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Quality control assessment of silicon detector construction using deep learning

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The wire-bond between the silicon sensor and the circuit board is the primary mode to collect the signal in many silicon detectors. Hence, the clean and unbroken bond is one of the vital demands in the silicon module during construction. Each of these bond holes needs to be inspected at least three times during the assembly i.e., before and after wire-bonding, and after encapsulation. Depending on the size of the detector, the number of holes to be quality checked are on the order of million. The small dimension of the bond holes and the thickness of the wires pose an additional challenge in quality control. As manually checking each hole would be cumbersome and prone to human errors, we have been exploring and testing deep learning based computer vision to automate this quality control (QC). In particular, the image classification technique with the convolutional neural networks to identify the quality of the bond hole. We present the case study of using image classification with CNN for quality control of the construction steps of the silicon detector. In addition, the implementation of the transfer learning and image segmentation techniques will be discussed.

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