CLAIMS

[1] A moving image encoding device comprising:

an encoding controlling unit for determining a maximum size of a block to be encoded which is a unit to be processed when a prediction process is carried out, and also determining a maximum hierarchy depth when a block to be encoded having the maximum size is divided hierarchically, and for selecting an encoding mode which determines an encoding method of encoding each block to be encoded from one or more available encoding modes;

a block dividing unit for dividing an inputted image into blocks to be encoded having a predetermined size, and also dividing each of said blocks to be encoded hierarchically until its hierarchy number reaches the maximum hierarchy depth determined by said encoding controlling unit;

a motion-compensated prediction unit for, when an inter encoding mode which is a direct mode is selected by said encoding controlling unit as an encoding mode corresponding to one of the blocks to be encoded into which the inputted image is divided by said block dividing unit, selecting a motion vector suitable for generation of a prediction image from one or more selectable motion vectors and also carrying out a motion-compensated prediction process on said block to be encoded to generate a prediction image by using said motion vector, and for outputting index information showing the motion vector;

a difference image generating unit for generating a difference image between the one of the blocks to be encoded into which the inputted image is divided by said block dividing unit, and the prediction image generated by said

motion-compensated prediction unit;

an image compression unit for compressing the difference image generated by said difference image generating unit, and outputting compressed data of said difference image; and

a variable length encoding unit for variable-length-encoding the compressed data outputted from said image compression unit, the encoding mode selected by said encoding controlling unit, and the index information outputted from said motion-compensated prediction unit to generate a bitstream into which encoded data of said compressed data, encoded data of said encoding mode, and encoded data of said index information are multiplexed.

[2] The moving image encoding device according to claim 1, wherein when an inter encoding mode other than direct modes is selected by the encoding controlling unit as the encoding mode corresponding to the one of the blocks to be encoded into which the inputted image is divided by the block dividing unit, the motion-compensated prediction unit searches through said one of the blocks to be encoded and a reference image for a motion vector, and carries out the motion-compensated prediction process on said one of the blocks to be encoded by using said motion vector to generate a prediction image, and, when variable-length-encoding the compressed data outputted from the image compression unit and the encoding mode selected by said encoding controlling unit, the variable length encoding unit variable-length-encodes said motion vector to generate a bitstream into which encoded data of said compressed data, encoded data of said encoding mode, and encoded data of said index information are multiplexed.

[3] The moving image encoding device according to claim

1 or 2, wherein said moving image encoding device includes an intra prediction unit for, when an intra encoding mode is selected by the encoding controlling unit as the encoding mode corresponding to the one of the blocks to be encoded into which the inputted image is divided by the block dividing unit, carrying out the intra prediction process on said one of the blocks to be encoded to generate a prediction image, and the difference image generating unit generates a difference image between the one of the blocks to be encoded into which the inputted image is divided by the block dividing unit and the prediction image generated by said intra prediction unit or said motion-compensated prediction unit.

[4] The moving image encoding device according to claim 2 or 3, wherein the encoding controlling unit determines a quantization parameter and a transformation block size which are used when the difference image is compressed for each of the blocks to be encoded, the image compression unit carries out a transformation process on the difference image generated by the difference image generating unit in units of a block having the transformation block size determined by said encoding controlling unit and also quantizes transform coefficients of said difference image by using the quantization parameter determined by said encoding controlling unit to output the transform coefficients quantized thereby as the compressed data of said difference image, and, when variable-length-encoding the compressed data outputted from said image compression unit, the encoding mode selected by said encoding controlling unit, and the index information or the motion vector outputted from the motion-compensated prediction unit, the variable length encoding unit

variable-length-encodes the quantization parameter and the transformation block size which are determined by said encoding controlling unit to generate the bitstream into which the encoded data of said compressed data, the encoded data of said encoding mode, the encoded data of said index information or said motion vector, the encoded data of said quantization parameter, and the encoded data of said transformation block size are multiplexed.

[5] The moving image encoding device according to claim 1, wherein when a list showing one or more selectable motion vectors is set for each of block sizes provided for the blocks to be encoded, the encoding controlling unit refers to said list to determine the one or more selectable motion vectors.

[6] The moving image encoding device according to claim 5, wherein when the list showing one or more selectable motion vectors is changed, the variable length encoding unit encodes list information showing the changed list to generate encoded data.

[7] A moving image decoding device comprising:

a variable length decoding unit for variable-length-decoding encoded data multiplexed into a bitstream to acquire compressed data, an encoding mode, and index information which are associated with each of coding blocks into which an image is hierarchically divided;

a motion-compensated prediction unit for, when an encoding mode associated with a coding block variable-length-decoded by said variable length decoding unit is an inter encoding mode which is a direct mode, selecting a motion vector shown by the index information associated with said coding block from one or more selectable motion vectors,

and carrying out a motion-compensated prediction process on said coding block by using said motion vector to generate a prediction image;

a difference image generating unit for generating a pre-compressed difference image from the compressed data associated with the coding block variable-length-decoded by said variable length decoding unit; and

a decoded image generating unit for adding the difference image generated by said difference image generating unit and the prediction image generated by said motion-compensated prediction unit to generate a decoded image.

[8] The moving image decoding device according to claim 7, wherein the variable length decoding unit variable-length-decodes the encoded data to acquire the compressed data, the encoding mode, and the motion vector which are associated with each of the coding blocks, and, when the encoding mode associated with one coding block variable-length-decoded by said variable length decoding unit is an inter encoding mode other than direct modes, the motion-compensated prediction unit carries out the motion-compensated prediction process on said coding block by using the motion vector associated with said coding block to generate a prediction image.

[9] The moving image decoding device according to claim 7 or 8, wherein said moving image decoding device includes an intra prediction unit for, when the encoding modes associated with the coding block variable-length-decoded by said variable length decoding unit is an intra encoding mode, carrying out an intra prediction process on said coding block to generate a prediction image, and the decoded image generating unit adds

the difference image generated by said difference image generating unit and the prediction image generated by said intra prediction unit or said motion-compensated prediction unit to generate a decoded image.

[10] The moving image decoding device according to claim 8 or 9, wherein the variable length decoding unit variable-length-decodes the encoded data multiplexed into the bitstream to acquire the compressed data, the encoding mode, the index information or a motion vector, a quantization parameter, and a transformation block size which are associated with each of the coding blocks, and the difference image generating unit inverse-quantizes the compressed data associated with the coding block which is variable-length-decoded by said variable length decoding unit by using the quantization parameter associated with said coding block and carries out an inverse transformation process on the compressed data inverse-quantized thereby in units of a block having said transformation block size to generate a pre-compressed difference image.

[11] The moving image decoding device according to claim 7, wherein when a list showing one or more selectable motion vectors is set for each of block sizes provided for the coding blocks, the motion-compensated prediction unit refers to said list to determine the one or more selectable motion vectors.

[12] The moving image decoding device according to claim 11, wherein the variable length decoding unit decodes the encoded data to acquire list information showing the list which is changed, and the motion-compensated prediction unit changes the list set thereto according to the list information variable-length-decoded by said variable length decoding unit.

[13] A moving image encoding method comprising:

an encoding control processing step of an encoding controlling unit determining a maximum size of a block to be encoded which is a unit to be processed when a prediction process is carried out and also determining a maximum hierarchy depth when a block to be encoded having the maximum size is divided hierarchically, and selecting an encoding mode which determines an encoding method of encoding each block to be encoded from one or more available encoding modes;

a block division processing step of a block dividing unit dividing an inputted image into blocks to be encoded having a predetermined size, and also dividing each of said blocks to be encoded hierarchically until its hierarchy number reaches the maximum hierarchy depth determined in said encoding control processing step;

a motion-compensated prediction processing step of, when an inter encoding mode which is a direct mode is selected in said encoding control processing step as an encoding mode corresponding to one of the blocks to be encoded into which the inputted image is divided in said block division processing step, a motion-compensated prediction unit selecting a motion vector suitable for generation of a prediction image from one or more selectable motion vectors and also carrying out a motion-compensated prediction process on said block to be encoded to generate a prediction image by using said motion vector, and outputting index information showing the motion vector;

a difference image generation processing step of a difference image generating unit generating a difference image between the one of the blocks to be encoded into which the

inputted image is divided in said block division processing step, and the prediction image generated in said motion-compensated prediction processing step;

an image compression processing step of an image compression unit compressing the difference image generated in said difference image generation processing unit, and outputting compressed data of said difference image; and

a variable length encode processing step of a variable length encoding unit variable-length-encoding the compressed data outputted in said image compression processing step, the encoding mode selected in said encoding control processing step, and the index information outputted in said motion-compensated prediction processing step to generate a bitstream into which encoded data of said compressed data, encoded data of said encoding mode, and encoded data of said index information are multiplexed.

[14] A moving image decoding method comprising:

a variable length decode processing step of a variable length decoding unit variable-length-decoding encoded data multiplexed into a bitstream to acquire compressed data, an encoding mode, and index information which are associated with each of coding blocks into which an image is hierarchically divided;

a motion-compensated prediction processing step of, when an encoding mode associated with a coding block variable-length-decoded by said variable length decoding unit is an inter encoding mode which is a direct mode, a motion-compensated prediction unit selecting a motion vector shown by the index information associated with said coding block from one or more selectable motion vectors, and carrying out

a motion-compensated prediction process on said coding block by using said motion vector to generate a prediction image;

a difference image generation processing step of a difference image generating unit generating a pre-compressed difference image from the compressed data associated with the coding block variable-length-decoded in said variable length decode processing step; and

a decoded image generation processing step of a decoded image generating unit adding the difference image generated in said difference image generation processing step and the prediction image generated in said motion-compensated prediction processing step to generate a decoded image.

[15] A moving image encoding device comprising:

an encoding controlling unit for determining a maximum size of a block to be encoded which is a unit to be processed when a prediction process is carried out, and also determining a maximum hierarchy depth when a block to be encoded having the maximum size is divided hierarchically, and for selecting an encoding mode which determines an encoding method of encoding each block to be encoded from one or more available encoding modes;

a block dividing unit for dividing an inputted image into blocks to be encoded having a predetermined size, and also dividing each of said blocks to be encoded hierarchically until its hierarchy number reaches the maximum hierarchy depth determined by said encoding controlling unit;

a motion-compensated prediction unit for, when an inter encoding mode is selected by said encoding controlling unit as an encoding mode corresponding to one of the blocks to be encoded into which the inputted image is divided by said block dividing

unit, searching for a motion vector suitable for generation of a prediction image, and carrying out a motion-compensated prediction process on said block to be encoded to generate a prediction image by using said motion vector;

a predicted vector generating unit for selecting a predicted vector which is used for motion vector encoding from one or more selectable motion vectors, and for outputting index information showing the predicted vector;

a difference image generating unit for generating a difference image between the one of the blocks to be encoded into which the inputted image is divided by said block dividing unit, and the prediction image generated by said motion-compensated prediction unit;

an image compression unit for compressing the difference image generated by said difference image generating unit, and outputting compressed data of said difference image; and

a variable length encoding unit for variable-length-encoding the compressed data outputted from said image compression unit, the encoding mode selected by said encoding controlling unit, and the index information outputted from said predicted vector generating unit to generate a bitstream into which encoded data of said compressed data, encoded data of said encoding mode, and encoded data of said index information are multiplexed,

wherein when a list showing one or more selectable motion vectors is set for each of block sizes provided for the blocks to be encoded, said encoding controlling unit determines the one or more selectable motion vectors by referring to said list.

[16] A moving image decoding device comprising:

a variable length decoding unit for

variable-length-decoding encoded data multiplexed into a bitstream to acquire compressed data, an encoding mode, and index information which are associated with each of coding blocks into which an image is hierarchically divided;

a motion-compensated prediction unit for, when an encoding mode associated with a coding block variable-length-decoded by said variable length decoding unit is an inter encoding mode, generating a list of candidate vectors which consists of one or more selectable motion vectors and also acquiring a predicted vector shown by the index information associated with said coding block from said list of candidate vectors on a basis of the index information variable-length-decoded by said variable length decoding unit, for decoding a motion vector from difference motion vector information variable-length-decoded by said variable length decoding unit and said predicted vector, and carrying out a motion-compensated prediction process on said coding block by using said motion vector decoded thereby to generate a prediction image;

a difference image generating unit for generating a pre-compressed difference image from the compressed data associated with the coding block variable-length-decoded by said variable length decoding unit; and

a decoded image generating unit for adding the difference image generated by said difference image generating unit and the prediction image generated by said motion-compensated prediction unit to generate a decoded image,

wherein said motion-compensated prediction unit determines a rule for generation of said list of candidate vectors for each of block sizes provided for the coding blocks.

Claims

Claim 1 An image decoding device comprising:

a variable length decoding unit for performing variable-length decoding process on coded data multiplexed into a bitstream to obtain compressed data, coding mode and index information, each associated with a coding block;

a motion compensation prediction unit for performing a motion compensation prediction process on said coding block based on said coding mode to generate a prediction image using a motion vector selected from one or more selectable motion vector candidate, said motion compensation prediction unit selecting said motion vector indicated by said index information;

a decoded image generating unit for generating decoded image data by adding a difference image which is obtained by decoding said compressed data and said prediction image generated by said motion compensation prediction unit; wherein

said motion compensation prediction unit selects a spatial motion vector which is obtained from a decoded block located around said coding block or a temporal motion vector which is obtained from a decoded picture which can be referred to by said coding block according to said index information.

Claim 2 An image decoding method comprising:

a step for performing a variable-length decoding process on coded data multiplexed into a bitstream to obtain compressed data, coding mode and index information, each associated with a coding block;

a step for performing a motion compensation prediction process on said coding block based on said coding mode to generate a prediction image using a motion vector selected from one or more selectable motion vector candidate, said motion vector is selected according to said index information;

a step for generating decoded image data by adding a difference image which is obtained by decoding said compressed data and said prediction image; wherein

said motion vector candidate includes at least a spatial motion vector which is obtained from a decoded block located around said coding block or a temporal motion vector which is obtained from a decoded picture which can be referred to by said coding block.