Pseudocolor. Pseudocolor display is a technique that maps each of the gray levels of a gray scale image into an assigned color[25]. As such, the pseudocolor operation can be viewed as a point, or pixelwise, operator as discussed above. The resultant colored image can make the identification of certain features easier for the observer. The mappings are computationally simple and fast. This makes pseudocolor an attractive technique for use on digital image processing systems that are designed to be used interactively. Furthermore, most commercially available image processing and display systems incorporate the necessary mapping registers and associated hardware (including color display capability) for pseudocolor implementations. Various color maps can give contrast enhancement effects, contouring effects, or gray-level mapping (depicting areas of a prescribed gray-level value). Pseudocolor schemes can also be designed to preserve or remove intensity information.

The relative success or failure of a particular pseudocolor scheme will depend on the nature of the image. One property that has a very noticeable effect is the noise in the image. Natural images such as digitized photographs of people, buildings, etc., tend to have variations of several gray levels in adjacent picture elements although the intensity may appear fairly uniform. The human visual system can filter out the high-frequency noise fairly well when the intensity is affected. However, when the intensity noise is converted to colors by a pseudocoloring operation, the image can be difficult, if not impossible, to see.

The effect of noise on pseudocolor schemes that change colors at high rates (such as a random color assignment) is severe. The eye will combine the many different colors in a small area into an intermediate color determined by color mixture laws. If these colors are not ordered in some fashion, it will be difficult to perceive features of interest in the image.

Change Detection via Pointwise Operators. A straightforward pointwise operator which can be extremely powerful in appropriate applications is that of image subtraction. The subtraction of similar images is particularly applicable to the general class of image processing problems called "change detection." In change detection, the objective is to identify differences between two variations of the same scene. Examples include detection of defects in LSI circuit masks (by comparing a test mask image with a master mask known to be good) and satellite monitoring of the movement of military equipment.

A major problem with change detection algorithms is that there may be large variations between the scenes being compared that are of no interest. For example, in the satellite monitoring of military equipment, variations in cloud cover, sensor performance, or scene illumination can make it virtually impossible to apply change detection in a meaningful way. Even in more well-controlled applications such as the comparison of circuit masks, a slight misregistration of the two images can cause severe problems for a change detection scheme.