DIGITAL PHOTOGRAPHY

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Abstract

The art of manipulating and transforming photographic images with chemicals or with an enlarger in a darkroom has a long tradition that can be traced back to the earliest days of photography. This type of image processing can serve two purposes: to enhance and to entertain. With the traditional tools, however, it can take remarkable skill of a manipulator to hide the traces of his or her work.

But now we have computers. We can digitize existing photographs without any loss of resolution or dynamic range, store them in a computer and manipulate them in a 'digital darkroom.' All computer manipulations are reversible, and can be standardized with meticulous precision. Best of all: the digitized images do not age or fade and can be used at any time to recreate the originals perfectly.

The effects of computer manipulation of photographs at high resolution can be startling. The talk will give some examples.

An Overview

A digital darkroom worker can mimic every standard or special effect that a skilled professional can achieve in a conventional darkroom with chemicals. Even the goofs can be reproduced. Who hasn't turned on the light by accident and unintentionally solarize the prints that were in the developer? The process can be duplicated with a very simple transformation filter that simply reverses the brighter values in an image and leaves the darker values unaffected. Contrast can be expanded or compressed, as if we were using different grades of printing paper. The picture can, of course, be enlarged or reduced, as if we moved the enlarger head up or down. The picture can be warped into a curve, as if we twisted the printing paper. A combination print of two or more pictures can be reproduced. And so on, and so on.

But, this is only where the really good part begins! In a digital darkroom, it is just as easy to improve the focus in a picture as it is to enhance contrast. And it is just as easy to twist the picture into a spiral or a sine wave, as it is to twist it into a regular curve. It is also just as easy to make a combination print of a negative and a positive as it is to print in the odd cloud. That's where the digital darkroom leaves the conventional darkroom behind.

Pico — A Simple Digital Darkroom

With little effort we can build a darkroom program that can produce all the effects mentioned above, by using a simple picture transformation language, just like the computer language 'Basic,' that knows about x and y coordinates, and brightness values. I build an editor of this type at Bell Labs, called 'pico,' that has proven to be an irresistible toy. A portable version, that takes up only about 500 lines of C-code, is described in my book [1]. It will run on any system with a C-compiler, from a million dollar supercomputer to a hundred dollar PC.

The photo that accompanies this article, for instance, was produced with 'pico.' It is a combination of two separate photos. The photos were originally shot on Polaroid Type 52 film, digitized at 500 dots per inch, enhanced and combined. The left profile was mirrored to produce a right profile and the three photos were then lined up at very high precision, and merged with a smooth linear fade across four different cut lines. The photo was then reproduced with a digital film printer onto 4x5" sheet film and printed. The result is startling, and can be enlarged to any size without giving away the fact that the photo was computer manipulated.

In Conclusion

It is not unlikely that within ten years from now conventional photography, with films, chemicals, and darkrooms, will have been completely replaced by digital photography. The camera of the future is a digital camera, with a CCD array (a charged coupled device, invented at Bell Labs in the early seventies) to translate brightness into a digital signal, and stored onto floppy disks inside the camera.

Sounds unbelievable? Such cameras already exist, and are being marketed by Sony (the Mavica camera) and Canon (the RC-701 camera). They are 'standard' SLR (single lens reflex) cameras, from the outside almost indistinguishable from a conventional photo camera. The floppy disks of these cameras can hold 50 color photos each, at a resolution of about 500x500 dots per picture. The disks are produced and sold by Kodak (who else) and have already been standardized among all the major current, and potential future, manufacturers.

Now in all fairness: the resolution of the first digital cameras leaves something to be desired. The reason for this is an effort by the large companies to try and be compatible with video systems, so that you will be able to capture video images onto the floppy disks, or store the contents of a disk onto a video tape. That unnecessarily restricts the resolution to an unconvincing level. For the digital cameras to become competitive with conventional cameras the resolution of the images will have to go up by about a factor of five, and the price of the cameras will have to come down by about the same factor. There is every reason to believe that they can and will.

Reference

[1] G.J. Holzmann, *Beyond Photography — The Digital Darkroom*, Prentice-Hall, 1988, 128 p., ISBN 0-13-074410-7.