[0004]

[NPL 1]

ISO/IEC 14496-10 "MPEG-4 Part 10 Advanced Video Coding"

[Summary of Invention]

[Technical Problem]

[0005]

However, in the aforementioned conventional art, filtering is performed also on the boundary of both kinds of blocks that are an IPCM block and a non-IPCM block. Here, an IPCM block is a block as to which the original pixel values are used. Thus, the conventional art has a problem that the image quality of IPCM blocks deteriorates when filtering is performed.

[0006]

Embodiments of t~~T~~he present invention ~~aims to~~ provide a filtering method which enables suppression of deterioration in the image quality of IPCM blocks.

[Solution to Problem]

[0007]

According to a first aspect of the present invention, there is provided ~~In order to achieve the aforementioned object,~~ a filtering method ~~according to an aspect of the present invention is for~~of filtering a plurality of blocks included in an image, the filtering method comprising: determining whether or not each of the blocks is an Intra Pulse Code Modulation (IPCM) block; filtering a non-IPCM block which is not the IPCM block out of the blocks to generate filtered data; and outputting the filtered data as a value of a pixel in the non-IPCM block, and outputting, as a value of a pixel in the IPCM block, an unfiltered value of the pixel in the IPCM block.

[0008]

With this structure, the filtering method according to an embodiment of the present invention does not involve filtering on an IPCM block, and thus is capable of suppressing degradation in image quality of the IPCM block.

[0009]

In addition, in the filtering, the filtered data of the non-IPCM block may be generated by performing filtering using both the value of the pixel in the IPCM block and the value of the pixel in the non-IPCM block.

[0010]

In addition, the filtering may be deblocking filtering, in the filtering, first filtered data may be generated by filtering a first non-IPCM block out of a first IPCM block and the first non-IPCM block which are adjacent to each other, and in the outputting, the first filtered data may be output as a value of a pixel in the first non-IPCM block, and an unfiltered value of a pixel in the first IPCM block may be output as a value of the pixel in the first IPCM block.

[0011]

In addition, in the filtering, only the non-IPCM block out of the blocks may be filtered, and the IPCM block does not need to be filtered.

[0012]

In addition, in the filtering, the filtered data may be generated by filtering all of the blocks, and in the outputting, a filtered value of the pixel in the IPCM block in the filtered data may be replaced by the unfiltered value of the pixel in the IPCM block.

[0013]

According to a second aspect~~Furthermore~~, there is provided a filtering method of~~according to an aspect of the present invention is for~~ filtering a boundary between an Intra Pulse Code Modulation (IPCM) block and a non-IPCM block which are adjacent to each other in an image, the filtering method comprising: setting a first filter strength for the non-IPCM block, and setting a second filter strength for the IPCM block, the second filter strength being lower than the first filter strength; and filtering the non-IPCM block using the first filter strength, and filtering the IPCM block using the second filter strength.

[0014]

With this structure, the filtering method according to an embodiment of the present invention is capable of reducing the strength of filtering on the IPCM block, and thereby suppressing

degradation in image quality of the IPCM block.

[0015]

In addition, the second filter strength may specify that filtering is skipped.

[0016]

With this structure, the filtering method according to an embodiment of the present invention does not involve filtering on an IPCM block, and thus is capable of suppressing degradation in image quality of the IPCM block.

[0017]

In addition, the first filter strength may be lower than a filter strength that is determined when the non-IPCM block is a block to be intra coded.

[0018]

It is to be noted that the present invention can be realized as not only such a filtering method but also as a filtering apparatus including units corresponding to the unique steps included in the filtering method, and as a program for causing a computer to execute these unique steps. Naturally, such a program can be distributed through non-transitory computer-readable recording media such as CD-ROM etc. and communication media such as the Internet.

[0019]

Furthermore, embodiments of the present invention can be realized as a moving picture coding method and a moving picture decoding method each including such a filtering method. Furthermore, embodiments of the present invention can be implemented as a moving picture coding apparatus and a moving picture decoding apparatus each including a filtering device, and as a moving picture coding and decoding apparatus including the moving picture coding apparatus and the moving picture decoding apparatus. Furthermore, embodiments of the present invention can be implemented as a semiconductor integrated circuit (LSI) which exerts part or all of the functions of the filtering device, the moving picture coding apparatus, or the moving picture decoding apparatus.

[0019a]

According to a third aspect, there is provided a moving picture coding apparatus which codes an input image signal to generate a coded bit stream, said moving picture coding apparatus comprising:

a subtractor which subtracts a prediction image signal from the input image signal to generate a residual signal;

a transform and quantization unit configured to transform and quantize the residual signal to generate a quantized coefficient;

a coding unit configured to code the quantized coefficient to generate a coded signal;

a selecting unit configured to:

(i) select the input image signal and output the selected signal as the coded bit stream when a current block is an IPCM block which belongs to an IPCM-type block; and

(ii) select the coded signal and output the selected signal as the coded bit stream when a current block is a non-IPCM block which is not the IPCM block;

an inverse quantization and inverse transform unit configured to perform inverse quantization and inverse transform on the quantized coefficient to generate a decoded residual signal;

an adder which adds the prediction image signal to the decoded residual signal to generate a decoded image signal;

a filtering unit configured to generate a first image signal by performing filtering according to Claim 1 using (i) a value of a pixel in the decoded image signal as the value of the pixel in the non-IPCM block and (ii) a value of a pixel in the input image signal as the value of the pixel in the IPCM block;

a memory in which the first image signal is stored; and

a prediction unit configured to generate the prediction image signal by performing prediction using the first image signal stored in said memory.

[0019b]

According to a fourth aspect, there is provided a moving picture decoding apparatus which decodes a coded bit stream to generate an output image signal, said moving picture decoding apparatus comprising:

a decoding unit configured to decode the coded bit stream to generate a quantized coefficient;

an inverse quantization and inverse transform unit configured to perform inverse quantization and inverse transform on the quantized coefficient to generate a decoded residual signal;

an adder which adds a prediction image signal to the decoded residual signal to generate a decoded image signal;

a filtering unit configured to generate a first image signal by performing filtering according to Claim 1 using (i) a value of a pixel in the decoded image signal as the value of the pixel in the non-IPCM block and (ii) a value of a pixel in the coded bit stream as the value of the pixel in the IPCM block;

a memory in which the first image signal is stored; and

a prediction unit configured to generate the prediction image signal by performing prediction using the first image signal stored in said memory.

[0019c]

According to a fifth aspect, there is provided a moving picture coding and decoding apparatus comprising: the moving picture coding apparatus according to the above third aspect; and the moving picture decoding apparatus according to the above fourth aspect.

[Advantageous Effects of Invention]