

Unit 4. Digital image processing

1. Types of images

1.1. Analog and digital images

Digital photography consists of obtaining images with a digital camera, similar to analog photography. However, analog images are recorded on photosensitive film and must be developed by using a chemical process, and digital images are recorded by an electronic sensor which transforms the light into an electric signal. This signal is digitalized and stored on a memory card.

1.2. Analog and digital images

The arrival of informatics has brought a change in the editing and treatment of images. Today analog cameras, which use rolls of film, have been reduced to almost exclusive use by devoted fans of old school photography. Designers don't do a rough draft on paper and they draw up blueprints using Computer Assisted Design programs (CAD).

1.3. Why use digital images?

The arrival of informatics has brought a change in the editing and treatment of images. Today analog cameras, which use rolls of film, have been reduced to almost exclusive use by devoted fans of old school photography. Designers don't do a rough draft on paper and they draw up blueprints using Computer Assisted Design programs (CAD).

1.4. Vector images

Vector images are made from basic shapes (lines, circles, etc.) that, when put together, form a drawing. Every one of these shapes can be separately edited. A vector image is different than the other types of images that you may know. Other images are made by pixels. Vector images are made by a group of shapes and are created by formulas.

Features of vector images

- Unlike a picture, vector images don't lose quality if you increase their size.
- The file sizes are usually smaller than a bitmap image.
- Vector files don't have the same level of detail as bitmaps, which is the reason that they are used by engineers and architects.

Vector image formats

- **wmf**: Used by Windows programs
- **odg**: Open office format
- **cdr**: Corel Draw
- **eps**: PostScript; used to professional printing.
- **swf**: Flash; commonly used on the internet.
- **svg**: Inkscape; used on the internet for simple graphics.

Edition programs

- **Corel Draw** Windows. Very powerful.
- **Adobe Illustrator** Windows/Mac OS. Works well in conjunction with Photoshop.

- **Inkscape** Linux/Windows/Mac OS. Free.
- **AutoCAD** Windows. The best program for architecture and engineering.
- **QCAD** Linux/Windows. Alternative to AutoCAD.

1.5. Bitmap images

Bitmaps are images made from a group of small points called pixels. Every point is defined by its color and brightness. Every point is defined by its color and brightness. Most of the images you can see in a book, in magazines, or on the internet, are bitmaps.

Features of vector images

- Unlike vector images, loses quality if its size is increased.
- Has bigger files than a vector image.
- Has greater detail and richness of color than a vector image.

Bitmap image formats

Not compressed

- **bmp**: Format for Microsoft Paint. Takes up a lot of space.
- **tif**: Stores information tags to be able to edit the image later. Takes up a lot of space.
- **psd**: Photoshop format. Allows true color, layers, and effects. Takes up a lot of space.
- **raw**: Contains the information from the camera's sensor without modification. For this reason these files take up a lot of space.

Compressed

- **gif**: Has 256 colors. It allows transparency and movement (animated gif).
- **png**: True color format with transparency.
- **jpg or jpeg**: True color format. When compressed, it loses image quality. Very common for posting pictures on the internet.

1.6. Hardware to acquire digital images

To digitalize an image is to acquire or transform in a digital format so that it can be visualized and edited using computer systems. The three most commonly used methods right now for digitalizing images are: digital cameras, graphics tablet and scanners

- **DIGITAL CAMERA**
- **GRAPHICS TABLET**: The graphics table is a peripheral that allows you to draw directly onto the computer as if drawing with a pencil on paper.
- **SCANNER**: The scanner is an input peripheral which allows to digitalize a flat image such as a document, photograph, etc. Bitmaps are images made from a group of small points called pixels. Every point is defined by its color and brightness. Every point is defined by its color and brightness. Most of the images you can see in a book, in magazines, or on the internet, are bitmaps.

How to do screen captures

To screen capture is to copy to the clipboard what you see on the screen to use it later. Depending on what we want to capture, we can screen capture two ways:

1. Pressing the Impr pant (Prnt scrn): copies the whole screen.
2. Pressing the Alt+Impr pant (Alt+Prnt scrn): only copies the content of the active window.

Once copied, we can paste this screen capture to whatever program we want as if it was any other image.

2. Parameters that are involved in a digital image

2.1. Color depth

The number of different colors that an image contains is known as the color depth, which gives us an idea of the image's quality. An image can be made by 1 or 2 colors, but the most usual is that they contain between 256 and 32 million colors. When the image contains 16 or 32 million colors it is called True color image. If the color depth is higher (more colors) the quality is better.

The memory space occupied by every pixel can tell you how many colors have an image. So, a black and white image has 2 colors (21) and is a 1 bit color image. Then, an image with 256 colors or a greyscale is an 8 bit image (28colors), and a true color image can have 24 bits.

2.2. Size of the image

The size of the image is measured in dots or pixels, and is expressed in the number of dots in width and height. The more pixels an image has, the better image quality the image will have, but it will also occupy more space on the disk. To know how many megapixels an image has we multiply the horizontal pixels by the vertical ones. A 1280 x 960 image will have 1.2 Mpx.

How to know the size of an image

To know how many megapixels a digital image has, we multiply the number of pixels wide by the number of pixels high and then we divide by a million. A 1280 x 960 image has 1.2 Mpx.

2.3. Resolution of the image

The resolution of an image is expressed in dots per inch (dpi) (punts per polzada (ppp)). The resolution indicates the number of dots or pixels there are in a specific length of image. Bigger resolutions give us images of better quality. This is important when we acquire images with a digital camera or a scanner. With a scanner we can choose the resolution of the scanned image, but with a camera we can't. That's why the resolution is an important feature to check before buying a camera.

2.4. Compression

Some formats of bitmaps were designed for printing on paper. Others, on the other hand, are made to be distributed through the internet. The first are in non-compressed format and do not lose quality, but are bigger sized files. The second type are compressed files that occupy less space but lose some image quality. For example, in the jpeg format, at greater than 60% compression, the loss of image quality is clearly visible, whereas **gif** and **png** formats don't lose image quality even after being highly compressed. Among the most used formats for working with paper is the **tiff**. The size of the image

3. Editing software

3.1. Editing software

Once you have purchased our digital image we have to edit it. To do this we need software specifically dedicated to this. GIMP is a free alternative which you can download by clicking [here](#). But there are a lot of programs for editing images, some of them you have seen in the previous point. There are also free internet services that perform this task in a very satisfactory way; click [here](#) to find out more.

Big editing image software

- **GIMP**: Linux/Windows. Powerful and free.
- **Adobe Photoshop**: Windows/Mac OS. The most widely used.
- **Corel Paint Shop Pro**: Windows. Very easy to use.
- **Photoscape**: Windows. It is very easy to use.

Other image editing software

There is a large amount of image editing software that is not well-known, but is very interesting. I suggest downloading and trying a couple:

- Paint.net
- Fotografix (portable)
- LazPaint (portable)

3.2. Editing software

Once you have your digital image you have to edit it. To do this you need to use specific software. There are a lot of programs for editing images, some you have seen in the previous point. GIMP is a free alternative which you can download by clicking [here](#). There are also free internet services that perform this task in a very satisfactory way. Here you can find three examples:

- Photoshop express
- Pixlr
- Sumo Paint

4. Publishing images on the internet

4.1. Copyright

The images published on the internet must be originals and mustn't include situations and/or people who haven't given their permission for the images to be published.

In few words, the law tries to avoid that the images of anonymous people (excluding the rich and famous) are recognizable, reproduced or published without their consent. The right of publication can only be given by the person photographed.

Therefore, we must ALWAYS obtain authorization to be photographed from the person that is in front of your lens (before taking the photograph). Also, permission must be given to reproduce the image or publish it. If we don't do this, we are violating their right to their image

and breaking the law. Because taking, reproducing and publishing are three different acts, a person could be authorized to take a photo, but not to reproduce or publish it. For this reason, it's necessary to obtain the authorization for all three things.

4.2. Places images can be published

Publishing and sharing pictures on the internet is becoming easier and easier and more and more common. Here you have some popular sites:

- Flickr
- Fotolog
- Instagram
- Imgur
- Panoramio