Image Based Detectability Criteria: Building a 1D and 2D Detectability Model

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With the increasingly broader use of raster scans and sensor arrays, a need for 1D and 2D detectability models is emerging. When a measurements process has more than one point measurement to obtain signals from the scan, the minimum signal to noise ratio decreases for which a detectably signal can be reliably discerned. Further the effects of defect morphology and orientation become more apparent. For irregularly shaped defects orientation changes can significantly alter the magnitude of that signal. The pattern of a defect signal as measured in a raster scan or area scan also has an impact on the detectability in that defects signals are clustered in a neighborhood. The combination of the clustering and the multiple measurement opportunities afforded by 1D and 2D data set require an extension to the detectability criteria used.

We have developed a binomial hypothesis test together with a spatial correlation criterion to produce a general detectability method for 1D or 2D data – it can also be extended to volumetric data. The hypothesis test is based on the idea that the odds of a cluster of pixels having similar values different from the mean at the same time are low. The probability of that signal being a noise fluctuation decreases as a function of the magnitude and the total number of pixels. Some preliminary data showing this detectability model is shown on both real data and simulated data.