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[NPL 2]
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[Summary]
[Technical Problem]
[0004]
However, in a point cloud that is an encoding target, a Point also exists at places other than an object surface due to noise or a characteristic of an imaging system. Therefore, it is sometimes difficult to project the point cloud to a two-dimensional plane, and there is a possibility for the quality to be degraded due to encoding that involves such projection to a two-dimensional plane.
[0005]
Embodiments of the present disclosure make it possible to suppress degradation of the quality due to two-dimensional projection of 3D data.

[Solution to Problem]
[0006]
According to a first aspect of the present disclosure, there is provided an image processing apparatus, including: a two-dimensional projection section configured to project all pieces of data for each position included in 3D data representative of a three-dimensional structure to a two-dimensional plane of plural layers, wherein the two-dimensional projection section projects pieces of data for each position overlapping in position with each other in a depthwise direction as viewed from a projection plane that are included in the 3D data to layers of the two-dimensional plane of the plural layers, the layers being different from each other, and wherein the two-dimensional projection section generates, in regard to the two-dimensional plane, layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D

data.

[0007]

According to a second aspect of the present disclosure, there is provided an image processing method, including: projecting all pieces of data for each position included in 3D data representative of a three-dimensional structure to a two-dimensional plane of plural layers wherein the projecting comprises projecting pieces of data for each position overlapping in position with each other in a depthwise direction as viewed from a projection plane that are included in the 3D data to layers of the two-dimensional plane of the plural layers, the layers being different from each other, and wherein the projecting, in regard to the two-dimensional plane, further comprises generating layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.

[0008]

According to a third aspect of the present disclosure, there is provided an image processing apparatus, including: a three-dimensional projection section configured to project all pieces of data for each position of 3D data projected to a two-dimensional plane having a number of layers indicated by layer number information related to a three-dimensional space, wherein the three-dimensional projection section projects pieces of data for each position overlapping in position with each other in the two-dimensional plane in a depthwise direction as viewed from a projection plane that are included in the 3D data to the number of layers of the two-dimensional plane, each of the number of layers being different from each other, and wherein the three-dimensional projection section generates, in regard to the two-dimensional plane, the number of layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.

[0009]

According to a fourth aspect of the present disclosure, there is provided an image processing method, including: projecting all pieces of data for each position of 3D data projected to a two-dimensional plane having a number of layers indicated by layer number information related to a three-dimensional space, wherein

the projecting comprises projecting pieces of data for each position overlapping in position with each other in the two-dimensional plane in a depthwise direction as viewed from a projection plane that are included in the 3D data to the number of layers of the two-dimensional plane, each of the number of layers being different from each other, and wherein the projecting, in regard to the two-dimensional plane, further comprises generating layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.

[0010]

In the image processing apparatus and method of the above aspects of the present disclosure, data for each of all positions included in 3D data representative of a three-dimensional structure is projected to a two-dimensional plane of plural layers.

[0011]

In the image processing apparatus and method of the above aspects of the present disclosure, data for each of all positions of 3D data projected to a two-dimensional plane having the number of layers indicated by layer number information is projected to a three-dimensional space.

[Advantageous Effect of Invention]

[0012]

According to embodiments of the present disclosure, information can be processed. Especially, degradation of the quality due to two-dimensional projection of 3D data can be suppressed.

[Brief Description of Drawings]

[0013]

[FIG. 1]

FIG. 1 is a view illustrating an example of a point cloud.

[FIG. 2]

FIG. 2 is a view illustrating an example of an overview

CLAIMS

1. An image processing apparatus, comprising:

a two-dimensional projection section configured to project all pieces of data for each position included in 3D data representative of a three-dimensional structure to a two-dimensional plane of plural layers, wherein

the two-dimensional projection section projects pieces of data for each position overlapping in position with each other in a depthwise direction as viewed from a projection plane that are included in the 3D data to layers of the two-dimensional plane of the plural layers, the layers being different from each other, and

wherein the two-dimensional projection section generates, in regard to the two-dimensional plane, layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.

2. The image processing apparatus according to claim 1, wherein

the two-dimensional projection section sets, for a position of the two-dimensional plane at which the data for each position does not exist, a predetermined value indicating that the data for each position does not exist.

3. The image processing apparatus according to claim 2, wherein

the predetermined value includes a fixed value determined in advance.

4. The image processing apparatus according to claim 2, wherein

the predetermined value includes a value higher than a maximum value of a depth of the 3D data.

5. The image processing apparatus according to claim 1, wherein

the two-dimensional projection section projects, when the pieces of data for each position of 3D data are projected to a two-dimensional plane by each predetermined region of a three-dimensional space to a two-dimensional plane, the pieces of data for each position within a range in a depthwise direction indicated by a depth parameter for restricting the range in the depthwise direction of pieces of data for each position of the 3D data capable of being projected to one layer set for each region, to the two-dimensional plane.

6. The image processing apparatus according to claim 1, further comprising:

an encoding section configured to encode the 3D data projected to the two-dimensional plane by the two-dimensional projection section.

7. The image processing apparatus according to claim 6, further comprising:

a bit stream generation section configured to generate a bit stream including information indicative of the number of layers of the two-dimensional plane to which the 3D data is projected by the two-dimensional projection section and encoded data obtained by encoding the two-dimensional plane by the encoding section.

8. The image processing apparatus according to claim 1, wherein

the 3D data includes a point cloud.

9. An image processing method, comprising:

projecting all pieces of data for each position included in 3D data representative of a three-dimensional structure to a two-dimensional plane of plural layers

wherein the projecting comprises projecting pieces of data for each position overlapping in position with each other in a depthwise direction as viewed from a projection plane that are included in the 3D data to layers of the two-dimensional plane of the plural layers, the layers being different from each other, and

wherein the projecting, in regard to the two-dimensional plane, further comprises generating layers in a number equal to a maximum number of pieces of data for each position

overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.

10. An image processing apparatus, comprising:

a three-dimensional projection section configured to project all pieces of data for each position of 3D data projected to a two-dimensional plane having a number of layers indicated by layer number information related to a three-dimensional space,

wherein the three-dimensional projection section projects pieces of data for each position overlapping in position with each other in the two-dimensional plane in a depthwise direction as viewed from a projection plane that are included in the 3D data to the number of layers of the two-dimensional plane, each of the number of layers being different from each other, and

wherein the three-dimensional projection section generates, in regard to the two-dimensional plane, the number of layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.

11. The image processing apparatus according to claim 10, wherein

the three-dimensional projection section projects, to the three-dimensional space, data that is among the pieces of data for each position included in the 3D data and that is other than data having a predetermined value indicating that the data for each position does not exist.

12. The image processing apparatus according to claim 11, wherein

the predetermined value includes a fixed value determined in advance.

13. The image processing apparatus according to claim 11, wherein

the predetermined value includes a value higher than a maximum value of a depth of the 3D data.

14. The image processing apparatus according to claim 10, wherein

the three-dimensional projection section projects, when the pieces of data for each position included in the 3D data are projected to the three-dimensional space by each predetermined region of the three-dimensional space, the pieces of data for each position within a range in a depthwise direction indicated by a depth parameter restricting the range in the depthwise direction of the pieces of data for each position of the 3D data capable of being projected to one layer set for each region, to the three-dimensional space.

15. The image processing apparatus according to claim 10, further comprising:

an extraction section configured to extract the layer number information included in a bit stream, wherein

the three-dimensional projection section is configured such that all the pieces of data for each position of the 3D data projected to the two-dimensional plane of a layer number indicated by the layer number information extracted by the extraction section are projected to the three-dimensional space.

16. The image processing apparatus according to claim 15, further comprising:

a decoding section configured to decode encoded data of the 3D data projected to the two-dimensional plane included in the bit stream, wherein

the three-dimensional projection section is configured such that all the pieces of data for each position of the 3D data obtained by decoding the encoded data by the decoding section and projected to the two-dimensional plane are projected to the three-dimensional space.

17. The image processing apparatus according to claim 10, wherein

the 3D data includes a point cloud.

18. An image processing method, comprising:

projecting all pieces of data for each position of 3D data projected to a two-dimensional plane having a number of layers indicated by layer number information related to a three-dimensional space,

wherein the projecting comprises projecting pieces of data for each position overlapping in position with each other in the two-dimensional plane in a depthwise direction as viewed from a projection plane that are included in the 3D data to the number of layers of the two-dimensional plane, each of the number of layers being different from each other, and

wherein the projecting, in regard to the two-dimensional plane, further comprises generating layers in a number equal to a maximum number of pieces of data for each position overlapping in position with each other in the depthwise direction as viewed from the projection plane that are included in the 3D data.