie*

I expect that most graphics artists — amateur and pro — are comfortable using the mainstays of graphic image formats for the Internet: GIFs and JPGs. Well, your expertise is about to be dealt a curveball. Since these formats were created, research has developed more sophisticated approaches. Besides, JPEG originated about ten years ago: current hardware brandishes more powerful processors and cheap memory. On the horizon is JPEG 2000 (from those wonderful folks who brought you JPG) that promises a host of improvements and the introduction of two new file extensions: JP2 and JPX.

Ideally, any compression scheme should feature:

high levels of compression (leading to minimal file size),
no loss of detail,
open standard (no royalties),
no visible artefacts,
no visible posterization (loss of colour information),
easy use (few user-controlled variables), and
fast execution.

Dunc Petrie

The Internet has fuelled much of the demand for image compression since end-users expect a website to pop up instantly on-screen. Despite faster connections large image file sizes are self-defeating. Smaller file sizes were championed at the expense of image quality. Current schemes differ from the ideal: as compression ratios increase (and file sizes shrink) visual artefacts become increasingly evident. Early in the life-cycle of the current image formats these inadequacies were largely masked by the comparatively low resolution of desktop monitors and a restricted colour palette. The landscape has changed: the explosion in popularity of digital cameras and photo-quality colour inkjets has fuelled demands for algorithms (often referred to as a 'transform') that can deliver images with the resolution and colour fidelity of the original intact.

Why JPEG can't 'cut' it

Most of the current compression schemes rely upon some variant of a scheme called Discrete Cosine Transform (DCT) — relax, I will spare you the math — combined with other tweaks to minimize the perceived (human visual-brain interpretation) image quality degradation. This scheme is lossy; data that is squeezed out during encoding is lost forever. Yes, lossless encoding schemes exist: Huffman or run-length encoding (RLE) is an example. Simplified, RLE instead of recording a string (run) of 200 red pixels with the code 'red, red, red¼' would be coded more economically as '200 times red.' DCT is more complex: suffice to say that it divides the image into 8x8 sub-blocks; each one is then processed separately, using the rules of the algorithm. Since the division of an image into blocks is consistent, these blocks occupy the same relative position within the image. Abrupt

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INSIDE

Next meeting: **WEDNESDAY, June 13th, 2001**

COMING UP IN JUNE

OPCUG is pleased to announce the June 13 presentation which will feature demonstrations of Olympus Digital Cameras, Digital Printers and Digital Audio recorders. Representatives from Olympus, **Norm Dutcher** and **Jean Pierre Serre**, will have samples on hand for attendees to try. Sample pictures will be taken and shown. Door prizes will be drawn. Don't miss it!

CLUB NEWS

Orphan SIG

by Henry Sims

At the June meeting of the Orphan's SIG, **Chris Taylor** will be discussing malware. If you always wanted to know the difference between a trojan, a worm and a virus, drop by after the general meeting and join the discussion. Find out what you should be worried about and how to protect your computer. With a few "best practices", you can easily avoid most problems brought on by malware.

Progress of orphans programme

Two sessions so far have been popular, **Brigitte Lord** in April on "Using Outlook Express", and **Vince Pizzamiglio** in May on "PC Hardware". Many people have asked questions, and there have been more questions than time to answer them. It seems probable that we shall have to have some sessions devoted entirely to questions.

Chris Taylor is planning to talk at the June meeting (see above). Bring your questions on all three talks to that meeting, and in the early autumn we shall also have one meeting just for questions. It would be helpful if you would put your question on paper and send it to the appropriate speaker by email in advance, or at least, have it written out for the speaker at the meeting. We shall be establishing a question box. The email addresses of all three of the above speakers are listed in this newsletter on the back page .

Questions can also be posted to the bulletin board on PUB II and there is a good chance that some well-informed member, if not the original speaker, will be able to respond.

CALENDAR

Meetings	Date	Time and venue
OPCUG General Meeting	Wednesday, June 13th	7:30 p.m. Auditorium of the National Museum of Science and Technology, 1867 St. Laurent Blvd.
Internet SIG (I-SIG)	Wednesday, June 13th	Come and join our discussions!
Developers SIG	Wednesday, June 13th	Immediately following the main OPCUG presentation, and occasionally at other locations in the region.
Delphi User Group	June 28	8:00 p.m. at Chapters Store in the Pinecrest Mall (at the Queensway)
Ottawa Paradox Users Group	3rd Thursday each month	6:00-8:00 p.m. — Corel Bldg 1600 Carling Ave
PIG SIG (i.e., Wing SIG)	June 13th (after SIGs)	"Good Times" cafe at Shoppers City West, Baseline and Woodroffe

Please note that unless otherwise noted, SIGs meet at 9:00 p.m. (immediately following the OPCUG General Meeting).

JPEG 2000 *...continued from front page*

transitions in the original image (light colour to dark, for example) tend to create edge artefacts that become increasingly more evident as the compression ratio is increased. As an analogy, think of the mosaic effect that is used to hide a person's identity on television in an investigative report. Lossy schemes are preferred since they offer higher compression ratios. Hence, a conflict exists between image file size and quality.

The mathematics aside, JPEG imposes other constraints: most notably, colour must be eight bits per pixel and only the RGB model is supported. Indeed, the 'stacked blocks' relegate JPEG as unsuitable for use in video. Since artifacts are the most stable feature in a video frame they are particularly evident since the rest of the frame's contents are moving around them. While commercial graphics printing is remote from my forte, JPEG's failings would be glaringly evident in any printed material.

A bit of oblique theory

Regardless of the transform employed, if the compression is lossy then artefacts are a fact of life. Evaluation of artefacts is tricky science. First, you must quantify the error. On that basis you may have the numbers to support your conclusion that method A is better than method B. The kicker with numbers: they ignore the human conscious interpretation of the 'raw' eye-brain data. Assume that you are evaluating two versions of the same image: one has been compressed using an algorithm that results in some loss of sharpness; the other as a result of compression exhibits DCT-style blockiness. While the numerical amount of distortion may be the same, in most cases the former image is perceived as better since the error pattern is more diffused.

JPEG 2000 to the rescue

The new codec employs Wavelet Theory (a search on 'wavelet' on the Internet will satisfy your curiosity) that operates on the entire image (as a single entity rather than the blocks of

Maximum quality JPG
150 dpi, 72 kb

Minimum quality JPG
150 dpi, 7 kb

DCT) and produces a continuous data stream instead of the chunks inherent in DCT; this approach eliminates the blocking artefacts. Wavelet theory deals with 'trends' — large image areas that have a slow rate of variation (for example, large expanse of a single colour), if any — and 'outliers' — concentrated nodes of intense activity (for example, edges). Compression can be lossy or lossless with lossy compression ratios up to 300:1. Practically, a compression ratio closer to 140:1 would define the ceiling for 'visibly lossless' (compression artefacts would remain invisible to a trained observer). The wavelet encoding process creates artefacts that are more difficult to perceive and characterize. They are much less visible in video sequences.

In comparison, the present JPEG would exhibit noticeable degradation at 30:1. The Wavelet transform encodes trends at a lower resolution and devotes more processing to the outliers. Wavelet images can be decompressed in a series of passes; each iteration improves the image quality (resolution and colour bit depth) up to a totally lossless reconstruction. The incorporation of a defined colour space, sRGB, provides built-in colour management. Considerable

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flexibility is possible since the standard offers definitions for extensions that would incorporate (singly or in any combination):

variable colour bit depths (up to 32 bits),
ICC colour profiles (necessary to support CMYK),
spot colours,
alpha layers (transparency),
masks,
metadata (copyright, camera /lens used, date/location, photographer),
error tolerance (repair damage due to noisy transmission lines)
multiple coding or mixed raster content (proposed)
video variant for Quick Time (proposed).

The multiple coding is intended for text and graphical content in the same document. When implemented, it would segment the graphics and text portions of a page. The graphics would be encoded with 'standard' JPEG 2000; a variation of the algorithm, tuned to maintain maximum sharpness of the letter forms, would be implemented to enhance OCR accuracy.

The competition

Another player, FlashPix, was a format developed by Kodak and partners for digital camera images. It can achieve many of the goals set for the JPEG 2000 format; however, the file sizes are larger.

In the larger scheme there are many Wavelet- dependent image storage formats; indeed, JPEG 2000 is not the first. The proprietary information is in the detail; in consequence, these processes are mutually exclusive. Compression engine suppliers include: LuRa Tech, Infinop, Summus, LizardTech, ER Mapper, and PIC Tools (there are likely others). Interoperability, using import/export filters, seems likely once JPEG 2000 has formed a user-base.

Conclusion

JPEG 2000 looks like a 'go.' It provides an incremental improvement on JPEG by offering higher compression ratios with less (visibly perceived) image degradation. Unlike GIF, proprietary issues (royalties) are not applicable. Many major players endorse the JPEG standard. While not a guarantee of success, a dearth of players would guarantee an early death. Once adopted, market penetration will depend upon its addition to graphics applications and browsers.

Given its native ability to incorporate many of the features that define current proprietary image formats (for example, transparency and alpha channels) combined with varying degrees of compression (even none) it has the credentials to replace these formats. Acceptance by the commercial printing industry remains an unknown; however, many industry leaders have apparently joined the JPEG 2000 standards committee. While nothing is guaranteed this format has, at least, the attributes that could satisfy that industry's technical requirements — a standard, at last?

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CLUB NEWS

June Raffle

At the May general meeting, **Allen McNamara** won the raffle prize which was a copy of VMWare Workstation. After some reflection Allen determined that he could not make use of the software. He generously offered it back to the OPCUG.

As it turns out this is very timely. Microsoft has donated a copy of Windows 2000 Professional for us to raffle off. Given that VMWare Workstation requires a base OS of Linux, Windows NT or Windows 2000, this seems like a good match.

So the raffle at the June general meeting will be for the combination of a copy of Windows 2000 Professional and a copy of VMWare Workstation. Many thanks to Microsoft and Allen McNamara. As always, tickets are $1 for one, $2 for three, or $5 for ten. Help keep membership dues low by purchasing some raffle tickets.

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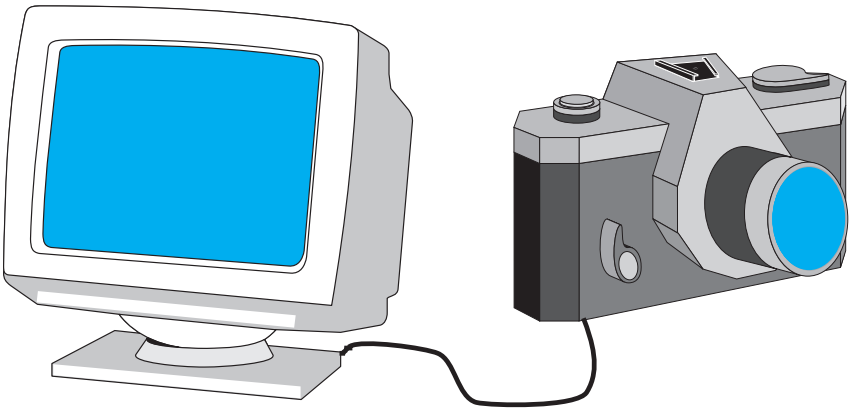
Choosing a Digital Camera

by Michael Murie



If you've upgraded to Easy CD Creator 5 Platinum or Toast 5 Titanium (you have, haven't you?), maybe you've begun to explore the new VideoCD creation features, which include making slide and movie shows, and perhaps you've played with the new versions of Photo Relay (in ECDC) or iView Multimedia (in Toast), which let you make family photo albums and much, much, more.

While you can used scanned-in photos for either task, a digital camera will greatly ease the process. With a digital camera, you can just hook it up directly to your computer and download the pics, no scanning necessary. Also, the quality of the images produced by digital cameras has improved so much that many people are finding that they don't use their film cameras any more.

Fortunately, it's a great time to buy a digital camera. The cost is coming down, the image quality is is going up, and there's a wide range to choose from. If anything, there are almost too many to choose between. And digital cameras still aren't for everybody. So here's a guide to help you decide if it's time to buy, and if so, what features you should look for.

Advantages of Digital Cameras:

Computer friendly: They are the best way to get images onto a computer for use in Web pages, CDs, and e-mail. You can make your own albums, or just distribute individual photos to friends and relatives. No film and paper costs: Until you print them, images cost virtually nothing (and wasted photos can be deleted for nothing).

Editable: With a printer and image editing software you can edit and print to any size. Editing can involve anything from color correction to compositing one or more pics into one.

Review: With the LCD display included on most cameras you can review the picture right after it's taken, and be sure that you got a good picture before it's too late to take another one.

Disadvantages:

You need a computer: While it's possible to store and print pictures without a computer, it's not yet easy and convenient to do so. But if you're reading this newsletter, we assume you have that base covered!

Expensive: A good digital camera is still expensive compared to a film camera of comparable quality. But prices are coming down, and with no film or developing costs, digital cameras can be cheaper in the long run, depending on how many pictures you take.

Higher per-print cost: Printing costs may actually be higher (if you print every picture) but if you find you only print one or two pictures (and send the rest via CD or e-mail) then you will save money.

Longevity problems: While inkjet printers can produce photo-quality images, the prints may not last as long as traditional prints. New archival papers have come out to address this issue.

Low light sensitivity: Film is available in a wide range of speeds (up to ISO 1600 or higher) Digital cameras tend to be slower, and images get noisier when pushed. Also, digital cameras tend to have noise problems when used for very long exposures.

Once you've decided to buy one, it's time to start looking at the different features and functions. With such a variety to choose among, you need to determine how much you want to spend, and what features are important to you. Let's look at the major features you should consider when looking at cameras. But it doesn't cover some of the

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Digital cameras *...continued from page 5*

extras you might find important, such as the ability to capture video sequences, or audio along with pictures. So it still behooves you to check out several cameras in your price range.

Cost

How much do I need to spend? The answer to that should emerge after you determine what resolution you need. Digital cameras with a resolution of 2.1 million pixels cost about $500, while top-end 3.1-megapixel cameras cost $700-$1,000 (US). Prices will continue to come down as resolution improves.

Resolution

What is resolution? For digital cameras, resolution is defined as the number of pixels in the image produced by the camera. You'll hear terms like 2.1 megapixel, where megapixel means millions of pixels. In their literature, manufacturers often refer to the number of pixels in the CCD (picture-taking element), which can be different from the number of pixels in the images recorded. The Nikon CoolPix 950, for example, is advertised as a 2-megapixel camera, though the images it produces are 1600-by-1200 (1,920,000 pixels.) This difference is due to masking and other issues which reduce the number of physically usable pixels. Some cameras actually enlarge the images they capture using interpolation, and the manufacturer will quote this enlarged number, even though the image has a lower actual resolution. How many pixels is big enough?

Here, the first question is what do you want to do with the images? If you want to use them for display on a computer screen only; for example to e-mail to friends, or to place on CDs and web pages, then you probably want an image from 640-by-480 to 1024-by-768 (the size of most screens). Even if that's the case, I'd still recommend getting a slightly larger camera (a 2.1 megapixel) just for the increased flexibility. With a larger image you can crop or reduce resolution easily, but you can't go the other way.

For printing, resolution is more complicated. What size image do you typically print? 4-by-5 or 8-by-10? After determining this you have to do a calculation to determine what resolution you need, based on the printer you are using.

As an example, the popular Epson Stylus Photo printer prints at 720 dots per inch. But you don't need to send the printer an image that is 720 pixels per inch (ppi). This is because the printer uses solid colored dots (cyan, magenta or yellow) at each dot, whereas each pixel of the computer image can be any one of 16 million colors. So if you send a 720 ppi image to a 720 dpi printer you'd be throwing away color data. The best sizes to send to the printer are either 360 or 180 ppi. Better images are produced if you use an even divisor of the resolution of your printer for the image you are printing (i.e. 720 divided by 2 or 4). So, if your printer is 600 dpi, use 300 or 150 dpi images.

Divide by 2 or 4, which is best?

Here's where it becomes a tradeoff between detail and performance. You will see a marginal difference between printing a 360 ppi image and a 180 ppi image on a 720 dpi printer (or between a 300 and 150 ppi image on a 600 dpi printer.) There will be some detail differences between images because sudden changes in brightness will be more accurately rendered in the 360 image than in the 180, but the color differences will be marginal. However, with the larger image it will take you longer to manipulate and print. So do a test first on your printer to see the differences, and then decide which resolution you prefer. Once you know which size you want, multiply the image size by the resolution:

10 inches x 180 dpi = 1800

8 inches x 180 dpi = 1440

So to print an 8 x 10 you'd ideally like to have a 1800-by-1440 pixel image. A 1600-by-1200 resolution camera produces images that are a little smaller than ideal. Still, it's 'close.' And if you only print 8-by-10s occasionally, probably fine for most purposes. If you prefer 360 dpi images, however, you should get a 3-megapixel camera.

A little-considered issue is the other meaning of the word resolution: the ability to capture fine detail. Two cameras producing the same image size might produce very different quality images. In other words, you might be able to see smaller changes in the image in one picture versus the other. This is different from being able to zoom in closer to see more detail. Image quality can be affected by the quality of the lens, any manipulation done by the camera (rescaling and color calculations) and the compression used on the image.

Most cameras use some kind of compression, typically JPEG, when saving the images. Most cameras have two or more different compression options (high, medium, or low quality, for example). No matter which setting you use, the resulting image size in pixels remains the same, but the file size (in

kilobytes) will be smaller for the more compressed images (low-quality). To compress the image, resolution (detail) is thrown away. Of course, the more compression used, the more images you can capture before the memory card is filled. Again, you should experiment with your camera to determine which compression choice gives the best detail, versus an acceptable number of images captured. You can always buy a larger memory card if needed.

Lenses

Optical Zoom

Most cameras feature some kind of zoom lens. It's important to distinguish between optical and digital zoom, however. An optical zoom uses lenses that move to scale the image (technically speaking, the focal length of the lens is being changed), whereas a digital zoom scales the image electronically, without actual additional picture information. There is therefore a big difference in quality between these two techniques. Optical zooms are always preferable, although many cameras offer a combination of both, using optical up to a point, then switching to digital.

When comparing lenses, we are most interested in the field of view of a lens (how wide or narrow the lens is.) Unfortunately, historically the focal length of the lens has been used as an indication of the field of view of a camera. For 35mm cameras, a 50mm is considered a "normal" lens, 28mm is considered "wide" and 150mm is a "long" lens. This measurement is based on the size of the image (in the case of a 35mm film camera, it's the film size), but in the case of digital cameras, the CCD chip is much smaller (in some cases 1/3 or 1/2 an inch.) So focal length is different. Since more people are familiar with the measurement for 35 mm cameras many digital camera manufacturers actually quote the range of a lens focal length converted to a 35mm camera equivalent.

The most common optical zoom lenses are 2X and 3X. A 3X means three times from widest to longest lens setting (i.e., 38mm to 120mm is a 3X, 38mm to 75mm is a 2X) There are a few cameras that come with long lens, a 6X or 10X. However be aware that as the lens gets longer, it gets more difficult to hold the lens steady enough while the picture is being taken. One manufacturer includes an image stabilization system in their long lens camera precisely because of this problem.

Digital Zoom

A digital zoom is software in the camera that "zooms" the image by scaling it. Essentially it does the same as what happens when you use an image editing application to enlarge an image. In its simplest form, to double the size of an image, the software duplicates every pixel. Ideally, the algorithm will average two adjoining pixels to create the new extra pixel; this is called interpolation.

Digital zooms aren't usually continuous: you can't zoom smoothly from one focal length to another, as with optical zoom. Instead, the zoom jumps from one multiple to another. The most obvious is 2X, which is multiplying each pixel by two. The real problem with digital zooming is that it doesn't really do much more than can already be done with a software application after the picture is transferred to the computer. It really just increases the file size in the camera unnecessarily, using up valuable memory card space.

So, consider a digital zoom only as a nice-to-have feature, and go for an optical zoom whenever possible.

Macro

This is the ability of the lens to focus on objects that are very close to the lens. Even with a zoom lens, if you want to take a close-up of an object, and the lens won't focus on something closer than four feet, you won't be able to fill the frame with a postage stamp. So if you plan to take close-ups you will want to make sure the camera has macro capability.

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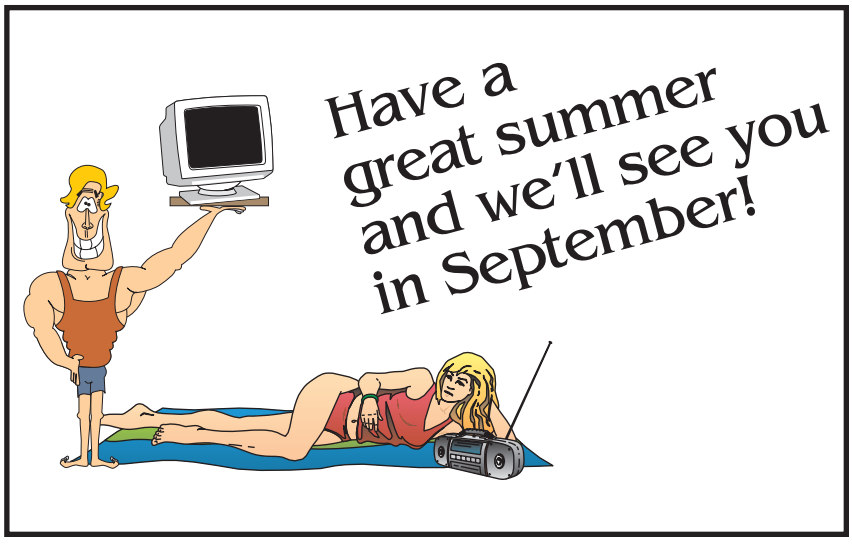

OTTAWA PC NEWS

Ottawa PC News is the newsletter of the Ottawa PC Users' Group (OPCUG), and is published monthly except in July and August. The opinions expressed in this newsletter may not necessarily represent the views of the club or its members.

Member participation is encouraged! If you would like to contribute an article to *Ottawa PC News*, please submit it to the newsletter editor (contact info below). Deadline for submissions is three Saturdays before the General Meeting.

Group Meetings
OPCUG meets on the second Wednesday in the month, except July and August, at the National Museum of Science and Technology, 1867 St. Laurent Blvd, Ottawa. Meetings are 7:30–9:00 p.m. and Special Interest Groups go until 10 p.m.

Fees
OPCUG annual membership: $25 per year.

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CLUB LIFE

Reduce, Reuse, Recycle

Bring your old computer books, software, hardware, and paraphenalia you want to **GIVE AWAY** to the General Meetings, and leave them at the table near the auditorium's entrance. *Please limit magazines to publication dates of less than two years old.*

You may **TAKE AWAY** any items of use to you. Stuff left over at the end of the meeting will be sent to the recycle bin.