a massive amount of data of a point cloud necessitates compression of the amount of three-dimensional data by encoding for accumulation and transmission, as in the case of a two-dimensional moving picture (examples include Moving Picture Experts Group-4 Advanced Video Coding (MPEG-4 AVC) and High Efficiency Video Coding (HEVC) standardized by MPEG).

[0004]

Meanwhile, point cloud compression is partially supported by, for example, an open-source library (Point Cloud Library) for point cloud-related processing.

[0005]

Furthermore, a technique for searching for and displaying a facility located in the surroundings of the vehicle by using three-dimensional map data is known (for example, see Patent Literature (PTL) 1).

Citation List

Patent Literature

[0006]

PTL 1: International Publication WO 2014/020663

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0007]

There has been a demand for improving coding efficiency in a three-dimensional data encoding process.

[0008]

~~The~~Embodiments of the present disclosure ~~has an object to~~ provide a three-dimensional data encoding method, a three-dimensional data decoding method, a three-dimensional data encoding device, or a three-dimensional data decoding device that is capable of improving the coding efficiency.

SOLUTIONS TO PROBLEM

[0009]

~~A three-dimensional data encoding method according to one aspect of the present disclosure includes: obtaining third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and generating encoded data by encoding the third point cloud data obtained. In the generating, identification information of each of the three-dimensional points is encoded as attribute information.~~

According to a first aspect of the present disclosure, there is provided a three-dimensional data encoding method, including: obtaining third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and generating encoded data by encoding the third point cloud data obtained, wherein in the generating, identification information of each of the three-dimensional points is encoded as attribute information, and in the generating, attribute information of a first three-dimensional point is encoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

[0009a]

According to a second aspect of the present disclosure, there is provided a three-dimensional data encoding device, including: a processor; and memory,

wherein using the memory, the processor: obtains third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and generates encoded data by encoding the third point cloud data obtained, in the generating, identification information of each of the three-dimensional points is encoded as attribute information, and in the generating, attribute information of a first three-dimensional point is encoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

[0010]

~~A three-dimensional data decoding method according to one aspect of the present disclosure includes: obtaining encoded data; and decoding the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data. The attribute information includes identification information indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs to.~~

According to a third aspect of the present disclosure, there is provided a three-dimensional data decoding method, including: obtaining encoded data; and decoding the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data, wherein the attribute information includes identification information indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs to, and in the obtaining, attribute information of a first three-dimensional point is decoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

[0010a]

According to a fourth aspect of the present disclosure, there is provided a three-dimensional data decoding device, including: a processor; and memory, wherein using the memory, the processor: obtains encoded data; and decodes the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data, the attribute information includes identification information indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs to, and in the obtaining, attribute information of a first three-dimensional point is decoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

ADVANTAGEOUS EFFECT OF INVENTION

[0011]

~~The~~Embodiments of the present disclosure provide~~s~~ a three-dimensional data encoding method, a three-dimensional data decoding method, a three-dimensional data encoding device, or a three-dimensional data decoding device that is capable of improving coding efficiency.

BRIEF DESCRIPTION OF DRAWINGS

CLAIMS

1. A three-dimensional data encoding method, comprising:

obtaining third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and

generating encoded data by encoding the third point cloud data obtained,

wherein in the generating, identification information of each of the three-dimensional points is encoded as attribute information.

2. The three-dimensional data encoding method according to claim 1,

wherein in the generating, attribute information of a first three-dimensional point is encoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

3. The three-dimensional data encoding method according to claim 2,

wherein the attribute information of the first three-dimensional point includes first identification information indicating that the first three-dimensional point belongs to the first point cloud data, and

the attribute information of the second three-dimensional point includes second identification information indicating that the second three-dimensional point belongs to the second point cloud data.

4. The three-dimensional data encoding method according to claim 2 or claim 3,

wherein in the generating,

a predicted value of the attribute information of the first three-dimensional point is calculated using the attribute information of the second three-dimensional point,

a prediction residual is calculated, the prediction residual being

~~a difference between the attribute information of the first three-dimensional point and the predicted value, and~~

~~encoded data including the prediction residual is generated.~~

~~5. The three-dimensional data encoding method according to any one of claim 1 to claim 4,~~

~~wherein in the obtaining, the third point cloud data is obtained by combining the first point cloud data and the second point cloud data.~~

~~6. The three-dimensional data encoding method according to any one of claim 1 to claim 5,~~

~~wherein the encoded data includes the identification information in a same data format as attribute information different from the identification information.~~

~~7. A three-dimensional data decoding method, comprising:~~

~~obtaining encoded data; and~~

~~decoding the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data,~~

~~wherein the attribute information includes identification information indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs to.~~

~~8. The three-dimensional data decoding method according to claim 7,~~

~~wherein in the obtaining, attribute information of a first three-dimensional point is decoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.~~

~~9. The three-dimensional data decoding method according to claim 8,~~

~~wherein the attribute information of the first three-dimensional point~~

~~includes first identification information indicating that the first three-dimensional point belongs to the first point cloud data, and~~

~~the attribute information of the second three-dimensional point includes second identification information indicating that the second three-dimensional point belongs to the second point cloud data.~~

~~10. The three-dimensional data decoding method according to claim 8 or claim 9,~~

~~wherein the encoded data includes a prediction residual, and~~

~~in the decoding,~~

~~a predicted value of the attribute information of the first three-dimensional point is calculated using the attribute information of the second three-dimensional point, and~~

~~the attribute information of the first three-dimensional point is calculated by adding the predicted value and the prediction residual.~~

~~11. The three-dimensional data decoding method according to any one of claim 7 to claim 10, further comprising:~~

~~dividing the third point cloud data into the first point cloud data and the second point cloud data using the identification information.~~

~~12. The three-dimensional data decoding method according to any one of claim 7 to claim 11,~~

~~wherein the encoded data includes the identification information in a same data format as attribute information different from the identification information.~~

~~13. A three-dimensional data encoding device, comprising:~~

~~a processor; and~~

~~memory,~~

~~wherein using the memory, the processor:~~

~~obtains third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and~~

~~identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and~~

~~generates encoded data by encoding the third point cloud data obtained, and~~

~~in the generating, identification information of each of the three-dimensional points is encoded as attribute information.~~

~~14. A three-dimensional data decoding device, comprising:~~

~~a processor; and~~

~~memory,~~

~~wherein using the memory, the processor:~~

~~obtains encoded data; and~~

~~decodes the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data, and~~

~~the attribute information includes identification information indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs to.~~

1. A three-dimensional data encoding method, comprising:

obtaining third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and

generating encoded data by encoding the third point cloud data obtained,

wherein in the generating, identification information of each of the three-dimensional points is encoded as attribute information, and

in the generating, attribute information of a first three-dimensional point is encoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional

points.

2. The three-dimensional data encoding method according to claim 1,

wherein the attribute information of the first three-dimensional point includes first identification information indicating that the first three-dimensional point belongs to the first point cloud data, and

the attribute information of the second three-dimensional point includes second identification information indicating that the second three-dimensional point belongs to the second point cloud data.

3. The three-dimensional data encoding method according to claim 1,

wherein in the generating,

a predicted value of the attribute information of the first three-dimensional point is calculated using the attribute information of the second three-dimensional point,

a prediction residual is calculated, the prediction residual being a difference between the attribute information of the first three-dimensional point and the predicted value, and

encoded data including the prediction residual is generated.

4. The three-dimensional data encoding method according to claim 1,

wherein in the obtaining, the third point cloud data is obtained by combining the first point cloud data and the second point cloud data.

5. The three-dimensional data encoding method according to claim 1,

wherein the encoded data includes the identification information in a same data format as attribute information different from the identification information.

6. A three-dimensional data decoding method, comprising:

obtaining encoded data; and

decoding the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data,

wherein the attribute information includes identification information

indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs to, and

in the obtaining, attribute information of a first three-dimensional point is decoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

7. The three-dimensional data decoding method according to claim 6,

wherein the attribute information of the first three-dimensional point includes first identification information indicating that the first three-dimensional point belongs to the first point cloud data, and

the attribute information of the second three-dimensional point includes second identification information indicating that the second three-dimensional point belongs to the second point cloud data.

8. The three-dimensional data decoding method according to claim 7,

wherein the encoded data includes a prediction residual, and

in the decoding,

a predicted value of the attribute information of the first three-dimensional point is calculated using the attribute information of the second three-dimensional point, and

the attribute information of the first three-dimensional point is calculated by adding the predicted value and the prediction residual.

9. The three-dimensional data decoding method according to claim 6, further comprising:

dividing the third point cloud data into the first point cloud data and the second point cloud data using the identification information.

10. The three-dimensional data decoding method according to claim 6,

wherein the encoded data includes the identification information in a same data format as attribute information different from the identification

information.

11 A three-dimensional data encoding device, comprising:

a processor; and

memory,

wherein using the memory, the processor:

obtains third point cloud data that is a combination of first point cloud data and second point cloud data, and includes geometry information of each of three-dimensional points included in the third point cloud data, and identification information indicating which of the first point cloud data and the second point cloud data each of the three-dimensional points belongs to; and

generates encoded data by encoding the third point cloud data obtained,

in the generating, identification information of each of the three-dimensional points is encoded as attribute information, and

in the generating, attribute information of a first three-dimensional point is encoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.

12. A three-dimensional data decoding device, comprising:

a processor; and

memory,

wherein using the memory, the processor:

obtains encoded data; and

decodes the encoded data to obtain geometry information and attribute information of each of three-dimensional points included in third point cloud data that is a combination of first point cloud data and second point cloud data,

the attribute information includes identification information indicating which of the first point cloud data and the second point cloud data one of the three-dimensional points that corresponds to the attribute information belongs

to, and

in the obtaining, attribute information of a first three-dimensional point is decoded using attribute information of a second three-dimensional point neighboring the first three-dimensional point, the first three-dimensional point and the second three-dimensional point being included in the three-dimensional points.