

# **A Guide to Choose Digital Camera and Camcorder**

## **Significance of the topic**

As computer and web become popular in human's life, digital images play an important role to express ideas. With the rapid development of technology, digital images can be easily uploaded to computers from the places manipulating by using a variety of software, email to friends or post on a website. Digital images can be saved without worrying about losing good quality of photograph paper or digital video clips can be used over and over again. Sometimes digital files can be used in different format such as mp3 or jpeg. There is also no need to worry about running out photo negatives or buying a roll of film when you want to take pictures. Before doing digital photographs, one of the most important things is to have good equipment. The purpose of this paper is to provide users a guide and basic concepts on hardware of digital cameras and camcorders.

## **Introduction to Digital Camera and Camcorder**

How do digital cameras work?

Simply speaking, a digital camera uses semiconductor chips, usually a single Charged Coupled Device (CCD) instead of conventional film. When the shutter opens and light strikes the CCD, temporary electronic changes to the CCD are converted into computer language and recorded on either internal or removable memory. Those images can be viewed on a small screen on the rear of the camera and then later, they can be downloaded to a computer where they can be edited, printed, sent to friends as email, or posted in albums to be shared with others on the Internet. A digital camera may look like a conventional camera, but the process is radically different, and so is the operation. Most digital cameras have more in common with automatic point-and-shoot cameras

than they do with professional SLR cameras. They generally have auto-focus, and they can adjust for brightness, shutter speed and aperture automatically. The "film" of a digital camera is a removable media-storage device (floppy disk, flash memory card, etc). As with a film camera, you simply replace the storage device when it's full and continue to take pictures. The difference is you don't need to develop digital pictures. You can download them directly to your computer and they are ready to use (Digital Camera [on-line]).

How do camcorders work?

Digital camcorders have elements of receiving information, LCD screen to see images, and have an added component that takes the analog information the camera gathers and translates it to bytes of data. Instead of storing the video signal as a continuous track of magnetic patterns, it records the picture and sound as ones and zeros. Digital camcorders are so popular because you can copy ones and zeros very easily without losing any of the information you've recorded. Analog information, on the other hand, "fades" with each copy -- the copying process doesn't reproduce the original signal exactly. Video information in digital form can also be loaded onto computers, where you can edit it, copy it, e-mail it and manipulate it. Camcorders and digital cameras both take pictures using CCDs. But since camcorders produce moving images, their CCDs have some additional pieces you won't find in digital camera CCDs. To create a video signal, a camcorder CCD must take many pictures every second, which the camera then combines to give the impression of movement (Howstuffworks [on-line]).

## **Consideration of Choosing a Digital Camera**

Price

Usually, the price differently depends upon the quality of machine and the retailer. The machine which contains higher functions (e.g., high resolution and zoom) usually cost users more money. Users need to know the purpose of using the machine and make a balanced decision between cost and quality. Different stores may have different price for the same product. Users can check price on-line and get the ideas of possible price. An available website is [www.pricescan.com](http://www.pricescan.com). The price range of digital camera is from \$50 to \$2500. Most of the digital cameras fall within \$200 to \$900 and a median price is \$450.

### Resolution

The resolution of a digital camera refers to the sharpness of its pictures. The higher the resolution, the better the picture. Resolution is expressed in pixels, and refers to the "true" (i.e., non-interpolated) resolution of the camera. Usually, resolution ranges are 1) 640 x 480 pixels—minimum computer resolution, 2) 1280 x 960 pixels—film resolution of 4" x 6" print, 3) 1600 x 1200 pixels—film resolution of 8" x 10" print, and 4) 1920 x 1600 pixels—very high resolution (PCPhoto Magazine [on-line]).

### Optical Zoom

An optical zoom has the image using multi-focal length lens, but a digital zoom only enlarges the center 50%. An optical zoom allows you to take more detailed pictures of objects which are far away. Magnification level is measured in degrees, such as "2X" or "3X." For example, a "2X" optical zoom means that if the camera's minimum focal length is 50mm, then it has the ability to take pictures up to 100mm. More than 50% of digital cameras on the market today do not have an optical zoom.

### Camera Size

Pocket size. This is a very small camera that you can put it in your pocket. Typically, these are extremely light and weight and have widths under 5 inches. They are also quite flat, with depths rarely exceeding 1.5 inches.

Medium size. These cameras are slightly larger than pocket size cameras, especially in terms of depth and weight. A Medium Size camera weighs between 0.5 lb. - 1 lb., averages 0.75 lb. Most digital cameras are Medium Size.

SLR size. The digital cameras which look like a standard SLR (Single-Lens-Reflex) camera. Larger than a *Medium Size* camera, these typically have a rectangular body with a substantial protruding lens and weigh more than 1 lb.

#### Storage type

Digital cameras can store images in a internal memory, or on removable memory devices that can be put in and take out like rolls of film. Some cameras offer both internal and removable storage options. The camera will come with some storage, and you can buy more to increase your shooting capacity.

3.5 inch Floppy. With this feature, the camera stores its images on the same floppy disks that you use in computer. To transfer the images to your computer, you would remove the floppy from the camera and put it into your computer's floppy drive. You don't need any specific cable to connect the camera and computer. Memory capacity is 1.4 MB per disk. The problem is that floppy storage capacity is very limited, so you won't find this media used in high-resolution cameras.

Examples of product which use 3.5" floppy are Sony Mavica series (e.g., MVC-FD87, MVC-FD92)

Removable memory. Many digital cameras store images on removable memory devices that can be put in and take out of the camera like rolls of film. These can be used with a variety of card readers (depending on the type of storage), which are typically purchased as an additional accessory. PCMCIA Type II or III cards are credit card size memory that do not require a card

reader to download the images; you can insert the card directly into laptop computers. One type of flash memory storage called memory stick, manufactured by Sony, which is smaller than a stick of chewing gum. Something important to realize about flash memory is that it's expensive, and most digital camera maker supply only 8 or 16 MB cards with their cameras. With a mega-pixel camera, a card of this size isn't going to hold many high-resolution images. "Removable Media" does not include 3.5 inch floppy disks. Examples of digital camera which use removable memory are Sony CyberShot DSC-S75 and canon PowerShot300.

CDR. Some newer cameras use specially made recordable CDs to save images. This gives you the opportunity to save about 150 megabytes of pictures onto a disc that will slip into you computer's CD-Rom drive, where you can copy the pictures straight to your hard drive. This feature will tend to make the camera larger, and you won't be able to copy over your pictures once you close the disc, but you may prefer the ease of transfer. An example of using CDR as storage is Sony MVC-CD200.

Transfer images to computer

Infrared. Infrared transmission uses invisible light to transfer pictures to your computer or printer. Also known as "IrDA," this technology allows one to download images without using cables or wires, but is also extremely slow.

Parallel Cable. This type of cable connection is quite common, and transfers images faster than a serial connection, as it is able to send multiple bits of information at the same time (i.e., "in parallel").

SCSI Cable. SCSI is a form of image transfer involving a high speed bus cable system, used mainly in Macintosh computers and newer PCs.

Serial Cable. The most standard type of serial cable is identified as a "RS-232" interconnector. This method is relatively slow in comparison to a USB cable connection, but it's still quite commonly available.

USB Cable. A USB (short for Universal Serial Bus) cable transports images from your digital camera via a connection that is much faster than a serial or parallel cable. It is important to note, however, that this type of connection can only be used with newer Pentium computers, and it won't work on PCs with slower or older processors. Note that many cameras with a USB cable will also offer a serial and/or parallel connection option.

### Flash Type

The flash makes a burst of light for shooting inside the building or in low-light conditions. The types of flash available vary from camera to camera. The flashes built into most digital cameras have limited range and adjustability (on average, these flashes do not work well beyond 10 feet), in comparison to external flash options which can provide a much more powerful and versatile flash. Keep in mind that a camera with a "Hot Shoe" or "Flash Sync," will often come with the standard built-in flash as well.

Off/On/Auto. This refers to the basic flash functions, where the flash is always off, always on (for fill-ins, for example), or set to fire automatically when needed.

Red-Eye Reduction. This refers to a mode of flash that helps prevent the appearance of people with red eyes in the picture.

Flash sync. This function allows you to use more powerful flashes, and/or place the flash strategically, by attaching an external flash unit to the camera. Typically, a camera with flash sync will also offer the more traditional forms of flash as well, such as auto flash.

### Special Features

People may have different needs for individual purposes. Several features are considered.

Add-On Lens. A lens that attaches to the lens built into the digital camera. While an add-on lens is not as versatile as an actual interchangeable lens, it does provide you with an alternative means of composing a shot, by providing a telephoto or wide-angle option or add-on filters, to name a few. To date, most digital cameras do not offer this feature.

Rotatable Lens. This allows you to adjust the angle of the lens (not the focusing ability of the camera). Some rotate 180 degrees while others can rotate a full 360 degrees, allowing you to compose a self-portrait while viewing yourself on the LCD panel.

Interchangeable Lens. This allows you to physically change the type of lens you use. Interchangeable lens capability is rarely found on digital cameras--and when it is, you can expect a hefty price tag along with it.

Audio Recording. This function allows you to record a short sound bite with each image, allowing you to make notes for future reference.

Mini Movie. This allows you to create a short movie, for those times when still images simply won't do the trick.

Remote Control. With this feature, you can take a picture without holding the camera - an alternative to using a self-timer.

Shooting Modes. Perhaps the most important of the special shooting modes is Macro, which allows you to get very close to your subject, usually within only a few inches, and still get a sharp, detailed photograph. This feature is common on most digital cameras today and is very useful (PCPhotoReview [on-line]).

## Strength and Weakness

There are many choices on digital cameras with or without different functions. The following is the comparison.

Features of Digital Camera		Strength	Weakness
Resolution	Low (640x480)	Small file size	Quality is fine
	Mid (1080x960)	Middle file size	Quality if better
	High (above 1600x1200)	Big file size	Quality is the best
Zoom	Digital		See limited scene in a far distance
	Optical	See detail in a far distance	
Storage Type	Floppy disk	Cheap, easy to get	Small storage size
	Memory	Max. storage size: 16mb	Expensive
	CD-R	Max storage size: 150mb	Not easy to transfer
Transferring data	Infrared	Available	Slow transfer speed
	Parallel	Available	Slow transfer speed
	SCSI		Only use in Mac/newer PC
	Serial	Commonly available	Slow transfer speed
	USB	Fast transfer speed	Only use in newer PC
Flash	Built-in	Convenient	Limited range/adjustability
	External	More powerful and versatile flash	
Lens	Add-on	Provide wide-angle option	Rarely found used
	Rotatable	Rotate 180/360 degree and can do self-portrait	
	Interchangeable	Physically change lens	Rarely found used

(Digital Camera [on-line]; PCPhoto Magazine [on-line])

## Models for Choosing Digital Camera

Digital Camera
<p style="text-align: center;">Basic Models (Special &amp; Fun Cameras)</p>
<p>Features:</p> <ul style="list-style-type: none"><li>• VGA up to 1-megapixel resolution</li><li>• Fixed focal-length lens</li><li>• Either an LCD or optical viewfinder, but not both</li><li>• A small amount of built-in memory or a very small removable card</li></ul> <p>Ease Of Use: Simple design with minimal buttons and menu options</p> <p>Best For:</p> <ul style="list-style-type: none"><li>• Infrequent photographers who are considering digital, but aren't ready to invest in more expensive gear</li><li>• Photographers who want images for use on the Web</li></ul> <p>Price Range: Up to about \$250</p> <p>Examples: Sony Cyber-shot DSC-P20, Kodak DX3200, SiPix SP1300</p>
<p style="text-align: center;">Intermediate Models (Point and Shoot Cameras)</p>
<p>Features:</p> <ul style="list-style-type: none"><li>• 2- to 3-megapixel resolution</li><li>• 2x or 3x zoom lenses</li><li>• LCD and an optical viewfinder</li><li>• Some exposure controls, probably more automatic settings than manual</li></ul> <p>Ease Of Use: Emphasis on automatic exposures, plus some manual overrides in the menus</p> <p>Best For:</p> <ul style="list-style-type: none"><li>• First-time digital buyers who photograph often, but want a minimal learning curve</li><li>• Snapshoters who want to make bigger prints than possible with the entry-level cameras</li></ul> <p>Price Range: \$200-\$600</p> <p>Examples: Nikon Coolpix 775, Canon PowerShot A20, Olympus Brio D-150</p>
<p style="text-align: center;">Advanced Models (Compact Cameras)</p>
<p>Features:</p> <ul style="list-style-type: none"><li>• 3- to 5-megapixel resolution</li><li>• 3x or greater zoom lenses</li><li>• LCD and an optical viewfinder</li><li>• Automatic and manual exposure controls, including old favorites like shutter- or aperture-priority and exposure compensation</li><li>• Advanced noise-reduction technologies, better battery performance and perhaps a TIFF or RAW file mode</li></ul> <p>Ease Of Use: Generally more sophisticated, and therefore more complicated than less expensive models</p> <p>Best For:</p> <ul style="list-style-type: none"><li>• Serious amateur photographers who want maximum image quality and control</li><li>• Professional photographers who want a compact digital alternative to their film equipment</li></ul> <p>Price Range: \$400-\$1,300</p> <p>Examples: Canon PowerShot Pro90 IS, Epson PhotoPC 3100Z, Sony DSC-707</p>

Professional Models (SLR & Pro Cameras)
<p>Features:</p> <ul style="list-style-type: none"> <li>• 2- to 6-megapixel resolution</li> <li>• SLR design allowing interchangeable lenses</li> <li>• Pro-level metering and exposure controls</li> <li>• Fast frame rates for continuous action shooting</li> <li>• TIFF or RAW files in addition to JPEG</li> </ul> <p>Ease Of Use: 35mm SLR photographers will feel right at home with many of the controls, but the on-screen menus can be complicated; have your manual handy until you learn the ropes</p> <p>Best For:</p> <ul style="list-style-type: none"> <li>• Professional photographers who need the best digital performance possible</li> <li>• Serious amateurs who have compatible 35mm lenses, want maximum control and don't mind the high price tag</li> </ul> <p>Price Range: \$3,000-\$6,000</p> <p>Examples: Canon EOS D30, Nikon D1x and D1h, Fujifilm Finepix S1, Sony FD-97</p>

(Digital cameras info. Digital Camera Review, Rating and Price Comparison [on-line]; Dreviews [on-line])

## **Consideration of Choosing a Camcorder**

When choosing a camcorder, the range of features can be confusing. Actually, there are key features that differentiate one camcorder from another. The following is a consideration on the major distinguishing features of a camcorder.

### Price

With camcorders, VHS, VHS-C and 8mm formats generally have lower prices than S-VHS, Hi-8 and Digital formats. However, when a model becomes older, its price drops, and more and more manufacturers are making higher resolution camcorders and selling them at lower prices. Price range is from \$300 to \$5,000. Most of the camcorders fall within \$400 to \$1000 with an average price of \$500.

### Format

Camcorders can be in different formats, which indicate the type of tape that the camcorder uses, and the method of recording the information. The key differences among camcorders are their

compatibility with a VCR (whether you can play the tape directly in the VCR, or have to play it by hooking the camcorder up to the television), maximum recording time, and picture resolution (measured in horizontal lines). Available formats are VHS, VHS-C, S-VHS, 8mm, Hi-8, MiniDV, Digital8, and MiniDisc. Here is a list of the current formats and their features:

Format	Feature Description
VHS	<ul style="list-style-type: none"> <li>• Records directly onto a VHS tape, which means it can be played in the VCR with no adapters.</li> <li>• One tape holds about 2 hours.</li> <li>• Lower resolution (250 lines)</li> </ul>
VHS-C	<ul style="list-style-type: none"> <li>• Records onto a compact VHS tape which can be played in your VCR with an adapter.</li> <li>• One tape holds 40 minutes.</li> <li>• Resolution is the same as VHS, about 250 lines.</li> </ul>
S-VHS	<ul style="list-style-type: none"> <li>• Records onto S-VHS tapes, which are playable only with the camcorder or an S-VHS VCR.</li> <li>• One tape holds 2 hours.</li> <li>• Resolution jumps from the VHS standard of 250 lines to around 400 lines.</li> </ul>
8mm	<ul style="list-style-type: none"> <li>• Records onto 8mm tapes, which are smaller than VHS, but can only be played with the camcorder.</li> <li>• One tape holds up to 5 hours.</li> <li>• Resolution is about 270 lines.</li> </ul>
Hi-8	<ul style="list-style-type: none"> <li>• Records onto 8mm tapes, which aren't compatible with a VHS VCR.</li> <li>• One tape holds up to 5 hours.</li> <li>• Hi-8s improve on the 8mm format, increasing the resolution to around 400 lines.</li> </ul>
Mini-DV	<ul style="list-style-type: none"> <li>• Records images digitally, with a very clear picture and no reduction in picture quality with copying.</li> <li>• Uses tiny mini-DV cassettes, which must be played back through the camcorder onto the television.</li> </ul>

	<ul style="list-style-type: none"> <li>• Recording time can vary from from 30 minutes up to 2 hours.</li> <li>• MiniDV camcorders have the highest resolution of all the camcorders, at about 500 lines.</li> </ul>
Digital 8	<ul style="list-style-type: none"> <li>• Records images digitally with a very clear picture and no reduction in picture quality with copying.</li> <li>• Records on 8mm cassettes instead of mini-DV (these are cheaper, and any 8mm recording will play on the camcorder).</li> <li>• One tape holds about 2 1/2 hours.</li> <li>• Resolution is around 500 lines.</li> </ul>
Mini-Disc	<ul style="list-style-type: none"> <li>• Records images digitally with a very clear picture and no reduction in picture quality with copying.</li> <li>• Records onto minidisks, which allows for easy editing and minidisk sound quality.</li> <li>• One minidisk holds about 20 minutes of digital video.</li> <li>• Resolution is around 500 lines.</li> </ul>

(Vaughan, 1998; What's the best camcorder? [on-line])

### Image Stabilization

This feature steadies the video and so that the shakiness which is common with hand-held camcorders is mostly eliminated. It can be done digitally or with the optical lenses. Manufacturers have different terms for this feature, such as Electronic Image Stabilizer (EIS) or Steady Shot.

### Horizontal Resolution

The maximum number of vertical lines counted horizontally across the screen. The higher the resolution, the better the picture.

### LCD Monitor

The Liquid Crystal Display monitor can be used as a viewfinder or playback screen. It comes in a range of sizes, and is often put on a swivel so that it can be turned around for different viewing angles.

### Optical Zoom

This allows the viewer to focus in on far away objects with the touch of a button. An optical zoom rated at 16X means that the camcorder can magnify the image up to 16 times larger than normal. There are two types of zoom, optical and digital. All cameras have optical zooms and most have digital. Optical zooms range from 10 up to 26X magnification, while digital zooms can be over 300X. An optical zoom uses the actual lens to magnify the image, whereas a digital zoom uses computer imaging to magnify the image. Although, digital zooms can go much farther than optical, they sacrifice quality as they are only computer approximations of the image, rather than the actual image (Active Buyer's Guide [on-line]).

#### Size

Camcorders have gotten progressively more compact, and today's models are the smallest yet. In general, VHS camcorders are the largest and heaviest, with S-VHS camcorders a bit smaller. The VHS-C is much more compact, but generally not as lightweight as the 8mm or Hi-8 camcorders. Digitals are the smallest ones on the market; in fact some of them are even small enough to fit in a pocket. These are general guidelines, however, there are some amazingly small 8mm camcorders and larger digital camcorders packed with features. Keep in mind that the more compact camcorders often come with a higher price tag (What's the best camcorder? [on-line]).

#### Color Viewfinder

This is a great feature, especially for those who don't have an LCD monitor. A color viewfinder allows you to check the balance of colors, and see whether the settings need any adjustment.

## **Research Findings and Summary**

After doing research on digital cameras and camcorders, I found that the higher function of features, the higher quality of images, but also the higher price. It is helpful if people understand

basic concepts of technical terms used in digital equipment and clearly knows his purpose of buying digital camera or camcorder. Then he can balance his budget and needs to buy an appropriate device. There are many considerations needed to think about and there are many choices of products out there in the market. Some digital equipment is still expensive. Meanwhile, when I see many products on the market, it seems that manufacturers have involved competition on developing new products. This maybe a good thing for customers because the quality will be improved and old product will drop the price.

## Reference

1. PCPhoto Magazine. <http://www.pcphotomag.com/>
2. Dcviews. Digital cameras and photography. <http://www.dcviews.com/>
3. PCPhotoReview. Digital camera reviews and community.  
<http://www.pcphotoreview.com/defaultcrx.aspx>
4. Digital cameras info. Digital Camera Review, Rating and Price Comparison.  
<http://www.digital-cameras-info.com/>
5. Howstuffworks. <http://www.howstuffworks.com/camcorder1.htm>
6. What's the best camcorder? Camcorder Buying Guide.  
[http://www.whatsthebest-camcorder.com/videocamera\\_tutor3.shtml](http://www.whatsthebest-camcorder.com/videocamera_tutor3.shtml)
7. Cinematography.org. Camcorder Buying Advice, part 1~4.  
<http://www.cinematography.org/camcorder/camcorder.html>
8. Digital Camera. <http://www.dcresource.com/>
9. Active Buyer's Guide. <http://www10.activebuyersguide.com/>
10. Vaughan T. (1998). Multimedia Making it Work (4<sup>th</sup> ed.). Berkely, CA: Osborne McGraw-Hill.

## Useful Links

Canon USA: <http://www.powershot.com/powershot2/home.html>

Casio USA: <http://www.casio.com/>

FujiFilm USA, Inc. <http://www.fujifilm.com/>

Kodak <http://www.kodak.com/US/en/digital/cameras/DCSGateway.jhtml>

Konica USA <http://www.konica.com/konicausa/products.html>

Nikon Inc. [http://www.nikonusa.com/usa\\_home/home.jsp](http://www.nikonusa.com/usa_home/home.jsp)

Olympus Image Systems <http://www.olympusamerica.com/innards/consumer.asp>

Panasonic <http://www.panasonic.com/>

Ricoh <http://www.ricohcpg.com/>

Samsung <http://www.samsungcamera.com/>

Sony <http://www.sonystyle.com/digitalimaging/>

Toshiba <http://www.toshiba.com/taisisd/dsc/>

Digital camera product review <http://www.all-digital-links.com/>

Price Tracking Site: [www.pricescan.com](http://www.pricescan.com)

This paper was written by Hui-Ching Ko for the course EDC385G Multimedia Authoring at the University of Texas at Austin