Claims

[1] An image decoding method for generating a decoded image, the decoded image being generated by adding a prediction image and a difference image comprising, the steps of:

variable-length-decoding an inputted encoded bit stream to obtain a parameter for prediction signal prediction, a compressed difference image, filters and class identification information for a block in the decoded image, the parameter being used for generating the prediction image, the compressed difference image being used for generating the difference image;

determining a class for the block according to the class identification information; and

carrying out a filtering process on the decoded image with the filters based on the determined class.

[2] The image decoding method according to claim 1, wherein the class identification information includes information indicating whether or not to perform the filtering process on the decoded image.

Claims

[1] An image encoding device comprising:

a prediction processing unit for detecting a parameter for prediction signal generation from an inputted image and a reference image to generate a prediction image from said parameter for prediction signal generation and said reference image, and for calculating a difference image which is a difference between said inputted image and said prediction image;

a difference image compression unit for compressing the difference image calculated by said prediction processing unit;

a local decoding unit for decoding the difference image compressed by said difference image compression unit and adding the difference image decoded thereby and the prediction image generated by said prediction processing unit to acquire a local decoded image;

a filtering unit for carrying out a filtering process of compensating for a distortion superimposed onto the local decoded image acquired by said local decoding unit, and for outputting the local decoded image filtered thereby to said prediction processing unit as the reference image; and

a variable length encoding unit for variable-length-encoding the parameter for prediction signal generation detected by said prediction processing unit, the difference image compressed by said difference image compression unit, and information about a filter which is used when said filtering unit carries out the filtering process, wherein

said filtering unit includes a region classifying unit

for extracting a feature quantity of each of the regions which construct the local decoded image acquired by said local decoding unit to classify each of the regions into a class to which said each of the regions belongs according to said feature quantity, and a filter designing and processing unit for, for each class to which one or more regions, among the regions which construct said local decoded image, belong, generating a filter which minimizes an error occurring between said inputted image and said local decoded image in each of the one or more regions belonging to said each class to compensate for a distortion superimposed onto said one or more regions by using said filter.

[2] The image encoding device according to claim 1, wherein the filter designing and processing unit compares errors occurring between the inputted image and the local decoded image in each of the blocks which construct the local decoded image acquired by the local decoding unit between before and after the filtering process, and performs the filtering process on a block in which the error occurring after the filtering process is smaller than the error occurring before the filtering process and outputs the filtered local decoded image to the prediction processing unit as the reference image while not performing the filtering process on a block in which the error occurring after the filtering process is equal to or larger than the error occurring before the filtering process and outputs the yet-to-be-filtered local decoded image to said prediction processing unit as the reference image.

[3] The image encoding device according to claim 1, wherein the filter designing and processing unit selects a filter which minimizes an error occurring between the inputted image and the local decoded image in each of the blocks which construct the

local decoded image acquired by the local decoding unit from among filters which said filter designing and processing unit generates for each class to which one or more regions belong to compensate for a distortion superimposed onto said each block by using said filter.

[4] The image encoding device according to claim 1, wherein the filter designing and processing unit selects a filter which minimizes an error occurring between the inputted image and the local decoded image in each of the blocks which construct the local decoded image acquired by the local decoding unit from among filters which the filter designing and processing unit generates for each class to which one or more regions belong and filters prepared in advance to compensate for a distortion superimposed onto said each block by using said filter.

[5] The image encoding device according to claim 1, wherein the filter designing and processing unit selects a filter which minimizes an error occurring between the inputted image and the local decoded image in each of the blocks which construct the local decoded image acquired by the local decoding unit from among filters which the filter designing and processing unit generates for each class to which one or more regions belong and filters used for an already-encoded frame to compensate for a distortion superimposed onto said each block by using said filter.

[6] An image decoding device comprising:

a variable length decoding unit for variable-length-decoding a parameter for prediction signal generation, a compressed difference image, and filter information, which are included in a stream;

a prediction image generating unit for generating a

prediction image from both the parameter for prediction signal generation which said variable length decoding unit has variable-length-decoded, and a reference image;

a decoding unit for decoding the compressed difference image which said variable length decoding unit has variable-length-decoded, and adding said difference image and the prediction image generated by said prediction image generating unit to acquire a decoded image; and

a filtering unit for carrying out a filtering process of compensating for a distortion superimposed onto the decoded image acquired by said decoding unit, and for outputting the decoded image filtered thereby to said prediction image generating unit as the reference image, as well as to outside said image decoding device as a filtered decoded image, wherein

said filtering unit includes a region classifying unit for extracting a feature quantity of each of the regions which construct the decoded image acquired by said decoding unit to classify each of the regions to a class to which said each of the regions belongs according to said feature quantity, and a filter processing unit for referring to the filer information which said variable length decoding unit has variable-length-decoded to generate a filter which is applied to the class to which each region classified by said region classifying unit belongs, and compensate for a distortion superimposed onto a region belonging to said class by using said filter.

[7] The image decoding device according to claim 6, wherein when the variable length decoding unit variable-length-decodes information included in the stream and showing whether or not to perform the filtering process on each of the blocks which

construct the decoded image, the filter processing unit performs the filtering process on a block which the information indicates is subjected to the filtering process, among the blocks which construct said decoded image, and outputting the filtered decoded image to the prediction image generating unit as the reference image, as well as to outside said image decoding device as the filtered decoded image, while not performing the filtering process on a block which the information indicates is not subjected to the filtering process, among the blocks which construct said decoded image, and outputting the yet-to-be-filtered decoded image to said prediction image generating unit as the reference image, as well as to outside said image decoding device as the filtered decoded image.

[8] An image decoding device comprising:

a variable length decoding unit for variable-length-decoding a parameter for prediction signal generation, a compressed difference image, and filer information including filter generation information and filter selection information about each small region, which are included in a stream;

a prediction image generating unit for generating a prediction image from both the parameter for prediction signal generation which said variable length decoding unit has variable-length-decoded, and a reference image;

a decoding unit for decoding the compressed difference image which said variable length decoding unit has variable-length-decoded, and adding said difference image and the prediction image generated by said prediction image generating unit to acquire a decoded image; and

a filtering unit for carrying out a filtering process of

compensating for a distortion superimposed onto the decoded image acquired by said decoding unit, and for outputting the decoded image filtered thereby to said prediction image generating unit as the reference image, as well as to outside said image decoding device as a filtered decoded image, wherein

said filtering unit includes a filter processing unit for referring to the filer information including the filter generation information and the filter selection information about each small region which said variable length decoding unit has variable-length-decoded to compensate for a distortion superimposed onto each small region.

[9] The image decoding device according to claim 8, wherein when the variable length decoding unit variable-length-decodes selection information included in the stream, and showing a used filter and including information whether or not to perform the filtering process on each of the blocks which construct the decoded image, the filter processing unit performs a filter selection according to said selection information and the filtering process on a block which the information indicates is subjected to the filtering process, among the blocks which construct said decoded image, and outputting the filtered decoded image to the prediction image generating unit as the reference image, as well as to outside said image decoding device as the filtered decoded image, while not performing the filtering process on a block which the information indicates is not subjected to the filtering process, among the blocks which construct said decoded image, and outputting the yet-to-be-filtered decoded image to said prediction image generating unit as the reference image, as well as to outside said image decoding device as the filtered decoded image.

[10] An image encoding method comprising:

a prediction processing step of a prediction processing unit detecting a parameter for prediction signal generation from an inputted image and a reference image to generate a prediction image from said parameter for prediction signal generation and said reference image, and calculating a difference image which is a difference between said inputted image and said prediction image;

a difference image compression processing step of a difference image compression unit compressing the difference image calculated by said prediction processing unit;

a local decoding processing step of a local decoding unit decoding the difference image compressed by said difference image compression unit and adding the difference image decoded thereby and the prediction image generated by said prediction processing unit to acquire a local decoded image;

a filtering processing step of a filtering unit carrying out a filtering process of compensating for a distortion superimposed onto the local decoded image acquired by said local decoding unit, and outputting the local decoded image filtered thereby to said prediction processing unit as the reference image; and

a variable length encoding processing step of a variable length encoding unit variable-length-encoding the parameter for prediction signal generation detected by said prediction processing unit, the difference image compressed by said difference image compression unit, and information about a filter which is used when said filtering unit carries out the filtering process, wherein

a region classifying unit of said filtering unit includes

a region classification processing step of extracting a feature quantity of each of the regions which construct the local decoded image acquired by said local decoding unit to classify each of the regions into a class to which said each of the regions belongs according to said feature quantity, and a filter designing and processing unit of said filtering unit includes a filter processing step of, for each class to which one or more regions, among the regions which construct said local decoded image, belong, generating a filter which minimizes an error occurring between said inputted image and said local decoded image in each of the one or more regions belonging to said each class to compensate for a distortion superimposed onto said one or more regions by using said filter.

[11] An image decoding method comprising:

a variable length decoding processing step of a variable length decoding unit variable-length-decoding a parameter for prediction signal generation, a compressed difference image, and filter information, which are included in a stream;

a prediction image generating processing step of a prediction image generating unit generating a prediction image from both the parameter for prediction signal generation which said variable length decoding unit has variable-length-decoded, and a reference image;

a decoding process step of a decoding unit decoding the compressed difference image which said variable length decoding unit has variable-length-decoded, and adding said difference image and the prediction image generated by said prediction image generating unit to acquire a decoded image; and

a filtering processing step of a filtering unit carrying out a filtering process of compensating for a distortion

superimposed onto the decoded image acquired by said decoding unit, and outputting the decoded image filtered thereby to said prediction image generating unit as the reference image, as well as to outside said filtering unit as a filtered decoded image, wherein

a region classifying unit of said filtering unit includes a region classification process step of extracting a feature quantity of each of the regions which construct the decoded image acquired by said decoding unit to classify each of the regions to a class to which said each of the regions belongs according to said feature quantity, and a filter processing unit of said filtering unit includes a filter processing step of referring to the filter information which said variable length decoding unit has variable-length-decoded to generate a filter which is applied to the class to which each region classified by said region classifying unit belongs, and compensate for a distortion superimposed onto a region belonging to said class by using said filter.

[12] An image decoding device comprising:

a variable length decoding processing step of a variable length decoding unit variable-length-decoding a parameter for prediction signal generation, a compressed difference image, and filter information including filter generation information and filter selection information about each small region, which are included in a stream;

a prediction image generating processing step of a prediction image generating unit generating a prediction image from both the parameter for prediction signal generation which said variable length decoding unit has variable-length-decoded, and a reference image;

a decoding process step of a decoding unit decoding the compressed difference image which said variable length decoding unit has variable-length-decoded, and adding said difference image and the prediction image generated by said prediction image generating unit to acquire a decoded image; and

a filtering processing step of a filtering unit carrying out a filtering process of compensating for a distortion superimposed onto the decoded image acquired by said decoding unit, and outputting the decoded image filtered thereby to said prediction image generating unit as the reference image, as well as to outside said filtering unit as a filtered decoded image, wherein

a filter processing unit of said filtering unit includes a filter processing step of referring to the filter information including the filter generation information and the filter selection information about each small region which said variable length decoding unit has variable-length-decoded to compensate for a distortion superimposed onto each small region.