

Cameras I

Basic operation and features



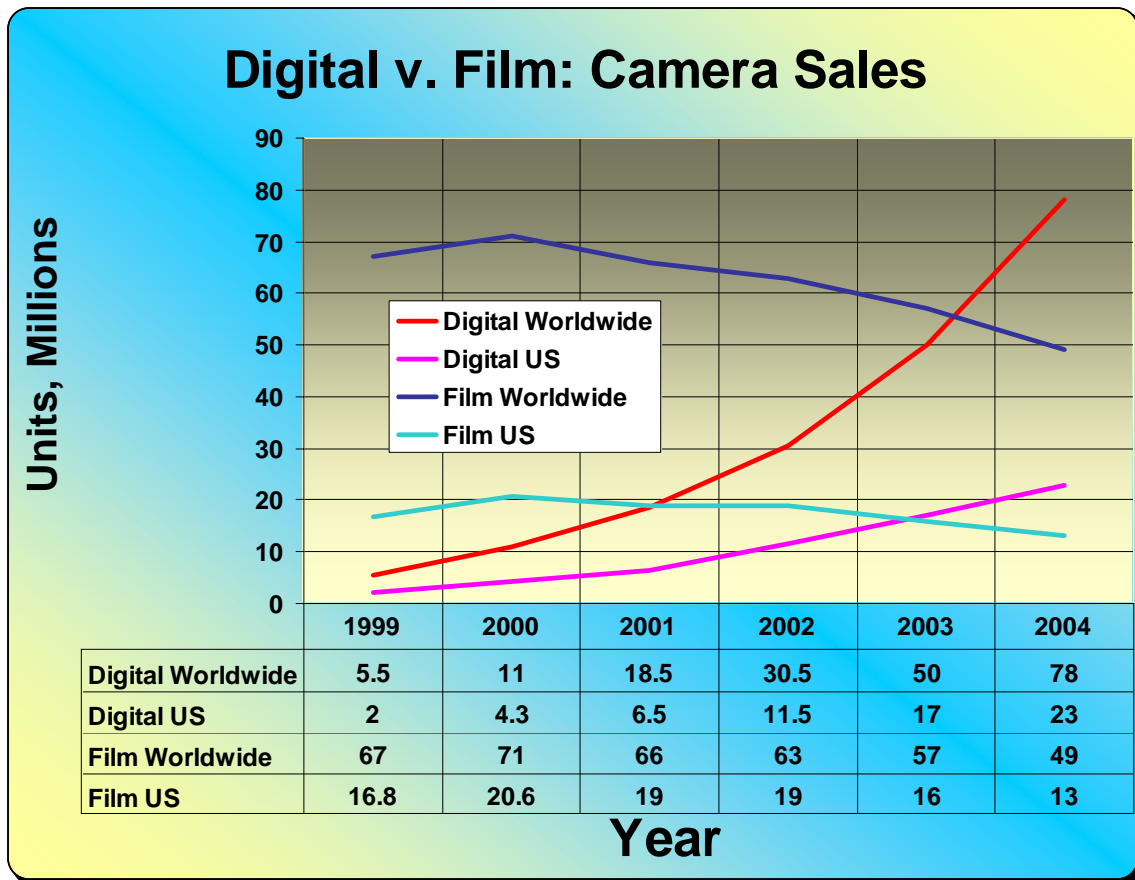
Why Digital?

With digital photography you can do things that you can not do with film:

- Snap anytime- there is no cost until you print!
- There is no such thing as a roll of film. Snap 2, 10 or 100 photos at a time.
- Use the camera's automatic mode – a computer helps take a great picture.
- Review the picture immediately after you snap it. Delete and re-snap if required.
- Print what you want, when you want.
- Save money at the photo counter – only print what you like.
- Edit your photos on the computer – Crop, remove red-eye, improve contrast and more.
- Combine photos for interesting effects. Add people or take them out!
- Make your own greeting cards, newsletters, brochures, business cards, all in full color.

2004 was a milestone year in digital photography. In 2000, digital camera sales worldwide in dollars exceeded film camera sales. In 2004, digital still cameras overtook film camera sales in numbers, with over 75 million units sold worldwide, as opposed to approximately 50 million film cameras sold. The number of film cameras sold is declining in double digit percentages.

Costs of digital camera have dropped to the point where they are competitive with film cameras.



We are in the midst of a technological revolution that rivals the inventions of the automobile, the telephone, the television and the computer. Only this revolution is happening much faster. Over 23 million digital cameras were sold in the US in 2004.

Why now?

Advances in computer processing coupled with drastic reductions in the cost of computer memory have converged to supply low cost cameras that can produce quality images. When you hold a digital camera in your hand, you hold a hundred times the processing power and memory of the flight computers on the Space Shuttle!

The digital camera allows the amateur to take better pictures than with film. Why? The computer in the camera makes many adjustments prior to the shot. It not only adjusts the focus, but plans the exposure, contrast, lighting and the flash and adjusts the color balance for the ambient light. A film photographer would change film types or add filters to do the same thing; but the camera does it all in less than a second.

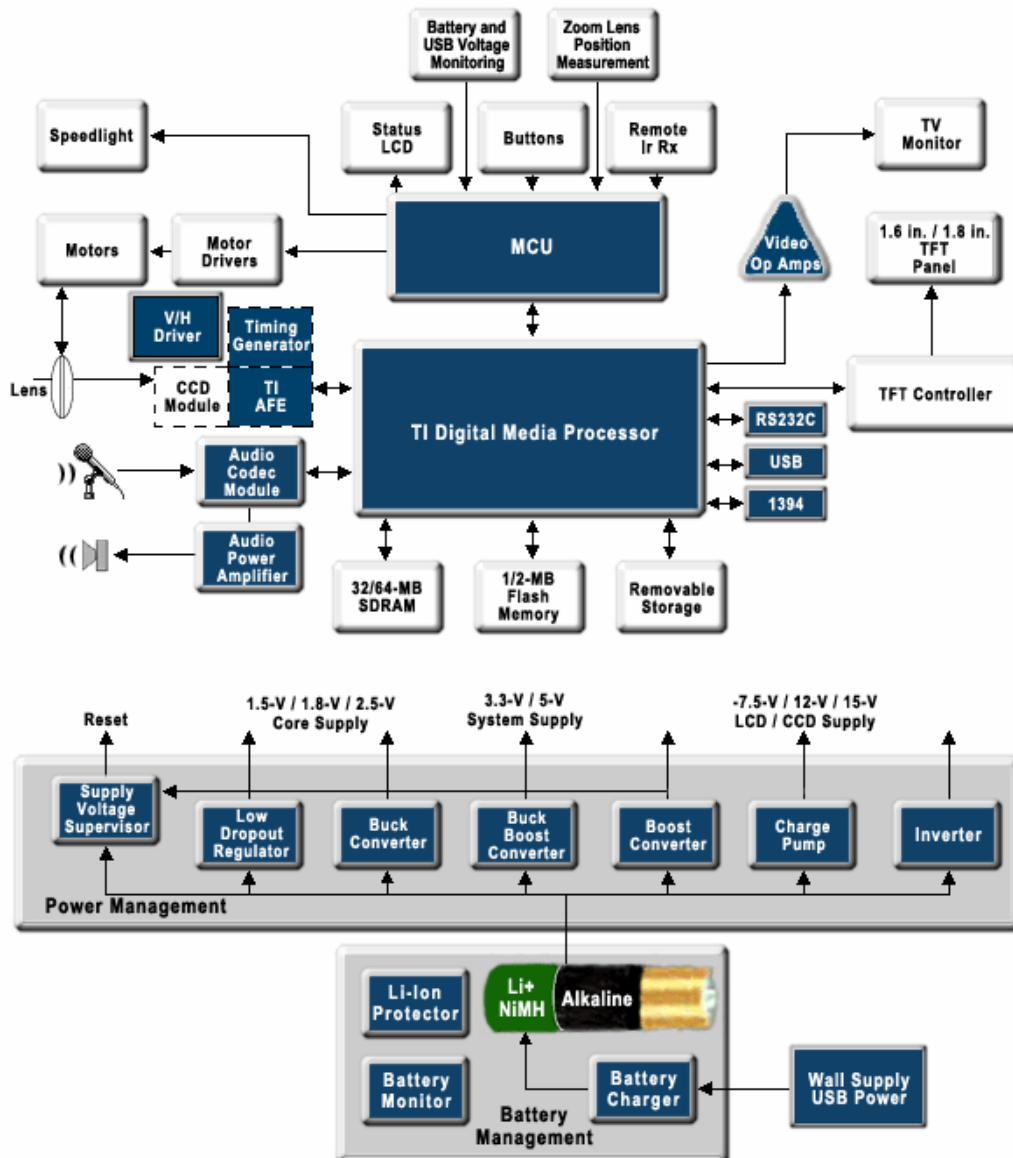
Elements of a digital camera

A digital camera is a lot different than a film camera. Until the advent of auto-focus in the 1980s, film cameras had very little in terms of electronics. A shutter release activated a spring loaded shutter and the film was briefly exposed to the image through the lens. The

shutter button and lens are virtually the only parts of the camera that remain in digital cameras.

The film has been replaced with a light sensitive chip, called a Charge Coupled Device (CCD). This chip is an array of millions elements that are sensitive to light. When light hits an element in the CCD array, a electrical charge is accumulated at a rate determined by the amount of light striking it. This charge is then measured by an analog to digital converter that converts the voltage to a digital value that can be stored in memory. The raw image derived from the CCD is too big to store. The camera contains a specialized chip know as the compression engine, which takes the raw image and compresses it to a size that can be stored on the memory card. This compression reduces the overall storage requirement by a factor of 3 to 16.

This is a block diagram of a camera from the Texas Instrument web site (www.ti.com). They want designers to use their integrated circuits, so they supply much of the design for the camera.



The block diagram shows a fast microprocessor, memory, a color display and buttons for a user interface; with a power supply for rechargeable battery operation. That would be a good description for a laptop computer. Add the lens and the CCD module and you have a camera!

All of this processing power means that the camera can make many calculations and decisions while you take the picture.

Before the shot:

- Display options on the screen and allow the user to change them with the buttons
- Display the viewed image on the LCD screen
- Focus the camera
- Determine exposure time and whether to fire the flash
- Charge the flash, if needed
- Determine the color balance to correct for lighting

During the shot

- Discharge the CCD
- Expose the CCD to the image for the time required
- Fire the flash
- Stop charging the CCD after the proper exposure is made

After the shot:

- Measure the charge on all the elements of the CCD (all 4 million in a 4 megapixel camera)
- Convert the voltage on each of the CCD elements to a number
- Store the raw image in memory
- Read the raw image out of memory and compress it using a JPEG algorithm
- Store the compressed image on the memory card
- Display the photo briefly on the LCD panel
- Calculate memory remaining and display the number of shots remaining.

Sound like a lot of computation. It is! And that's just part of it, since it must do all that three times to do color!

The focus, exposure and color balance calculations are the principle reason that most people take better photos with a digital camera than with film. Although modern film cameras do an admirable job with focus and exposure control, no film camera can do color compensation. With film you must use a different film for outdoor and indoor shots, or put a filter over the lens.

What the heck is a megapixel?

Mega is a prefix that means million. A pixel refers to the element on the CCD that captures light. Thus a 4 megapixel camera has approximately 4 million sensing elements on its CCD.

The megapixels a camera has nothing to do with the size of the image, but has everything to do with resolution. You can get a print of any size with any camera, but the image quality will be better the higher the resolution.

Here is an extreme example:



1600x1200 pixels



80x60 pixels

The following is a guide to the maximum size of pictures from common cameras:

- 2-megapixel** - 1600x1200
- 3-megapixel** - 2048x1536
- 4-megapixel** - 2272 x 1704
- 5-megapixel** - 2568 x 1928
- 6-megapixel** - 3072 x 2000
- 8-megapixel** - 3264 x 2448
- 11-megapixel** - 4064 x 2704

The higher the number of pixels, the greater the need for storage. An image stored in a 4 megapixel camera takes twice the memory space as does that from a 2 megapixel camera.

Cameras can take pictures in lower resolution. For example, a 4 megapixel camera can be set to take pictures in 2 megapixel or 1 megapixel mode. The only advantage to this is the reduction in required storage space; more pictures will be stored on the memory card. For example, a four megapixel camera will take pictures at 2272 x 1704 and also 1600x1200 as a 2-megapixel camera would. When would you want to cut down the resolution? If you know that you are producing photos for the web or eBay or any purpose where resolution is not needed, go ahead and use the lower resolution. Otherwise, shoot at the highest resolution of your camera.

Remember: while you can always decrease resolution using editing software, you can never increase it.

A rough rule of thumb is that the memory required per picture is one half of the megapixel rating of the camera. Thus a 4 megapixel camera will require 2 Mbytes of storage per picture.

Professionals put the resolution required for parity with film at about 250-300 pixels per inch. Thus for an 8x10" print, a 6 megapixel camera would be required.

This rule is somewhat subjective. Most find that 8x10s are satisfactorily produced with 4, 3 or even 2 megapixel cameras, although most notice some degradation and tiling at 2 megapixels and below.

In the following example, I have reproduced several images on the page in resolutions that represent the resolution produced by cameras printing an 8x10" print in 6, 4, 2 and 1 megapixel resolution.



300 pixels per inch, same as a 6 megapixel camera printing an 8x10



225 pixels per inch, same as a 4 megapixel camera printing an 8x10



160 pixels per inch, same as a 2 megapixel camera printing an 8x10



100 pixels per inch, same as a 1 megapixel camera printing an 8x10

Can you see the difference? You can probably tell that the 1 megapixel camera is not as good for 8x10s. It is still adequate for email or eBay work but not acceptable for taking quality pictures that will be enlarged. Is 2 megapixels enough? That is up to you: it may be, if a camera has other features you like. Certainly by the time you get to 3, 4 or 5 megapixels you are going to get quality prints (in my opinion). If you are a person who will accept nothing but the absolute best quality, spring for a 6 megapixel or greater camera. You will be pleased with the quality you achieve.

One more thing to consider when considering what megapixel camera to buy: as the megapixels go up, so do the features found in the camera. Generally the more expensive the camera, the higher the megapixels, the better the lens and feature set in that camera.

How will you be using the camera?

Low resolution applications:

Posting photos on the internet or viewing them on the computer
Sending photographs by email

Medium Resolution applications

Printing photos on standard paper or making small (4x6" or 5x7") at the photo kiosk

High resolution applications.

Printing enlargements, including 8x10s
Professional graphics

Zoom: Optical required, Digital only is not acceptable

An optical zoom uses the lens system in the camera to "zoom in" on the subject. The subject is larger with no loss of resolution or image quality. A digital zoom works by increasing the subject size digitally. A section of the image is magnified to the full resolution of the camera. For example: a 3x digital zoom takes 1/9th of the image and converts it to full frame. Since no more megapixels have been added to the CCD, resolution is lost. Using a 2 megapixel camera with at 3x digital zoom is the same as using a 0.3 megapixel camera. The image quality will be poor. You will notice a grainy and blocky picture, as illustrated above. This is no different than taking a un-zoomed picture into a editing programming and cropping and enlarging it three times. Low cost cameras often tout their digital zoom without an optical zoom. **DO NOT BUY A CAMERA WITH ONLY A DIGITAL ZOOM.**

Most cameras now have an optical zoom. 3x is very common, although some now offer 7 to 10x zooms. For most applications 3x is a good compromise and will work great. Generally a 3x zoom will be the equivalent of a 35-105 mm lens on a 35mm camera, which is slightly wide angle to telephoto. It is not a strong enough zoom to get very distant objects. If your hobby is bird-watching or sports photography, consider a 7 to 10x zoom.

Many cameras offer a digital zoom in addition to the optical zoom. That's ok. If you never use the digital portion, which is activated automatically when the limit of the optical zoom is reached, then you never suffer a loss of resolution. It is always there if you really need it.

Do you need greater than 10x? A professional camera with changeable lens system is your best bet. Get the checkbook ready!

LCD screen

LCD stands for Liquid Crystal Display. Are the acronyms getting to you yet? This screen is the same as a flat panel computer monitor. On a digital camera this monitor is used for many things. It is the only way to change many of the cameras settings, even if your camera has a mechanical setting wheel on the top. The LCD will also offer a preview of the picture before you snap it, and review of it after you snap, usually for 2 seconds. With the LCD you can review all the pictures contained in the camera on the memory card. You can verify that the picture you want is properly exposed and stored. The LCD is the most fragile part of a camera not protected by a cover when the camera is not in use. Many of the more rugged cameras have smaller or recessed LCDs to protect them from damage. If you drop your camera and break the LCD screen you will be buying another camera: the camera is ruined.



Your options are to buy a camera with a small LCD screen, around 1" diagonal, a medium 1.5" diagonal or a large LCD with a two inch or larger LCD. LCDs are difficult to see and use in bright sunlight; you will still use the viewfinder to frame the picture.

This may be a lesser consideration than the other features of the camera, nevertheless, make sure that you can adequately see the options menu on the screen, with or without your reading glasses!

Memory cards

Once the image has been compressed, the camera stores that image on a memory card. The memory card is used over and over again. Once full, you erase it by moving the pictures onto your computer or printing them and then erasing the card. An erased memory card is the same as a new one. You don't ever need to buy another as you did with film.

There are many types of memory cards. Some names of the cards are Compact Flash or CF, Smart Media, Secure Digital or SD. Older technology cards, such as CF (compact flash) and Smart media are larger, and less "dense" than newer cards, such as SD (secure digital) and xD (eXtreme Digital) cards. Inside all the cards is the same type of non-volatile memory – your pictures are preserved even when the card is out of the camera.

Remember the rule of thumb for storage? One half the megapixel rating per picture. So a 4 megapixel camera will require 2 megabytes of storage per picture. Thus the 32 mbyte card that came with the 4 megapixel camera will only hold 16 shots. 16 shots is not enough for a good afternoon, especially if you decide to shoot some video. Unfortunately, in an effort to save money most digital cameras come with only a small memory card. Plan on buying a 128 or 256 megabyte card when you buy the camera. A 256 Mbyte card will hold 128 pictures from a 4 megapixel camera. That's enough memory to get most people through a long weekend of digital photography. If this is still not good enough, you can get a 512 megabyte or a 1 Gbyte (1000 mbyte) card at a reasonable price to hold more. A couple good size memory cards are all you need for a long vacation trip *without* your computer.

There are slight differences in pricing per megabyte on cards. The best deals seem to be on the older technology cards, but since you are going to buy one or two cards and reuse them over and over again the cost of the card should not be a big consideration.

When you buy a camera, make sure you are comfortable with the way the memory card is accessed in the camera. You will be taking it out occasionally and the newer cards, like SD and xD, are very small. If you have large hands or tactile issues you might find it easier to use a larger card, such as a compact Flash (CF).

Some cameras do not have memory cards. They have internal memory only. STAY AWAY from these cameras. You need a computer to empty the camera; the storage is small and cannot be expanded. They aren't worth the savings you get when you buy one.

Compression: What is a "JPEG?"

The CCD is organized in pixels, and each pixel conveys color and luminosity (brightness) information. It takes about 12 bits (a bit is a 0 or a 1) or 1½ bytes (a byte is 8 bits) Your 4 megapixel camera is storing 6 Megabytes of information internally. From our rule of thumb the storage on the card will only be 2 megabytes. How does the picture get from 6 megabytes to 2 megabytes? The answer is compression.

The standard algorithm for compression is the JPEG algorithm. An algorithm is a procedure defined by a series of computer operations that solves a problem, in this case reducing the size of the required memory.

JPEG is short for "Joint Photographic Experts Group" which was the name of the group of scientists and mathematicians that developed it. Files stored in this format are given the suffix .jpg or .jpeg and are the industry standard for compressed photographic files.

The JPEG algorithm reduces the file size because it removes features that the human eye and brain have difficulty resolving. Information is lost when JPEG compression is performed. It is also "scalable," which means you can specify how much compression takes place and how much information is lost.

There is a compression setting on the camera, which allows you to set the compression level:

Good, Better, Best or Normal, Fine, Superfine

At the highest quality, ***Best*** or ***Superfine***, the compression removes only the artifacts that the JPEG scientists decided that humans cannot resolve anyway, in other words the picture quality is near perfect.

Setting your camera to the lower quality setting, with higher compression, will result in the algorithm reducing the detail in the picture, reducing the file size and also reducing the detail in the image. Highly compressed images can look blocky or blurry, especially in areas of high detail. The effect is the same as reducing resolution. The file size is greatly reduced, so more photos will fit on the card, but at the cost of resolution.

With memory as inexpensive as it is, why compromise your pictures to save space on your memory card? When a 64 Mbyte card cost \$100, which was as recent as 2002, this may have been important. Memory has dropped in price substantially, so a large card is affordable and will hold many pictures. Always use your camera in the highest resolution and with the best (***best*** or ***superfine***) compression available.

Big/Small – Rugged/Fragile

Consider how you are going to use the camera. Do you want to put in your jacket pocket on a downhill ski trip? Do you want to take it traveling on airplanes in your carry-on luggage? Do you want to carry it in a shirt pocket or a purse? Some cameras have metal cases and sliding covers that cover the lens; that's tough. Some have pop up flashes, large lenses that don't retract and that's not tough. Large cameras also require a neck strap and will not fit into your pocket.

When you buy a camera consider also how you will be carrying and using it. You will still get great pictures, but carrying a small camera may not give you access to all the features a large professional model has.

Lenses

The lens of a digital camera is the most important individual element in getting a good picture. It is one of the only differentiable features in the camera, but the most often ignored. If the lens of the camera is not good, the picture quality will be compromised.

Most manufacturers of cameras do not make their own lenses, but contract out for their manufacture. For the most part the quality of lens in midrange cameras is very good. Watch out for low cost cameras! They may have a lens of lesser quality. Some midrange to high-end cameras boast lenses from a specific lens manufacturer. For example the Carl Zeiss Company is advertised as a producer of lenses for some cameras. This is also an assurance that you are getting a lens of the highest quality for the type of camera you are buying. Will you notice the difference? That depends on how exacting you are with your demands on that particular camera.

Another feature of lenses is the objective diameter; the size of the opening at the front of the lens. Larger lenses gather more light than smaller ones. Any aberrations in the lens

are spread over a larger area so apparent distortions are lessened. Professional quality cameras have large lenses with large objectives. Higher zooms require more light and a larger objective lens. Of course cameras with such lenses won't fit in your pocket.

Cleaning the lens of a camera

Lenses are extraordinarily fragile, and once damaged cannot be repaired.

When light hits the surface of the lens, some is reflected and some is transmitted through the lens. Most of the light that is lost is lost at the interface between the glass and the air. To counteract this lenses are coated with a very thin coating meant to inhibit reflection and maximize light transmission. If you are too rough during lens cleaning the coating may be scratched or rubbed off.

The solution to this is to use a non-abrasive lens cleaner. These have names like "lens cleaner cloth" or "micro fiber" cloth. You can also get a lens cleaning solution from the camera store. Never rub the lens when it is dry. It is better to breathe on the lens to fog it than to rub a dry lens. You can also blow the dust off with compressed gas, cans of which are available in photo and computer stores.

Do not clean the lens with paper towels or Kleenex. These are made from trees and are wood. They will destroy the coating on the lens. We have all done it: wiped the lens with a dry tissue. If you don't do it very often, the lens and its coating will last a very long time.

Digital camera flash

Like most "point and shoot" cameras the flash of a digital camera is normally built in. Even high end cameras will have a built-in flash. The flash control is an easy button to find; it has a lightning bolt next to it. It is one of the most important buttons to learn on the camera. With all the processing power in the camera, the computer can take better pictures if a flash is available. There is no adjusting the flash; the camera does it for you.

A common drawback of all digital cameras is "red eye." This effect is a result of the flash being close to the lens causing a reflection off the subject's retina and a red glow in the eyes. Even with very good cameras you will encounter this problem.

Most cameras have a red-eye reduction mode that flashes a second light just before the main flash. This reduces the subject's pupil size and makes the subject look off the flash axis. It will reduce the effect. There are some cameras made by HP that offer to take out the red-eye in the camera, and you can always remove it easily with photo editing software.

USB: The connection from the camera to the computer

In the box with the camera will be a special USB cable. One end of the cable will be a USB connector for your computer, the other end is special connector that will fit into the camera. When you connect the two, the camera will appear under "My Computer" as a

new disk drive. Newer operating systems, such as Windows XP may do this automatically, older operating systems, particularly Windows 98 and ME, will require that you install drivers from the included disk.

After you plug the cable into the computer, leave it there. Don't carry it around with you. It is difficult and expensive to replace.

If you need to access the pictures on the road, use a "card reader." These will allow you to read the pictures off the card directly without the special cable and without powering up the camera. These are available as a single card reader of the type you need or a "multi-card" reader that will accept most common cards. They plug right into your computer and you read the card just like another disk drive. You don't need to add any software from the camera's disk, as you do to use most cameras' USB port (again with the exception of Windows 98 and ME).

Digital camera software

When you buy a digital camera it will come with some software. This software is broken into three categories:

- Drivers so your camera will interface properly with your computer
- Simple album and editing software to organize your photos, make galleries and slide shows. This software usually provides the ability to crop and adjust color. It is usually limited to only simple editing tasks.
- Optional stitching software to make panorama with the "stitch assist" shooting mode of the camera

Once you get the pictures into the computer and begin editing you will quickly outgrow the software that came with the camera. There are some great photo editing suites on the market:

Adobe Photoshop, \$600: The undisputed industry standard for professionals. It has so many features that non-professionals may find most options inaccessible. It is simply too much for most people.

★ **Adobe Photoshop Elements**, \$99: The new "light" version of Photoshop. Extensive built-in documentation means you should never need the manual. You can do almost anything with this software. It has a "quick-fix" function to quickly fix photos and an "email" function to automatically reduce file size and send via internet. For the money, this is a phenomenal value.

Corel Photopaint, \$99: Competitor to Photoshop. Very capable. Almost as powerful as Photoshop and some people think it is easier to use than Photoshop. Not as good built in documentation.

Jasc Paint Shop Pro, \$99: A highly rated editor, with many similarities to Photopaint. Well regarded as a very capable package.

Microsoft Picture-It, (free with XP?): Pretty limited, but good for simple tasks.

Make sure that the software (and the drivers for the camera), are compatible with your own computer. If you are running Windows 95 or a Macintosh, you are likely to have a more difficult time finding a camera and software that will work with your computer. Windows 98 is OK, Windows 2000 and XP work well also.

What can you do with photo editing software?

Most of the time photo editing is about sharing. Fix the red-eye, the contrast and crop the photo before you email it. Another fun thing is to build story pictures or panoramas of places to which you travel. Once and a while you can tackle a very interesting graphic problem, as with this example:

I got a call from a friend. It seems that she wanted a person removed from a photo.



The picture on the left had five friends together after a wedding, but an in-law had jumped into the shot. “Could you remove Mom?” asked my friend. She offered the picture on the right for additional raw material.

It took 1.5 hours with Photoshop Elements to come up with the solution. I teach this to all my students in my eight week course.



The final result

Photo restoration:

The following severely damaged file was restored using Photoshop Elements:



File types

Different file types can be determined by the suffix on the file name, for example, a JPEG file might be called “*filename.jpeg*” or “*filename.jpg*.” The most common file types are sufficient for most uses, they are:

JPG: example: “*filename.jpg*” or “*filename.jpeg*.” This is the native or internal file format for most cameras. It is the best **starting and ending point for photo editing**. It is a compressed format, and you will get good results even with small files. Rule of thumb: Always use this format for emailing. NEVER send an email attachment larger than 500k. (Good photos can be sent less than 250 Kbytes.)

PSD: example: “*filename.psd*.” This is the Photoshop format. It contains all the working information. Use this format as you work on a file. When you are finished “save as” a **.jpg**.

BMP: example: “*filename.bmp*.” Uncompressed bitmap file. Common from scanners. Pull into Photoshop and work on it as a **.psd** then convert to a **.jpg** to compress it to make it smaller.,

TIFF: example: “*filename.tiff*.” Another compressed format, found on some cameras. It is good for taking pictures and getting them into the editor. Although compressed, this format is lossless, so some prefer it for high resolution editing and publishing.

GIF: example: “*filename.gif*.” The original file compression format promulgated in the early days of computer photos. It is still used extensively on the web: it has an animation feature. Gif images are very popular for graphics, as they have a limited range of colors (256 maximum) which makes very small file sizes. Not commonly used for editing or emailing anymore, since JPG images have a wider color range. For photos, JPGs have surpassed GIFs in common usage.

RAW: example: “*filename.raw*.” You might see this proprietary (meaning it has slight variations by different manufacturers) format if you have a very high end 6 megapixel or greater camera. These formats promise better picture quality than .jpg files, but most except the most discerning will not notice.

There are several other formats you might encounter. They are all just ways of storing the picture on a disk in a way that other software programs can read them. To find out more about any particular format, use a search engine such as www.google.com to locate additional information.

Batteries

All that computing power and the LCD mean that your camera needs lots of power. Whatever your camera, plan on using rechargeable batteries and learning how to use the charger. You will need it often. There are two types of batteries, proprietary ones which

tend to be smaller and are definitely more expensive, and standard size batteries that you can buy in any electronics, grocery or drug store.

Proprietary battery packs:

If you opt for a very small camera you are going to get a special small battery supplied by the manufacturer. If you want a second back-up battery they are expensive, \$40 to \$50. The advantage to these batteries is that they are small and light. The downside?...if you run out of power at a remote location you'd better have a spare or your charger with you.

Standard rechargeable batteries:

Larger cameras use size AA or similar batteries. You can get Nickel Metal Hydride, NiMH, batteries at any electronics store and some drug stores. A charger will cost about \$20. The advantage of a standard size battery is that if you ever find yourself on the road with a low battery, you can buy an alkaline replacement almost anywhere.

Some other common features on many cameras

There are a number of other common features on most digital cameras. Most cameras have the following modes.

- **Automatic:** The camera makes the decisions: It makes pretty good ones most of the time!
- **Manual Mode:** Set the flash on to fill or adjust the exposure manually.
- **Movie Mode with sound:** Take full motion videos for computer viewing and editing.
- **Self Timer:** Put the camera on a tripod and take a picture of yourself.
- **Macro Focusing:** Focus up close on flowers or small objects.
- **Infinity Focusing:** Hold the focus far away for landscape shots.
- **Black and White Mode:** Take black and white pictures.
- **Night shot (also called Slo-Synchro):** At night you get both the subject and the background!
- **Portrait mode:** Made for professional looking portraits.
- **Continuous high speed shooting:** Just like a motor drive!

Some cameras have this setting:

- **Panorama** – “stitch assist” holds the exposure and lets the LCD assist you in putting together a panorama. This is a lot of fun!

In addition to the above some higher end cameras offer these additional features.

- **Custom modes:** Save settings that you commonly use.
- **Aperture or shutter priority:** For when you want to control the depth of field or the shutter speed.

Putting it all together

What differentiates one digital camera from another? It is more than just megapixels and optical zoom. Buying a digital camera is a highly personal process that lets you choose from many options that are right for you.

One web site that you will find particularly helpful is CNET which you can view at www.cnet.com . There are many reviews of cameras, and some customer comments as well. The product reviews are very professional and worth reading. Take the customer comments with a grain of salt.

Here are some ads for cameras from the local newspaper. Look at the advertised features and consider the features articulated on the checklist. What do you think of these cameras?

FREE! Lexmark Z816 Color Inkjet Printer After Instant Coupon and Rebates when Purchased with PDC 3030 Digital Camera!
\$39.99 - \$29.99 instant coupon - \$20 mfr's mail-in rebate* = \$50 bundle mail-in rebate* = \$0 2080-2209
Coupon # 0688002100190443

\$79.99 Reg. \$149.99 **Save \$70**

POLAROID PDC 3030
3.2 Megapixel Digital Camera
• 3x digital zoom • 8MB internal memory
• SmartMedia card compatible 2078-5043

FREE! Olympus 64MB xD-Picture Card with Purchase. A \$39.99 Value! 1802-7832

\$449.99

OLYMPUS C-60
6.1 Megapixel Digital Camera
• 12x total zoom (3x optical, 4x digital)
• 1.8" LCD display • 32MB xD-picture card included
• TruePic and PictBridge technology 2078-9823

FREE! Toshiba 128MB Secure Digital Card with Purchase. A \$49.99 Value! 2078-7978

\$349.99

HP PhotoSmart R707
5.1 Megapixel Digital Camera
• 24x total zoom (3x optical/8x digital)
• 1.5" LCD display • 32MB internal memory
• SD card & MMC compatible 2079-9637

Save \$40 - \$60!
After Instant & Mail-in Rebates

Lexar 256MB Memory Stick Pro 2057-8602
\$119.99 - \$35 instant rebate - \$15 mail-in rebate* = \$69.99

Olympus 256MB xD-Picture Card 2074-9674
\$119.99 - \$45 instant rebate - \$15 mail-in rebate* = \$59.99

Kingston 256MB CompactFlash Memory Card 2075-8734
\$69.99 - \$25 instant rebate - \$15 mail-in rebate* = \$29.99

Toshiba 256MB Secure Digital Card 2076-7485
\$79.99 - \$35 instant rebate - \$15 mail-in rebate* = \$29.99

\$59.99

HP ScanJet 2400
• 48-bit color • 1200 dpi
• Plug-and-play USB compatibility
• Auto-scanning and color copying 2082-8967

Hurry, While Supplies Last!
Save \$30
\$199.99 Reg. \$229.99

SONY DSC-P72
3.2 Megapixel Digital Camera
• 9.6x total zoom (3x optical/3.2x digital) • 1.5" LCD display
• Rechargeable NiMH batteries included
• 8MB internal memory • Memory stick compatible 2082-8334

Hurry, While Supplies Last!
Save \$30
\$149.99 Reg. \$179.99

CANON PowerShot A310
3.2 Megapixel Digital Camera
• Fixed optical zoom/5.1x digital zoom • 1.5" LCD display
• 2 AA batteries • PictBridge compatible 2078-7779

\$20 OfficeMax Gift Card by Mail with Purchase*

Both of these ads appeared in the Sunday paper. There are three cameras in them that you should not buy. Can you spot them?

Hint: Digital zoom without an optical zoom is not a good option.

It turns out that the Polaroid camera will take a memory card, although one is not included. It doesn't matter anyway because it does not have an optical zoom.

DIGITAL CAMERAS

OLYMPUS
3.2 MEGAPIXEL
DIGITAL CAMERA

• 2.5x Digital Zoom
• 6 Shooting Modes
• QuickTime Movie Mode

D395
#4018992

\$147

SONY
3.2 MEGA PIXEL
DIGITAL CAMERA

• 3x optical zoom
• AF illuminator
• 1.5" LCD
• 3 area Multi-Point Auto Focus

DSC-P72 #3599694

\$169

Canon
3.2 MEGAPIXEL
DIGITAL CAMERA

• 10x Optical Zoom
• Optical Image Stabilizer
• Vari-Angle 1.5" LCD

S1 IS
#3972608

\$397

Printing at the digital kiosk

You don't need a computer to enjoy the benefits of digital photography. With the introduction of digital kiosks in many photo, discount and drug stores you can select, edit, make prints and burn your photos onto a CD without ever getting near a computer.

The photo at right is a kiosk at a well known department store. The machine is linked to the normal photo processing machine, so photos pop out as they normally would with film.

You order the prints using the touch screen monitor. It is easy to use and a menu system walks you through each step. You start by taking the memory card out of the camera and inserting it into the slot in the front of the machine. The machine will also accept CDs and floppy disks.

Once you place the card in the machine, the touch screen will take you through the following steps:

- Choose the photos you want to print
- Choose the size for each, 4x6", 5x7", or 8x10"
- Rotate, crop and perform simple color corrections
- Print a contact sheet, or thumbnail print, of all photos on the card
- Print your selected enlargements



Once you are finished a receipt is printed, you pay and a few minutes later your prints are ready. The prints are the same quality as normal photo processing with a matte or gloss finish. At the kiosk above each 4x6 print costs \$0.24. For an additional charge you can have all your photos transferred from the card to a CD-ROM. This provides a secure archive for all your prints and allows you to erase the card to begin anew.

There are two disadvantages to using the kiosk

- The machine will crop odd-sized photos. This is especially true with panoramas, which are long and skinny: they will be badly cropped. You can overcome this by adjusting the print size in a photo editor before you take it to the kiosk
- You must go to the store. If you want a print instantly, you may be better off buying a color printer.

Note: The kiosk can't tell if you have edited your photos! You can enhance them with a photo editor and put them back on the card before you get the high quality prints the kiosk provides.

Addendum

Copyright law

If you take a picture with your camera, you own it. You can copyright it, print it, sell it and freely modify it. If you use someone else's copyrighted image, from the internet for example, you lose some of these rights. Unless you obtain permission of the original photographer or the owner of the photograph, you may have no rights to use that photo or any part of it in any commercial way.

Under the principle of "Fair Use," you are generally allowed to use copyrighted work for personal, non-commercial or educational purposes. You also may be able to use portions of a copyrighted work if your use constitutes a "transformative" use, such as commentary or parody. In general, as long as you are not selling the resulting product, or using it commercially, you can freely use the copyrighted works of others in your work. You may be able to use a work if you use a small portion and have no effect on the commercial market or potential use of the work.

Here are some interesting issues with digital photography, good for thought and discussion.

Discussion questions on ethics:

You see a news photo in a magazine: Is it an accurate depiction of the truth?

Are advertising pictures different? Can/should they be manipulated?

What about political ads: Is it ok to remove wrinkles and whiten the teeth of a politician?

What about taking undesirable people out of political ads, or adding people of diversity?

Are digital photos legal as evidence?

Can you tell if a photo has been digitally manipulated? Should it be identified as such?

Discussion questions on copyrights:

Should you get permission to alter an image?

Who owns an image that combines several copyrighted images?

Will you get caught? - Does it matter?

What is in the public domain?

When should you put © notices on your photos?

Is it possible to enforce copyright laws?

Buying a digital camera: **Checklist:**

1. Megapixels:

- ~~< 2 Megapixels – eBay low quality only~~
- 2 Megapixels
- 3 Megapixels

Very High Quality

- 4 Megapixels
- 5 Megapixels
- 6 Megapixels

Professional

- 8 Megapixels
- 11 Megapixels

2. Zoom:

- ~~Digital Only~~
- 3X Optical Zoom
- 7X Optical Zoom
- 10X Optical Zoom
- Digital Zoom in addition to Optical Zoom

Professional

- Interchangeable Lenses

3. Memory card:

- ~~Internal memory only~~
- Easily removable memory card
- Memory card tough to access

4. Feature/Mode Select

- Mechanical/selector wheel
- Menu system – button select

5. LCD display

- ~~No LCD~~
- Small LCD
- Medium LCD

- Large LCD

6. Size:

- Small – fit in pocket
- Medium – midsize
- Large – Neck strap

7. Construction

- Rugged- with well protected lens recessed flash
- Medium –good case but some exposed parts, pop-up flash
- Large camera with exposed parts and lens that requires careful handling. Flash shoe.

8. Batteries:

- Standard Size: AA or similar (can use rechargeable)
- Proprietary: (special brand charger)

9. Optional shooting modes:

- Panorama – “stitch assist”
- Custom modes
- Aperture or shutter priority
- Night shot
- Automatic
- Manual
- Portrait mode
- Continuous high speed shooting

10. Features common to most cameras:

- Movie Mode with sound
- Self Timer
- Macro Focusing
- Infinity Focusing
- Black and White Mode

Addendum 2: Digital cameras versus the Space Shuttle

I make the comment all the time, “Your digital camera has more computing power than the space shuttle! Is that true? Let’s look at the facts:



Space Shuttle:	Camera:
<p>Computer:</p> <p>Computer is a hardened derivative of the IBM 360 mainframe, first introduced in 1964. 480,000 operations per second</p>	<p>Most use an advanced RISC processor, 80 MHz, with one operation per clock. 80,000,000 operations per second Advantage Camera: 166x</p>
<p>Memory:</p> <p>700 Kbytes core memory</p>	<p>Internal: 32 Mbytes Card: 128 Mbytes Advantage Camera: 228x</p>
<p>Cost:</p> <p>\$5 billion development, Minimum \$113,000 (1964 dollars) each.</p>	<p>\$150 - \$600 (2004 dollars) or more</p>

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