CLAIMS

[1] A moving image encoding device comprising:

an encoding controlling unit for determining a maximum size of a coding block which is a unit to be processed at a time when a prediction 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 which determines an encoding method of encoding each coding block from one or more available encoding modes;

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

an intra prediction unit for, when an inter encoding mode is selected by said encoding controlling unit as an encoding mode corresponding to one of the coding blocks into which the inputted image is divided by said block dividing unit, carrying out an intra-frame prediction process to generate a prediction image by using an already-encoded image signal in a frame;

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

when generating the prediction image, said intra prediction unit selects a predetermined filter from one or more filters which are prepared in advance, carries out a filtering process on said prediction image by using said filter, and outputs the prediction image on which said intra prediction unit has carried out the filtering process to said difference image generating unit.

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

[3] The moving image encoding device according to claim 2, 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 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.

[4] The moving image encoding device according to claim 3, wherein the intra prediction unit selects a filter which is used for the filtering process in consideration of at least one of a size of the block on which the intra prediction unit carries out the intra prediction, the quantization parameter determined by said encoding controlling unit, a distance between the already-encoded image signal in the frame which is used when generating the prediction image and a target pixel to be

filtered, and the intra prediction parameters determined by said encoding controlling unit.

[5] The moving image encoding device according to claim 1, wherein the intra prediction unit designs a Wiener filter which minimizes a sum of squared errors between the one of the coding blocks into which the inputted image is divided by said block dividing unit, and the prediction image, and, when use of said Wiener filter increases a degree of reduction in prediction errors as compared with use of the filter selected from the one or more filters which are prepared in advance, carries out the filtering process on the prediction image by using said Wiener filter, instead of the filter which the intra prediction unit has selected, and outputs the prediction image on which said intra prediction unit has carried out the filtering process to the difference image generating unit, and the variable length encoding unit variable-length-encodes filter coefficients of the Wiener filter designed by said intra prediction unit and multiplexes encoded data of said filter coefficients into the bitstream.

[6] A moving image decoding device comprising:

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

an intra prediction unit for, when an encoding mode associated with a coding block which is variable-length-decoded by said variable length decoding unit is an intra encoding mode, carrying out an intra-frame prediction process to generate a prediction image by using an already-decoded image signal in

a frame;

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 intra prediction unit to generate a decoded image, wherein

when generating the prediction image, said intra prediction unit selects a predetermined filter from one or more filters which are prepared in advance, carries out a filtering process on said prediction image by using said filter, and outputs the prediction image on which said intra prediction unit has carried out the filtering process to said decoded image generating unit.

[7] The moving image decoding device according to claim 6, wherein said moving image encoding device includes a motion-compensated prediction unit for, when the encoding mode associated with the coding block, which is variable-length-decoded by the variable length decoding unit, is an inter encoding mode, carrying out a motion-compensated prediction process on said coding block to generate a prediction image by using a reference image, and the decoded image generating unit adds the difference image generated by the difference image generating unit and the prediction image generated by the intra prediction unit or 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 multiplexed into the bitstream to obtain 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 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.

[9] The moving image decoding device according to claim 8, wherein the intra prediction unit selects a filter which is used for the filtering process in consideration of at least one of a size of the block on which the intra prediction unit carries out the intra prediction, the quantization parameter variable-length-decoded by said variable length decoding unit, a distance between the already-decoded image signal in the frame which is used when generating the prediction image and a target pixel to be filtered, and the intra prediction parameters variable-length-decoded by said variable length decoding unit.

[10] The moving image decoding device according to claim 6, wherein when the variable length decoding unit variable-length-decodes the encoded data multiplexed into the bitstream to obtain filter coefficients of a Wiener filter, the intra prediction unit carries out the filtering process on the prediction image by using said Wiener filter instead of the filter which the intra prediction unit has selected from the

one or more filters which are prepared in advance, and outputs the prediction image on which the intra prediction unit has carried out the filtering process to the decoded image generating unit.

[11] An moving image encoding method comprising:

an encoding control processing step of an encoding controlling unit determining a maximum size of a coding block which is a unit to be processed at a time when a prediction 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 selecting an encoding mode which determines an encoding method of encoding each coding block from one or more available encoding modes;

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

an intra prediction processing step of, when an inter encoding mode is selected in said encoding control processing step as an encoding mode corresponding to one of the coding blocks into which the inputted image is divided in said block division processing step, an intra prediction unit carrying out an intra-frame prediction process to generate a prediction image by using an already-encoded image signal in a frame;

a difference image generation processing step of a difference image generating unit generating a difference image between the one of the coding blocks into which the inputted image is divided in said block division processing step; and

the prediction image generated in said intra prediction processing step;

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

a variable length coding process step of a variable length encoding unit variable-length-encoding the compressed data outputted in said image compression processing step and the encoding mode selected in said encoding control processing step to generate a bitstream into which encoded data of said compressed data and encoded data of said encoding mode are multiplexed, wherein

when generating the prediction image in said intra prediction process step, a predetermined filter is selected from one or more filters which are prepared in advance, a filtering process is carried out on said prediction image by using said filter, and the prediction image on which the filtering process has been carried out is outputted to said difference image generating unit.

[12] A moving image decoding device comprising:

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

an intra prediction processing step of, when an encoding mode associated with a coding block which is variable-length-decoded in said variable length decode processing step is an intra encoding mode, an intra prediction

unit carrying out an intra-frame prediction process to generate a prediction image by using an already-decoded image signal in a frame;

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 generating process 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 intra prediction processing step to generate a decoded image, wherein

when generating the prediction image in said intra prediction processing step, a predetermined filter is selected from one or more filters which are prepared in advance, a filtering process is carried out on said prediction image by using said filter, and the prediction image on which the filtering process has been carried out is outputted to said decoded image generating unit.

Claims

1. An image decoding device comprising:

an intra prediction unit for generating an intra prediction image by obtaining a prediction value based on reference samples for each pixel according to an intra prediction mode,

wherein said intra prediction unit performs a filtering process on at least one pixel of said intra prediction image according to said intra prediction mode used to generate said intra prediction image.

2. An image decoding method comprising:

generating an intra prediction image by obtaining a prediction value based on reference samples for each pixel according to an intra prediction mode,

wherein a filtering process is performed on at least one pixel of said intra prediction image according to said intra prediction mode used to generate said intra prediction image.

3. An image encoding device comprising:

an intra prediction unit for generating an intra prediction image by obtaining a prediction value based on reference samples for each pixel according to an intra prediction mode,

wherein said intra prediction unit performs a filtering process is performed on at least one pixel of said intra prediction image according to said intra prediction mode used to generate said intra prediction image.

4. An image encoding method comprising:

carrying out an intra prediction process to generate an intra prediction image by obtaining a prediction value based on reference samples for each pixel according to an intra prediction mode,

wherein a filtering process is performed on at least one pixel of said intra prediction image according to said intra prediction mode to generate said intra prediction image.

5. A data structure of coded data generated by performing a prediction process on an image which is divided into coding blocks, said coded data comprising:

a coded data of coding mode indicating a prediction mode of each of said coding blocks;

a compressed data obtained by performing a compression process on a difference between said image and a prediction image generated by performing a intra prediction process or an inter prediction process according to said coding mode; and

a coded data of an intra prediction mode used to perform said intra prediction process to generate an intra prediction mage by obtaining a prediction value based on reference samples for each pixel according to said intra prediction mode;

wherein a filtering process is performed on at least one pixel of said intra prediction image according to said intra prediction mode used to generate said intra prediction image.