[DESCRIPTION]

[Title of Invention]

IMAGE CODING METHOD, IMAGE DECODING METHOD, IMAGE CODING APPARATUS, IMAGE DECODING APPARATUS, AND IMAGE CODING AND DECODING APPARATUS

[Technical Field]

[0001]

The present invention relates to an image coding method for coding an image using plural intra prediction modes.

[Background Art]

[0002]

Examples of a technique with regard to an image coding method for coding an image using plural intra prediction modes include techniques disclosed in Non Patent Literatures (NPLs) 1 and 2.

[Citation List]

[Non Patent Literature]

[0003]

[NPL 1] ITU-T Recommendation H.264 "Advanced video coding for generic audiovisual services", March, 2010

[NPL 2] JCT-VC "WD3: Working Draft 3 of High-Efficiency Video Coding", JCTVC-E603, March 2011

[Summary of Invention]

[Technical Problem]

[0004]

Inefficiently coding an image causes a delay of processing, and also exerts an influence on decoding the image.

[0005]

Embodiments~~In view of this, an object~~ of the present invention ~~is to~~ provide an image coding method for efficiently coding information of an image.

[Solution to Problem]

[0006]

According to a first~~In order to achieve the above object, an image coding method according to an~~ aspect of the present invention, there is provided an image coding method for coding an image using plural intra prediction modes, the image coding method including coding first binary data and second binary data, the first binary data indicating a first intra prediction mode used to code the image, the second binary data indicating a second intra prediction mode used to code the image, wherein in the coding, a first context adaptive portion and a second context adaptive portion are coded by context adaptive binary arithmetic coding, the first context adaptive portion being part of the first binary data, the second context adaptive portion being part of the second binary data, the context adaptive binary arithmetic coding being arithmetic coding using a variable probability updated based on coded data, a first bypass portion and a second bypass portion are coded by bypass coding, the first bypass portion being different part of the first binary data, the second bypass portion being different part of the second binary data, the bypass coding being arithmetic coding using a predetermined fixed probability, and coded data is generated which includes the first context adaptive portion, the second context adaptive portion, the first bypass portion, and the second bypass portion, the first bypass portion and the second bypass portion being included subsequent to the first context adaptive portion and the second context adaptive portion.

According to a second aspect of the present invention, there is provided an image decoding method for decoding an image using plural intra prediction modes, the image decoding method comprising decoding first binary data and second binary data, the first binary data indicating a first intra prediction mode to be used to decode the image, the second binary data indicating a second intra prediction mode to be used to decode the image, wherein in the decoding, coded data is obtained which includes a first context adaptive portion, a second context adaptive portion, a first bypass portion, and a second bypass portion, the first context adaptive portion being part of the first binary data, the second context adaptive portion being part of the second binary data, the first bypass portion being different part of the first binary data, the second bypass portion being

different part of the second binary data, the first bypass portion and the second bypass portion being included subsequent to the first context adaptive portion and the second context adaptive portion, the first context adaptive portion and the second context adaptive portion are decoded by context adaptive binary arithmetic decoding which is arithmetic decoding using a variable probability updated based on decoded data, and the first bypass portion and the second bypass portion are decoded by bypass decoding which is arithmetic decoding using a predetermined fixed probability.

According to a third aspect of the present invention, there is provided an image coding apparatus which codes an image using plural intra prediction modes, the image coding apparatus comprising a coder which codes first binary data and second binary data, the first binary data indicating a first intra prediction mode used to code the image, the second binary data indicating a second intra prediction mode used to code the image, wherein the coder (i) codes a first context adaptive portion and a second context adaptive portion by context adaptive binary arithmetic coding, the first context adaptive portion being part of the first binary data, the second context adaptive portion being part of the second binary data, the context adaptive binary arithmetic coding being arithmetic coding using a variable probability updated based on coded data, (ii) codes a first bypass portion and a second bypass portion by bypass coding, the first bypass portion being different part of the first binary data, the second bypass portion being different part of the second binary data, the bypass coding being arithmetic coding using a predetermined fixed probability, and (iii) generates coded data which includes the first context adaptive portion, the second context adaptive portion, the first bypass portion, and the second bypass portion, the first bypass portion and the second bypass portion being included subsequent to the first context adaptive portion and the second context adaptive portion.

According to a fourth aspect of the present invention, there is provided an image decoding apparatus which decodes an image using plural intra prediction modes, the image decoding apparatus comprising a decoder which decodes first binary data and second binary data, the first binary data indicating a first intra prediction mode to be used to decode the image, the second binary data

indicating a second intra prediction mode to be used to decode the image, wherein the decoder (i) obtains coded data which includes a first context adaptive portion, a second context adaptive portion, a first bypass portion, and a second bypass portion, the first context adaptive portion being part of the first binary data, the second context adaptive portion being part of the second binary data, the first bypass portion being different part of the first binary data, the second bypass portion being different part of the second binary data, the first bypass portion and the second bypass portion being included subsequent to the first context adaptive portion and the second context adaptive portion, (ii) decodes the first context adaptive portion and the second context adaptive portion by context adaptive binary arithmetic decoding which is arithmetic decoding using a variable probability updated based on decoded data, and (iii) decodes the first bypass portion and the second bypass portion by bypass decoding which is arithmetic decoding using a predetermined fixed probability.

According to a fifth aspect of the present invention, there is provided an image coding and decoding apparatus comprising the above image coding apparatus and the above image decoding apparatus.

[0007]

It should be noted that these general and specific aspects may be implemented using an apparatus, a system, an integrated circuit, a computer program, a computer-readable non-transitory recording medium such as a CD-ROM, or an arbitrary combination of apparatuses, systems, methods, integrated circuits, computer programs or recording media.

[Advantageous Effects of Invention]

[0008]

Embodiments of t~~T~~he present invention allows information of an image to be efficiently coded.

[Brief Description of Drawings]

[0009]

[FIG. 1] FIG. 1 is a flowchart illustrating coding processing on an intra prediction mode.

[FIG. 2] FIG. 2 is a block diagram illustrating an example of a configuration of an intra prediction mode decoder.

[FIG. 3] FIG. 3 is a flowchart illustrating decoding processing in an intra prediction mode.

[FIG. 4] FIG. 4 is a flowchart illustrating context adaptive binary arithmetic decoding processing of an arithmetic decoding method.

[FIG. 5] FIG. 5 is a flowchart illustrating bypass arithmetic decoding processing of the arithmetic decoding method.

[FIG. 6] FIG. 6 is a flowchart illustrating normalizing processing of the arithmetic decoding method.

[FIG. 7] FIG. 7 is a block diagram illustrating a configuration of an intra prediction mode decoder according to Embodiment 1.

[FIG. 8] FIG. 8 is a flowchart illustrating processing by the intra prediction mode decoder according to Embodiment 1.

[FIG. 9] FIG. 9 illustrates an example of operation according to Embodiment 1.

[FIG. 10] FIG. 10 is a block diagram illustrating an example of a configuration of an image decoding apparatus according to Embodiment 1.

[FIG. 11] FIG. 11 is a block diagram illustrating a configuration of an intra prediction mode decoder according to a variation of Embodiment 1.

[FIG. 12] FIG. 12 illustrates examples of binary code strings according to the variation of Embodiment 1.

[FIG. 13] FIG. 13 is a flowchart illustrating processing by the intra prediction mode decoder according to the variation of Embodiment 1.

[FIG. 14] FIG. 14 illustrates syntax showing an example of a data structure according to the variation of Embodiment 1.