

CLAIMS

What is claimed is:

1. A model gradient determining method based on federated learning, comprising:
obtaining data volume information of a participating node, wherein the data volume information is used to indicate an amount of data used by the participating node to train a basic training model based on local data, and the local data comprises user data of a target organization corresponding to the participating node;

obtaining a node local gradient obtained by training the basic training model based on the local data by the participating node;

determining, based on the data volume information and the node local gradient, a global gradient of a federated learning model that the participating node participates in, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes, and the global gradient comprises a plurality of global gradient factors;

determining a degree of participation of the participating node based on the node local gradient of the participating node and the global gradient, wherein the degree of participation is used to indicate a degree of participation of the participating node in federated learning model training; and

determining an actual model gradient of the participating node based on the degree of participation, wherein the determining an actual model gradient of the participating node based on the degree of participation comprises determining a quantity of matching gradients corresponding to the participating node based on the degree of participation, and selecting global gradient factors of the quantity of matching gradients from the global gradient to obtain the actual model gradient.

2. The method according to claim 1, wherein after the obtaining a node local gradient obtained by training the basic training model based on the local data by the participating node, the method further comprises:

obtaining a marginal loss of the participating node, wherein the marginal loss is

used to represent a degree of influence of the node local gradient of the participating node on performance of the federated learning model; and

determining node mass of the participating node based on the marginal loss; and

the determining, based on the data volume information and the node local gradient, a global gradient of a federated learning model that the participating node participates in specifically comprises:

determining, based on the data volume information, the node local gradient, and the node mass, the global gradient of the federated learning model that the participating node participates in.

3. The method according to claim 2, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes; and

the obtaining a marginal loss of the participating node specifically comprises:

determining a first reference global model based on a node local gradient of each participating node in the plurality of participating nodes;

determining a second reference global model based on a node local gradient of each participating node other than the participating node in the plurality of participating nodes;

determining a first model loss of the first reference global model based on a predetermined verification set;

determining a second model loss of the second reference global model based on the predetermined verification set; and

determining the marginal loss of the participating node based on the first model loss and the second model loss.

4. The method according to claim 2, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes; and

the determining node mass of the participating node based on the marginal loss specifically comprises:

determining the node mass of the participating node based on a marginal loss of each participating node in the plurality of participating nodes and a normalization algorithm.

5. The method according to claim 2, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes;

the method further comprises:

determining a participating node with a marginal loss greater than or equal to a predetermined loss threshold in the plurality of participating nodes as an effective participating node; and

the determining, based on the data volume information, the node local gradient, and the node mass, the global gradient of the federated learning model that the participating node participates in specifically comprises:

performing an aggregation operation on a node local gradient of each of the effective participating nodes based on data volume information of the participating node and node mass of the participating node, to obtain the global gradient.

6. The method according to claim 1, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes; and

the determining a degree of participation of the participating node based on the node local gradient of the participating node and the global gradient specifically comprises:

determining a node contribution degree of each of the plurality of participating nodes based on a node local gradient of each participating node and the global gradient; and

determining a relative contribution degree of the participating node based on a node contribution degree of the participating node and the node contribution degree of each participating node.

7. The method according to claim 6, wherein the global gradient comprises a gradient obtained through a target quantity of rounds of iterative calculations; and

the method further comprises:

obtaining a trustworthiness parameter of the participating node, wherein the trustworthiness parameter is used to represent a comprehensive degree of reliability of the participating node in the target quantity of rounds of calculation processes of the global gradient; and

determining a reputation degree of the participating node based on the relative contribution degree and the trustworthiness parameter.

8. The method according to claim 7, wherein the obtaining a trustworthiness parameter of the participating node specifically comprises:

determining a first quantity of times that the participating node is determined as an effective participating node in the target quantity of rounds, wherein the effective participating node represents a participating node with a marginal loss greater than or equal to a predetermined loss threshold;

determining a second quantity of times that the participating node is determined as an ineffective participating node in the target quantity of rounds, wherein the ineffective participating node represents a participating node with a marginal loss less than the predetermined loss threshold; and

determining the trustworthiness parameter of the participating node based on the first quantity of times and the second quantity of times.

9. The method according to claim 7, wherein the global gradient comprises a plurality of global gradient factors, the participating node participating in the federated learning model comprises a plurality of participating nodes, and the global gradient comprises the gradient obtained through the target quantity of rounds of iterative calculations; and

the determining the quantity of matching gradients corresponding to the participating node comprises:

determining the quantity of matching gradients corresponding to the participating node based on a ratio of the reputation degree of the participating node to the greatest reputation degree, wherein the greatest reputation degree is used to represent the greatest reputation degree in reputation degrees of the plurality of participating nodes.

10. The method according to claim 9, wherein the global gradient comprises a plurality of global gradient factors, and the node local gradient comprises a plurality of local gradient factors;

the method further comprises:

obtaining a node influence degree of each global gradient factor relative to the

participating node, wherein the node influence degree is used to indicate a degree that each global gradient factor is influenced by the participating node; and

sorting the global gradient factors in the global gradient based on the node influence degree, to obtain the sorted global gradient factors; and

the selecting global gradient factors of the quantity of matching gradients from the global gradient to obtain the actual model gradient further comprises:

selecting global gradient factors of the quantity of matching gradients from the sorted global gradient factors based on a predetermined order, to obtain the actual model gradient.

11. The method according to claim 10, wherein the obtaining a node influence degree of each global gradient factor relative to the participating node specifically comprises:

determining a first distribution parameter corresponding to each local gradient factor in the local gradient of the participating node, wherein the first distribution parameter is used to indicate a proportion of each local gradient factor in the local gradient;

determining a second distribution parameter corresponding to each global gradient factor in the global gradient, wherein the second distribution parameter is used to indicate a proportion of each global gradient factor in the global gradient; and

determining the node influence degree of each global gradient factor relative to the participating node based on the first distribution parameter and the second distribution parameter.

12. A model gradient determining apparatus based on federated learning, comprising:

a volume information acquisition module, configured to obtain data volume information of a participating node, wherein the data volume information is used to indicate an amount of data used by the participating node to train a basic training model based on local data, and the local data comprises user data of a target organization corresponding to the participating node;

a local gradient acquisition module, configured to obtain a node local gradient

obtained by training the basic training model based on the local data by the participating node;

a global gradient determining module, configured to determine, based on the data volume information and the node local gradient, a global gradient of a federated learning model that the participating node participates in, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes, and the global gradient comprises a plurality of global gradient factors;

a degree-of-participation determining module, configured to determine a degree of participation of the participating node based on the node local gradient of the participating node and the global gradient, wherein the degree of participation is used to indicate a degree of participation of the participating node in federated learning model training; and

an actual gradient determining module, configured to determine an actual model gradient of the participating node based on the degree of participation, wherein determining the actual model gradient comprises determining a quantity of matching gradients corresponding to the participating node based on the degree of participation, and selecting global gradient factors of the quantity of matching gradients from the global gradient to obtain the actual model gradient.

13. A model gradient determining device based on federated learning, comprising:

at least one processor; and

a memory communicatively connected to the at least one processor, wherein

the memory stores an instruction that can be executed by the at least one processor, and the instruction is executed by the at least one processor so that the at least one processor can:

obtain data volume information of a participating node, wherein the data volume information is used to indicate an amount of data used by the participating node to train a basic training model based on local data, and the local data comprises user data of a target organization corresponding to the participating node;

obtain a node local gradient obtained by training the basic training model based on the local data by the participating node;

determine, based on the data volume information and the node local gradient, a global gradient of a federated learning model that the participating node participates in, wherein the participating node participating in the federated learning model comprises a plurality of participating nodes, and the global gradient comprises a plurality of global gradient factors;

determine a degree of participation of the participating node based on the node local gradient of the participating node and the global gradient, wherein the degree of participation is used to indicate a degree of participation of the participating node in federated learning model training; and

determine an actual model gradient of the participating node based on the degree of participation, wherein determining the actual model gradient comprises determining a quantity of matching gradients corresponding to the participating node based on the degree of participation, and selecting global gradient factors of the quantity of matching gradients from the global gradient to obtain the actual model gradient.

14. A computer-readable medium, storing a computer-readable instruction, wherein the computer-readable instruction can be executed by a processor to implement the model gradient determining method based on federated learning according to any one of claims 1 to 11.