[DESCRIPTION]

[Title of Invention]
IMAGE CODING METHOD, IMAGE CODING APPARATUS, IMAGE DECODING METHOD, IMAGE DECODING APPARATUS, AND IMAGE CODING AND DECODING APPARATUS

[Technical Field]
[0001]
The present invention relates to an image coding method, an image coding apparatus, an image decoding method, an image decoding apparatus, and an image coding and decoding apparatus, and in particular to an image coding method, an image coding apparatus, an image decoding method, an image decoding apparatus, and an image coding and decoding apparatus for performing arithmetic coding or arithmetic decoding on a sample adaptive offset (SAO) parameter.

[Background Art]
[0002]
Recent years have seen the significant technical development in digital video apparatuses, and increasing chances for compression-coding a video signal (a plurality of images arranged in time series) and recording the video signal onto recording media such as DVDs and hard disks or distributing the video signal on the Internet. For example, the H.264/AVC (MPEG-4 AVC) is one of the standards for compression-coding a video signal. Furthermore, the High Efficiency Video Coding (HEVC) standard is currently being considered as a next-generation standard.
[0003]
The current HEVC standard (NPL 1) has an offset process called SAO. The SAO process is a process for adding an offset value to each pixel of an image decoded from a bitstream (coded bitstream). Performing the SAO process enables reduction in image degradation by coding and making the decoded image more similar to the original image. In accordance with the current HEVC standard, the arithmetic coding is performed on an offset value in the SAO process, and the offset value is added to the bitstream.

[Citation List]
[Non Patent Literature]
[0004]
[NPL 1] Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 9th Meeting: Geneva, CH, 27 April – 7 May 2012, JCTVC-I0602_CDTexts_r2.doc, BoG report on integrated text of SAO adoptions on top of JCTVC-I0030,
http://phenix.it-sudparis.eu/jct/doc_end_user/documents/9_Geneva/wg11/JCTVC-I0602-v3.zip

[Summary of Invention]

[Technical Problem]
[0005]
In the conventional technique, accelerated processing is desired in coding and decoding an image.
[0006]
Embodiments of the present invention provide an image coding method and an image decoding method in which the processing can be accelerated.

[Solution to Problem]
[0006a]
According to a first aspect of the present invention, there is provided a method including: determining a sample adaptive offset (SAO) type parameter for a SAO value, wherein the SAO type parameter indicates whether the SAO value is an edge offset value or a band offset value, and the SAO value is to be added to a pixel value of a reconstructed image; encoding the SAO type parameter into a bitstream; determining an integer indicating a magnitude of the SAO value; and encoding the determined integer using variable length coding into a plurality of bins, wherein each bin of the plurality of bins is encoded into the bitstream using bypass arithmetic coding with a fixed probability.
[0006b]
According to a second aspect of the present invention, there is provided an apparatus, including: at least one processor; at least one memory including computer program code, the memory and the computer program code configured to, working with the at least one processor, cause the apparatus to perform at least the following: decode a sample adaptive offset (SAO) type parameter from a bitstream; determine from the SAO type parameter an SAO type for an SAO value, wherein the SAO type parameter indicates whether the SAO value is an edge offset value or a band offset value, and the SAO value is to be added to a pixel value of a reconstructed image; decode from the bitstream, using bypass arithmetic coding with a fixed probability, a plurality of bins with variable length coding, wherein the plurality of bins represents an integer indicating a magnitude of the SAO value; determine the integer indicating the magnitude of the SAO value, based on the plurality of bins decoded using bypass arithmetic coding with a fixed probability; and determine the SAO value using the determined integer.
[0006c]
According to a third aspect of the present invention, there is provided a method including: decoding a sample adaptive offset (SAO) type parameter from a bitstream; determining from the SAO type parameter an SAO type for an SAO value, wherein the SAO type parameter indicates whether the SAO value is an edge offset value or a band offset value, and the SAO value is to be added to a pixel value of a reconstructed image; decoding from the bitstream, using bypass arithmetic coding with a fixed probability, a plurality of bins with variable length coding, wherein the plurality of bins represents an

integer indicating a magnitude of the SAO value; determining the integer indicating the magnitude of the SAO value, based on the plurality of bins decoded using bypass arithmetic coding with a fixed probability; and determining the SAO value using the determined integer.

[0007]

Disclosed herein is an image coding method for coding an input image, and includes: converting, into a bin string, an offset value used in an offset process to be applied to a pixel value of a reconstructed image corresponding to the input image; and performing bypass arithmetic coding on the bin string using a fixed probability.

[0008]

Disclosed herein is an image decoding method for decoding a coded image, and includes: performing bypass arithmetic decoding on a bin string using a fixed probability, the bin string being coded and indicating an offset value used in an offset process to be applied to a pixel value of a reconstructed image corresponding to the coded image; and converting, into the offset value, the bin string on which the bypass arithmetic decoding is performed.

[0009]

These general or specific aspects of the present invention may be implemented by a system, an apparatus, an integrated circuit, a computer program, a computer-readable recording medium, such as a CD-ROM, or an arbitrary combination of the system, the apparatus, the integrated circuit, the computer program, and the recording medium.

[Advantageous Effects of Invention]

[0010]

With the image coding method, the image coding apparatus, the image decoding method, the image decoding apparatus, and the image coding and decoding apparatus according to the present invention, the processing can be accelerated.

[Brief Description of Drawings]

[0011]

[FIG. 1] FIG. 1 is a block diagram illustrating an example configuration of an image coding apparatus according to Embodiment 1.

[FIG. 2] FIG. 2 is a block diagram illustrating an example configuration of an SAO parameter coding unit.

[FIG. 3] FIG. 3 is a block diagram illustrating an example configuration of an sao_offset coding unit.

[FIG. 4] FIG. 4 is a flowchart indicating example processes of the image coding apparatus according to Embodiment 1.

[FIG. 5] FIG. 5 is a flowchart indicating example processes of the SAO parameter coding unit according to Embodiment 1.

[FIG. 6A] FIG. 6A is a flowchart indicating example processes of the sao_offset coding unit according to Embodiment 1.

[FIG. 6B] FIG. 6B is a flowchart indicating example processes of the

CLAIMS:

1. A method comprising:

determining a sample adaptive offset (SAO) type parameter for a SAO value, wherein the SAO type parameter indicates whether the SAO value is an edge offset value or a band offset value, and the SAO value is to be added to a pixel value of a reconstructed image;

encoding the SAO type parameter into a bitstream;

determining an integer indicating a magnitude of the SAO value; and

encoding the determined integer using variable length coding into a plurality of bins,

wherein each bin of the plurality of bins is encoded into the bitstream using bypass arithmetic coding with a fixed probability.

2. The method of claim 1, wherein the fixed probability is a 50% probability.

3. An apparatus, comprising:

at least one processor;

at least one memory including computer program code, the memory and the computer program code configured to, working with the at least one processor, cause the apparatus to perform at least the following:

decode a sample adaptive offset (SAO) type parameter from a bitstream;

determine from the SAO type parameter an SAO type for an SAO value, wherein the SAO type parameter indicates whether the SAO value is an edge offset value or a band offset value, and the SAO value is to be added to a pixel value of a reconstructed image;

decode from the bitstream, using bypass arithmetic coding with a fixed probability, a plurality of bins with variable length coding, wherein the plurality of bins represents an integer indicating a magnitude of the SAO value;

determine the integer indicating the magnitude of the SAO value, based on the plurality of bins decoded using bypass arithmetic coding with a fixed probability; and

determine the SAO value using the determined integer.

4. The apparatus of claim 3, wherein the memory and the computer program code are configured to, working with the at least one processor, cause the apparatus to add the SAO value to a pixel value of an image.

5. The apparatus of claim 3, wherein the fixed probability is a 50% probability.

6. A method comprising:

decoding a sample adaptive offset (SAO) type parameter from a bitstream;

determining from the SAO type parameter an SAO type for an SAO value, wherein the SAO type parameter indicates whether the SAO value is an edge offset value or a band offset value, and the SAO value is to be added to a pixel value of a reconstructed image;

decoding from the bitstream, using bypass arithmetic coding with a fixed probability, a plurality of bins with variable length coding, wherein the plurality of bins represents an integer indicating a magnitude of the SAO value;

determining the integer indicating the magnitude of the SAO value, based on the plurality of bins decoded using bypass arithmetic coding with a fixed probability; and

determining the SAO value using the determined integer.

7. The method of claim 6, further comprising adding the SAO value to a pixel value of an image.

8. The method of claim 6, wherein the fixed probability is a 50% probability.