[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]

It is still desirable to increase coding efficiency for image coding and decoding in which inter prediction is used, beyond the above-described conventional technique.

[0005]

Embodiments~~In view of this, the object~~ of the present invention ~~is to~~ provide an image coding method and an image decoding method with which coding efficiency in image coding and image decoding using inter prediction is increased.

[Solution to Problem]

[0005a]

According to a first aspect, there is provided an image coding method for coding a current block, comprising: deriving a first candidate having a first motion vector that has been used to code a first block; deriving a second candidate having a second motion vector that has been used to code a second block which is different from the first block; determining whether or not a total number of candidates having the first candidate and the second candidate is less than a maximum candidate number; deriving a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being

identical to the first motion vector, the fourth motion vector being identical to the second motion vector; coding an index corresponding to a candidate having a motion vector; and generating a bitstream having the coded index, wherein the maximum candidate number is used to code the index, wherein the motion vector is used to code the current block, and wherein the candidate is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0005b]

According to a second aspect, there is provided an image decoding method for decoding a current block, comprising: deriving a first candidate having a first motion vector that has been used to decode a first block; deriving a second candidate having a second motion vector that has been used to decode a second block which is different from the first block; determining whether or not a total number of candidates having the first candidate and the second candidate is less than a maximum candidate number; deriving a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being identical to the first motion vector, the fourth motion vector being identical to the second motion vector; and decoding a coded index corresponding to a candidate having a motion vector, wherein the maximum candidate number is used to decode the coded index, wherein a bitstream has the coded index, wherein the motion vector is used to decode the current block, and wherein the candidate is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0005c]

According to a third aspect, there is provided a motion vector derivation method, comprising: deriving a first candidate having a first motion vector that has been used to decode a first block; deriving a second candidate having a second motion vector that has been used to decode a

second block which is different from the first block; determining whether or not a total number of candidates having the first candidate and the second candidate is less than a maximum candidate number; deriving a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being identical to the first motion vector, the fourth motion vector being identical to the second motion vector; and deriving a motion vector, wherein a coded index corresponds to a candidate having the motion vector, wherein the maximum candidate number is used to decode the coded index, wherein a bitstream has the coded index, wherein the motion vector is used to decode a current block, and wherein the candidate having the motion vector is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0005d]

According to a fourth aspect, there is provided an image coding apparatus that codes a current block, comprising: a first deriver configured to derive a first candidate having a first motion vector that has been used to code a first block; a second deriver configured to derive a second candidate having a second motion vector that has been used to code a second block which is different from the first block; a determiner configured to determine whether or not a total number of candidates having the first candidate and the second candidate is less than a maximum candidate number; a third deriver configured to derive a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being identical to the first motion vector, the fourth motion vector being identical to the second motion vector; and a coder configured to code an index corresponding to a candidate having a motion vector; and a generator configured to generate a bitstream having the coded index, wherein the maximum candidate number is used to code the index,

wherein the motion vector is used to code the current block, and wherein the candidate is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0005e]

According to a fifth aspect, there is provided an image decoding apparatus that decodes a current block, comprising: a first deriver configured to derive a first candidate having a first motion vector that has been used to decode a first block; a second deriver configured to derive a second candidate having a second motion vector that has been used to decode a second block which is different from the first block; a determiner configured to determine whether or not a total number of candidates having the first candidate and the second candidate is less than a maximum candidate number; a third deriver configured to derive a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being identical to the first motion vector, the fourth motion vector being identical to the second motion vector; and a decoder configured to decode a coded index corresponding to a candidate having a motion vector, wherein the maximum candidate number is used to decode the coded index, wherein a bitstream has the coded index, wherein the motion vector is used to decode the current block, wherein the candidate is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0005f]

According to a sixth aspect, there is provided a motion vector derivation apparatus, comprising: a first deriver configured to derive a first candidate having a first motion vector that has been used to decode a first block; a second deriver configured to derive a second candidate having a second motion vector that has been used to decode a second block which is different from the first block; a determiner configured to determine whether or not a total number of candidates having the first candidate and the second

candidate is less than a maximum candidate number; a third deriver configured to derive a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being identical to the first motion vector, the fourth motion vector being identical to the second motion vector; and a fourth deriver configured to derive a motion vector, wherein a coded index corresponds to a candidate having the motion vector, wherein the maximum candidate number is used to decode the coded index, wherein a bitstream has the coded index, wherein the motion vector is used to decode a current block, and wherein the candidate having the motion vector is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0005g]

According to a seventh aspect, there is provided an integrated circuit, comprising: a first deriver configured to derive a first candidate having a first motion vector that has been used to decode a first block; a second deriver configured to derive a second candidate having a second motion vector that has been used to decode a second block which is different from the first block; a determiner configured to determine whether or not a total number of candidates having the first candidate and the second candidate is less than a maximum candidate number; a third deriver configured to derive a third candidate having a third motion vector and a fourth motion vector when the total number of candidates having the first candidate and second candidates is less than the maximum candidate number, the third motion vector being identical to the first motion vector, the fourth motion vector being identical to the second motion vector; and a decoder configured to decode a coded index corresponding to a candidate having a motion vector, wherein the maximum candidate number is used to decode the coded index, wherein a bitstream has the coded index, wherein the motion vector is used to decode the current block, and wherein the candidate is one of a plurality of candidates having the first candidate, the second candidate, and the third candidate.

[0006]

Disclosed herein~~An image coding method according to an aspect of the present invention~~ is a method for coding an image on a block-by-block basis to generate a bitstream, the method inlcuding~~and includes~~: determining a maximum number of merging candidates each of which is a combination of a prediction direction, a motion vector, and a reference picture index for use in coding of a current block; deriving a plurality of first merging candidates based on prediction directions, motion vectors, and reference picture indexes used in coding of blocks spatially or temporally neighboring the current block; determining whether or not a total number of the derived first merging candidates is smaller than the maximum number; deriving, by making a combination out of the derived first merging candidates, a second merging candidate

for bi-directional prediction when it is determined that the total number of the derived first merging candidates is smaller than the maximum number; selecting a merging candidate to be used for the coding of the current block from the derived first merging candidates and the derived second merging candidate; and coding, using the determined maximum number, an index for identifying the selected merging candidate, and attaching the coded index to the bitstream.

[0007]

It should be noted that these general or specific aspects can be implemented as a system, a method, an integrated circuit, a computer program, a computer-readable recording medium such as a compact disc read-only memory (CD-ROM), or as any combination of a system, a method, an integrated circuit, a computer program, and a computer-readable recording medium.

[Advantageous Effects of Invention]

[0008]

According to embodiments~~an aspect~~ of the present invention, coding efficiency in image coding and decoding using inter prediction can be increased.

[Brief Description of Drawings]

[0009]

[FIG. 1A] FIG. 1A is a diagram for illustrating an exemplary reference picture list for a B picture;

[FIG. 1B] FIG. 1B is a diagram for illustrating an exemplary reference picture list of a prediction direction 0 for a B picture;

[FIG. 1C] FIG. 1C is a diagram for illustrating an exemplary reference picture list of a prediction direction 1 for a B picture;

[FIG. 2] FIG. 2 is a diagram for illustrating motion vectors for use in the temporal motion vector prediction mode;

[FIG. 3] FIG. 3 shows an exemplary motion vector of a neighboring block for use in the merging mode;

[FIG. 4] FIG. 4 is a diagram for illustrating an exemplary merging block candidate list;