CLAIMS

[1] A video decoding device comprising:

a variable length decoder that variable-length-decodes compressed data associated with each of coding blocks hierarchically partitioned from encoded data multiplexed into a bitstream and also variable-length-decodes, as filter parameters, an index indicating a class classifying method for each coding block having a largest size and an offset of each class for each coding block having the largest size from said encoded data;

a predictor that carries out a prediction process on said coding block to generate a prediction image;

a difference image generator that generates a pre-compressed difference image from the compressed data associated with the coding block variable-length-decoded by said variable length decoder;

a decoded image generator that adds the difference image generated by said difference image generator and the prediction image generated by said predictor to generate a decoded image; and

a filter that carries out a filtering process on the decoded image generated by said decoded image generator and outputs the decoded image filtering-processed thereby as a reproduced image, wherein

said filter carries out a pixel adaptive offset process of performing a class classification of each pixel in the decoded image generated by said decoded image generator into one class for each coding block having the largest size by using said class classifying method, and adding the offset of each

class to a pixel value of each pixel belonging to said class.

[2] The video decoding device according to claim 1, wherein the variable length decoder variable-length-decodes, as filter parameters, the index indicating the class classifying method for each coding block having the largest size, the offset of each class for each coding block having the largest size, a filter used for a local decoded image belonging to each class, and class classification information about each coding block having the largest size from the encoded data multiplexed into the bitstream, and the filter is comprised of the pixel adaptive offset process of performing the class classification of each pixel in the decoded image generated by the decoded image generator into one class for each coding block having the largest size by using said class classifying method, and adding the offset of each class to a pixel value of each pixel belonging to said class, and an adaptive filtering process of carrying out the filtering process on said decoded image by using said filter for each class.

[3] The video decoding device according to claim 1, wherein said video decoding device includes: the variable length decoder that variable-length-decodes the compressed data and a coding mode associated with each of the coding blocks hierarchically partitioned from the encoded data multiplexed into the bitstream and also variable-length-decodes, as filter parameters, the index indicating the class classifying method for each coding block having the largest size and the offset of each class for each coding block having the largest size from said encoded data; and the predictor that carries out the prediction process according to the coding mode associated with the coding block variable-length-decoded by said variable

length decoder to generate the prediction image.

[4] The video decoding device according to claim 3, wherein said video decoding device includes an intra predictor that, when the coding mode associated with the coding block variable-length-decoded by the variable length decoder is an intra coding mode, carries out an intra-frame prediction process corresponding to said intra coding mode on each prediction block which is a unit for prediction process at a time of carrying out the prediction process on said coding block to generate a prediction image, and the decoded image generator adds the difference image generated by the difference image generator and the prediction image generated by said intra predictor to generate the decoded image.

[5] The video decoding device according to claim 4, wherein said video decoding device includes a motion-compensated predictor that, when the coding mode associated with the coding block variable-length-decoded by the variable length decoder is an inter coding mode, carries out a motion-compensated prediction process on each prediction block, which is a unit for prediction process at a time of carrying out the prediction process on the coding block, by using a reference image to generate a prediction image, and the decoded image generator adds the difference image generated by the difference image generator and the prediction image generated by the intra predictor or said motion-compensated predictor to generate the decoded image and the filter carries out the filtering process on the decoded image acquired by said decoded image generator and outputs the decoded image filtering-processed thereby to said motion-compensated predictor as a reference image.

[6] The video decoding device according to claim 5, wherein

the variable length decoder variable-length-decodes block partitioning information from the encoded data multiplexed into the bitstream, and variable-length-decodes compressed data, a coding mode, an intra prediction parameter or an inter prediction parameter, a quantization parameter, and a transformation block size which are associated with each coding block which is driven from said block partitioning information, and the difference image generator inverse-quantizes the compressed data associated with the coding block variable-length-decoded by said variable length decoder by using the quantization parameter associated with said coding block and carries out an inverse transformation process on the compressed data inverse-quantized thereby for each block having said transformation block size to generate the pre-compressed difference image.

[7] A video encoding device comprising:

an encoding controller that determines a largest size of a coding block which is a unit to be processed at a time when an encoding process is carried out;

a block partitioner that partitions an inputted image into coding blocks each having the largest size determined by said encoding controller, and also partitions each of said coding blocks hierarchically;

a motion-compensated predictor that carries out a motion-compensated prediction process on each prediction block which is a unit for prediction process at a time of carrying out the prediction process on said coding block by using a reference image to generate a prediction image;

a local decoded image generator that decodes compressed data about a difference image between the coding block

partitioned by said block partitioner and the prediction image generated by said motion-compensated predictor, and that adds the difference image decoded and the prediction image generated by said motion-compensated predictor to generate a local decoded image;

a filter that carries out a filtering process on the local decoded image generated by said local decoded image generator, and outputs the local decoded image filtering-processed thereby to said motion-compensated predictor as said reference image; and

a variable length encoder that variable-length-encodes said compressed data and filter parameters which are used when the filtering process is carried out by said filter, and that generates a bitstream into which encoded data of said compressed data and encoded data of said filter parameters are multiplexed, wherein

said filter carries out a pixel adaptive offset process of selecting a class classifying method for each coding block having the largest size determined by said encoding controller, performing a class classification of each pixel of a local decoded image in the coding block having the largest size into one class by using said class classifying method, calculating an offset of each class, and adding the offset to the pixel value of each pixel belonging to said class, and said variable length encoder encodes, as filter parameters, an index indicating the class classifying method which is selected for each coding block having the largest size by said filter and the offset of each class calculated for each coding block having the largest size.

[8] The video encoding device according to claim 7, wherein said filter is comprised of the pixel adaptive offset process

of selecting a class classifying method for each coding block having the largest size, performing a class classification of each pixel of the local decoded image in the coding block having the largest size into one class by using said class classifying method, calculating the offset of each class, and adding the offset to the pixel value of each pixel belonging to said class, and an adaptive filtering process of performing a class classification of said local decoded image into one class for each coding block having the largest size, designing a filter used for each class, and performing a filtering process on said local decoded image by using said filter, and wherein said variable length encoder encodes, as filter parameters, the index indicating the class classifying method which is selected for each coding block having the largest size by said filter, the offset of each class calculated for each coding block having the largest size, the filter designed by said filter and used for the local decoded image belonging to each class, and class classification information about each coding block having the largest size.

[9] The video encoding device according to claim 7, wherein said video encoding device includes: the encoding controller that determines the largest size of a coding block which is a unit to be processed at a time when the encoding process is carried out, and also determines an upper limit on a number of hierarchical layers when a coding block having the largest size is hierarchically partitioned, and that selects a coding mode corresponding to each of coding blocks partitioned hierarchically from one or more available coding modes; the block partitioner that partitions the inputted image into coding blocks each having the largest size determined by said

encoding controller, and also partitions each of said coding blocks hierarchically until the number of hierarchical layers reaches the upper limit on the number of hierarchical layers which is determined by said encoding controller; the motion-compensated predictor that, when an inter coding mode is selected by said encoding controller as the coding mode corresponding to the coding block partitioned by said block partitioner, carries out the motion-compensated prediction process on each prediction block which is a unit for prediction process at a time of carrying out the prediction process on said coding block by using the reference image to generate the prediction image; a difference image generator that generates a difference image between the coding block partitioned by said block partitioner and the prediction image generated by said motion-compensated predictor; an image compressor that compresses the difference image generated by said difference image generating unit and outputs compressed data about said difference image; the local decoded image generator that decodes the difference image compressed by said image compressor and adds the difference image decoded and the prediction image generated by said motion-compensated predictor to generate the local decoded image; the filter that carries out the filtering process on the local decoded image generated by said local decoded image generator, and outputs the local decoded image filtering-processed thereby to said motion-compensated predictor as said reference image; and the variable length encoder that variable-length-encodes the compressed data outputted from said image compressor, the coding mode selected by said encoding controller, and the filter parameters used when the filtering process is carried out by

said filter, and that generates the bitstream into which the encoded data of said compressed data, encoded data of said coding mode, and the encoded data of said filter parameters are multiplexed.

[10] The video encoding device according to claim 9, wherein said video encoding device includes an intra predictor that, when an intra coding mode is selected by the encoding controller as the coding mode corresponding to the coding block partitioned by said block partitioner, carries out an intra-frame prediction process corresponding to said intra coding mode on each prediction block which is a unit for prediction process at a time of carrying out the prediction process on the coding block to generate a prediction image, and wherein the difference image generator generates a difference image between the coding block partitioned by said block partitioner and the prediction image generated by said intra predictor or the motion-compensated predictor, and the local decoded image generator adds the difference image decoded and the prediction image generated by said intra predictor or said motion-compensated predictor to generate the local decoded image.

[11] The video encoding device according to claim 10, wherein the encoding controller determines a quantization parameter and a transformation block partitioning state, which are used when the difference image is compressed, for each coding block, and also determines an intra prediction parameter or an inter prediction parameter, which is used when the prediction process is carried out, for each prediction block of said coding block, the image compressor carries out the transformation process on the difference image generated by the difference image

generator for each transformation block determined by said encoding controller and also quantizes transform coefficients of said difference image by using the quantization parameter determined by said encoding controller and outputs the transform coefficients quantized thereby as the compressed data about said difference image, and, when variable-length-encoding the compressed data outputted from said image compressor, the coding mode selected by said encoding controller, and the filter parameters used when the filtering process is carried out by the filter, the variable length encoder variable-length-encodes the intra prediction parameter or the inter prediction parameter determined by said encoding controller, and the quantization parameter and transformation block partitioning information to generate the bitstream into which the encoded data of said compressed data, the encoded data of said coding mode, the encoded data of said filter parameters, encoded data of said intra prediction parameter or said inter prediction parameter, encoded data of said quantization parameter, and encoded data of said transformation block partitioning information are multiplexed.

[12] A video decoding method comprising:

a variable length decoding processing step of a variable length decoder variable-length-decoding block partitioning information from encoded data multiplexed into a bitstream and also variable-length-decoding compressed data associated with each of coding blocks hierarchically partitioned from said encoded data by referring to a partitioning state of each of coding blocks indicated by said block partitioning information, and further variable-length-decoding, as filter parameters, an

index indicating a class classifying method for each coding block unit having a largest size and an offset of each class for each coding block having the largest size from said encoded data;

a prediction processing step of a predictor carrying out a prediction process on said coding block to generate a prediction image;

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

a decoded image generation processing step of a decoded image generator adding the difference image generated in said difference image generation processing step and the prediction image generated in said prediction processing step to generate a decoded image; and

a filtering processing step of a filter carrying out a filtering process on the decoded image generated in said decoded image generation processing step and outputting the decoded image filtering-processed thereby as a reproduced image,

wherein in said filtering processing step, a pixel adaptive offset process of performing a class classification of each pixel in the decoded image generated in said decoded image generation processing step for each coding block having the largest size into one class by using said class classifying method, and adding the offset of each class to a pixel value of each pixel belonging to said class is carried out.

[13] A video encoding method comprising:

an encoding control processing step of an encoding

controller determining a largest size of a coding block which is a unit to be processed at a time when an encoding process is carried out;

a block partitioning processing step of a block partitioner partitioning an inputted image into coding blocks each having the largest size determined in said encoding control processing step, and also partitioning each of said coding blocks hierarchically;

a motion-compensated prediction processing step of a motion-compensated predictor carrying out a motion-compensated prediction process on each prediction block which is a unit for prediction process at a time of carrying out the prediction process on said coding block by using a reference image to generate a prediction image;

a local decoded image generation processing step of a local decoded image generator decoding compressed data about a difference image between the coding block partitioned in said block partitioning processing step and the prediction image generated in said motion-compensated prediction processing step, and adding the difference image decoded and the prediction image generated in said motion-compensated prediction processing step to generate a local decoded image;

a filtering processing step of a filter carrying out a filtering process on the local decoded image generated in said local decoded image generation processing step, and outputting the local decoded image filtering-processed thereby to said motion-compensated predictor as said reference image; and

a variable length encoding processing step of a variable length encoder variable-length-encoding said compressed data and filter parameters which are used when the filtering process

is carried out in said filtering processing step, and generating a bitstream into which encoded data of said compressed data and encoded data of said filter parameters are multiplexed,

wherein in said filtering processing step, a pixel adaptive offset process of selecting a class classifying method for each coding block having the largest size determined in said encoding control processing step, performing a class classification of each pixel of a local decoded image in the coding block having the largest size into one class by using said class classifying method, calculating an offset of each class, and adding the offset to a pixel value of each pixel belonging to said class is carried out, and, in said variable length encoding processing step, an index indicating the class classifying method which is selected for each coding block having the largest size in said filtering processing step and the offset of each class calculated for each coding block having the largest size are encoded as filter parameters.

1. An image decoding device comprising:

a decoder that decodes first information from encoded data, the first information indicating whether a filter parameter for a largest coding block to be decoded is same as that for another largest coding block which is adjacent to top or left of the largest coding block, and decodes second information indicating whether or not to carry out a filtering process on a coding block divided from the largest coding block; and

a filter that, when the second information indicates that the filtering process is not carried out on the coding block, carries out the filtering process on the largest coding block excluding the coding block with the filter parameter for the another largest coding block, and generates a decoded image on which the filtering process is carried out.

2. An image decoding method comprising:

decoding first information from encoded data, the first information indicating whether a filter parameter for a largest coding block to be decoded is same as that for another largest coding block which is adjacent to top or left of the largest coding block;

decoding second information indicating whether or not to carry out a filtering process on a coding block divided from the largest coding block;

carrying out, when the second information indicates that the filtering process is not carried out on the coding block, the filtering process on the largest coding block excluding the coding block with the filter parameter for the another largest coding block; and

generating a decoded image on which the filtering process is carried out.

3. An image encoding device comprising:

a coding parameter determinator that determines a largest coding block

in a picture;

a block divider that divides the picture by the largest coding block, and divides the largest coding block into coding blocks; and

a filter that carries out a filtering process on the largest coding block excluding one of the coding blocks on which the filtering process is not carried out, the filtering process being same as that for another largest coding block which is adjacent to top or left of the largest coding block,

an encoder encodes first information indicating whether a filter parameter for the largest coding block is same as that for the another largest coding block which is adjacent to top or left of the largest coding block, and second information indicating whether or not to carry out the filtering process on the one of the coding blocks.

4. An image encoding method comprising:

determining a largest coding block in a picture;

dividing the picture by the largest coding block, and dividing the largest coding block into coding blocks; and

carrying out a filtering process on the largest coding block excluding one of the coding blocks on which the filtering process is not carried out, the filtering process being same as that for another largest coding block which is adjacent to top or left of the largest coding block,

encoding first information indicating whether a filter parameter for the largest coding block is same as that for the another largest coding block which is adjacent to top or left of the largest coding block, and second information indicating whether or not to carry out the filtering process on the one of the coding blocks.

5. A bit stream which is obtained by carrying out a filtering process on a picture and encoding, the bit stream comprising:

first information indicating a size of a largest coding block divided from

the picture:

second information indicating a size of a coding block divided from the largest coding block;

third information indicating whether a filter parameter for the largest coding block is same as that for another largest coding block which is adjacent to top or left of the largest coding block; and

fourth information indicating whether or not to carry out the filtering process on the coding block divided from the largest coding block.