What is claimed is:

1. A method comprising:
receiving, a wafer map at a processor, wherein the wafer map is for a surface of an entire wafer, wherein the processor is configured to run a machine learning based model for classifying the wafer map; and
classifying the wafer map using the machine learning based model and a signature on the wafer map, wherein the machine learning based model uses transfer learning.

2. The method of claim 1, further comprising determining a confidence level for the classifying, wherein the confidence level is based on criticality of a defect in the signature.

3. The method of claim 1, further comprising sending an alert if the signature is outside of a confidence level.

4. The method of claim 1, further comprising:
receiving a plurality of sample wafer maps at the processor;
classifying the sample wafer maps based on a root cause of a defect using the processor; and
generating a library of sample signatures from the sample wafer maps using the processor.

5. The method of claim 4, further comprising:
extracting images from a plurality of defect maps, bin sort maps, and/or metrology maps using the processor; and
augmenting the images using the processor.

6. The method of claim 5, further comprising training the machine learning based model using extracted features from the images.

7. The method of claim 1, further comprising grouping the wafer map with wafer maps having a same classification.

8. A system comprising:
a semiconductor wafer inspection system; and

a processor in electronic communication with the semiconductor wafer inspection system,

wherein the processor is configured to:

receive a wafer map, wherein the wafer map is for a surface of an entire wafer, wherein the processor is configured to run a machine learning based model for classifying the wafer map; and

classify the wafer map using the machine learning based model and a signature on the wafer map, wherein the machine learning based model uses transfer learning.

9. The system of claim 8, wherein the semiconductor wafer inspection system includes a light source or an electron beam source.

10. The system of claim 8, wherein the semiconductor wafer inspection system generates the wafer map.

11. The system of claim 8, wherein the processor is further configured to determine a confidence level for the classifying, wherein the confidence level is based on criticality of a defect in the signature.

12. The system of claim 8, wherein the processor is further configured to send an alert if the signature is outside of a confidence level.

13. The system of claim 8, wherein the processor is further configured to:

receive a plurality of sample wafer maps;

classify the sample wafer maps based on a root cause of a defect; and

generate a library of sample signatures from the sample wafer maps.

14. The system of claim 13, wherein the processor is further configured to:

extract images from a plurality of defect maps, bin sort maps, and/or metrology maps; and

augment the images.

15. The system of claim 14, wherein the processor is further configured to train the machine learning based model using extracted features from the images.

16. The system of claim 8, wherein the processor is further configured to group the wafer map with wafer maps having a same classification.

17. A non-transitory computer-readable storage medium, comprising one or more programs for executing the following steps on one or more computing devices:

classify a wafer map using a machine learning based model and a signature on the wafer map, wherein the machine learning based model uses transfer learning, and wherein the wafer map is for a surface of an entire wafer.

18. The non-transitory computer-readable storage medium of claim 17, wherein the steps further include:

receiving a plurality of sample wafer maps;

classifying the sample wafer maps based on a root cause of a defect; and

generating a library of sample signatures from the sample wafer maps.

19. The non-transitory computer-readable storage medium of claim 18, wherein the steps further include:

extracting images from a plurality of defect maps, bin sort maps, and/or metrology maps; and augmenting the images.

20. The non-transitory computer-readable storage medium of claim 19, wherein the steps further include training the machine learning based model using extracted features from the images.