CLAIMS

1. A decoding method, comprising:

decoding a target feature corresponding to a current picture block from a bitstream corresponding to the current picture block;

determining a first input feature of a target decoding network based on the target feature;

obtaining a target feature-value quantization bit width and a target feature-value quantization hyperparameter of the target decoding network, and converting the first input feature of the target decoding network into a second input feature of the target decoding network based on the target feature-value quantization bit width and the target feature-value quantization hyperparameter;

processing the second input feature of the target decoding network based on an integer-type weight of the target decoding network to obtain an output feature of the target decoding network; wherein the integer-type weight of the target decoding network is determined based on a target weight quantization bit width and a target weight quantization hyperparameter of the target decoding network; and

determining a reconstructed picture block corresponding to the current picture block based on the output feature of the target decoding network.

2. The method according to claim 1, wherein the target decoding network comprises at least one target network layer, wherein the at least one target network layer each adopts an integer-type weight, and the method comprises: for each of the at least one target network layer in the target decoding network,

converting a first input feature of the target network layer into a second input feature of the target network layer based on a target feature-value quantization bit width and a target feature-value quantization hyperparameter of the target network layer; and

processing the second input feature of the target network layer based on an integer-type weight of the target network layer to obtain an output feature of the target network layer; wherein the integer-type weight of the target network layer is determined based on a target weight quantization bit width and a target weight quantization hyperparameter of the target network layer;

wherein target feature-value quantization bit widths in different target network layers are same or different,

target feature-value quantization hyperparameters in different target network layers are same or different,

target weight quantization bit widths in different target network layers share a fixed bit

width, and

target weight quantization hyperparameters in different target network layers are same or different;

wherein converting the first input feature of the target network layer into the second input feature of the target network layer based on the target feature-value quantization bit width and the target feature-value quantization hyperparameter of the target network layer comprises:

converting the first input feature of the target network layer into the second input feature of the target network layer through a following formula:

$quant = clip(round(data \times 2^{param}), -2^{bw-1}, 2^{bw-1} - 1)$; or

$quant = clip(round(data \div param), -2^{bw-1}, 2^{bw-1} - 1)$;

wherein $quant$ represents the second input feature of the target network layer,

$data$ represents the first input feature of the target network layer,

$param$ represents the target feature-value quantization hyperparameter in the target network layer,

bw represents the target feature-value quantization bit width of the target network layer,

clip represents a clipping function, and

$round$ represents a rounding operation.

3. The method according to any one of claims 1-2, wherein a sample decoding network comprises a plurality of network layers using floating-point-type weights, wherein the plurality of network layers comprise at least one target network layer of the sample decoding network, and the method further comprises: for each of the at least one target network layer of the sample decoding network:

obtaining a weight quantization hyperparameter candidate list corresponding to the target network layer, wherein the weight quantization hyperparameter candidate list comprises a plurality of candidate weight quantization hyperparameters;

for each of the plurality of candidate weight quantization hyperparameters,

performing simulated quantization on the floating-point-type weight of the target network layer by a fixed quantization bit width and the candidate weight quantization hyperparameter, to obtain a candidate simulated weight;

processing a floating-point-type input feature of the target network layer based on the candidate simulated weight, to obtain a floating-point-type output feature of the target network layer;

determining a quantization error corresponding to the candidate weight quantization

hyperparameter based on the floating-point-type output feature of the target network layer;

based on the quantization error corresponding to each of the plurality of candidate weight quantization hyperparameters, determining a candidate weight quantization hyperparameter corresponding to a minimum quantization error as a target weight quantization hyperparameter of the target network layer, and determining the fixed quantization bit width as a target weight quantization bit width of the target network layer;

performing fixed-point quantization on the floating-point-type weight of the target network layer based on the target weight quantization bit width and the target weight quantization hyperparameter of the target network layer, to obtain an integer-type weight of the target network layer; and

generating the target decoding network based on the integer-type weight of each of the plurality of target network layers in the sample decoding network.

4. The method according to claim 3, wherein obtaining the weight quantization hyperparameter candidate list corresponding to the target network layer comprises:

determining a maximum weight value based on all floating-point-type weights of the target network layer; wherein each of the all floating-point-type weights comprises a plurality of weight values, and the maximum weight value is a maximum value in all weight values of the all floating-point-type weights;

generating an initial weight quantization hyperparameter corresponding to the target network layer based on the maximum weight value; and

constructing the weight quantization hyperparameter candidate list based on the initial weight quantization hyperparameter;

wherein generating the initial weight quantization hyperparameter corresponding to the target network layer based on the maximum weight value comprises:

generating the initial weight quantization hyperparameter through a following formula:

$param = bw - 1 - ceil(log2(max))$; or

$param = (max)/2^{bw-1}$;

wherein param represents the initial weight quantization hyperparameter corresponding to the target network layer,

bw represents the fixed quantization bit width,

max represents the maximum weight value, and

ceil represents a rounding up operation.

5. The method according to claim 3, wherein performing simulated quantization on the

floating-point-type weight of the target network layer by the fixed quantization bit width and the candidate weight quantization hyperparameter, to obtain the candidate simulated weight comprises:

performing simulated quantization on the floating-point-type weight of the target network layer to obtain the candidate simulated weight, by a following formula:

$quant = 2^{-param} \times clip(round(data \times 2^{param}), -2^{bw-1}, 2^{bw-1} - 1)$; or

$quant = param \times clip(round(data \div param), -2^{bw-1}, 2^{bw-1} - 1)$;

wherein $quant$ represents the candidate simulated weight,

$param$ represents the candidate weight quantization hyperparameter,

$data$ represents the floating-point-type weight of the target network layer,

bw represents the fixed quantization bit width,

clip represents a clipping function, and

$round$ represents a rounding operation.

6. The method according to claim 3, wherein determining the quantization error corresponding to the candidate weight quantization hyperparameter based on the floating-point-type output feature of the target network layer comprises:

determining a sample output feature based on the floating-point-type output feature of the target network layer, wherein the sample output feature is an output feature of a reference network layer in the sample decoding network, and the reference network layer is any one network layer located after the target network layer; and

determining the quantization error corresponding to the candidate weight quantization hyperparameter based on the sample output feature and a reference output feature;

wherein obtaining the reference output feature comprises: decoding a sample feature from a sample bitstream, determining a floating-point-type input feature corresponding to the sample decoding network based on the sample feature, and determining the reference output feature based on the floating-point-type input feature, wherein the reference output feature is an output feature of the reference network layer in the sample decoding network.

7. The method according to any one of claims 1-2, wherein a sample decoding network comprises a plurality of network layers using floating-point-type weights, wherein the plurality of network layers comprise at least one target network layer of the sample decoding network, and the method further comprises: for each of the at least one target network layer of the sample decoding network:

obtaining a feature-value quantization hyperparameter candidate list and a quantization

bit width set corresponding to the target network layer, wherein the feature-value quantization hyperparameter candidate list comprises a plurality of candidate feature-value quantization hyperparameters, and the quantization bit width set comprises at least two quantization bit widths;

traversing the at least two quantization bit widths from the quantization bit width set;

for each of the plurality of candidate feature-value quantization hyperparameters,

performing simulated quantization on a floating-point-type input feature of the target network layer by a current quantization bit width and the candidate feature-value quantization hyperparameter, to obtain a candidate input feature;

processing the candidate input feature based on a pseudo weight of the target network layer, to obtain a floating-point-type output feature of the target network layer;

determining a quantization error corresponding to the candidate feature-value quantization hyperparameter based on the floating-point-type output feature of the target network layer; and

based on the quantization error corresponding to each of the plurality of candidate feature-value quantization hyperparameters under the current quantization bit width, in response to determining that a minimum quantization error is less than a preset threshold, determining a candidate feature-value quantization hyperparameter corresponding to the minimum quantization error as the target feature-value quantization hyperparameter of the target network layer, and determining the current quantization bit width as the target feature-value quantization bit width of the target network layer.

8. The method according to claim 7, further comprising:

based on the quantization error corresponding to each of the plurality of candidate feature-value quantization hyperparameters under the current quantization bit width, in response to determining that the minimum quantization error is greater than or equal to the preset threshold, determining whether the current quantization bit width is a last quantization bit width in the quantization bit width set; and

in response to determining that the current quantization bit width is the last quantization bit width in the quantization bit width set, determining the candidate feature-value quantization hyperparameter corresponding to the minimum quantization error as the target feature-value quantization hyperparameter of the target network layer, and determining the current quantization bit width as the target feature-value quantization bit width of the target network layer.

9. The method according to claim 7, wherein obtaining the feature-value quantization

hyperparameter candidate list corresponding to the target network layer comprises:

determining a maximum feature value based on all floating-point-type input features of the target network layer; wherein each of the all floating-point-type input features comprises a plurality of feature values, and the maximum feature value is a maximum value in all feature values of the all floating-point-type input features;

generating an initial feature-value quantization hyperparameter corresponding to the target network layer based on the maximum feature value; and

constructing the feature-value quantization hyperparameter candidate list based on the initial feature-value quantization hyperparameter;

wherein generating the initial feature-value quantization hyperparameter corresponding to the target network layer based on the maximum feature value comprises:

generating the initial feature-value quantization hyperparameter by a following formula:

$param = bw - 1 - ceil(log2(max))$; or

$param = (max)/2^{bw-1}$;

wherein param represents the initial feature-value quantization hyperparameter corresponding to the target network layer,

bw represents the current quantization bit width,

max represents the maximum feature value, and

ceil represents a rounding up operation.

10. The method according to claim 7, wherein performing simulated quantization on the floating-point-type input feature of the target network layer by the current quantization bit width and the candidate feature-value quantization hyperparameter, to obtain the candidate input feature comprises:

performing simulated quantization on the floating-point-type input feature of the target network layer to obtain the candidate input feature by a following formula:

$quant = 2^{-param} \times clip(round(data \times 2^{param}), -2^{bw-1}, 2^{bw-1} - 1)$; or

$quant = param \times clip(round(data \div param), -2^{bw-1}, 2^{bw-1} - 1)$;

wherein $quant$ represents the candidate input feature,

$param$ represents the candidate feature-value quantization hyperparameter,

$data$ represents the floating-point-type input feature,

bw represents the current quantization bit width,

clip represents a clipping function, and

$round$ represents a rounding operation.

11. The method according to claim 7, further comprising:

performing simulated quantization on the floating-point-type weight of the target network layer by the target weight quantization hyperparameter of the target network layer and the target weight quantization bit width of the target network layer, to obtain the pseudo weight of the target network layer.

12. The method according to claim 7, wherein determining the quantization error corresponding to the candidate feature-value quantization hyperparameter based on the floating-point-type output feature of the target network layer comprises:

determining a sample output feature based on the floating-point-type output feature of the target network layer, wherein the sample output feature is an output feature of a reference network layer in the sample decoding network, and the reference network layer is any one network layer located after the target network layer;

determining the quantization error corresponding to the candidate feature-value quantization hyperparameter based on the sample output feature and a reference output feature;

wherein obtaining the reference output feature comprises: decoding a sample feature from a sample bitstream, determining a floating-point-type input feature corresponding to the sample decoding network based on the sample feature, and determining the reference output feature based on the floating-point-type input feature, wherein the reference output feature is an output feature of the reference network layer in the sample decoding network.

13. A decoding apparatus, comprising:

a decoding module, configured to decode a target feature corresponding to a current picture block from a bitstream corresponding to the current picture block;

a determining module, configured to determine a first input feature of a target decoding network based on the target feature;

a processing module, configured to obtain a target feature-value quantization bit width and a target feature-value quantization hyperparameter of the target decoding network, and convert the first input feature of the target decoding network into a second input feature of the target decoding network based on the target feature-value quantization bit width and the target feature-value quantization hyperparameter; process the second input feature of the target decoding network based on an integer-type weight of the target decoding network to obtain an output feature of the target decoding network; wherein the integer-type weight of the target decoding network is determined based on a target weight quantization bit width and a target weight quantization hyperparameter of the target decoding network; and

a determining module, configured to determine a reconstructed picture block

corresponding to the current picture block based on the output feature of the target decoding network.

14. A decoding device, comprising: one or more processors and one or more machine-readable storage media, wherein the one or more machine-readable storage media store machine executable instructions that are executable by the one or more processors; and

the one or more processors are configured to execute the machine executable instructions to implement the method according to any one of claims 1 to 12.

15. A machine readable storage medium, wherein the machine readable storage medium stores computer instructions, and when the computer instructions are executed by one or more processors, the method according to any one of claims 1 to 12 is implemented.