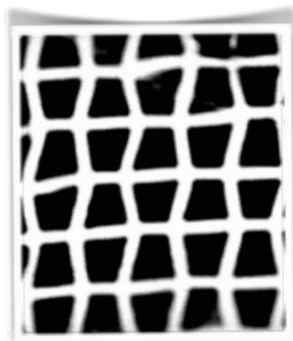
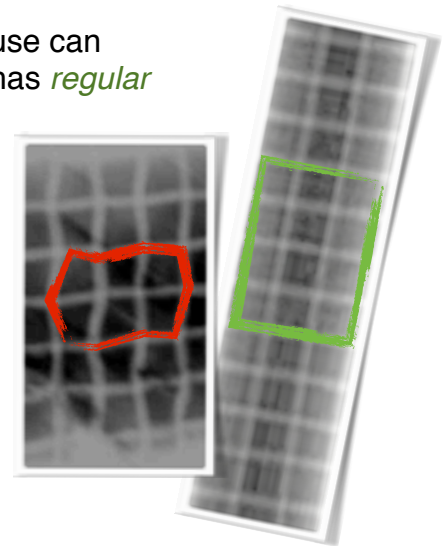


Stressing Silicon

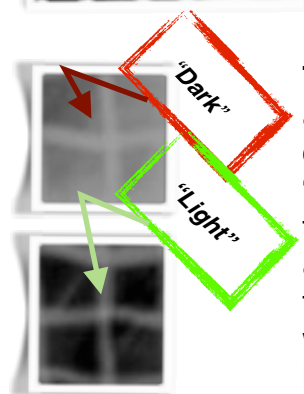
Silicon stress from manufacturing and use can damage electronics. Unstressed silicon has *regular cells as outlined in green*.

However under stress a silicon wafer's regular grid of cells becomes *distorted as outlined in red*.

The material sciences department at Stony Brook wanted to understand how stress was induced and to identify the typical patterns of stress so they needed a way of rapidly analyzing and mapping the distortions to a wafer depicted in a photograph.



I first needed a way to determine if some point in the image was in a cell or a gap. Once I knew what points were in a cell, I could find the outline of the cells and could proceed to identify the shape of the cell. So, to find if a point was in a cell or not I increased the contrast: made dark parts of the image black, and light parts white. For example, in the figure on the left, I can easily test if a point is in a cell by seeing if it is **black**.



The problem was that as shown in the figure on the left, what is "dark" in one part of the image is "light" in another. A simple threshold rule for what is dark and light is not sufficient.

Original



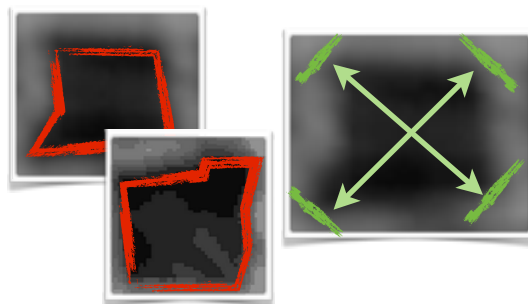
Assimilated



I devised a method that worked regardless of the changing ambient intensity throughout the image. I changed a point of color to black or *assimilated* it if its *change in color* from the previous point of color was sufficiently low. In the figure above we see chains of points of similar color all change to black or white based on their neighbors.

Corner detection was not a snap.

The figures to the right show that simply drawing an outline around the black cells renders objects with more than four sides. I developed a method that avoids this. I created a diamond at the center of each cell which expanded outward until it reached the last dark point in the cell, marking this as one of the four corners.



I also matched the warped and unwarped cells between images. I did it by matching the top and bottom corners as I processed each cell, telling me how many rows and columns there were. Once I knew the row and column of a cell, I could match it. The figure below shows my final tool's interactive display. I contracted to do this work as a sophomore in 2007. Stress recognition was an exploration of visual recognition, and how to work with a customer to develop a product designed to suit their specific needs. I checked in a couple years ago and they are still using it.

