

CLAIMS

What is claimed is:

1. A method for determining an operating state of a photovoltaic array, comprising:
acquiring present output current values of photovoltaic strings comprised in the
5 photovoltaic array, wherein the photovoltaic array comprises at least two photovoltaic strings
in parallel;
determining a target abnormality score predicting model based on the present output
current values, wherein different abnormality score predicting models correspond to different
characteristic current value ranges, and the abnormality score predicting model is obtained by
10 training based on a historical output current value of the photovoltaic array;
determining a present abnormality score corresponding to the photovoltaic array by
inputting the present output current values into the target abnormality score predicting model;
and
determining the operating state of the photovoltaic array by comparing the present
15 abnormality score with a target abnormality score, wherein different abnormality score
predicting models correspond to different abnormality scores, and the abnormality score is
obtained after inputting the historical output current value into the abnormality score
predicting model.
- 20 2. The method according to claim 1, wherein determining the operating state of the
photovoltaic array by comparing the present abnormality score with the target abnormality
score comprises:
determining that the operating state of the photovoltaic array is normal in response to the
present abnormality score being less than or equal to the target abnormality score;
25 acquiring present abnormality scores corresponding to N continuous sampling moments
in response to the present abnormality score being greater than the target abnormality score,
wherein N is an integer greater than or equal to 1; and
determining that the operating state of the photovoltaic array is abnormal in response to

present abnormality scores corresponding to at least M continuous sampling moments being greater than the target abnormality score, wherein M is an integer greater than or equal to 1, and M is less than or equal to N.

5 3. The method according to claim 2, wherein after determining that the operating state of the photovoltaic array is abnormal, the method further comprises:

 determining a minimum output current value of the present output current values corresponding to the M continuous sampling moments; and

 determining a photovoltaic string corresponding to the minimum output current value as
10 an abnormal photovoltaic string.

 4. The method according to any one of claims 1 to 3, wherein determining the target abnormality score predicting model based on the present output current values comprises:

 obtaining filtered present output current values by filtering the present output current
15 values based on a current threshold, wherein the current threshold is determined based on historical operating state data of the photovoltaic array, the historical operating state data comprising a historical output current value of the photovoltaic string, a historical irradiance corresponding to the photovoltaic string, a historical ambient temperature and a historical wind speed of environment where the photovoltaic string is located, and the filtered present
20 output current values are less than or equal to the current threshold;

 determining a K percentile in the filtered present output current values as a present characteristic current value, wherein K is an integer greater than or equal to 50, and the present characteristic current value characterizes present current characteristics corresponding to the photovoltaic array at a present acquisition moment; and

25 determining the target abnormality score predicting model based on the present characteristic current value, wherein the present characteristic current value is within a target characteristic current value range corresponding to the target abnormality score predicting model.

30 5. The method according to claim 4, wherein before acquiring the present output current

values of the photovoltaic strings comprised in the photovoltaic array, the method further comprises:

acquiring the historical operating state data of the photovoltaic array within a preset time period;

5 calculating a photovoltaic module temperature corresponding to the photovoltaic array based on a maximum irradiance, a maximum wind speed and a maximum ambient temperature, wherein the maximum irradiance is determined based on the historical irradiances, the maximum ambient temperature is determined based on the historical ambient temperatures, and the maximum wind speed is determined based on the historical wind
10 speeds;

calculating a first maximum output current value corresponding to the photovoltaic array based on the photovoltaic module temperature and the maximum irradiance, wherein the first maximum output current value is an output current value of the photovoltaic string under the maximum irradiance;

15 calculating a second maximum output current value corresponding to the photovoltaic array based on a rated installed capacity and a maximum system voltage, wherein the rated installed capacity is a rated power of a combiner connected to the photovoltaic array, the maximum system voltage is a system voltage of an inverter connected to the combiner, and the second maximum output current value is a maximum current value that the combiner
20 allows the photovoltaic strings to input; and

determining a minimum value of the first maximum output current value and the second maximum output current value as the current threshold.

6. The method according to claim 4, further comprising:

25 acquiring filtered historical output current values by filtering the historical output current values based on the current threshold, wherein the filtered historical output current values are less than or equal to the current threshold;

determining a historical characteristic current value based on the filtered historical output current values, wherein the historical characteristic current value characterizes historical
30 current characteristics corresponding to the photovoltaic array at each acquisition moment;

determining at least one training sample by dividing the filtered historical output current values based on the historical characteristic current value, wherein the historical output current values comprised in different training samples correspond to different characteristic current value ranges, and the characteristic current value ranges are determined based on the
5 historical characteristic current value; and

training the abnormality score predicting model based on the training sample.

7. The method according to claim 6, wherein the abnormality score predicting model adopts an Isolation Forest algorithm, and the abnormality score predicting model comprises S
10 binary trees, wherein S is an integer greater than or equal to 1; and

after training the abnormality score predicting model based on the training sample, the method further comprises:

acquiring S path lengths corresponding to the training sample by inputting the training sample into the S binary trees; and

15 calculating an abnormality score corresponding to the training sample based on the S path lengths.

8. An apparatus for determining an operating state of a photovoltaic array, comprising:

a first acquiring module, configured to acquire present output current values of
20 photovoltaic strings comprised in a photovoltaic array, wherein the photovoltaic array comprises at least two photovoltaic strings in parallel;

a first determining module, configured to determine a target abnormality score predicting model based on the present output current values, wherein different abnormality score predicting models correspond to different characteristic current value ranges, and the
25 abnormality score predicting model is obtained by training based on a historical output current value of the photovoltaic array;

a second determining module, configured to determine a present abnormality score corresponding to the photovoltaic array by inputting the present output current values into the target abnormality score predicting model; and

30 a third determining module, configured to determine the operating state of the

photovoltaic array by comparing the present abnormality score with a target abnormality score, wherein different abnormality score predicting models correspond to different abnormality scores, and the abnormality score is obtained by inputting the historical output current value into the abnormality score predicting model.

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9. A computer device, comprising a processor and a memory storing at least one instruction, at least one program, a code set or an instruction set therein, wherein the at least one instruction, the at least one program, the code set or the instruction set, when loaded and executed by the processor, causes the processor to perform the method for determining the operating state of the photovoltaic array according to any one of claims 1 to 7.

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10. A computer-readable storage medium, storing at least one instruction, at least one program, a code set or an instruction set therein, wherein the at least one instruction, the at least one program, the code set or the instruction set, when loaded and executed by a processor, causes the processor to perform the method for determining the operating state of the photovoltaic array according to any one of claims 1 to 7.

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