

CLAIMS

What is claimed is:

1. A load prediction method based on a neural network, comprising:

receiving a time period to be predicted;

5 inputting the time period into a neural network model for predicting an energy load, wherein the neural network model is a radial basis function (RBF) neural network^[ax1] obtained by means of training based on a hybrid particle swarm optimization algorithm; and using the neural network model to predict an energy load value in the time period.

2. The method according to claim 1, wherein before inputting the time period into a neural network model for predicting an energy load, the method further comprises:

acquiring the neural network model from a third party; and

obtaining the neural network model by training sample data.

3. The method according to claim 2, wherein obtaining the neural network model by training sample data comprises:

15 determining topology of an initial model, wherein the topology comprises: an input layer, a hidden layer, and an output layer;

encoding parameters of the initial model to obtain an initial particle population, wherein the parameters comprise: a center parameter of a radial basis function, a variance parameter, a weight parameter of the hidden layer, and a weight parameter of the output layer, and each
20 parameter is one particle;

decoding the initial particle population to obtain initial parameters of the initial model;

assigning the initial parameters to the initial model to obtain an RBF network model; and

optimizing the RBF network model by using a training sample and a test sample.

4. The method according to claim 3, wherein optimizing the RBF network model by
25 using a training sample and a test sample comprises:

inputting the training sample and the test sample into the RBF network model respectively to obtain a test value and an expected value;

selecting a norm of an error matrix consisting of the predicted value and the expected

value as a fitness value; and

updating particles in the population by using the fitness value.

5. The method according to claim 4, wherein updating particles in the population by using the fitness value comprises:

5 updating velocities and positions of the particles in the population;

updating an individual extremum of the particles in the population by using the fitness value, and updating a population extremum of the particles in the population by using the fitness value; and

10 mutating the particles in the population, and updating the particles when a fitness value of a new particle is better than that of an old particle.

6. The method according to claim 5, wherein updating velocities and positions of the particles in the population comprises:

iteratively updating the velocities and the positions of the particles in the population by using the following formulas:

15
$$V_{id}^{k+1} = wV_{id}^k + c_1r_1(P_{id}^k - X_{id}^k) + c_2r_2(P_{gd}^k - X_{id}^k);$$

$$X_{id}^{k+1} = X_{id}^k + V_{k+1,id};$$

where $X_i = (x_{i1}, x_{i2}, \dots, x_{iD})$ denotes a population particle with D dimensions,

$V_i = (v_{i1}, v_{i2}, \dots, v_{iD})$ denotes the velocity of a population particle with D dimension,

$P_i = (p_{i1}, p_{i2}, \dots, p_{iD})$ denotes an extremum of an individual particle with D dimensions,

20 $P_g = (p_{g1}, p_{g2}, \dots, p_{gD})$ denotes a population extremum with D dimensions, w is an inertia weight, $d=1, 2, \dots, D, i=1, 2, \dots, n, k$ is a current iteration number, V_{id} is a particle velocity, c_1 and c_2 are nonnegative constants and are acceleration factors, and r_1 and r_2 are random numbers distributed in [0,1].

7. A load prediction apparatus based on a neural network, comprising:

25 a receiving module configured to receive a time period to be predicted;

an input module configured to input the time period into a neural network model for predicting an energy load, wherein the neural network model is a radial basis function (RBF) neural network obtained by means of training based on a hybrid particle swarm optimization

algorithm; and

a prediction module configured to use the neural network model to predict an energy load value in the time period.

8. The apparatus according to claim 7, wherein the apparatus further comprises:

5 a determination module configured to, before the input module inputs the time period into a neural network model for predicting an energy load, determine topology of an initial model, wherein the topology comprises: an input layer, a hidden layer, and an output layer;

10 an encoding module configured to encode parameters of the initial model to obtain an initial particle population, wherein the parameters comprise: a center parameter of a radial basis function, a variance parameter, a weight parameter of the hidden layer, and a weight parameter of the output layer, and each parameter is one particle;

a decoding module configured to decode the initial particle population to obtain initial parameters of the initial model;

15 an assignment module configured to assign the initial parameters to the initial model to obtain an RBF network model; and

an optimization module configured to optimize the RBF network model by using a training sample and a test sample.

20 9. A storage medium, wherein a computer program is stored in the storage medium, and the computer program is configured to perform, when run, the method according to any one of claims 1 to 6.

10. An electronic device, comprising a memory and a processor, wherein a computer program is stored in the storage medium, and the processor is configured to run the computer program to perform the method according to any one of claims 1 to 6.

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5 inputting the time period into a neural network model for predicting an energy load, wherein the neural network model is a radial basis function (RBF) neural network obtained by means of training based on a hybrid particle swarm optimization algorithm; and using the neural network model to predict an energy load value in the time period.

2. The method according to claim 1, wherein before inputting the time period into a neural
10 network model for predicting an energy load, the method further comprises:

acquiring the neural network model from a third party; and

obtaining the neural network model by training sample data.

3. The method according to claim 2, wherein obtaining the neural network model by training sample data comprises:

15 determining topology of an initial model, wherein the topology comprises: an input layer, a hidden layer, and an output layer;

encoding parameters of the initial model to obtain an initial particle population, wherein the parameters comprise: a center parameter of a radial basis function, a variance parameter, a weight parameter of the hidden layer, and a weight parameter of the output layer, and each

20 parameter is one particle;

decoding the initial particle population to obtain initial parameters of the initial model;

assigning the initial parameters to the initial model to obtain an RBF network model; and optimizing the RBF network model by using a training sample and a test sample.

4. The method according to claim 3, wherein optimizing the RBF network model by using
25 a training sample and a test sample comprises:

inputting the training sample and the test sample into the RBF network model respectively to obtain a test value and an expected value;

selecting a norm of an error matrix consisting of the test value and the expected value as a

fitness value; and

updating particles in the population by using the fitness value.

5. The method according to claim 4, wherein updating particles in the population by using the fitness value comprises:

5 updating velocities and positions of the particles in the population;

updating an individual extremum of the particles in the population by using the fitness value, and updating a population extremum of the particles in the population by using the fitness value; and

10 mutating the particles in the population, and updating the particles when a fitness value of a new particle is better than that of an old particle.

6. The method according to claim 5, wherein updating velocities and positions of the particles in the population comprises:

iteratively updating the velocities and the positions of the particles in the population by using the following formulas:

$$15 \quad V_{id}^{k+1} = wV_{id}^k + c_1r_1(P_{id}^k - X_{id}^k) + c_2r_2(P_{gd}^k - X_{id}^k);$$

$$X_{id}^{k+1} = X_{id}^k + V_{k+1,id};$$

where $X_i = (x_{i1}, x_{i2}, \dots, x_{iD})$ denotes a population particle with D dimensions,

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7. A load prediction apparatus based on a neural network, comprising:

a receiving module configured to receive a time period to be predicted;

an input module configured to input the time period into a neural network model for predicting an energy load, wherein the neural network model is a radial basis function (RBF)

5 neural network obtained by means of training based on a hybrid particle swarm optimization algorithm; and

a prediction module configured to use the neural network model to predict an energy load value in the time period.

8. The apparatus according to claim 7, wherein the apparatus further comprises:

10 a determination module configured to, before the input module inputs the time period into a neural network model for predicting an energy load, determine topology of an initial model, wherein the topology comprises: an input layer, a hidden layer, and an output layer;

an encoding module configured to encode parameters of the initial model to obtain an initial particle population, wherein the parameters comprise: a center parameter of a radial basis
15 function, a variance parameter, a weight parameter of the hidden layer, and a weight parameter of the output layer, and each parameter is one particle;

a decoding module configured to decode the initial particle population to obtain initial parameters of the initial model;

20 an assignment module configured to assign the initial parameters to the initial model to obtain an RBF network model; and

an optimization module configured to optimize the RBF network model by using a training sample and a test sample.

9. A storage medium, wherein a computer program is stored in the storage medium, and the computer program is configured to perform, when run, the method according to any one of
25 claims 1 to 6.

10. An electronic device, comprising a memory and a processor, wherein a computer program is stored in the storage medium, and the processor is configured to run the computer program to perform the method according to any one of claims 1 to 6.