

## CLAIMS

[1] A video encoding device comprising:

a filter that carries out a filtering process on a local decoded image which is a result of addition of a difference image  
5 decoded from compressed data about an inputted image and a prediction image, and that outputs the local decoded image on which the filtering process is carried out as a reference image used when generating said prediction image; and

a variable length encoder that variable-length-encodes  
10 said compressed data and a filter parameter used when the filtering process is carried out by said filter, and that generates a coded bitstream into which coded data about said compressed data and coded data about said filter parameter are multiplexed,

15 wherein said filter determines a classification method of carrying out a class classification on each coding block having a largest size, carries out a class classification on each pixel within a block in question by using said classification method, calculates an offset value for each  
20 class, and carries out a pixel adaptive offset process of adding said offset value to a pixel value of a pixel belonging to a corresponding class, and said variable length encoder variable-length-encodes an index indicating the classification method of carrying out a class classification  
25 on each coding block having the largest size, the classification method being determined by said filter, and also variable-length-encodes a parameter about the offset value for each class determined for each coding block having the largest size on a basis of a binarization process using a truncated unary  
30 code.

[2] The video encoding device according to claim 1, wherein said video encoding device includes: a slice partitioner that partitions an inputted image into slices which are a plurality of part images; a coding parameter determinator that  
5 determines the largest size of a coding block which is a unit to be processed at a time when an encoding process is carried out and also determines an upper limit on a number of hierarchies at a time when a coding block having the largest size is partitioned hierarchically, and that assigns a coding mode to  
10 each of coding blocks which are partitioned hierarchically; a block partitioner that partitions a slice which is partitioned by said slice partitioner into coding blocks each having the largest size determined by said coding parameter determinator, and that partitions each of said coding blocks hierarchically  
15 into blocks until its number of hierarchies reaches the upper limit on the number of hierarchies which is determined by said coding parameter determinator; a predictor that carries out a prediction process according to the coding mode assigned by said coding parameter determinator on each of the coding blocks  
20 which are partitioned by said block partitioner so as to generate a prediction image; a difference image generator that generates a difference image between each of the coding blocks which are partitioned by said block partitioner and the prediction image generated by said predictor; an image  
25 compressor that carries out a transformation process on the difference image generated by said difference image generator and quantizes transform coefficients of said difference image, and that outputs the transform coefficients quantized thereby as compressed data; and a local decoded image generator that  
30 decodes the difference image from the compressed data outputted

from said image compressor, and adds the difference image decoded and the prediction image generated by said predictor so as to generate a local decoded image, wherein said variable length encoder variable-length-encodes the compressed data  
5 outputted from said image compressor, the coding mode assigned by said coding parameter determinator, a quantization matrix parameter for generating a quantization matrix used when the transform coefficients are quantized by said image compressor, the filter parameter used when the filtering process is carried  
10 out by said filter, and header information of each slice including information about the partitioning into the slices by said slice partitioner so as to generate a coded bitstream into which the coded data about said compressed data, coded data about said coding mode, coded data about said quantization  
15 matrix parameter, the coded data about said filter parameter, and coded data about said header information are multiplexed.

[3] The video encoding device according to claim 2, wherein when an intra coding mode is assigned, as the coding mode corresponding to a coding block partitioned by the block  
20 partitioner, by the coding parameter determinator, the predictor 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 so as to generate  
25 a prediction image.

[4] The video encoding device according to claim 3, wherein when an inter coding mode is assigned, as the coding mode corresponding to a coding block partitioned by the block partitioner, by the coding parameter determinator, the  
30 ~~predictor 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 so as to generate a prediction image.

- 5 [5] The video encoding device according to claim 4, wherein the coding parameter determinator determines both a quantization parameter used when the difference image is compressed and a transformation block partitioning state for each of the coding blocks, and also determines an intra  
10 prediction parameter or an inter prediction parameter used when the prediction process is carried out for each prediction block of said coding block, the predictor carries out an intra-frame prediction process by using said intra prediction parameter when an intra coding mode is assigned by said coding parameter  
15 determinator and carries out a motion-compensated prediction process by using said inter prediction parameter when an inter coding mode is assigned by said coding parameter determinator, the image compressor carries out the transformation process on the difference image generated by the difference image  
20 generator for each transformation block determined by said coding parameter determinator, and also quantizes the transform coefficients of said difference image by using the quantization parameter and the quantization matrix parameter which are determined by said coding parameter determinator and outputs  
25 the transform coefficients quantized thereby as the compressed data about said difference image, and, when variable-length-encoding said compressed data, the coding mode, said quantization matrix parameter, the filter parameter, and the header information of each slice, the variable length  
30 encoder variable-length-encodes the intra prediction

parameter or the inter prediction parameter, which is determined by said coding parameter determinator, and transformation block partitioning information so as to generate the coded bitstream into which the coded data about said compressed data, the coded data about said coding mode, the coded data about said quantization matrix parameter, the coded data about said filter parameter, the coded data about said header information, coded data about said intra prediction parameter or said inter prediction parameter, and coded data about said transformation block partitioning information are multiplexed.

[6] A video decoding device comprising:

a variable length decoder that variable-length-decodes compressed data and a filter parameter from coded data multiplexed into a coded bitstream; and

a filter that carries out a filtering process on a decoded image decoded from the compressed data variable-length-decoded by said variable length decoder by using the filter parameter variable-length-decoded by said variable length decoder, and that outputs the decoded image on which the filtering process is carried out as a reproduced image,

wherein said variable length decoder variable-length-decodes, as a filter parameter, an index indicating a classification method of carrying out a class classification on each coding block having a largest size from the coded data multiplexed into said coded bitstream, and also variable-length-decodes a parameter about an offset value for each class for each coding block having the largest size on a basis of a binarization process using a truncated unary code, and said filter specifies the classification method of carrying

out a class classification on each coding block having the largest size by using the index indicating the classification method of carrying out a class classification on each coding block having the largest size, carries out a class  
5 classification on each pixel by using the classification method of carrying out a class classification, the classification method corresponding to each coding block having said largest size, calculates an offset value from the parameter about the offset value for each class for each coding block having the  
10 largest size, and carries out a pixel adaptive offset process of adding said offset value to a pixel value of a pixel belonging to a corresponding class.

[7] The video decoding device according to claim 6, wherein said video decoding device includes: a variable length decoder  
15 that variable-length-decodes header information about each slice, a quantization matrix parameter, and a filter parameter from the coded data multiplexed into the coded bitstream, and that variable-length-decodes compressed data and a coding mode associated with each of coding blocks which are hierarchically  
20 partitioned from said coded data; a predictor that carries out a prediction process according to the coding mode variable-length-decoded by said variable length decoder and associated with the coding block so as to generate a prediction image; a difference image generator that inverse-quantizes  
25 transform coefficients which are compressed data variable-length-decoded by said variable length decoder and associated with the coding block by using a quantization parameter and said quantization matrix parameter which are variable-length-decoded by said variable length decoder, and  
30 that inverse-transforms the transform coefficients

inverse-quantized thereby so as to generate a difference image before compression; and a decoded image generator that adds the difference image generated by said difference image generator and the prediction image generated by said predictor so as to generate a decoded image.

[8] The video decoding device according to claim 7, wherein when the coding mode variable-length-decoded by the variable length decoder and associated with the coding block is an intra coding mode, the predictor 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 so as to generate a prediction image.

[9] The video decoding device according to claim 8, wherein when the coding mode variable-length-decoded by the variable length decoder and associated with the coding block is an inter coding mode, the predictor 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 so as to generate a prediction image.

[10] The video decoding device according to claim 9, wherein when variable-length-decoding the compressed data, the coding mode, and an adaptation parameter set from the coded data multiplexed into the coded bitstream, the variable length decoder variable-length-decodes an intra prediction parameter or an inter prediction parameter, and transformation block partitioning information, when the coding mode variable-length-decoded by said variable length decoder and associated with the coding block is an intra coding mode, the

predictor carries out the intra-frame prediction process by using said intra prediction parameter, and, when the coding mode variable-length-decoded by said variable length decoder and associated with the coding block is an inter coding mode, carries out the motion-compensated prediction process by using said inter prediction parameter, and the difference image generator inverse-transforms the transform coefficients inverse-quantized thereby for each of transformation blocks acquired from the transformation block partitioning information variable-length-decoded by said variable length decoder so as to generate a difference image before compression.

[11] A video encoding method comprising:

a filtering process step of a filter carrying out a filtering process on a local decoded image which is a result of addition of a difference image decoded from compressed data about an inputted image and a prediction image, and outputting the local decoded image on which the filtering process is carried out as a reference image used when generating said prediction image; and

a variable length encoding process step of a variable length encoder variable-length-encoding said compressed data and a filter parameter used when the filtering process is carried out in said filtering process step, and generating a coded bitstream into which coded data about said compressed data and coded data about said filter parameter are multiplexed,

wherein said filtering process step includes the steps of determining a classification method of carrying out a class classification on each coding block having a largest size, carrying out a class classification on each pixel within a block in question by using said classification method, calculating

an offset value for each class, and carrying out a pixel adaptive offset process of adding said offset value to a pixel value of a pixel belonging to a corresponding class, and said variable length encoding process step includes the steps of  
5 variable-length-encoding an index indicating the classification method of carrying out a class classification on each coding block having the largest size, the classification method being determined in said filtering process step, and also variable-length-encoding a parameter about the offset value for  
10 each class determined for each coding block having the largest size on a basis of a binarization process using a truncated unary code.

[12] A video encoding method comprising:

a filtering process step of a filter carrying out a  
15 filtering process on a local decoded image which is a result of addition of a difference image decoded from compressed data about an inputted image and a prediction image, and outputting the local decoded image on which the filtering process is carried out as a reference image used when generating said  
20 prediction image; and

a variable length encoding process step of a variable length encoder variable-length-encoding said compressed data and a filter parameter used when the filtering process is carried out in said filtering process step, and generating a  
25 coded bitstream into which coded data about said compressed data and coded data about said filter parameter are multiplexed,

wherein said filtering process step includes the steps of determining a classification method of carrying out a class classification on each coding block having a largest size,  
30 carrying out a class classification on each pixel within a block

in question by using said classification method, determining a parameter for calculating an offset value for each class and also calculating an offset value for each class from said parameter, and carrying out a pixel adaptive offset process of adding said offset value to a pixel value of a pixel belonging to a corresponding class, and said variable length coding process step includes the steps of variable-length-encoding an index indicating the classification method of carrying out a class classification on each coding block having the largest size, the classification method being determined by said filtering process step, and also variable-length-encoding a parameter about the offset value for each class determined for each coding block having the largest size on a basis of a binarization process using a truncated unary code.

[13] A video decoding method comprising:

a variable length decoding process step of a variable length decoder variable-length-decoding compressed data and a filter parameter from coded data multiplexed into a coded bitstream;

a filtering process step of a filter carrying out a filtering process on a decoded image decoded from the compressed data variable-length-decoded in said variable length decoding process step by using the filter parameter variable-length-decoded in said variable length decoding process step, and outputting the decoded image on which the filtering process is carried out as a reproduced image,

wherein said variable length decoding process step includes the steps of variable-length-decoding, as a filter parameter, an index indicating a classification method of carrying out a class classification on each coding block having

a largest size from the coded data multiplexed into said coded bitstream, and also variable-length-decoding a parameter about an offset value for each class for each coding block having the largest size on a basis of a binarization process using a truncated unary code, and said filtering process step includes the steps of specifying the classification method of carrying out a class classification on each coding block having the largest size by using the index indicating the classification method of carrying out a class classification on each coding block having the largest size, carrying out a class classification on each pixel by using the classification method of carrying out a class classification, the classification method corresponding to each coding block having said largest size, calculating an offset value from the parameter for calculating the offset value for each class for each coding block having the largest size, and carrying out a pixel adaptive offset process of adding said offset value to a pixel value of a pixel belonging to a corresponding class.

## CLAIMS

[1] A moving image decoding device comprising:

a variable length decoder that carries out a variable length decoding process on coded data multiplexed into a bitstream to generate compressed data and a coding mode associated with each of coding blocks which are hierarchically partitioned;

a motion-compensated predictor that carries out a motion-compensated prediction process according to the coding mode associated with each of the coding blocks generated by the variable length decoder to generate a prediction image; and

a decoded image generator that adds a difference image and the prediction image generated by the motion-compensated predictor to generate a decoded image, the difference image being decoded from the compressed data associated with each of the coding blocks generated by the variable length decoder.