

## SEMICONDUCTOR MANUFACTURING

**Deep learning spots the defect***IEEE Trans. Semicond. Manuf.*<https://doi.org/10.1109/TSM.2018.2795466> (2018)

Wafer maps are used to identify processing issues in the manufacturing of semiconductor wafers. Identifying and classifying the precise type of defect mode on the wafer can help engineers determine the origin of these defects. The fabrication process can then be adjusted according to the nature of the defect, leading to improved manufacturing yield. Takeshi Nakazawa and Deepak Kulkarni from the Intel Corporation have now developed an approach to classify and identify defects in wafer maps using convolutional neural networks. Their method has an overall classification accuracy of 98.2% for a test dataset of 6,600 wafer maps.

The researchers trained their convolutional neural networks to recognize 22 classes of defect using data based on 28,600 simulated wafer maps. By using wafer maps based on synthetic data, rather than real data, their convolutional neural network is able to identify rare defect patterns. Beyond individual defect classification, their approach can also match whole wafers to existing defected wafers from a library of 18,000 maps, a functionality commonly known as image retrieval. Nakazawa and Kulkarni evaluated the performance of their trained convolutional neural network using data from 1,191 real wafers, the retrieval error rate was 3.7% and image retrieval took 0.13 seconds per wafer map.

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Published online: 9 March 2018

<https://doi.org/10.1038/s41928-018-0050-z>