

CLAIMS

[1] An image decoding device comprising:

an intra prediction unit for, when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block,

wherein, when an intra prediction parameter indicates a horizontal prediction process, the intra prediction unit

adds, as to each row within a predetermined number of rows locating from an upper end of the block, a value to a luminance value of a pixel adjacent to left of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a horizontal direction of luminance value of pixels adjacent to top of the block, and

sets, as to remaining rows of the block, a luminance value of pixels adjacent to left of the block as a predicted value of the prediction image.

[2] The image decoding device according to claim 1, wherein the predetermined number of rows indicates a single row.

[3] An image decoding device comprising:

an intra prediction unit for, when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block,

wherein, when an intra prediction parameter indicates a vertical prediction process, the intra prediction unit

adds, as to each column within a predetermined number of columns locating from a left end of the block, a value to a luminance value of a pixel adjacent to top of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a vertical direction of luminance value of pixels adjacent to left of the block, and

sets, as to remaining columns of the block, a luminance value of pixels adjacent to top of the block as a predicted value of the prediction image.

[4] The image decoding device according to claim 3, wherein the predetermined number of columns indicates a single column.

[5] An image decoding method comprising an intra prediction processing step performed by an intra prediction unit, the intra prediction processing step including processes of,

when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block, and

when an intra prediction parameter indicates a horizontal prediction process,

adding, as to each row within a predetermined number of rows locating from an upper end of the block, a value to a luminance value of a pixel adjacent to left of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a horizontal direction of luminance value of pixels adjacent to top of the block, and

setting, as to remaining rows of the block, a luminance value of pixels adjacent to left of the block as a predicted value of the prediction image.

[6] The image decoding method according to claim 5, wherein the predetermined number of rows indicates a single row.

[7] An image decoding method comprising an intra prediction processing step performed by an intra prediction unit, the intra prediction processing step including processes of,

when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block, and

when an intra prediction parameter indicates a vertical prediction process,

adding, as to each column within a predetermined number of columns locating from a left end of the block, a value to a luminance value of a pixel adjacent to top of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a vertical direction of luminance value of pixels adjacent to left of the block, and

setting, as to remaining columns of the block, a luminance value of pixels adjacent to top of the block as a predicted value of the prediction image.

[8] The image decoding method according to claim 7, wherein the predetermined number of columns indicates a single column.

[9] An image encoding device comprising:

an intra prediction unit for, when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block,

wherein, when an intra prediction parameter indicates a horizontal prediction process, the intra prediction unit

adds, as to each row within a predetermined number of rows locating from an upper end of the block, a value to a luminance value of a pixel adjacent to left of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a horizontal direction of luminance value of pixels adjacent to top of the block, and

sets, as to remaining rows of the block, a luminance value of pixels adjacent to left of the block as a predicted value of the prediction image.

[10] The image encoding device according to claim 9, wherein the predetermined number of rows indicates a single row.

[11] An image encoding device comprising:

an intra prediction unit for, when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block,

wherein, when an intra prediction parameter indicates a vertical prediction process, the intra prediction unit

adds, as to each column within a predetermined number of columns locating from a left end of the block, a value to a luminance value of a pixel adjacent to top of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a vertical direction of luminance value of pixels adjacent to left of the block, and

sets, as to remaining columns of the block, a luminance value of pixels adjacent to top of the block as a predicted value of the prediction image.

[12] The image encoding device according to claim 11, wherein the predetermined number of columns indicates a single column.

[13] An image encoding method comprising an intra prediction processing step performed by an intra prediction unit, the intra prediction processing step including processes of,

when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block, and

when an intra prediction parameter indicates a horizontal prediction process,

adding, as to each row within a predetermined number of rows locating from an upper end of the block, a value to a luminance value of a pixel adjacent to left of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a horizontal direction of luminance value of pixels adjacent to top of the block, and

setting, as to remaining rows of the block, a luminance value of pixels adjacent to left of the block as a predicted value of the prediction image.

[14] The image encoding method according to claim 13, wherein the predetermined number of rows indicates a single row.

[15] An image encoding method comprising an intra prediction processing step performed by an intra prediction unit, the intra prediction processing step including processes of,

when a coding mode for a coding block is an intra coding mode, carrying out an intra-frame prediction process on each block to generate a prediction image, said block being a unit for prediction process of said coding block, and

when an intra prediction parameter indicates a vertical prediction process,

adding, as to each column within a predetermined number of columns locating from a left end of the block, a value to a luminance value of a pixel adjacent to top of the block and sets a result of the addition as a predicted value of the prediction image, the value being proportional to a change in a vertical direction of luminance value of pixels adjacent to left of the block, and

setting, as to remaining columns of the block, a luminance value of pixels

adjacent to top of the block as a predicted value of the prediction image.

[16] The image encoding method according to claim 15, wherein the predetermined number of columns indicates a single column.

[17] An image decoding device comprising an intra prediction unit for carrying out an intra-frame prediction process to generate a prediction image.

CLAIMS

[1] A moving image encoding device comprising an intra prediction unit for, when an intra encoding mode is selected as an encoding mode corresponding to a coding block, carrying out an intra-frame prediction process corresponding to said intra encoding mode on each prediction block, which is a unit for prediction process at a time of carrying out a prediction process on said coding block, to generate a prediction image, wherein when the intra-frame prediction process at the time of generating said prediction image is a horizontal one, said intra prediction unit adds a value proportional to a change in a horizontal direction of luminance values of pixels adjacent to top of said each prediction block to a luminance value of a pixel adjacent to left of said each prediction block to determine a result of the addition as a predicted value of said prediction image, whereas when the intra-frame prediction process at the time of generating said prediction image is a vertical one, said intra prediction unit adds a value proportional to a change in a vertical direction of luminance values of pixels adjacent to the left of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine a result of the addition as a predicted value of said prediction image.

[2] The moving image encoding device according to claim 1, wherein said moving image encoding device includes:

an encoding controlling unit for determining a maximum size of a coding block which is a unit to be processed at a time when an encoding process is carried out, and also determining a hierarchy number upper limit at a time when a coding block having the maximum size is divided hierarchically, and for

selecting an encoding mode corresponding to each of coding blocks into which the coding block having the maximum size is divided hierarchically from one or more available encoding modes;

5 a block dividing unit for dividing an inputted image into coding blocks each having the maximum size determined by said encoding controlling unit, and also dividing each of said coding blocks hierarchically until its hierarchy number reaches the hierarchy number upper limit determined by said encoding
10 controlling unit;

 a difference image generating unit for generating a difference image between each of the coding blocks into which the inputted image is divided by said block dividing part, and the prediction image generated by said intra prediction unit;

15 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
20 said image compression unit and the encoding mode selected by said encoding controlling unit to generate a bitstream into which encoded data of said compressed data and encoded data of said encoding mode are multiplexed.

[3] The moving image encoding device according to claim 2,
25 wherein said moving image encoding device includes a motion-compensated prediction unit for, when the encoding controlling unit selects an inter encoding mode as the encoding mode corresponding to one of the coding blocks into which the inputted image is divided by the block dividing part, carrying
30 out a motion-compensated prediction process on each prediction

block, which is a prediction unit at the time of carrying out a prediction process on the coding block, by using a reference image to generate a prediction image, and the difference image generating unit generates a difference image between the one of said coding blocks into which the inputted image is divided by said block dividing part, and the prediction image generated by the intra prediction unit or said motion-compensated prediction unit.

[4] The moving image encoding device according to claim 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 coding blocks, and also determines intra prediction parameters or inter prediction parameters which are used when the prediction process is carried out for each prediction block of said each of the coding blocks, 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 and the encoding mode selected by said encoding controlling unit, the variable length encoding unit variable-length-encodes the intra prediction parameters or the inter prediction parameters which are determined by said encoding controlling unit, and the quantization parameter and the transformation block size to

generate a bitstream into which the encoded data of said compressed data, the encoded data of said encoding mode, encoded data of said intra prediction parameters or said inter prediction parameters, encoded data of said quantization parameter, and encoded data of said transformation block size are multiplexed.

[5] The moving image encoding device according to claim 1, wherein when the intra-frame prediction process at the time of generating the prediction image is a horizontal one, the intra prediction unit adds a value calculated by multiplying the change in the horizontal direction of the luminance values of the pixels adjacent to the top of said each prediction block by a scaling value set for each row of said each prediction block to the luminance value of the pixel adjacent to the left of said each prediction block to determine the result of the addition as the predicted value of said prediction image, and, when the intra-frame prediction process at the time of generating the prediction image is a vertical one, the intra prediction unit adds a value calculated by multiplying the change in the vertical direction of the luminance values of the pixels adjacent to the left of said each prediction block by a scaling value set for each column of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine the result of the addition as the predicted value of said prediction image.

[6] The moving image encoding device according to claim 5, wherein the scaling value associated with each row which is used when the intra prediction unit carries out the horizontal prediction process is set to be a smaller value with distance from the pixels adjacent to the top of said each prediction block,

and the scaling value associated with each column which is used when the intra prediction unit carries out the vertical prediction process is set to be a smaller value with distance from the pixels adjacent to the left of said each prediction
5 block.

[7] The moving image encoding device according to claim 1, wherein when the intra-frame prediction process at the time of generating the prediction image is a horizontal one, for each of a predetermined number of rows extending horizontally, the
10 rows being numbered from the one at an upper end of said each prediction block, the intra prediction unit adds the value proportional to the change in the horizontal direction of the luminance values of the pixels adjacent to the top of said each prediction block to the luminance value of the pixel adjacent
15 to the left of said each prediction block to determine the result of the addition as the predicted value of said prediction image, and, for each of remaining rows in said each prediction block, the intra prediction unit determines the luminance value of the pixel adjacent to the left of said each prediction block as the
20 predicted value of said prediction image, and, when the intra-frame prediction process at the time of generating the prediction image is a vertical one, for each of a predetermined number of columns extending vertically, the columns being numbered from the one at a left end of said each prediction block,
25 the intra prediction unit adds the value proportional to the change in the vertical direction of the luminance values of the pixels adjacent to the left of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine the result of the addition
30 as the predicted value of said prediction image, and, for each

of remaining rows in said each prediction block, the intra prediction unit determines the luminance value of the pixel adjacent to the top of said each prediction block as the predicted value of said prediction image.

5 [8] The moving image encoding device according to claim 5, wherein the variable length encoding unit variable-length-encodes the scaling value set for each row of said each prediction block and the scaling value set for each column of said each prediction block, and generates the
10 bitstream into which encoded data of said scaling values, the encoded data of the compressed data, and the encoded data of the encoding mode are multiplexed.

[9] The moving image encoding device according to claim 7, wherein the variable length encoding unit
15 variable-length-encodes either intra-block information for specifying the rows for each of which the result of the addition of the value proportional to the change in the horizontal direction of the luminance values of the pixels adjacent to the top of said each prediction block and the luminance value of
20 the pixel adjacent to the left of said each prediction block is determined as the predicted value, or intra-block information for specifying the columns for each of which the result of the addition of the value proportional to the change in the vertical direction of the luminance values of the pixels
25 adjacent to the left of said each prediction block and the luminance value of the pixel adjacent to the top of said each prediction block is determined as the predicted value, and generates the bitstream into which encoded data of said intra-block information, the encoded data of the compressed data, and the encoded data of the encoding mode are multiplexed.
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[10] A moving image decoding device comprising an intra prediction unit for, when an encoding mode associated with a variable-length-decoded coding block is an intra encoding mode, carrying out an intra-frame prediction process corresponding to said intra encoding mode on each prediction block, which is a unit for prediction process at a time of carrying out a prediction process on said coding block, to generate a prediction image, wherein when the intra-frame prediction process at the time of generating said prediction image is a horizontal one, said intra prediction unit adds a value proportional to a change in a horizontal direction of luminance values of pixels adjacent to top of said each prediction block to a luminance value of a pixel adjacent to left of said each prediction block to determine a result of the addition as a predicted value of said prediction image, whereas when the intra-frame prediction process at the time of generating said prediction image is a vertical one, said intra prediction unit adds a value proportional to a change in a vertical direction of luminance values of pixels adjacent to the left of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine a result of the addition as a predicted value of said prediction image.

[11] The moving image decoding device according to claim 10, wherein said moving image decoding device includes:

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

a difference image generating unit for generating a

pre-compressed difference image from the compressed data associated with said each of coding blocks variable-length-decoded by said variable length decoding unit; and

5 a decoded image generating unit for adding the difference image generated by said difference image generating unit and the prediction image generated by said intra prediction unit to generate a decoded image.

[12] The moving image decoding device according to claim 11,
10 wherein said moving image decoding device includes a motion-compensated prediction unit for, when the encoding mode associated with said each of coding blocks variable-length-decoded by the variable length decoding unit is an inter encoding mode, carrying out a motion-compensated
15 prediction process on each prediction block which is a prediction unit at the time of carrying out a prediction process on the coding block by using a reference image to generate a prediction image, and the decoded image generating unit adds the difference image generated by the difference image
20 generating unit and the prediction image generated by the intra prediction unit or said motion-compensated prediction unit to generate a decoded image.

[13] The moving image decoding device according to claim 12,
 wherein the variable length decoding unit
25 variable-length-decodes the encoded data multiplexed into the bitstream to acquire compressed data, an encoding mode, intra prediction parameters or inter prediction parameters, a quantization parameter, and a transformation block size which are associated with each of the coding blocks, and the
30 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.

[14] The moving image decoding device according to claim 10, wherein when the intra-frame prediction process at the time of generating the prediction image is a horizontal one, the intra prediction unit adds a value calculated by multiplying the change in the horizontal direction of the luminance values of the pixels adjacent to the top of said each prediction block by a scaling value set for each row of said each prediction block to the luminance value of the pixel adjacent to the left of said each prediction block to determine the result of the addition as the predicted value of said prediction image, and, when the intra-frame prediction process at the time of generating the prediction image is a horizontal one, the intra prediction unit adds a value calculated by multiplying the change in the vertical direction of the luminance values of the pixels adjacent to the left of said each prediction block by a scaling value set for each column of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine the result of the addition as the predicted value of said prediction image.

[15] The moving image decoding device according to claim 14, wherein the scaling value associated with each row which is used when the intra prediction unit carries out the horizontal prediction process is set to be a smaller value with distance

from the pixels adjacent to the top of said each prediction block,
and the scaling value associated with each column which is used
when the intra prediction unit carries out the vertical
prediction process is set to be a smaller value with distance
5 from the pixels adjacent to the left of said each prediction
block.

[16] The moving image decoding device according to claim 10,
wherein when the intra-frame prediction process at the time of
generating the prediction image is a horizontal one, for each
10 of a predetermined number of rows extending horizontally, the
rows being numbered from the one at an upper end of said each
prediction block, the intra prediction unit adds the value
proportional to the change in the horizontal direction of the
luminance values of the pixels adjacent to the top of said each
15 prediction block to the luminance value of the pixel adjacent
to the left of said each prediction block to determine the result
of the addition as the predicted value of said prediction image,
and, for each of remaining rows in said each prediction block,
the intra prediction unit determines the luminance value of the
20 pixel adjacent to the left of said each prediction block as the
predicted value of said prediction image, and, when the
intra-frame prediction process at the time of generating the
prediction image is a vertical one, for each of a predetermined
number of columns extending vertically, the columns being
25 numbered from the one at a left end of said each prediction block,
the intra prediction unit adds the value proportional to the
change in the vertical direction of the luminance values of the
pixels adjacent to the left of said each prediction block to
the luminance value of the pixel adjacent to the top of said
30 each prediction block to determine the result of the addition

as the predicted value of said prediction image, and, for each of remaining rows in said each prediction block, the intra prediction unit determines the luminance value of the pixel adjacent to the top of said each prediction block as the predicted value of said prediction image.

[17] The moving image decoding device according to claim 14, wherein when variable-length-decoding the encoded data multiplexed into the bitstream to acquire compressed data and an encoding mode associated with said each of coding blocks, the variable length decoding unit variable-length-decodes the scaling value set for each row of said each prediction block and the scaling value set for each column of said each prediction block.

[18] The moving image decoding device according to claim 16, wherein when variable-length-decoding the encoded data multiplexed into the bitstream to acquire compressed data and an encoding mode associated with said each of coding blocks, the variable length decoding unit variable-length-decodes either intra-block information for specifying the rows for each of which the result of the addition of the value proportional to the change in the horizontal direction of the luminance values of the pixels adjacent to the top of said each prediction block and the luminance value of the pixel adjacent to the left of said each prediction block is determined as the predicted value, or intra-block information for specifying the columns for each of which the result of the addition of the value proportional to the change in the vertical direction of the luminance values of the pixels adjacent to the left of said each prediction block and the luminance value of the pixel adjacent to the top of said each prediction block is determined as the

predicted value.

[19] A moving image encoding method comprising an intra prediction processing step of, when an intra encoding mode is selected as an encoding mode corresponding to a coding block, an intra prediction unit carrying out an intra-frame prediction process corresponding to said intra encoding mode on each prediction block, which is a unit for prediction process at a time of carrying out a prediction process on said coding block, to generate a prediction image, wherein said intra prediction processing step includes a step of, when the intra-frame prediction process at the time of generating said prediction image is a horizontal one, adding a value proportional to a change in a horizontal direction of luminance values of pixels adjacent to top of said each prediction block to a luminance value of a pixel adjacent to left of said each prediction block to determine a result of the addition as a predicted value of said prediction image, whereas when the intra-frame prediction process at the time of generating said prediction image is a vertical one, adding a value proportional to a change in a vertical direction of luminance values of pixels adjacent to the left of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine a result of the addition as a predicted value of said prediction image.

[20] A moving image decoding method comprising an intra prediction processing step of, when an encoding mode associated with a variable-length-decoded coding block is an intra encoding mode, an intra prediction unit carrying out an intra-frame prediction process corresponding to said intra encoding mode on each prediction block, which is a unit for

prediction process at a time of carrying out a prediction process on said coding block, to generate a prediction image, wherein said intra prediction processing step includes a step of, when the intra-frame prediction process at the time of generating said prediction image is a horizontal one, adding a value proportional to a change in a horizontal direction of luminance values of pixels adjacent to top of said each prediction block to a luminance value of a pixel adjacent to left of said each prediction block to determine a result of the addition as a predicted value of said prediction image, whereas when the intra-frame prediction process at the time of generating said prediction image is a vertical one, adding a value proportional to a change in a vertical direction of luminance values of pixels adjacent to the left of said each prediction block to the luminance value of the pixel adjacent to the top of said each prediction block to determine a result of the addition as a predicted value of said prediction image.