

CLAIMS

1. A method comprising:

creating a reference fingerprint for a first semiconductor processing tool running a recipe using reference data pertaining to the first semiconductor processing tool performing within parameters associated with running the recipe and a plurality of nearest neighbor values determined from the reference data, the reference fingerprint comprising a target baseline and a plurality of allowable ranges based on the target baseline;

determining whether sample data associated with a second semiconductor processing tool running the recipe is within the reference fingerprint by calculating a distance between a portion of the sample data and a corresponding portion of the target baseline of the reference fingerprint, the second semiconductor processing tool being the first semiconductor processing tool or another semiconductor processing tool of a same type as the first semiconductor processing tool, and the sample data corresponding to data from a plurality of sensors of the second semiconductor processing tool running the recipe;

providing a classification of the second semiconductor processing tool to at least one of a system or a user based on the calculated distance and the plurality of allowable ranges based on the target baseline, the classification indicating whether the second semiconductor processing tool is performing within the reference fingerprint;

responsive to the classification indicating that the second semiconductor processing tool is not performing within the reference fingerprint, identifying a sensor from the plurality of sensors of the second semiconductor processing tool contributing to a deviation of the calculated distance from the plurality of allowable ranges and a process step of the second semiconductor processing tool running the recipe when the identified sensor contributes to the deviation; and

using the classification and the identification of the sensor to provide maintenance for the second semiconductor processing tool.

2. The method of claim 1, further comprising:
 - identifying one or more deviations between the sample data and the reference fingerprint;
 - determining that the second semiconductor processing tool is not performing within the parameters based on the one or more deviations; and
 - providing additional data to identify a cause of the second semiconductor processing tool not performing within the parameters.
3. The method of claim 2, wherein the additional data comprises contribution data describing contribution of the plurality of sensors of the second semiconductor processing tool.
4. The method of claim 1, wherein the classification is normal when the sample data is within the reference fingerprint and the classification is abnormal when the sample data is not within the reference fingerprint.
5. The method of claim 1, wherein creating the reference fingerprint comprises:
 - creating a vector of the plurality of nearest neighbor values using the reference data, wherein the vector indicates performance of a plurality of sensors for the first semiconductor processing tool for the recipe;
 - determining a target value from the vector, wherein the target value represents an expected performance of the plurality of sensors;
 - determining the allowable ranges for the expected performance of the plurality of sensors based on the target value; and
 - defining the reference fingerprint as the target value and the plurality allowable ranges.
6. The method of claim 5, wherein determining the target value comprises:
 - determining a mean of the plurality of nearest neighbor values in the vector.

7. The method of claim 5, wherein determining the allowable ranges comprises:
determining one or more standard deviations from the target value.
8. A system comprising:
a memory; and
a processing device, coupled with the memory, to:
create a reference fingerprint for a first semiconductor processing tool
running a recipe using reference data pertaining to the first semiconductor
processing tool performing within parameters associated with running the recipe
and a plurality of nearest neighbor values determined from the reference data, the
reference fingerprint comprising a target baseline and a plurality of allowable
ranges based on the target baseline;
determine whether sample data associated with a second semiconductor
processing tool running the recipe is within the reference fingerprint by
calculating a distance between a portion of the sample data and a corresponding
portion of the target baseline of the reference fingerprint, the second
semiconductor processing tool being the first semiconductor processing tool or
another semiconductor processing tool of a same type as the first semiconductor
processing tool, and the sample data corresponding to data from a plurality of
sensors of the second semiconductor processing tool running the recipe;
provide a classification of the second semiconductor processing
tool to at least one of a system or a user based on the calculated distance
and the plurality of allowable ranges based on the target baseline, the
classification indicating whether the second semiconductor processing tool
is performing within the reference fingerprint;
responsive to the classification indicating that the second semiconductor
processing tool is not performing within the reference fingerprint, identify a
sensor from the plurality of sensors of the second semiconductor processing tool
contributing to a deviation of the calculated distance from the plurality of
allowable ranges and a process step of the second semiconductor processing tool
running the recipe when the identified sensor contributes to the deviation; and

use the classification and the identification of the sensor to provide maintenance for the second semiconductor processing tool.

9. The system of claim 8, wherein the processing device is further to:
 - identify one or more deviations between the sample data and the reference fingerprint;
 - determine that the second semiconductor processing tool is not performing within the parameters based on the one or more deviations; and
 - provide additional data to identify a cause of the second semiconductor processing tool not performing within the parameters, wherein the additional data comprises contribution data describing contribution of the plurality of sensors of the second semiconductor processing tool.
10. The system of claim 8, wherein the classification is normal when the sample data is within the reference fingerprint and the classification is abnormal when the sample data is not within the reference fingerprint.
11. The system of claim 8, wherein to create the reference fingerprint comprises the processing device to:
 - create a vector of the plurality of nearest neighbor values using the reference data, wherein the vector indicates performance of a plurality of sensors for the first semiconductor processing tool for the recipe;
 - determine a target value from the vector, wherein the target value represents an expected performance of the plurality of sensors;
 - determine the allowable ranges for the expected performance of the plurality of sensors based on the target value; and
 - define the reference fingerprint as the target value and the allowable ranges.

12. The system of claim 11, wherein to determine the target value comprises the processing device to:

determine a mean of the plurality of nearest neighbor values in the vector.

13. The system of claim 11, wherein to determine the allowable ranges comprises the processing device to:

determine one or more standard deviations from the target value.

14. A non-transitory computer readable storage medium including instructions that, when executed by a processing device, cause the processing device to perform operations comprising:

creating, by the processing device, a reference fingerprint for a first semiconductor processing tool running a recipe using reference data pertaining to the first semiconductor processing tool performing within parameters associated with running the recipe and a plurality of nearest neighbor values determined from the reference data, the reference fingerprint comprising a target baseline and a plurality of allowable ranges based on the target baseline;

determining whether sample data associated with a second semiconductor processing tool running the recipe is within the reference fingerprint by calculating a distance between a portion of the sample data and a corresponding portion of the target baseline of the reference fingerprint, the second semiconductor processing tool being the first semiconductor processing tool or another semiconductor processing tool of a same type as the first semiconductor processing tool, and the sample data corresponding to data from a plurality of sensors of the second semiconductor processing tool running the recipe;

providing a classification of the second semiconductor processing tool to at least one of a system or a user based on calculated distance and the plurality of allowable ranges based on the target baseline, the classification indicating whether the second semiconductor processing tool is performing within the reference fingerprint;

responsive to the classification indicating that the second semiconductor processing tool is not performing within the reference fingerprint, identifying a sensor

from the plurality of sensors of the second semiconductor processing tool contributing to a deviation of the calculated distance from the plurality of allowable ranges and a process step of the second semiconductor processing tool running the recipe when the identified sensor contributes to the deviation; and

using the classification and the identification of the sensor to provide maintenance for the second semiconductor processing tool.

15. The non-transitory computer readable storage medium of claim 14, the operations further comprising:

identifying one or more deviations between the sample data and the reference fingerprint;

determining that the second semiconductor processing tool is not performing within the parameters based on the one or more deviations; and

providing additional data to identify a cause of the second semiconductor processing tool not performing within the parameters.

16. The non-transitory computer readable storage medium of claim 15, wherein the additional data comprises contribution data describing contribution of the plurality of sensors of the second semiconductor processing tool.

17. The non-transitory computer readable storage medium of claim 14, wherein the classification is normal when the sample data is within the reference fingerprint and the classification is abnormal when the sample data is not within the reference fingerprint.

18. The non-transitory computer readable storage medium of claim 14, wherein creating the reference fingerprint comprises:

creating a vector of the plurality of nearest neighbor values using the reference data, wherein the vector indicates performance of a plurality of sensors for the first semiconductor processing tool for the recipe;

determining a target value from the vector, wherein the target value represents an expected performance of the plurality of sensors;

determining the allowable ranges for the expected performance of the plurality of sensors based on the target value; and

defining the reference fingerprint as the target value and the one or more allowable ranges.

19. The non-transitory computer readable storage medium of claim 18, wherein determining the target value comprises:

determining a mean of the plurality of nearest neighbor values in the vector.

20. The non-transitory computer readable storage medium of claim 18, wherein determining the allowable ranges comprises:

determining one or more standard deviations from the target value.