and each of the two captured digital images are obtained. The corresponding pixels are the pixels that are sensed from substantially the same physical location on the substrate. The maxima is the highest pixel intensity of the pixel pairs and the minima is the smallest intensity. When red, green and blue signals are captured there would be pixel values for each color channel. In steps **204** and **206**, data-processing system **18** finds the maximum and minimum amplitude intensity for the pixel pairs. By obtaining the maxima and the minima, it is possible to obtain density plots of the maximum and minimum. These density plots are illustrated in FIGS. **8***a* and **8***b*.

FIG. **8***a* illustrates the maximum pixel intensity for each pixel and FIG. **8***b* illustrates the minimum pixel intensity for each pixel. In step **208**, the difference between the maximum and minimum is obtained. By obtaining this difference, it is possible to obtain a density plot of the difference between a maximum and a minimum. Such a density plot is illustrated in FIG. **8***c*. As is apparent from FIG. **8***c,* the difference between the minimum and the maximum is a center region **250** having a small difference value which corresponds to the center region of the defect, which on either side of the center region will be a very large difference value. The large value difference exists due to the fact that light from each side of the pixel will cast a shadow in the opposite direction and therefore the difference between the maximum and the minimum on the opposite side of the defects will be large. Note that the operations of steps **204**, **206** and **208** can be implemented in a variety of different manners of those skilled in the art. As will be apparent to one of ordinary skill in the art, the maximum of the two pixels minus the minimum of the two pixels is equivalent to the absolute value of one pixel minus the other.

In step **210**, the differences of each pixel are used to create a defect map in which adjacent pixels, each indicative of a defect at the pixel level, are combined. This forms a region of pixels corresponding to a single defect. As can be seen in the difference between the density plots of FIGS. **8***c* and **8***d,* clusters of pixels will be operated upon, such that the maximum pixel difference value in the cluster will be assigned to all the pixels in the cluster, so long as the pixel values do not exceed a lower threshold value **816** such as an amplitude of 35. The lowest threshold value is used to indicate that if a pixel has a value below that threshold it does not contain a defect. The lower threshold value is empirically determined. Using this regional maximum tends to linearize portions of the density plot, which can be seen in FIG. **8***d,* and also aids in establishing more accurate borders **254** of the defect. For example, the first three pixels in FIG. **8***c* have different amplitude values. By considering these pixels to be part of the same cluster, we assign them the same value. This can be seen by examining the first three pixels of **8***d*. These pixels now have the same intensity value. This allows for differences in amplitudes to be determined more distinctly and therefore leads to a more accurate determination of borders.

In determining the defect map, the present invention also applies an upper threshold value **252** to the difference data to obtain a mask of the areas that correspond to a defect. Thus, all pixel locations have a difference value that is greater than the upper threshold value **252**, which in this example is 75, will be considered to contain a pure defect and can be fully corrected as described below.

The area between the thresholds, considered to contain a partial defect, will be partially corrected, to avoid hard edges, as described below. While the upper threshold value, with an amplitude of 75, and the lower threshold value, with an amplitude of 35, have been found useful, other values can be used. It should be noted, therefore, that the defect map contains information not only to the presence or absence of defects, but also to the degree to which a defect exists. This helps, as will be appreciated by those of ordinary skill in the art, in blending together regions that do not contain a defect with adjacent regions that do contain a defect. While FIGS. **6***a,* **6***b,* **8***a,* **8***b,* **8***c* and **8***d* illustrate the use of density plots to locate defects, other graphical representations could also be used to analyze the data.

In addition to the line scanner **16** shown in FIG. **1**, numerous other image-capturing devices and/or device configurations can also be used in accordance with particular applications and source media for the present invention. For example, such alternatives can comprise drum-type document scanners, film scanners, page scanners, integrated circuit printers, film-developing systems, and other types of image-capturing devices. Such devices might further utilize a wide variety of sensors, sensor components, and sources of electromagnetic radiation, and other components, as is appropriate to a particular application. Many other image-processing alternatives can also be utilized.

For example, FIG. **9** illustrates an embodiment with similar components to those in FIG. **1**, but that captures data from a substrate that is transparent or semitransparent document (such as film **23** or an overhead projection slide) using a transmissive scanner **12**. In this embodiment, the light sources are on one side of the substrate and the sensing device is on the other side of the substrate. The sensing device will detect light from the light sources after interacting with the medium.

Those skilled in the art will also appreciate that alternative scan-cycle configurations can be utilized with line scanner **16** (FIG. **1**), as well as with other image-capturing devices. For example, where only two light sources have been discussed previously, more than two light sources can be used to produce multiple datasets that might be useful in identifying defects.

Another example is that scanning can be conducted using "multiple-pass" scanning techniques, i.e., wherein relative positioning corresponds to movement over at least a portion of a source image more than once. Multiple-pass scanning can also be conducted uni-directionally (i.e., where capturing occurs in conjunction with movement in only one direction) or multi-directionally (i.e., where capturing occurs in conjunction with movement in more than one direction). However, image capturing provides at least two image datasets, corresponding to illumination from at least two separately illuminated light sources.

A number of other types of light sources can also be utilized in accordance with a particular application of the present invention, such as light emitting diodes (LEDs), multiple separate light sources, and arrayed light sources. Lights of different wavelengths besides fluorescent, such as infrared (IR), near infrared (NIR), and ultraviolet (UV), can be used. Different wavelengths can be used for each separate light source.

For example, if the substrate is scanned using a light having a wavelength in a part of the spectrum that reflects very little light off a substrate, the present invention tends to distinguish defects where there are specular highlights. If the substrate is scanned using light having a wavelength where the substrate is highly reflective, the present invention tends to distinguish defects by shadows. If the substrate is red, for example, a light source using red light will distinguish shadows, whereas a light source using green light will