

WHAT IS CLAIMED IS:

1. A method, comprising:
 - obtaining optical-inspection results for one or more semiconductor wafers;
 - based on the optical-inspection results, identifying a plurality of defects on the one or more semiconductor wafers;
 - classifying defects, of the plurality of defects, that have identical die locations on multiple die of the one or more semiconductor wafers as repeater defects;
 - based on the optical-inspection results, using unsupervised machine learning to cluster the repeater defects into a plurality of clusters;
 - scoring the repeater defects, comprising assigning respective scores to respective repeater defects based on degrees to which clusters in the plurality of clusters include multiple instances of the respective repeater defects; and
 - ranking the repeater defects based on the respective scores.
2. The method of claim 1, further comprising:
 - selecting repeater defects having respective scores that satisfy a threshold; and
 - generating a report specifying the selected repeater defects.
3. The method of claim 1, wherein the classifying comprises classifying defects, of the plurality of defects, that have identical reticle-level locations on the one or more semiconductor wafers as the repeater defects.
4. The method of claim 1, wherein each score corresponds to a maximum percentage of instances of a respective repeater defect in a cluster of the plurality of clusters.
5. The method of claim 1, wherein each score corresponds to a mean of non-zero percentages of instances of a respective repeater defect in the plurality of clusters.
6. The method of claim 1, further comprising extracting defect attributes for the repeater defects from the optical-inspection results, wherein the unsupervised machine learning uses the defect attributes.

7. The method of claim 6, wherein the defect attributes comprise defect attributes selected from the group consisting of size, die location, wafer location, and optical intensity.
8. The method of claim 1, wherein:
the optical-inspection results comprise target images of die on the one or more semiconductor wafers and difference images of the die on the one or more semiconductor wafers, each difference image being a difference between a respective target image and a reference image;
the identifying comprises identifying the plurality of defects in the difference images; and
using the unsupervised machine learning to cluster the repeater defects comprises providing the target images to an unsupervised machine-learning algorithm.
9. The method of claim 1, wherein using the unsupervised machine learning to cluster the repeater defects is performed using an unsupervised machine-learning algorithm that does not specify a predefined number of clusters.
10. A non-transitory computer-readable storage medium storing one or more programs for execution by one or more processors, the one or more programs including instructions for:
obtaining optical-inspection results for one or more semiconductor wafers;
based on the optical-inspection results, identifying a plurality of defects on the one or more semiconductor wafers;
classifying defects, of the plurality of defects, that have identical die locations on multiple die of the one or more semiconductor wafers as repeater defects;
based on the optical-inspection results, using unsupervised machine learning to cluster the repeater defects into a plurality of clusters;
scoring the repeater defects, comprising assigning respective scores to respective repeater defects based on degrees to which clusters in the plurality of clusters include multiple instances of the respective repeater defects; and
ranking the repeater defects based on the respective scores.
11. The computer-readable storage medium of claim 10, the one or more programs further comprising instructions for:
selecting repeater defects having respective scores that satisfy a threshold; and

generating a report specifying the selected repeater defects.

12. The computer-readable storage medium of claim 10, wherein the instructions for classifying comprise instructions for classifying defects, of the plurality of defects, that have identical reticle-level locations on the one or more semiconductor wafers as the repeater defects.
13. The computer-readable storage medium of claim 10, wherein each score corresponds to a maximum percentage of instances of a respective repeater defect in a cluster of the plurality of clusters.
14. The computer-readable storage medium of claim 10, wherein each score corresponds to a mean of non-zero percentages of instances of a respective repeater defect in the plurality of clusters.
15. The computer-readable storage medium of claim 10, the one or more programs further comprising instructions for extracting defect attributes for the repeater defects from the optical-inspection results, wherein the instructions for using the unsupervised machine learning comprise instructions for clustering the repeater defects using the defect attributes.
16. The computer-readable storage medium of claim 15, wherein the defect attributes comprise defect attributes selected from the group consisting of size, die location, wafer location, and optical intensity.
17. The computer-readable storage medium of claim 10, wherein:
 - the optical-inspection results comprise target images of die on the one or more semiconductor wafers and difference images of the die on the one or more semiconductor wafers, each difference image being a difference between a respective target image and a reference image;
 - the instructions for identifying comprise instructions for identifying the plurality of defects in the difference images; and
 - the instructions for using the unsupervised machine learning to cluster the repeater defects comprise instructions for providing the target images to an unsupervised machine-learning algorithm.

18. The computer-readable storage medium of claim 10, wherein the instructions for using the unsupervised machine learning to cluster the repeater defects comprise instructions for using an unsupervised machine-learning algorithm that does not specify a predefined number of clusters.
19. A system, comprising:
an optical inspection tool;
one or more processors; and
memory storing one or more programs for execution by the one or more processors, the one or more programs comprising instructions for:
obtaining optical-inspection results for one or more semiconductor wafers from the optical inspection tool;
based on the optical-inspection results, identifying a plurality of defects on the one or more semiconductor wafers;
classifying defects, of the plurality of defects, that have identical die locations on multiple die of the one or more semiconductor wafers as repeater defects;
based on the optical-inspection results, using unsupervised machine learning to cluster the repeater defects into a plurality of clusters;
scoring the repeater defects, comprising assigning respective scores to respective repeater defects based on degrees to which clusters in the plurality of clusters include multiple instances of the respective repeater defects; and
ranking the repeater defects based on the respective scores.
20. The system of claim 19, the one or more programs further comprising instructions for:
selecting repeater defects having respective scores that satisfy a threshold; and
generating a report specifying the selected repeater defects.
21. The system of claim 19, wherein the instructions for classifying comprise instructions for classifying defects, of the plurality of defects, that have identical reticle-level locations on the one or more semiconductor wafers as the repeater defects.
22. The system of claim 19, wherein each score corresponds to a maximum percentage of instances of a respective repeater defect in a cluster of the plurality of clusters.

23. The system of claim 19, wherein each score corresponds to a mean of non-zero percentages of instances of a respective repeater defect in the plurality of clusters.
24. The system of claim 19, the one or more programs further comprising instructions for extracting defect attributes for the repeater defects from the optical-inspection results, wherein the instructions for using the unsupervised machine learning comprise instructions for clustering the repeater defects using the defect attributes.
25. The system of claim 24, wherein the defect attributes comprise defect attributes selected from the group consisting of size, die location, wafer location, and optical intensity.
26. The system of claim 19, wherein:
the optical-inspection results comprise target images of die on the one or more semiconductor wafers and difference images of the die on the one or more semiconductor wafers, each difference image being a difference between a respective target image and a reference image;
the instructions for identifying comprise instructions for identifying the plurality of defects in the difference images; and
the instructions for using the unsupervised machine learning to cluster the repeater defects comprise instructions for providing the target images to an unsupervised machine-learning algorithm.
27. The system of claim 19, wherein the instructions for using the unsupervised machine learning to cluster the repeater defects comprise instructions for using an unsupervised machine-learning algorithm that does not specify a predefined number of clusters.