Application Note

Imagenation **PXC200A**

Automatic Contrast & Brightness Adjustments

Written in C

Overview Most pictures, whether machine vision images or vacation pictures, are taken in less-than-perfect lighting. If you get a bad bunch of vacation pictures, you may just be stuck with them, but machine vision images can be corrected. In fact, if you are using the Imagenation PXC200AL or PXC200AF, you can correct poorly exposed images before they even reach computer memory for processing. Why would you want to do that? A poorly exposed image is not only difficult to see but may be difficult or impossible for image-processing software to process. This application note presents an algorithm that automatically adjusts the PXC200A for the correct brightness and contrast.

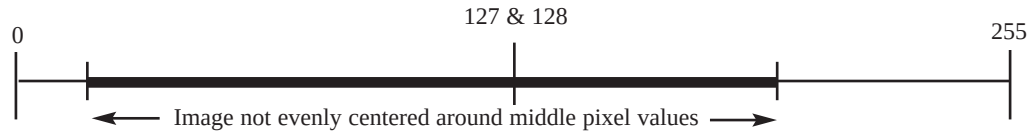
Applications Brightness and contrast adjustments can be used in almost any machine vision application. A few examples are:

1. Optical character recognition (OCR)
2. Barcode reading
3. Presence or absence checking, e.g., bottle caps
4. Intruder detection for a security system

Exposure Exposure is the process of putting the right amount of light onto a piece of film or onto a CCD array. It involves both light and time. If you have more light, you need less time, and if you have less light, you need more time. The objective is to capture exactly the right amount of light to fully illuminate the darkest areas of an image as well as the lightest. It is a tricky problem, and very few of us are experts at it. That is why consumer and professional cameras alike have automatic exposure controls. If your machine vision camera does not have automatic exposure controls, you can use the PXC200A along with the algorithm described in this application note to compensate for poor exposure and changing lighting conditions.The best way to use this application note is to decide which language you like and then study that source code. There is probably no point in comparing the two.

Contrast An eight-bit digital monochrome image can have 256 different pixel values ranging from a value of 0 to 255. A properly exposed image not only uses all 256 values but centers the image evenly around pixel value 127. If an image does not use all of the values from 0 to 255, then it has poor contrast. For example, if an image uses only the values from 0 to 127, then there is quite a bit of detail missing, because half of the possible shades of gray are not represented. This kind of poor contrast would probably not be visible to the human eye but would most likely cause problems for image processing software.

Brightness A full-contrast image (one that uses all of the pixel values from 0 to 255) is too bright or too dark if it is not evenly centered around pixel values 127 & 128. In other words, it is offset in one direction or the other. If it is offset above 128, it is too bright. If it is offset below 127, it is too dark. The medium light value of an image should be at or near pixel values 127 & 128.



Contrast & brightness settings Since the Imagenation PXC200AL & PXC200AF both have settings for adjusting the contrast and brightness of an acquired image, it is possible to design an algorithm to make adjustments automatically. Contrast and brightness are discussed in the Imagenation PXC200A Color Frame Grabber User's Guide on pages 49 and 50. The API calls for *GetContrast()* and *SetContrast()* are on pages 83 & 98 respectively, and the API calls for *GetBrightness()* and *SetBrightness()* are on pages 82 & 96 respectively.

Algorithm description The algorithm, which is fully explained by comments in the source code, first centers the brightness around pixel values 127 & 128 then adjusts the contrast to use all of the pixel values that the PXC200A is capable of producing*. The algorithm is iterative and requires several images-minimally four to six. Centering the brightness requires a minimum of two to three images-usually more, because the algorithm checks for clipping at the upper and lower boundaries, changes the brightness setting, and then checks on the next image acquisition. Adjusting the contrast requires a minimum of one or two successive images.

Algorithm usage This algorithm is intended for use during setup or periodic adjustment. Obviously, it cannot be used continuously since it requires a minimum of four to six images and usually more. As a setup algorithm, it can be run in a few seconds at the beginning of the day or the beginning of a line change. As a periodic adjustment, it can be run on a fixed period—once per hour—or it can be initiated manually by a mouse click.

Additional details Please consult the source code for more details. This algorithm is at the end of the source code file: “PXC_AutoGain.C” and is contained in the two functions: *AutoGain()* and *CheckGain()*. Please feel free to copy this algorithm and paste it into your application.

****Note*** The PXC200A only produces gray scale values from about 15 to about 245 depending on the camera.

Telephone Service

Toll Free:	800-366-9131
Phone:	503-495-2200
Fax:	503-495-2201

Online Service

Email:	CSsupport@cyberoptics.com
Web:	http://www.imagenation.com

CyberOptics Semiconductor
13555 SW Millikan Way
Beaverton, OR 97005