

## Detecting Pixel Defects

A new software method detects pixel defects in all types of digital imagers (e.g. cameras, X-ray detector arrays, and infrared imagers). The algorithm uses any sequence of pictures taken under normal operation in the field. The statistical procedure analyzes these pictures to identify faulty pixels. It finds both simple stuck black or white defects, low or high sensitivity pixels, and works in the presence of pixel noise. This new method can be directly applied by a camera's internal circuits or can be used to post-process already collected pictures. Tests prove that it rapidly finds all dead pixels, even at extremely high defect levels, yet does not misidentify any working pixels as defective.

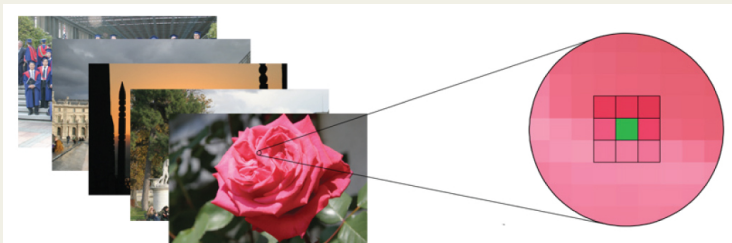


Figure 1. Camera Defective Pixels are identified using a series of pictures by the errors they create

### The Problem

Pixel failures while operating in the field have become more noticeable as digital camera use has become more widespread. Faults in digital imagers (Charge Coupled Devices (CCD) or Active Pixel Sensors (APS)) are increasing as imager areas and pixel counts grow while pixel size shrinks. Pixel defects create light or dark spots in pictures, which are very noticeable. As digital cameras age, like all microelectronics, they start to produce failures, which for imagers are not fatal, but result in dead pixels appearing over time. Since the sensor is never changed this is one of the disadvantages of digital cameras over film cameras where the film is always new. Picture defects really stand out to the human eye. Identifying and correcting for pixel faults is crucial to improve the yield (during fabrication) and reliability (during operation) of digital imagers.

### The Need

With expensive digital SLR cameras costing over \$1000, owners do not want to replace a camera just because several pixels are dead, but will find their presence in every picture highly disturbing. For commercial digital systems, such as Infrared security cameras and medical X-ray digital imagers, defects are far more common and distort vital data. Users of these expensive high-end cameras, or costly commercial imagers, are very focused on image quality, so a system or software that extends high quality imager lifetime for real-time operation will gain market interest.

### The Alternative

The only current option for system owners is using hardware methods to recalibrate the sensor. This usually involves taking pictures of uniformly illuminated areas generally called light field (fully white) and dark field (fully black) images. The problem is that those calibrations require specialized setups which often forces users to send the camera or imager back to the factory or test labs, which is often not possible.

Existing software defect detection methods using images from the field fail to find all defects. Worse, they tend to create many false positives: pixels that are working which are misidentified as bad. Adding these false positives degrade images, as the interpolation method used to correct defects always produces error in the pixel value compared to the working pixel measurement.

### The Benefits

The patent pending SFU software to detect pixel defects eliminates the need for hardware recalibration of imagers. The algorithms identify all defect pixels very rapidly, usually in less than 20 pictures, without creating any false positives. It is no more computationally intensive than current common camera image processes. Using the real-time detection of picture defects extends expensive camera/imager lifetime offering real advantages to users. Software aimed at post processing image correction allows this algorithm to be applied to cameras already in the field without modifying their internal systems.



Figure 2. : Problems created by different types of pixel defects.

### Partnering Opportunity

Seeking partners to implement pixel defect detection technology with particular interest in:

- Camera manufactures
- X-ray or infrared digital imager manufacturers
- Image processing software developers.

### Contact

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