

[CLAIMS]

{Claim 1}

1. A moving-picture decoding method comprising:

analyzing a coded moving picture bitstream to obtain difference data of a target block among a plurality of blocks of two or more sizes;

performing intra prediction on the target block to calculate values of predicted samples of the target block; and

calculating reconstructed samples of the target block by adding the difference data and the values of the predicted samples,

wherein in said performing of intra prediction includes,:

~~validity of each of reference samples that are located one of immediately above and immediately to the left of the target block is determined, and when the reference samples include both a valid reference sample and an invalid reference sample, the intra prediction is performed using the valid reference sample, and~~

~~an intra-predicted reference sample is determined as a valid reference sample, and an inter-predicted reference sample is determined as an invalid reference sample.~~

determining, for each of a plurality of reference samples each located at bottom left, left, top left, top, or top right of the target block, the reference sample to be a valid reference sample if the reference sample is intra-predicted, and to be an invalid reference sample if the reference sample is inter-predicted;

selecting, if the plurality of reference samples include both a valid reference sample and an invalid reference sample, the valid reference sample as a selected sample, and using a value of the selected sample as a complementary value of the invalid reference sample; and

calculating the predicted sample of the target block, using a value of the valid reference sample and the complementary value of the invalid reference sample, and

in said selecting,

a search starts from a location of a reference sample at bottom left of the target block among locations of all the plurality of reference samples, and is conducted in search order: locations of reference samples at left; top left; top; and top right of the target block, and

when a valid reference sample found first in the search is a first valid reference sample, and a valid reference sample found next in the search is a second valid reference sample,

a value of the first valid reference sample is used as the complementary value of the invalid reference sample that is located between the location of the reference sample at bottom left of the target block and a location of the second valid reference sample, both exclusive, in the search order.

[Claim 2]

2. ~~The moving-picture decoding method according to Claim 1,~~
~~wherein in said analyzing, the coded moving picture bitstream is further analyzed to determine an intra prediction method, and~~
~~said performing of intra prediction further includes:~~
~~calculating a complementary sample using one or more valid reference samples including the valid reference sample, the complementary sample being a reference sample at a location of the invalid reference sample; and~~
~~calculating the predicted samples of the target block in accordance with the intra prediction method, using the valid reference sample and the complementary sample.~~

wherein in said selecting,

when a valid reference sample found in the search after the second valid reference sample is found is a third valid reference sample,

a value of the second valid reference sample is used as the complementary value of the invalid reference sample that is located between the location of the second valid reference sample and a

location of the third valid reference sample, both exclusive, in the search order.

[Claim 3]

~~—— The moving picture decoding method according to Claim 2,
—— wherein said calculating of a complementary sample includes:
—— selecting one of the valid reference samples as a selected sample; and
—— determining a value of the selected sample as a value of the complementary sample.~~

[Claim 4]

~~—— The moving picture decoding method according to Claim 3,
—— wherein said selecting includes:
—— identifying, as a start reference sample location, a location of a valid reference sample found first in a search in a direction starting from a location of a bottom-left reference sample and ending at a location of a top-right reference sample among locations of all the reference samples;
—— determining whether the invalid reference sample is located before or after the start reference sample location in a sample order that is the same as an order of samples in the search;
—— selecting a sample at the start reference sample location as the selected sample when the invalid reference sample is located before the start reference sample location; and
—— selecting, when the invalid reference sample is located after the start reference sample location, a valid reference sample as the selected sample in accordance with the sample order that is the same as the order of samples in the search, the valid reference sample being located before and closest to a location of the invalid reference sample.~~

[Claim 5]

~~—— The moving picture decoding method according to Claim 2,
—— wherein said calculating of a complementary sample includes:
—— selecting the valid reference samples as a plurality of selected samples;
—— calculating a plurality of scaling values by multiplying a value of each of the selected samples by a predetermined scaling factor;
—— calculating a first sum total value that is a sum total of the scaling values;
—— calculating a second sum total value that is a sum of the first sum total value and a predetermined offset value; and
—— calculating a value of the complementary sample by down-shifting the second sum total value by a predetermined shift step value.~~

[Claim 6]

3. The moving picture decoding method according to Claim 1,
wherein the intra prediction is intra DC prediction.

[Claim 7]

~~—— The moving picture decoding method according to Claim 6,
—— wherein said performing of intra prediction includes:
—— selecting each of one or more valid reference samples including the valid reference sample as a selected sample;
—— specifying the number of the selected samples;
—— selecting a scaling factor, an offset value, and a shift step value, using a look-up table, in accordance with the number of the selected samples;
—— calculating a first sum total value that is a sum total of values of the selected samples;
—— calculating a scaling value by multiplying the first sum total value by the selected scaling factor;
—— calculating a second sum total value that is a sum of the selected offset value and the scaling value; and~~

~~—generating each value of all the predicted samples of the target block by down-shifting the second sum total value by the selected shift step value.—~~

~~[Claim 8]~~

4. The ~~moving~~-picture decoding method according to Claim ~~63~~, wherein said performing of intra prediction further includes performing of intra prediction in the case in which a predetermined value is determined as each value of all the predicted samples of the target block.

~~[Claim 9]~~

5. The ~~moving~~-picture decoding method according to any one of Claims 1 to ~~84~~,

wherein in said analyzing, selection information coded in a header of the coded moving picture bitstream is further obtained,

the selection information indicates one of (1) a constrained intra prediction scheme that is the intra prediction and (2) an unconstrained intra prediction scheme for performing intra prediction using all the reference samples without determining the validity of each of the reference samples, and

in said performing of intra prediction, the intra prediction is performed using one of the constrained intra prediction scheme and the unconstrained intra prediction scheme indicated by the selection information.

~~[Claim 10]~~

6. The ~~moving~~-picture decoding method according to any one of Claims 1 to ~~95~~,

wherein in said performing of intra prediction, a reference sample outside a target picture is determined as an invalid reference sample.

~~{Claim 11}~~

7. The ~~moving-picture~~ decoding method according to any one of Claims 1 to 9~~6~~,

wherein in said performing of intra prediction, a reference sample that is not included in the same unit of picture division as the target block is determined as an invalid reference sample.

~~{Claim 12}~~

8. The ~~moving-picture~~ decoding method according to Claim ~~11~~7, wherein the unit of picture division is a slice.

~~{Claim 13}~~

9. The ~~moving-picture~~ decoding method according to Claim ~~11~~7, wherein the unit of picture division is a lightweight slice.

~~{Claim 14}~~

10. The ~~moving-picture~~ decoding method according to Claim ~~11~~7, wherein the unit of picture division is a tile.

~~{Claim 15}~~

11. The ~~moving-picture~~ decoding method according to Claim ~~11~~7, wherein the unit of picture division is a wavefront parallel processing unit (WPP).

~~{Claim 16}~~

12. A ~~moving-picture~~ coding method comprising:
dividing an original picture into a plurality of blocks of two or more sizes;

performing intra prediction on a target block among the blocks to calculate values of predicted samples;

calculating difference data that represents a difference between an original image in the target block and the values of the predicted samples; and

coding the difference data to generate a coded moving picture bitstream,

wherein ~~in~~ said performing of intra prediction includes,:

~~_____ validity of each of reference samples that are located one of immediately above and immediately to the left of the target block is determined, and when the reference samples include both a valid reference sample and an invalid reference sample, the intra prediction is performed using the valid reference sample, and~~

~~_____ an intra-predicted reference sample is determined as a valid reference sample, and an inter-predicted reference sample is determined as an invalid reference sample.~~

_____ determining, for each of a plurality of reference samples each located at bottom left, left, top left, top, or top right of the target block, the reference sample to be a valid reference sample if the reference sample is intra-predicted, and to be an invalid reference sample if the reference sample is inter-predicted;

_____ selecting, if the plurality of reference samples include both a valid reference sample and an invalid reference sample, the valid reference sample as a selected sample, and using a value of the selected sample as a complementary value of the invalid reference sample; and

_____ calculating the predicted sample of the target block, using a value of the valid reference sample and the complementary value of the invalid reference sample, and

_____ in said selecting,

_____ a search starts from a location of a reference sample at bottom left of the target block among locations of all the plurality of reference samples, and is conducted in search order: locations of reference samples at left; top left; top; and top right of the target block, and

_____ when a valid reference sample found first in the search is a first valid reference sample, and a valid reference sample found next in the search is a second valid reference sample,

a value of the first valid reference sample is used as the complementary value of the invalid reference sample that is located between the location of the reference sample at bottom left of the target block and a location of the second valid reference sample, both exclusive, in the search order.

[Claim 17]

13. A ~~moving-picture~~ decoding apparatus comprising:

an analyzing unit configured to analyze a coded moving picture bitstream to obtain difference data of a target block among a plurality of blocks of two or more sizes;

an intra predicting unit configured to perform intra prediction on the target block to calculate values of predicted samples of the target block; and

a reconstructed sample calculating unit configured to calculate reconstructed samples of the target block by adding the difference data and the values of the predicted samples,

wherein said intra predicting unit ~~is configured to~~ includes:

~~—determine validity of each of reference samples that are located one of immediately above and immediately to the left of the target block, and perform, when the reference samples include both a valid reference sample and an invalid reference sample, the intra prediction using the valid reference sample, and—~~

~~—determine an intra-predicted reference sample as a valid reference sample, and determine an inter-predicted reference sample as an invalid reference sample.~~

a determining unit configured to determine, for each of a plurality of reference samples each located at bottom left, left, top left, top, or top right of the target block, the reference sample to be a valid reference sample if the reference sample is intra-predicted, and to be an invalid reference sample if the reference sample is inter-predicted;

a sample selecting unit configured to select, if the plurality of

reference samples include both a valid reference sample and an invalid reference sample, the valid reference sample as a selected sample, and use a value of the selected sample as a complementary value of the invalid reference sample; and

a predicted sample calculating unit configured to calculate the predicted sample of the target block, using a value of the valid reference sample and the complementary value of the invalid reference sample, and

said sample selecting unit is configured to:

start a search from a location of a reference sample at bottom left of the target block among locations of all the plurality of reference samples, and conduct the search in search order: locations of reference samples at left; top left; top; and top right of the target block; and

when a valid reference sample found first in the search is a first valid reference sample, and a valid reference sample found next in the search is a second valid reference sample,

use a value of the first valid reference sample as the complementary value of the invalid reference sample that is located between the location of the reference sample at bottom left of the target block and a location of the second valid reference sample, both exclusive, in the search order.

~~{Claim 18}~~

14. A moving-picture coding apparatus comprising:

a dividing unit configured to divide an original picture into a plurality of blocks of two or more sizes;

an intra predicting unit configured to perform intra prediction on a target block among the blocks to calculate values of predicted samples;

a difference data calculating unit configured to calculate difference data that represents a difference between an original image in the target block and the values of the predicted samples;

and

a coding unit configured to code the difference data to generate a coded moving picture bitstream,

wherein said intra predicting unit ~~is configured to~~ includes:

~~—— determine validity of each of reference samples that are located one of immediately above and immediately to the left of the target block, and perform, when the reference samples include both a valid reference sample and an invalid reference sample, the intra prediction using the valid reference sample, and~~

~~—— determine an intra-predicted reference sample as a valid reference sample, and determine an inter-predicted reference sample as an invalid reference sample.~~

—— a determining unit configured to determine, for each of a plurality of reference samples each located at bottom left, left, top left, top, or top right of the target block, the reference sample to be a valid reference sample if the reference sample is intra-predicted, and to be an invalid reference sample if the reference sample is inter-predicted;

—— a sample selecting unit configured to select, if the plurality of reference samples include both a valid reference sample and an invalid reference sample, the valid reference sample as a selected sample, and use a value of the selected sample as a complementary value of the invalid reference sample; and

—— a predicted sample calculating unit configured to calculate the predicted sample of the target block, using a value of the valid reference sample and the complementary value of the invalid reference sample, and

said sample selecting unit is configured to:

—— start a search from a location of a reference sample at bottom left of the target block among locations of all the plurality of reference samples, and conduct the search in search order: locations of reference samples at left; top left; top; and top right of the target block; and

when a valid reference sample found first in the search is a first valid reference sample, and a valid reference sample found next in the search is a second valid reference sample,

use a value of the first valid reference sample as the complementary value of the invalid reference sample that is located between the location of the reference sample at bottom left of the target block and a location of the second valid reference sample, both exclusive, in the search order.

[~~Claim 19~~]

15. A ~~moving-picture~~ coding and decoding apparatus comprising:
the ~~moving-picture~~ coding apparatus according to Claim ~~18~~14;
and
the ~~moving-picture~~ decoding apparatus according to Claim ~~17~~13.