

Organization/International Electrotechnical Commission (ISO/IEC) specified by "MPEG-x". Currently, the latest and most advanced video coding standard is presented by the H.264/AVC or MPEG-4 AVC standard (see Non Patent Literatures 1 and 2).

[0004]

Moreover, various studies are made to improve the coding efficiency by the High Efficiency Video Coding (HEVC) standard which is a next-generation image coding standard (see Non Patent Literature 3).

[Citation List]

[Non Patent Literature]

[0005]

[NPL 1]

ISO/IEC 14496-10 "MPEG-4 Part 10, Advanced Video Coding"

[NPL 2]

Thomas Wiegand et al, "Overview of the H.264/AVC Video Coding Standard", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, JULY 2003, PP. 1 - 1

[NPL 3]

Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11 5th Meeting: Geneva, CH,-6-23 March, 2011 JCTVC-E603 Title:WD3: Working Draft 3 of High-Efficiency Video Coding ver.7
http://phenix.int-evry.fr/jct/doc_end_user/documents/5_Geneva/wg11/JCTVC-E603-v7.zip

[Summary of Invention]

[Technical Problem]

[0006]

In recent years, image quality is required to be improved while the coding efficiency is maintained.

[0007]

Embodiments of the present invention~~In view of this, the present invention is conceived to solve the aforementioned conventional problem, and has an object to provide an image coding method and an image decoding method capable of improving a coded image and a decoded image in image quality.~~

[Solution to Problem]

[0008]

~~The image coding method in an aspect according to the preset invention is a method of coding an input block included in an image. To be more specific, the image coding method includes generating a predicted block by predicting the input block; calculating a residual block by subtracting the predicted block from the input block; calculating quantized coefficients by performing transform and quantization on the residual block; calculating a coded residual block by performing inverse quantization and inverse transform on the quantized coefficients; generating a temporary coded block by adding the coded residual block to the predicted block; determining whether or not an offset process for correcting an error included in the temporary coded block is required, to generate first flag information indicating a result of the determination, the error being caused by the quantization in the calculating of quantized coefficients; executing the offset process on the temporary coded block when it is determined in the determining that the offset process is required; and performing variable-length coding on the quantized coefficients and the first flag information.~~According to a first aspect, there is provided an image coding method of coding an input block included in an image, the image coding method comprising: generating a predicted block by predicting the input block; calculating a residual block by subtracting the predicted block from the input block; calculating quantized coefficients by performing transform and quantization on the residual block; calculating a coded residual block by performing inverse quantization and inverse transform on the quantized coefficients; generating a temporary coded block by adding the coded residual block to the predicted block; determining whether or not an offset process for correcting an error included in the temporary coded block is required; generating first flag information indicating a result of the determining; executing the offset process on the temporary coded block when it is determined in the determining that the offset process is required;

and performing variable-length coding on the quantized coefficients and the first flag information, wherein the offset process is executed to add an offset value to a value of a pixel included in the temporary coded block, in the determining, whether an offset value for a previously-coded block adjacent to the input block or the offset value newly calculated for the temporary coded block is used in the offset process to be executed on the temporary coded block is further determined to generate second flag information indicating a result of the determining, in the executing, the offset process is executed on the temporary coded block using the offset value indicated by the second flag information, and in the performing variable-length coding, variable-length coding is further performed on the second flag information.

[0008a]

According to a second aspect, there is provided an image decoding method of decoding a bitstream to generate a decoded block, the image decoding method comprising: obtaining quantized coefficients and first flag information that indicates whether or not an offset process is required, by performing variable-length decoding on the bitstream; obtaining a decoded residual block by performing inverse quantization and inverse transform on the quantized coefficients; generating a predicted block by predicting the decoded block; generating a temporary decoded block by adding the decoded residual block to the predicted block; and generating the decoded block by executing, on the temporary decoded block, the offset process for correcting an error that is included in the temporary decoded block, when the first flag information indicates that the offset process is required, wherein the offset process is executed to add an offset value to a value of a pixel included in the temporary decoded block, in the obtaining of quantized coefficients and first flag information, second flag information is further obtained, the second flag information indicating whether the offset value for a previously-decoded block adjacent to the decoded block or the offset value newly calculated for the temporary decoded block is used in the

offset process to be executed on the temporary decoded block, and in the generating of the decoded block, the offset process is executed on the temporary decoded block using the offset value indicated by the second flag information.

[0008b]

According to a third aspect, there is provided an image coding apparatus that codes an input block included in an image, the image coding apparatus comprising: a prediction unit configured to generate a predicted block by predicting the input block; a calculation unit configured to calculate a residual block by subtracting the predicted block from the input block; a transform-quantization unit configured to calculate quantized coefficients by performing transform and quantization on the residual block; an inverse quantization-transform unit configured to calculate a coded residual block by performing inverse quantization and inverse transform on the quantized coefficients; a generation unit configured to generate a temporary coded block by adding the coded residual block to the predicted block; a determination unit configured to determine whether or not an offset process for correcting an error included in the temporary coded block is required, and configured to generate first flag information indicating a result of the determination; an offset processing unit configured to execute the offset process on the temporary coded block when it is determined by the determination unit that the offset process is required; and a variable-length coding unit configured to perform variable-length coding on the quantized coefficients and the first flag information, wherein the offset processing unit is configured to add an offset value to a value of a pixel included in the temporary coded block, the determination unit is configured to generate second flag information, the second flag information indicating whether the offset value for a previously-coded block adjacent to the input block or the offset value newly calculated for the temporary coded block is used in the offset process to be executed on the temporary coded block, the offset processing unit is configured to execute the offset

process on the temporary coded block using the offset value indicated by the second flag information, and the variable-length coding unit is configured to perform variable-coding on the second flag information.

[0008c]

According to a fourth aspect, there is provided an image decoding apparatus that decodes a bitstream to generate a decoded block, the image decoding apparatus comprising: a variable-length decoding unit configured to obtain quantized coefficients and first flag information that indicates whether or not an offset process is required, by performing variable-length decoding on the bitstream; an obtainment unit configured to obtain a decoded residual block by performing inverse quantization and inverse transform on the quantized coefficients; a prediction unit configured to generate a predicted block by predicting the decoded block; a generation unit configured to generate a temporary decoded block by adding the decoded residual block to the predicted block; and an offset processing unit configured to generate the decoded block by executing, on the temporary decoded block, the offset process for correcting an error that is included in the temporary decoded block, when the first flag information indicates that the offset process is required, wherein the offset processing unit is configured to execute to add an offset value to a value of a pixel included in the temporary decoded block, the variable-length coding unit is configured to obtain second flag information when obtaining the quantized coefficients and first flag information, the second flag information indicating whether the offset value for a previously-decoded block adjacent to the decoded block or the offset value newly calculated for the temporary decoded block is used in the offset process to be executed on the temporary decoded block, and the offset processing unit is configured to execute the offset process on the temporary decoded block using the offset value indicated by the second flag information to generate the decoded block.

[0008d]

According to a fifth aspect, there is provided an image coding-decoding apparatus comprising the image coding apparatus according to the third aspect; and the image decoding apparatus according to the fourth aspect.

[0009]

It should be noted that a general or specific embodiment in an aspect may be implemented by a system, a method, an integrated circuit, a computer program, or a recording medium, or by any combination of a system, a method, an integrated circuit, a computer program, and a recording medium.

[Advantageous Effects of Invention]

[0010]

Embodiments of tThe present invention can reduce distortion of a chroma signal and improve subjective image quality.

[Brief Description of Drawings]

[0011]

[Fig. 1]

FIG. 1 is a block diagram showing an example of a configuration of an image coding apparatus in Embodiment 1