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Digital Photography in Computer Science – Technical and Social Aspects

Introduction

Photography is a kind of art. It is a kind of techniques, also. Modern digital photography becomes a new way of creation reality. Some people think, that new digital photography, which have a lot of automatically options will make each users of digital camera, professional photograph. It is false opinion. To be a good photograph it is necessary to know a lot of technical parameters and possibilities of digital camera and know a lot of information about photography art. Knowledge is not enough. Experience is sometimes more important. In this paper there are some historical and modern information about role of creative in making and proceeding, in aiming of computer software, photos. Creative is very important, because sometimes people thought that technique is main aspects, when we use computer or other automatically tool, like camera. Experience teaches, that perfect pictures can do only these people, who can born skills and talents or people, who have been learning in long time education. Of course, this process is possible not automatically, but in helping of tutor.

Traditional photography

About 900 Islamic scientists invented “camera obscura”, a new method of processing pictures. It was a base theory of photography. It was a fully closed box, with a small slot. Light rays fall into band back in the line of slot and on the other side of box we received reduced and inversed picture of object, on which the slot was directed. Arabs used camera obscura to observe the Sun eclipse [1, p. 84]. In 1321 Jewish philosophy, mathematics and astronomy Levi Ben Gerson wrote camera obscura. It was about 200 years before Leonardo da Vinci, however some sources say that he was the inventor [1, p.92].

The develop in sphere of optics and chemistry became a stimulator to find better possibility to take and record pictures obtained from camera obscura. The next step was a new technique - daguerreotype. It was about 1840. Then a lens and a celluloid film were invented.

Traditional photography is a process in two levels. First is making photo by camera. The purpose is to obtain the best color saturation, contrast and tonal moving (crossing). Next is necessary to develop negative and make prints. Now the purpose is to play back information written during making photo. First step is chemistry process with photographic film. We do it in photography lab – the soundproof depth room. The film we put into special black can. The can has an airtight cover with a slot. Then we pour developer, designed for photographic film. We pour out developer after suitable time and rinse running water. The next step is chemistry record and final rinse running water. The last process is drying. Chemical form of photographic film is rather easy. It is necessary to obey parameters of quantity, time and temperature.

The second phase is more interesting. We need a photograph enlarger. We put negative under source of light and a picture from negative will be on the light-sensitive paper. The time of exposing is important. The next phase is more interesting. There are baths in three small tubs: one with developer for photographic papers, second with breaker and the last with recorder. It is time for lover of photography. It is possible to experiment with a time of each of phase. The last is drying papers prints. Making film and prints is possible for amateurs only in black-white photography. Color photography is more complicated and in practice possible in professional photographic labs. Process of making analog photos is automatic now. There

are no possibility to experiment in this process, like in black-white photography. It is a pity, because invention in photography is very important not only during making photo but also during preparing prints.

Traditional (analog) photography create base of digital photography. Some terms are the same, for example: exposition, aperture, time of exposing, depth of focus, arrangement. It is interesting that some years ago a lot of lovers of photography reluctantly changed traditional photography to digital photography. Now most of them changed their analog cameras to digital cameras and find new experiments in processing prints with aiding computer software.

The base of digital photography

Genesis of word "photography" is from Greek (photos it means – light, graphein – draw) and it means to draw with light. Natural source of light is Sun light. A man perceives Sun light as a white light. In fact Sun light is a blend of diverse colors. Sun light spectrum is from ultraviolet up to infrared light. A man can not notice these colors. He can distinguish about 380 000 colors. Cameras have got their own specification of light perception. Photographic film can store x-ray and converters, used in digital cameras, without special filters, can store infrared light. Each color we can define with a model of color space. There are some standards of colors space. The most popular is RGB (red, green, blue) standard. The model RGB is used in monitors, scanners and digital cameras. We called it additive model, because each color becomes in principle of additive mixing colors. This principle relates to source of light.

There are some alternative models. Subtractive model CMY – cyan, magenta, yellow, relates to objects colors. This model we used in printers and plotters. Then we add fourth color black and model called CMYK. The models RGB and CMY (CMYK) are oriented on hardware. There are some models oriented on user (for example HSV and YIQ) or not independent from hardware (CIE L*a*b). Model HSV, used in electronic transmission of pictures, consists of three elements: hue, saturation and value. Hue contains information about color, saturation adds white and value adds black. Artists use this model, because it is easy control color with its brightness. Model YIQ is used in USA to code colors in television transmission. Model CIE contains full visible specter. Parameter "L" describes brightness, parameter "a" describes passing from green to red and parameter "b" passing from blue to yellow. Model CIE L*a*b is used in pictures in format Photo CD. It is difficult to use this model, because colors we defined by numbers [2].

Compatibility of models of colors is very important. Visible spectra of models are different. Everybody can notice that picture on monitor often is different than the same picture in printer. How to minimize these differences? First step is calibration all devices in computer system. The second is to use special computer programs CMS (Color Management System) which translate value of colors between input and output devices [3].

Depth of colors is one of the parameters, which decides about quality of picture. Depth of colors depends on number of colors. Depth of colors defines in bits (look tab. 1).

Tab. 1 Depth of colors

Number of bits	Number of colors
1	2
4	16
8	256
16	65 536
24	16 777 216
32	16 777 216

Number of colors we count as a 2 to power of number of bits. Standard of writing picture is to use 8 bits for each main canal. For model RGB it means 8 bits for R, G and B. Picture in model RGB needs 24 bits for each pixel. We call this tribe True Color.

Some devices can use 48 bits depth on one pixel. It means using 16 bits for each canal. These pictures are perfect and have smooth tonal passing. There is a format of writing data in 48 bits depth. We call its RAW. It is only full information from matrix CCD. File in format RAW must be transform to another format. It is like negative in analog camera. Its transformation is similar to develop of negative. We converse RAW to some possible format like: TIFF, JPEG and GIF. TIFF (Tagged Image File Format) gives the best effects. It has compression without loss (LZW). Most popular is JPEG (Joint Photographic Experts Group), which loses only details of data but the size of file are many times smaller then TIFF. The next generation of JPEG format, offering better quality at the same compression, is format JPEG200 (jpeg2). GIF (Graphics Interchange Format) has a big compression (only 8 colors) and is used when we need a small size of file – for example in Internet. In 1995 was created a format called PNG (Portable Network Graphics), which has got better quality and also all advantages of GIF format.

Digital cameras

Beginning of technology of CCD (Charge Coupled Device) is connected with research in NASA. Matrix of CCD is equivalent of photo film in analog camera. 20 years ago only professional publishing and journalist firms used digital camera, because they cost about 30 thousands of dollars. In 1994 price got out to one thousand dollars and digital camera were available for each. In 1998 author could use first digital camera Sony MVC-FD7 and year after the next model MVC-xxx, which had video function. In these cameras the floppy disc 1,44MB was used. It was comfortable to use for students during laboratories of computer science. I used it up to nowadays. The main parameters of Sony MVC-FD7 camera are:

- resolution 380 000 pixels;
- 10x optical zoom;
- data stored on floppy disc 3,5”;
- data storage format JPEG, VGA (640x480).

Today, cameras available for amateur photographs, equipped in 12,8 MP full frame CMOS sensor, can take more than 3 pictures per second, can store RAW/JPEG images and they have Photo Professional software.

Prices of digital camera are from two hundred dollars for simple model up to one thousand for device, which can be used by professionalizes.

Future of digital photography / trends of growth of digital photography

Digital photography evolves very quickly. Any attempt to predict future of it is very difficult. But it’s easy to see and describe two visible trends in it. One of it refers technical specification and possibilities of digital cameras, second one refer to application of photography. A final product of photography was always a picture, stored in photo album. Growth of digital photography shows many solutions, which could replace photo albums. It could be devices oneself or integrated with cameras. It is possible, that soon, photo albums will be replaced by devices, able to store thousands of pictures and display them with quality equal to photographic prints. Capital change is in the contingency of shearing and copying digital pictures. Photos stored in digital albums can by easy exchange with anyone.

Integration of digital cameras and mobile phones gives opportunity to transfer pictures in easy way. Picture, together with voice and text message, become third, common used, communication method. It affects on mobile and internet communication. Digital photography allows not only to catch passing moments but also share them.

Trends described above refer amateur photography. Digital technology do not change so much professional and art photography, where about results decides skill and talent, not technical way of storing pictures.

Social and creative aspects of making prints

Creating pictures allow express emotion, feeling, evoke bond between author and viewer and passing information. One picture gives one thousand information more than one word – the old Chinese proverb speaks. To express emotion is necessary to know some arrange rules. Arranging is first process of authorship photography. Gold division, known from antiquity gives impression of harmony and deal. Similar effects we got use strong points rule. Sometimes it is necessary to use different geometrical principles, for example symmetry. Good effects give following by eyes of user. In arranging making photos important is dept of focus and perspective and point of view.

Photography was, is and will be a source of inspiration. Diversity of topics of making photo is infinite. Each user of camera should first answers himself what is the main topic of photo, what is a main object of photo. There are some kinds of it: people, landscape, still life, buildings, animals, sport photos, meteorology phenomena, panoramas and often connected this. There are some principles how to do with typical situation, often there are special functions in professional camera allowed do good photo, even by nonprofessional photographer. [4].

After the first stage (photo session) we begin the second one. Sometimes we call it work in digital photo darkroom. All of modern operating systems have special software to transfer data from digital camera to computer. Camera accumulates data on memory card for example Compact Flash, Smart Media, Memory Stick. Capacity of these cards is more then 512 MB. Connecting camera and computer is by serial port, particularly by USB. We do it thanks to program (in Windows XP it is creator of scanner and camera). After transfer of photos it is necessary to select bad photos and delete them, next catalog others. It is very important because photo files take up a lot of memory.

The very important stage to prepare photos to catalog or to printing is edition. We can use some computer programs – graphics editors, like: Adobe Photoshop, Corel Photo and GIMP. Edition allows change of orientation, cropping photos, correction of errors in exposing, selected light up or dark photos, global correction, deleted effects of red eyes, increase or decrease of colors saturation, sharp masking, deleting of noise [5].

Conclusion

Knowledge, experience and creativity give the chance to see and record the word by camera. Digital photography and new possibility of graphic editors give a big potential to make perfect prints. Effects depend on knowledge about colors, possibilities of digital camera, software and art talent.

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