

CLAIMS

~~What is claimed is:~~

1. ~~A~~ ~~model test~~ computer-implemented method for testing image recognition models,
 5 comprising:

obtaining a sample image from a test sample set;

~~inputting~~ the sample image into a plurality of ~~to-be-tested~~ image recognition models
 comprised in a model set that are to ~~obtain output results of the to-be-tested~~ models, wherein the
 plurality of ~~to-be-tested~~ image recognition models comprise at least one neural network model;

10 obtaining a plurality of output results, comprising obtaining, from each model of the
plurality of image recognition models, a respective output result;

determining ~~a test result~~, based on the plurality of output results, whether a test result
satisfies a predetermined condition, wherein the test result comprises at least one of a first test
 result or a second test result, wherein the first test result comprises a plurality of output result
 15 accuracies ~~corresponding to~~, wherein each output result accuracy of the plurality of ~~to-be-~~
~~tested~~ output result accuracies corresponds to a respective model of the plurality of image
recognition models, and wherein the second test result comprises at least one neuron coverage
 rate ~~of~~ corresponding to the at least one neural network model; ~~and~~

~~when in response to determining that~~ the test result does not satisfy ~~at~~ the predetermined
 20 condition;

generating ~~a new sample~~, based on the sample image and a predetermined rule,
~~and adding the a new sample image, comprising:~~

identifying a specified range corresponding to a feature of the sample
image; and

25 generating a new sample image by adding, based on the specified range, a
random error term to one or more values associated with the feature of the sample image; and

adding the new sample image to the test sample set; and

in response to determining that the test result satisfies the predetermined condition:

removing the plurality of image recognition models from the model set.

2.- ~~The~~ computer-implemented method according to claim 1, wherein ~~when~~ the test

result comprises the first test result, ~~the~~and wherein determining ~~at~~the test result ~~based on the output results~~ comprises:

determining, through voting, a correct output result for ~~to be tested models with an additional plurality of image recognition models that are of the~~ same function ~~and that are~~ comprised in the plurality of ~~to be tested~~image recognition models, wherein an output result ~~with having~~ the ~~largest quantity of most~~ votes is the correct output result; and

in response to determining that ~~an a~~ particular output result of a ~~to be tested~~particular model ~~whose output result is~~matches the correct output result, determining that the particular output result of the particular model is accurate.

___3. ___The computer-implemented method according to claim 1, wherein the model set comprises a standard model; and

~~the wherein~~ determining ~~at~~the test result ~~based on the output results~~ comprises:

determining, based on an output result of the standard model, a correct output result ~~of a to be tested model that~~ for a particular model of the plurality of image recognition models, wherein the particular model has ~~at~~the same function as the standard model; and

in response to determining that ~~an output result of the to be tested model whose a particular~~ output result ~~is of the particular model matches~~ the correct output result, determining that the particular output result of the particular model is accurate.

___4. ___The computer-implemented method according to claim 1, wherein ~~when~~ the test result comprises the second test result, ~~the wherein~~ determining ~~at~~the test result ~~based on the output results~~ comprises:

~~counting a quantity of covered neurons of for~~ each neural network model ~~based on whether an output of each neuron in of~~ the at least one neural network model;

determining, based on whether a respective output of each neuron in each neural network model satisfies an output condition, a quantity of covered neurons, wherein the quantity of covered neurons ~~comprises is~~ a quantity of neurons that satisfy the output condition ~~in a test process~~; and

determining ~~a neuron coverage rate of each neural network model,~~ based on the quantity of covered neurons, a neuron coverage rate of the each neural network model, wherein

the neuron coverage rate is positively correlated with a ratio of the quantity of covered neurons to a total quantity of neurons of the each neural network model among the at least one neural network model.

5 5. The computer-implemented method according to claim 4, wherein the predetermined condition comprises:

~~the at least one each~~ neuron coverage rate of the at least one ~~neural network model each~~ neuron coverage rate is greater than a predetermined coverage rate threshold.

10 6. The computer-implemented method according to claim 5, wherein the predetermined condition further comprises:

~~the each output result accuracy of the plurality of~~ output result accuracies ~~of the plurality of to be tested models each are~~ is greater than a predetermined accuracy threshold.

15 7. ~~The method according to claim 1, wherein the generating a new sample based on the sample and a predetermined rule comprises:~~

~~obtaining a specified range of each feature in the sample; and~~

~~adding a random error term to the sample based on the specified range of each feature to generate the new sample.~~

~~8. The method according to claim 1, wherein the method further comprises~~

20 7. A non-transitory, computer-readable medium storing one or more ~~of the~~ following:

~~removing a to be tested model whose test result satisfies the predetermined condition from the model set; or~~

~~adding a new to be tested model to the model set.~~

25 9. ~~A model test apparatus;~~ instructions executable by a computer system to perform operations comprising:

~~an acquisition unit, configured to obtain~~ obtaining a sample image from a test sample set;

~~a test unit, configured to input~~ inputting the sample image into a plurality of ~~to be tested~~ image recognition models comprised in a model set ~~that are to obtain output results of the~~ to be tested models, wherein the plurality of ~~to be tested~~ image recognition models comprise at least one neural network model;

30

~~a-obtaining a plurality of output results, comprising obtaining, from each model of the plurality of image recognition models, a respective output result;~~

determining ~~unit, configured to determine a test result,~~ based on the plurality of output results, whether a test result satisfies a predetermined condition, wherein the test result comprises at least one of a first test result or a second test result, wherein the first test result comprises a plurality of output result accuracies ~~corresponding to the to-be-tested models, and the , wherein~~ each output result accuracy of the plurality of output result accuracies corresponds to a respective model of the plurality of image recognition models, and wherein the second test result comprises at least one neuron coverage rate ~~of~~corresponding to the at least one neural network model; ~~and~~

~~a-generation unit, configured to, when-in response to determining that~~ the test result does not satisfy the predetermined condition:

generating, based on the sample image and a predetermined condition, ~~generaterule,~~ a new sample image, comprising:

identifying a specified range corresponding to a feature of the sample image; and

generating a new sample image by adding, based on the specified range, a random error term to one or more values associated with the feature of the sample image; and

adding the new sample based on image to the test sample set; and a predetermined rule, and add the new sample to the test sample set.

~~10. in response to determining that the test result satisfies the predetermined condition:~~

removing the plurality of image recognition models from the model set.

8. The ~~apparatus~~non-transitory, computer-readable medium according to claim 97, wherein ~~when~~ the test result comprises the first test result, ~~the~~and wherein determining ~~unit~~the test result comprises:

~~a result~~ determining ~~module, configured to determine,~~ through voting, a correct output result for ~~to-be-tested~~an additional plurality of image recognition models ~~with-athat~~ are of the same function and that are comprised in the plurality of ~~to-be-tested~~image recognition models, wherein an output result ~~with~~having the ~~largest quantity of~~most votes is the correct output result; and

~~an accuracy in response to~~ determining ~~module, configured to determine~~ that ~~an~~

particular output result of a ~~to-be-tested~~particular model ~~whose output result is~~matches the correct output result, determining that the particular output result of the particular model is accurate.

~~11.~~

5 9. The ~~apparatus~~non-transitory, computer-readable medium according to claim 97, wherein the model set comprises a standard model; ~~and, and wherein determining the test result~~
comprises:

~~the determining unit comprises:~~

10 ~~a result determining module, configured to determine~~, based on an output result of the standard model, a correct output result ~~of a to-be-tested model that for a particular model of the~~
plurality of image recognition models, wherein the particular model has ~~at the~~ same function as the standard model; and

~~an accuracy in response to determining module, configured to determine that a~~
particular output result of the ~~to-be-tested~~particular model ~~whose output result is~~matches the
15 correct output result-, determining that the particular output result of the particular model is accurate.

~~12.~~

10. The ~~apparatus~~non-transitory, computer-readable medium according to claim 97, wherein ~~when~~ the test result comprises the second test result, ~~the~~wherein determining ~~unit~~the test
20 result comprises:

~~a counting module, configured to count a quantity of covered neurons of for~~ each neural network model ~~based on whether an output of each neuron in of~~ the at least one neural network model-;

25 determining, based on whether a respective output of each neuron in each neural network model satisfies an output condition, a quantity of covered neurons, wherein the quantity of covered neurons ~~comprises is~~ a quantity of neurons that satisfy the output condition ~~in a test process~~; and

~~a coverage rate determining module, configured to determine a neuron coverage rate of each neural network model determining,~~ based on the quantity of covered neurons, a
30 neuron coverage rate of the each neural network model, wherein the neuron coverage rate is positively correlated with a ratio of the quantity of covered neurons to a total quantity of neurons

of the each neural network model among the at least one neural network model.

11. ~~13.~~ The ~~apparatus~~non-transitory, computer-readable medium according to claim 1210, wherein the predetermined condition comprises:

the each neuron coverage rate of the at least one neural network model each neuron coverage rate is greater than a predetermined coverage rate threshold.

14.

12. The ~~apparatus~~non-transitory, computer-readable medium according to claim 1311, wherein the predetermined condition further comprises:

the each output result accuracy of the plurality of output result accuracies corresponding to the plurality of to be tested models each are greater than a predetermined accuracy threshold.

13. 15. The ~~apparatus~~ according to claim 9, wherein the generation unit is further configured to:

obtain A computer-implemented system, comprising:

one or more computers; and

one or more computer memory devices interoperably coupled with the one or more computers and having tangible, non-transitory, machine-readable media storing one or more instructions that, when executed by the one or more computers, perform one or more operations comprising:

obtaining a sample image from a test sample set;

inputting the sample image into a plurality of image recognition models comprised in a model set that are to be tested, wherein the plurality of image recognition models comprise at least one neural network model;

obtaining a plurality of output results, comprising obtaining, from each model of the plurality of image recognition models, a respective output result;

determining, based on the plurality of output results, whether a test result satisfies a predetermined condition, wherein the test result comprises at least one of a first test result or a second test result, wherein the first test result comprises a plurality of output result accuracies, wherein each output result accuracy of the plurality of output result accuracies corresponds to a

respective model of the plurality of image recognition models, and wherein the second test result comprises at least one neuron coverage rate corresponding to the at least one neural network model;

in response to determining that the test result does not satisfy the predetermined
5 condition:

generating, based on the sample image and a predetermined rule, a new
sample image, comprising:

identifying a specified range of each corresponding to a feature
in of the sample image; and

10 adding, based on the specified range of each, a random error term to one or more values
associated with the feature to generate of the new sample image; and

adding the new sample image to the test sample set; and
in response to determining that the test result satisfies the predetermined

15 condition:
removing the plurality of image recognition models from the model set.

14. The computer-implemented system according to claim 13, wherein the test result
comprises the first test result, and wherein determining the test result comprises:

20 determining, through voting, a correct output result for an additional plurality of image
recognition models that are of the same function and that are comprised in the plurality of image
recognition models, wherein an output result having the most votes is the correct output result;
and

in response to determining that a particular output result of a particular model matches
25 the correct output result, determining that the particular output result of the particular model is
accurate.

15. The apparatus computer-implemented system according to claim 913, wherein the
apparatus further model set comprises one or more of a standard model, and wherein determining
30 the following test result comprises:

a removing unit, configured to remove a to be tested determining, based on an output

result of the standard model whose, a correct output result for a particular model of the plurality of image recognition models, wherein the particular model has the same function as the standard model; and

in response to determining that a particular output result of the particular model matches the correct output result, determining that the particular output result of the particular model is accurate.

16. The computer-implemented system according to claim 13, wherein the test result comprises the second test result, wherein determining the test result comprises:

for each neural network model of the at least one neural network model:

determining, based on whether a respective output of each neuron in each neural network model satisfies an output condition, a quantity of covered neurons, wherein the quantity of covered neurons is a quantity of neurons that satisfy the output condition; and

determining, based on the quantity of covered neurons, a neuron coverage rate of the each neural network model, wherein the neuron coverage rate is positively correlated with a ratio of the quantity of covered neurons to a total quantity of neurons of the each neural network model among the at least one neural network model.

17. The computer-implemented system according to claim 16, wherein the predetermined condition ~~from the model set; or~~ comprises:

~~an adding unit, configured to add a new to-be-tested model to the model set.~~

~~17. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program, and when the computer program runs on a computer, the computer is enabled to perform the method according to any one of each neuron coverage rate of the at least one neuron coverage rate is greater than a predetermined coverage rate threshold.~~

18. The computer-implemented system according to claim 17, wherein the predetermined condition further comprises:

each output result accuracy of the plurality of output result accuracies is greater than a predetermined accuracy threshold. ~~claims 1 to 8.~~

~~18. A computing device, comprising a memory and a processor, wherein the memory stores executable code, and when the processor executes the executable code, the method according to any one of claims 1 to 8 is implemented.~~