[DESCRIPTION]

[Title]

IMAGE PROCESSING APPARATUS AND IMAGE PROCESSING METHOD

[CROSS REFERENCE TO RELATED APPLICATIONS]

[0001]

This application claims the benefit of Japanese Priority Patent Application JP 2014-182785 filed on September 8, 2014, the entire contents of which are incorporated herein by reference.

[Technical Field]

[0002]

A technology disclosed in the present description relates to an image processing apparatus and an image processing method which are for processing image information. Specifically, the technology relates to an image processing apparatus and an image processing method which are for transmitting/receiving or displaying a high-dynamic-range image.

[Background Art]

[0003]

Recently, the number of bits of an imaging element (image sensor) is increased and an image comes to be in a dynamic range. Generally, a dynamic range of an image can be expressed by a ratio between minimum luminance and peak luminance. In an HDR image, a contrast ratio between a color with a maximum color value and a color with a minimum color value is, for example, 10000 : 1 or higher. Thus, the HDR image can express an actual world realistically. The HDR image can record luminance in a whole visible range and can support a dynamic range

and a color gamut which are equivalent to those of a visual characteristic of a human. The HDR image has an advantage that shading can be expressed realistically, exposure can be simulated, and brightness can be expressed.

[0004]

As described above, while an HDR image is photographed on a content production side, displays with various kinds of performance such as a display corresponding to a standard dynamic range (SDR) which is compressed into about one fortieth of the dynamic range and a display, peak luminance of which is 500 nits or 1000 nits and which corresponds to an HDR, are used in houses in which content is viewed. Thus, processing to adapt a dynamic range of original content to performance of a display in an image output destination (hereinafter, also referred to as "display mapping") is necessary (see, for example, Patent Literature 1).

[0005]

However, in the display mapping, when conversion of a dynamic range is performed simply by linear scaling, it is concerned that a great amount of information is lost and a visual effect, which is seen by a human, of an image becomes greatly different before and after the conversion. Such a loss of information is not intended by a content producer.

[Summary]

[Technical Problem]

[0006]

It is desirable to provide a superior image processing apparatus and image processing method which can transmit/receive or display a high-dynamic-range image suitably.

[Solution to Problem]

[0007]

Embodiments of the present invention are provided in view of the forgoing.

[0008]

According to a first aspect of the present invention, there is provided an image processing apparatus including circuitry configured to: generate, based on metadata including luminance conversion information and a capability of a display in an output destination, second luminance conversion information for adaptation of content in a first dynamic range to the display; process the content in the first dynamic range based on the second luminance conversion information; generate a conversion table to convert a luminance value in the first dynamic range into a luminance value in the display with a predetermined peak luminance based on the metadata including a relationship between luminance values before and after conversion from the first dynamic range into a second dynamic range at one or more points; and convert luminance of the content in the first dynamic range based on the conversion table.

[0009]

According to a second aspect of the present invention, there is provided an image processing method including generating, by a processing device, based on metadata including luminance conversion information and a capability of a display in an output destination, second luminance conversion information for adaptation of content in a first dynamic range to the display; processing, by the processing device, the content in the first dynamic range based on the second luminance conversion information; generating a conversion table to convert a luminance value in the first dynamic range into a luminance

value in the display with a predetermined peak luminance based on the metadata including a relationship between luminance values before and after conversion from the first dynamic range into a second dynamic range at one or more points; and converting luminance of the content in the first dynamic range based on the conversion table.

[0010]

According to a third aspect of the present invention, there is provided an image processing apparatus including circuitry configured to: acquire luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range; generate metadata of content based on the luminance conversion information, in which the luminance conversion information is based on an intension of a content producer for use in display mapping; and generate the metadata including a relationship between luminance values before and after conversion from the first dynamic range into the second dynamic range at one or more points.

[0011]

According to a fourth aspect of the present invention, there is provided an image processing method including information acquiring, by a processing device, to acquire luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range; metadata generating, by the processing device, to generate metadata of content based on the luminance conversion information, in which the luminance conversion information is based on an intension of a content producer for use in display mapping; generating metadata, by the processing device, to generate metadata of content based on the luminance conversion information, in which the luminance conversion information is based on an intension of a content producer for use in display mapping; and generating the

metadata including a relationship between luminance values before and after conversion from the first dynamic range into the second dynamic range at one or more points.

[0012]

Disclosed herein is an image processing apparatus including: an information acquisition unit configured to acquire luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range; and a metadata generation unit configured to generate metadata of content based on the luminance conversion information.

[0013]

According to an embodiment, the metadata generation unit of the image processing apparatus is configured to generate the metadata including a relationship between luminance values before and after conversion from the first dynamic range into the second dynamic range at one or more points.

[0014]

According to an embodiment, the image processing apparatus further includes a transmission unit configured to transmit the metadata while storing the metadata in a predetermined transmission container.

[0015]

According to an embodiment, the transmission unit of the image processing apparatus is configured to transmit the metadata expressing luminance conversion information in a linear luminance value.

[0016]

According to an embodiment, the transmission unit of the image processing apparatus is configured to store the metadata into knee_function_info SEI of the content.

[0017]

According to an embodiment, the transmission unit of the image processing apparatus is configured to transmit the metadata expressing luminance conversion information in a code value.

[0018]

According to an embodiment, the transmission unit of the image processing apparatus is configured to store the metadata into Tone_mapping_info SEI of the content.

[0019]

Also, according to an embodiment, an image processing apparatus includes: a metadata processing unit configured to generate, based on metadata including luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range, second luminance conversion information for adaptation of the content in the first dynamic range to a display in an output destination; and a content processing unit configured to process the content in the first dynamic range based on the second luminance conversion information.

[0020]

According to an embodiment, the metadata processing unit of the image processing apparatus is configured to generate a conversion table to convert a luminance value in the first dynamic range into a luminance value in the display with a predetermined peak luminance based on the metadata including a relationship between luminance values before and after conversion from the first dynamic range into the second dynamic range at one or more points, and the content processing unit is configured to convert luminance of the content in the first dynamic range based on the conversion table.

[0021]

According to an embodiment, the metadata processing unit of the image processing apparatus is configured to generate the second luminance conversion information based on metadata stored in a predetermined transmission container.

[0022]

According to an embodiment, the metadata processing unit of the image processing apparatus is configured to generate the second luminance conversion information based on the metadata expressing luminance conversion information in a linear luminance value, and the content processing unit is configured to perform processing with respect to a luminance signal, on which electro-optical linear conversion processing is performed, based on the second luminance conversion information.

[0023]

According to an embodiment, the metadata processing unit of the image processing apparatus is configured to generate the second luminance conversion information based on metadata stored in knee_function_info SEI of the content.

[0024]

According to an embodiment, the metadata processing unit of the image processing apparatus is configured to generate the second luminance conversion information based on the metadata expressing luminance conversion information in a code value, and the content processing unit is configured to perform processing with respect to a luminance code value, on which electro-optical linear conversion processing is performed, based on the second luminance conversion information.

[0025]

According to an embodiment, the metadata processing unit of the image

processing apparatus is configured to generate the second luminance conversion information based on metadata stored in Tone_mapping_info SEI of the content.

[0026]

According to an embodiment, when peak luminance of the display is higher than peak luminance of the first dynamic range, the metadata processing unit of the image processing apparatus is configured not to generate the second luminance conversion information and not to make the content processing unit perform processing of the content in the first dynamic range.

[0027]

Also, according to an embodiment, an image processing method includes: information acquiring to acquire luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range; and metadata generating to generate metadata of content based on the luminance conversion information.

[0028]

Also, according to an embodiment, an image processing method includes: metadata processing to generate, based on metadata including luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range, second luminance conversion information for adaptation of the content in the first dynamic range to a display in an output destination; and content processing to process the content in the first dynamic range based on the second luminance conversion information.

[Advantageous Effects of Invention]

[0029]

According to embodiments of the present invention, a superior image

processing apparatus and image processing method which suitably provide information related to luminance conversion of an image or which can suitably perform dynamic range conversion of an image based on provided information related to luminance conversion can be provided.

[0030]

Note that an effect described in the present description is just an example and an effect of the present technology is not limited thereto. Also, there is a case where the present technology has an additional effect other than the above-described effect.

[0031]

A further different aspect, characteristic, or advantage of the technology disclosed in the present description will be understood in a detail description based on an embodiment or attached drawings described later.

[Brief Description of Drawings]

[0032]

[Fig. 1]

Fig. 1 is a view schematically illustrating a configuration of an image providing system 100 to which a technology disclosed in the present description is applied.

[Fig. 2]

Fig. 2 is a view schematically illustrating a workflow in which HDR content is processed on a side of an image providing apparatus 200 (or content production side).

[Fig. 3]

Fig. 3 is a view schematically illustrating a workflow in which HDR content is processed on a side of an image utilization

CLAIMS

1. An image processing apparatus comprising:

circuitry configured to:

generate, based on metadata including luminance conversion information and a capability of a display in an output destination, second luminance conversion information for adaptation of content in a first dynamic range to the display;

process the content in the first dynamic range based on the second luminance conversion information;

generate a conversion table to convert a luminance value in the first dynamic range into a luminance value in the display with a predetermined peak luminance based on the metadata including a relationship between luminance values before and after conversion from the first dynamic range into a second dynamic range at one or more points; and

convert luminance of the content in the first dynamic range based on the conversion table.

2. The image processing apparatus according to claim 1, wherein the capability includes a peak luminance of the display and the metadata is generated based on comparison of peak luminance of the display in the output destination with peak luminance of the content in the first dynamic range.

3. The image processing apparatus according to any one of the preceding claims, wherein the circuitry is configured to generate the second luminance conversion information based on metadata stored in a predetermined transmission container.

4. The image processing apparatus according to any one of the preceding claims, wherein the circuitry is configured to:

generate the second luminance conversion information based on the metadata expressing luminance conversion information in a linear luminance value, and

perform processing with respect to a luminance signal, on which electro-optical linear conversion processing is performed, based on the second luminance conversion information.

5. The image processing apparatus according to any one of the preceding claims, wherein circuitry is configured to generate the second luminance conversion information based on metadata stored in knee_function_info supplemental enhancement information (SEI) of the content.

6. The image processing apparatus according to any one of the preceding claims, wherein the circuitry is configured to:

generate the second luminance conversion information based on the metadata expressing luminance conversion information in a code value, and

perform processing with respect to a luminance code value, on which electro-optical linear conversion processing is performed, based on the second luminance conversion information.

7. The image processing apparatus according to any one of the preceding claims, wherein the circuitry is configured to generate the second luminance conversion information based on metadata stored in Tone_mapping_info supplemental enhancement information (SEI) of the content.

8. The image processing apparatus according to any one of the preceding claims, wherein when peak luminance of the display is higher than peak luminance of the first dynamic range, the circuitry does not generate the second luminance conversion information and does not perform processing of the content in the first dynamic range.

9. An image processing method comprising:

generating, by a processing device, based on metadata including luminance conversion information and a capability of a display in an output destination, second luminance conversion information for adaptation of content in a first dynamic range to the display;

processing, by the processing device, the content in the first dynamic range based on the second luminance conversion information;

generating a conversion table to convert a luminance value in the first dynamic range into a luminance value in the display with a predetermined peak luminance based on the metadata including a relationship between luminance values before and after conversion from the first dynamic range into a second dynamic range at one or more points; and

converting luminance of the content in the first dynamic range based on the conversion table.

10. An image processing apparatus comprising:

circuitry configured to:

acquire luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range;

generate metadata of content based on the luminance conversion information, in which the luminance conversion information is based on an intension of a content producer for use in display mapping; and

generate the metadata including a relationship between luminance values before and after conversion from the first dynamic range into the second dynamic range at one or more points.

11. The image processing apparatus according to claim 10, wherein the circuitry is configured to transmit the metadata while storing the metadata in a predetermined transmission container.

12. The image processing apparatus according to any one of claims 10 to 11, wherein the circuitry is configured to transmit the metadata expressing luminance conversion information in a linear luminance value.

13. The image processing apparatus according to any one of claims 10 to 12, wherein the circuitry is configured to store the metadata into knee_function_info supplemental enhancement information (SEI) of the content.

14. The image processing apparatus according to any one of claims 10 to 13, wherein the circuitry is configured to transmit the metadata expressing luminance conversion information in a code value.

15. The image processing apparatus according to any one of claims 10 to 14, wherein the circuitry is configured to store the metadata into Tone_mapping_info supplemental enhancement information (SEI) of the content.

16. The image processing apparatus according to any one of claims 10 to 15, wherein the circuitry is configured to transmit the metadata expressing flag information indicating whether the metadata indicates a knee function curve or the luminance conversion information based on the intension of the content producer.

17. The image processing apparatus according to any one of claims 10 to 16, wherein the circuitry is configured to transmit the metadata expressing flag information indicating whether the metadata indicates tone mapping information or the luminance conversion information based on the intension of the content producer.

18. The image processing apparatus according to any one of claims 10 to 17, wherein the luminance conversion information describes a plurality of points representative of a luminance conversion function which is based on the intension of the content producer, in which a first line extending from a first point to a second point of the plurality of points has a first inclination and a second line extending from the second point to a third point of the plurality points has a second inclination, and in which the second inclination has a second gradient different from a first gradient of the first inclination in accordance with the intension of the content producer.

19. The image processing apparatus according to any one of claims 10 to 18, wherein the second gradient is greater or less than the first gradient.

20. An image processing method comprising:

acquiring information, by a processing device, to acquire luminance conversion information for conversion of content in a first dynamic range into content in a second dynamic range;

generating metadata, by the processing device, to generate metadata of content based on the luminance conversion information, in which the luminance conversion information is based on an intension of a content producer for use in display mapping; and

generating the metadata including a relationship between luminance values before and after conversion from the first dynamic range into the second dynamic range at one or more points.