DESCRIPTION

ENCODING DEVICE~~METHOD~~, DECODING DEVICE~~METHOD~~, ENCODING METHOD~~DEVICE~~, AND DECODING METHOD~~DEVICE~~

Field

[0001] The present invention relates to an encoding method, a decoding method, an encoding device, and a decoding device.

Background

[0002] In recent years, a method of encoding an image with markedly improved coding efficiency is recommended as ITU-T REC. H.264 and ISO/IEC 14496-10 (hereinafter, referred to as "H.264") in cooperation of ITU-T (International Telecommunication Union Telecommunication Standardization Sector) and ISO (International Organization for Standardization)/IEC (International Electrotechnical Commission).

[0003] In H.264, an inter-prediction coding system is disclosed in which redundancy in the time direction is eliminated to achieve high coding efficiency by making a motion compensation prediction of fractional precision using a coded image as a reference image.

[0004] In addition, a system is proposed in which a moving image including a fading or dissolving effect is encoded with efficiency higher than that of an inter-prediction coding system according to ISO/IEC MPEG (Moving Picture Experts Group)-1, 2, 4. In this system, a motion compensation prediction of fractional precision is made for an input moving image having luminance and two color differences as frames for predicting a change in the brightness in the time direction. Then, by using a reference image, luminance, and a weighting factor for each luminance and two color differences, an offset and for each luminance and two color differences, and the like, a predicted image is multiplied by a weighting factor, and an

offset is added thereto. The weighting factor can represent a fraction with predetermined precision using a parameter representing fixed point precision, and a weighted motion-compensated prediction can be made for a pixel value change between images with more delicate precision.

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Laid-open Patent Publication No. 2004-7377

Summary

Technical Problem

[0006] In a conventional technology as described above, while a reference image, a weighting factor, an offset, and the like are encoded as an index, the index is defined to be represented with predetermined bit precision, and accordingly, there are cases where a weighting factor cannot be represented. An object of the present invention is to provide an encoding method, a decoding method, an encoding device, and a decoding device capable of improving the coding efficiency while representing a weighting factor with predetermined bit precision.

Solution to Problem

[0007] An encoding device~~method~~ according to an embodiment includes a deriving unit~~step~~ and an encoding unit~~step~~. The driving unit~~step~~ derives a first reference value ~~that is a reference value of a weighting factor~~ based on fixed point precision representing roughness of a~~the~~ weighting factor that is used for making a motion-compensated prediction of ~~a change in~~ a pixel value by multiplying a reference image by the weighting factor. The encoding unit~~step~~ encodes a first difference value that is a difference value between the weighting factor and the first reference value and the fixed point precision. The

first difference value~~weighting factor~~ is included in a first range of predetermined bit precision having a~~the~~ predetermined first ~~reference~~ value at approximate center.

Brief Description of Drawings

[0008] FIG. 1 is a block diagram that illustrates an example of an encoding device according to a first embodiment.

FIG. 2A is an explanatory diagram that illustrates an example of a predicted coding sequence for a pixel block according to the first embodiment.

FIG. 2B is an explanatory diagram that illustrates another example of a predicted coding sequence for a pixel block according to the first embodiment.

FIG. 3A is a diagram that illustrates an example of the size of a coding tree block according to the first embodiment.

FIG. 3B is a diagram that illustrates a specific example of the coding tree block according to the first embodiment.

FIG. 3C is a diagram that illustrates another specific example of the coding tree block according to the first embodiment.

FIG. 3D is a diagram that illustrates another specific example of the coding tree block according to the first embodiment.

FIG. 4 is a block diagram that illustrates an example of a predicted image generating unit according to the first embodiment.

FIG. 5 is a diagram that illustrates an example of the relation between motion vectors for a motion-compensated prediction in a bidirectional prediction according to the first embodiment.

[0098] In addition, in the first embodiment, although an example has been described in which the selection range of the weighting factor is derived by the index setting unit 108, the deriving of the selection range is not limited thereto but may be performed by the encoding unit 110. Each of the index setting unit 108 and the encoding unit 110 may be referred to as a deriving unit.

[0099] FIGS. 13A and 13B are diagrams illustrating examples of the WP parameter information that is input to the index setting unit 108 according to the first embodiment. An example of the WP parameter information at the time of P-slice is as illustrated in FIG. 13A, and an example of the WP parameter information at the time of B-slice is as illustrated in FIGS. 13A and 13B. A list number is an identifier representing a prediction direction. The list number has a value of "0" in the case of a single-directional prediction. On the other hand, in the case of a bi-directional prediction, two types of prediction can be used, and accordingly, the list number has two values of "0" and "1". A reference number is a value corresponding to any one of 1 to N represented in the frame memory 206. Since the WP parameter information is maintained for each reference list and reference image, in a case where there are N reference images, 2N pieces of information are necessary at the time of B-slice.

[0100] FIG. 14 is a flowchart that illustrates an example of the process of deriving the selection range of the weighting factor according to the first embodiment. Here, while a case is assumed for description in which the index setting unit 108 performs the process of deriving the selection range of the weighting factor, as described above, the process may be performed by the encoding unit 110.

[0101] First, the index setting unit 108 derives fixed point precision LWD of the weighting factor (Step S02). Here, the index setting unit 108 may derive the fixed point

the predicted image generating unit 805. More specifically, the index setting unit 806 receives the index information that has been processed to be decoded by the entropy decoding unit 801A and is reconfigured by the index reconfiguring unit 801B. Then, the index setting unit 806 checks a list of reference images and a reference number, converts the index information into WP parameter information, and outputs the converted WP parameter information to the predicted image generating unit 805. When the index information is converted into WP parameter information, the index setting unit 806 derives the selection range of the weighting factor and checks that the weighting factor is included in the selection range. Here, the driving of the selection range of the weighting factor is the same as that of the first embodiment, and thus, detailed description thereof will not be presented. In addition, the driving of the selection range may be performed not by the index setting unit 806 but by the index reconfiguring unit 801B. Each of the index setting unit 806 and the index reconfiguring unit 801B (the decoding unit 801) may be referred to as a deriving unit.

[0165] In addition, similarly to the first embodiment, the WP parameter information includes information of a first WP application flag, a second WP application flag, and weighting information. Furthermore, similarly to the first embodiment, the weighting information includes information of a value w_{0C} of the first weighting factor, a value w_{1C} of the second weighting factor, fixed point precision LWD of the first and second weighting factors, a first offset o_{0C}, and a second offset o_{1C}.

[0166] The predicted image generating unit 805 generates a predicted image by using the motion information input from the decoding unit 801, the WP parameter information input from the index setting unit 806, and the decoded image input from the addition unit 804.

CLAIMS

1. An encoding devicemethod comprising the steps of:

a deriving unit configured to derive a first reference value that is a reference value of a weighting factor based on fixed point precision representing roughness of athe weighting factor that is used for making a motion-compensated prediction of a change in a pixel value by multiplying a reference image by the weighting factor; and

an encoding unit configured to encode a first difference value that is a difference value between the weighting factor and the first reference value and the fixed point precision,

wherein the weighting factor is included in a first range of predetermined bit precision having the first reference value at approximate center, and the first difference value is in the predetermined range.

2. The encoding device according to claim 1, wherein the predetermined range is of -128 to 127.

32. The encoding devicemethod according to claim 1, wherein the first reference value indicates a factor to be set if a difference of pixel value between a reference image and a target image to be encoded is less than or

equal to a specific value~~is a reference value of the weighting factor when the change in the pixel value to which the weighting factor is applied is a predetermined value or less~~.

~~3. The encoding method according to claim 1, wherein the first difference value is included in a fixed range of the predetermined bit precision that does not depend on the fixed point precision.~~

~~4. The encoding method according to claim 1, further comprising the step of performing a clipping process such that the weighting factor is included in the range of the predetermined bit precision when the weighting factor is not included in the range of the predetermined bit precision.~~

~~5. The encoding method according to claim 1, wherein the weighting factor is included in the range of the predetermined bit precision having a value acquired by shifting the first reference value by a predetermined shift amount as approximate center.~~

46. The encoding device~~method~~ according to claim 1, wherein

the ~~step of~~ deriving unit is configured to~~the first reference value includes~~ further derive~~ing~~ a second reference value that is a reference value of an offset used for correcting the pixel value by being added to the reference image, by subtracting a value obtained by multiplying a median value of a maximum pixel value by the weighting factor from~~and by subtracting~~ the median value ~~from a resultant value~~,

the ~~step of~~ encoding unit is configured to~~the first difference value includes~~ further encode~~ing~~ a second difference value that is a difference value between the offset and the second reference value, and

the second difference value~~offset~~ is included in a second~~the~~ range of ~~the~~ predetermined bit precision having a predetermined~~the~~ second ~~reference~~ value as approximate center.

57. The encoding device~~method~~ according to claim 46, wherein the second range~~difference value~~ is a~~included in the~~ fixed range of the predetermined bit precision.

68. The encoding devicemethod according to claim 47, further comprising the deriving unit is configured tostep of performing a clipping process such that the offset is included in the first range of the predetermined bit precision when the offset is not included in the first range of the predetermined bit precision.

7. The encoding device according to claim 1, wherein the deriving unit derives the first reference value being 2 raised to the power of the fixed point precision.

89. A decoding devicemethod comprising the steps of:

a first decoding unit configured to decodederiving a first reference value that is a reference value of a weighting factor based on fixed point precision representing roughness of athe weighting factor that is used for making a motion-compensated prediction of a change in a pixel value by multiplying a reference image by the weighting factor;

a deriving unit configured to derive a first reference value based on the fixed point precision; and

a second decoding unit configured to decode the weighting factor by adding the first reference value to a

first difference value that is a difference value between the weighting factor and the first reference value,

wherein the weighting factor is included in a first range of predetermined bit precision having the first reference value at approximate center, and the first difference value is in a predetermined range.

9. The decoding device according to claim 8, wherein the predetermined range is of -128 to 127.

10. The decoding device~~method~~ according to claim 8~~9~~, wherein the first reference value indicates a factor to be set if a difference of pixel value between a reference image and a target image to be encoded is less than or equal to a specific value~~is a reference value of the weighting factor of a case where the change in the pixel value to which the weighting factor is applied is a predetermined value or less~~.

~~11. The decoding method according to claim 9, wherein the first difference value is included in a fixed range of the predetermined bit precision that does not depend on the fixed point precision.~~

~~12. The decoding method according to claim 9, further comprising the step of performing a clipping process such that the weighting factor is included in the range of the predetermined bit precision when the weighting factor is not included in the range of the predetermined bit precision.~~

~~13. The decoding method according to claim 9, wherein the weighting factor is included in the range of the predetermined bit precision having a value acquired by shifting the first reference value by a predetermined shift amount as approximate center.~~

11~~14~~. The decoding device~~method~~ according to claim 8~~9~~, wherein

the ~~step of~~ deriving unit is configured to~~the first reference value includes~~ further derive~~ing~~ a second reference value that is a reference value of an offset used for correcting the pixel value by being added to the reference image, by subtracting a value obtained by multiplying a median value of a maximum pixel value by the weighting factor from~~and subtracting~~ the median value ~~from a resultant value~~,

the secondstep of decoding unit is configured to furtherthe weighting factor includes decodeing the offset by adding the second reference value to a second difference value that is a difference value between the offset and the second reference value, and

the second difference valueoffset is included in athe range of the predetermined bit precision having the second reference value as approximate center.

12~~15~~. The decoding devicemethod according to claim 11~~14~~, wherein the range of the second difference value is a~~included in the~~ fixed range of the predetermined bit precision.

13~~16~~. The decoding devicemethod according to claim 11~~15~~, whereinfurther comprising the deriving unit is configured tostep of performing a clipping process such that the offset is included in the first range ~~of the predetermined bit precision~~ when the offset is not included in the first range ~~of the predetermined bit precision~~.

14. The decoding device according to claim 8, wherein the deriving unit derives the first reference value being 2 raised to the power of the fixed point precision.

1517. An encoding methoddevice comprising:

an encoding unit configured to derivinge a reference value of a weighting factor based on fixed point precision representing roughness of athe weighting factor that is used for making a motion-compensated prediction of a change in a pixel value by multiplying a reference image by the weighting factor; and

encodinges a difference value between the weighting factor and the reference value and the fixed point precision,

wherein the weighting factor is included in a range of predetermined bit precision having the reference value at approximate center, and the difference value is in a predetermined range.

1618. A decoding methoddevice comprising:

a decoding unit configured to derive a reference value of a weighting factor based on fixed point precision representing roughness of athe weighting factor that is used for making a motion-compensated prediction of a change in a pixel value by multiplying a reference image by the weighting factor,;

deriving a reference value based on the fixed point precision; and

decoding the weighting factor by adding~~s~~ the reference value to a difference value that is a difference value between the weighting factor and the reference value, ~~and decodes the weighting factor,~~

wherein the weighting factor is included in a range of predetermined bit precision having the reference value at approximate center, and the difference value is in a predetermined range.