

CLAIMS

1. A method for point cloud completion, comprising:

determining a probability distribution of an acquired first point cloud;

completing the first point cloud based on the probability distribution to obtain a primary completed point cloud;

concatenating the primary completed point cloud and the first point cloud to obtain a concatenated point cloud;

determining association relationships between the concatenated point cloud and multiple groups of neighbouring points of the concatenated point cloud; and

completing the concatenated point cloud based on the association relationships to obtain a second point cloud from completion to the first point cloud,

wherein the completing the first point cloud based on the probability distribution to obtain a primary completed point cloud comprises:

predicting a first appearance shape of an object to which the first point cloud belongs based on the probability distribution;

determining a second appearance shape of the object represented by the first point cloud, wherein an integrity of the first appearance shape is greater than an integrity of the second appearance shape; and

completing the second appearance shape based on the first appearance shape to obtain the primary completed point cloud.

2. The method of claim 1, wherein the determining a probability distribution of the acquired first point cloud comprises:

performing variational encoding on the first point cloud to obtain an encoded point cloud;

performing residual processing on the encoded point cloud to obtain a residual point cloud; and

determining the probability distribution based on the residual point cloud.

3. The method of claim 1, wherein the completing the concatenated point cloud based on the association relationships to obtain a second point cloud from completion to the first point cloud comprises:

determining an association feature of each data point in the concatenated point cloud based on association relationships between the each data point in the concatenated point cloud and corresponding groups of neighbouring points;

determining a target feature of the each data point based on the association feature of the each data point; and

obtaining the second point cloud from the completion to the first point cloud based on the target feature of the each data point in the concatenated point cloud.

4. The method of claim 3, wherein the determining a target feature of the each data point based on the association feature of the each data point comprises:

performing average pooling processing on the association feature of the each data point corresponding to the groups of neighbouring points to obtain a pooling feature;

determining a group association degree between the each data point and each corresponding group of neighbouring points based on the pooling feature; and

determining the target feature of the each data point based on the group association degree and the association feature of the each data point.

5. The method of claim 4, wherein the determining a group association degree between the each data point and each corresponding group of neighbouring points based on the pooling feature comprises:

determining an association degree between each data point and each neighbouring point

in the each corresponding group of neighbouring points based on the pooling feature to obtain a set of point association degrees; and

determining a group association degree of the each group of neighbouring points based on the set of point association degrees.

6. The method of claim 4, wherein the determining the target feature of the each data point based on the group association degree and the association feature of the each data point comprises:

adjusting the association feature of the each data point based on the group association degree of the each group of neighbouring points to obtain an adjusted association feature corresponding to the each group of neighbouring points; and

fusing the adjusted association features corresponding to the groups of neighbouring points of the each data point to obtain the target feature of the each data point.

7. The method of claim 1, wherein the determining association relationships between the concatenated point cloud and multiple groups of neighbouring points of the concatenated point cloud comprises:

determining a first initial feature of each group of neighbouring points and a second initial feature of each data point in the concatenated point cloud, respectively;

performing linear transformation on the first initial feature based on a first preset value to obtain a first transformed feature;

performing linear transformation on the second initial feature based on the first preset value to obtain a second transformed feature; and

determining a relationship parameter between the first transformed feature of the each group of neighbouring points and the second transformed feature as an association relationship between the each group of neighbouring points and a corresponding data point.

8. The method of any one of claims 3 to 6, wherein the determining an association feature of each data point in the concatenated point cloud based on association relationships between the each data point in the concatenated point cloud and corresponding groups of neighbouring points comprises:

performing linear transformation on a first initial feature of each group of neighbouring points based on a second preset value to obtain a third transformed feature, wherein there is a multiple relationship between the second preset value and a first preset value; and

determining the association feature of the each data point based on the association relationships and the third transformed feature of the each group of neighbouring points.

9. The method according to any one of claims 4 to 8, wherein after the determining the target feature of the each data point based on the association feature of the each data point, the method further comprises:

performing linear transformation on the target feature to obtain a core target feature;

performing linear transformation on a second initial feature of the each data point to obtain a residual feature of the each data point; and

updating the target feature based on the residual feature and the core target feature to obtain an updated target feature.

10. A method for training a point cloud completion network, comprising:

acquiring a first sample point cloud;

determining a sample probability distribution of the first sample point cloud using a preset probability generation network;

predicting a complete shape of the first sample point cloud based on the sample probability distribution to obtain a first predicted point cloud;

adjusting the first predicted point cloud based on the first sample point cloud by using a

preset relationship enhancement network to obtain a second predicted point cloud;

adjusting a network parameter of the probability generation network based on loss of the first predicted point cloud, and adjusting a network parameter of the relationship enhancement network based on loss of the second predicted point cloud; and

generating a point cloud completion network based on the probability generation network with the adjusted parameter and the relationship enhancement network with the adjusted parameter.

11. The method of claim 10, wherein the first sample point cloud comprises a sample incomplete point cloud of an incomplete shape and a sample complete point cloud corresponding to the sample incomplete point cloud, and wherein the determining a sample probability distribution of the first sample point cloud using a preset probability generation network comprises:

performing variational encoding on the sample incomplete point cloud through the preset probability generation network to determine a first probability distribution of the sample incomplete point cloud;

performing variational encoding on the sample complete point cloud through the preset probability generation network to determine a second probability distribution of the sample complete point cloud; and

obtaining the sample probability distribution based on the first probability distribution and the second probability distribution.

12. The method of claim 11, wherein the predicting a complete shape of the first sample point cloud based on the sample probability distribution to obtain a first predicted point cloud comprises:

completing the sample incomplete point cloud based on the first probability distribution of the sample probability distribution to obtain a sample primary completed point cloud;

reconstructing the sample complete point cloud based on the second probability distribution of the sample probability distribution and the first probability distribution to obtain a

reconstructed complete point cloud; and

determining the sample primary completed point cloud and the reconstructed complete point cloud as the first predicted point cloud.

13. The method of claim 12, wherein the adjusting a network parameter of the probability generation network based on loss of the first predicted point cloud comprises:

determining completion loss based on a similarity between the first probability distribution and the second probability distribution as well as a similarity between the sample primary completed point cloud and the sample complete point cloud;

determining first reconstruction loss based on a similarity between the second probability distribution and a preset standard distribution as well as a similarity between the reconstructed complete point cloud and the sample complete point cloud; and

adjusting the network parameter of the probability generation network based on the completion loss and the first reconstruction loss to obtain the probability generation network with the adjusted parameter.

14. The method of claim 10, wherein the adjusting a network parameter of the relationship enhancement network based on loss of the second predicted point cloud comprises:

determining second reconstruction loss based on a similarity between the second predicted point cloud and the sample complete point cloud; and

adjusting the network parameter of the relationship enhancement network based on the second reconstruction loss to obtain the relationship enhancement network with the adjusted parameter.

15. An apparatus for point cloud completion, comprising:

a first determination module, configured to determine a probability distribution of an

acquired first point cloud;

a first completion module, configured to complete the first point cloud based on the probability distribution to obtain a primary completed point cloud;

a first concatenation module, configured to concatenate the primary completed point cloud and the first point cloud to obtain a concatenated point cloud;

a second determination module, configured to determine association relationships between the concatenated point cloud and multiple groups of neighbouring points of the concatenated point cloud; and

a first adjustment module, configured to complete the concatenated point cloud based on the association relationships to obtain a second point cloud from completion to the first point cloud,

wherein the completing the first point cloud based on the probability distribution to obtain a primary completed point cloud comprises:

predicting a first appearance shape of an object to which the first point cloud belongs based on the probability distribution;

determining a second appearance shape of the object represented by the first point cloud, wherein an integrity of the first appearance shape is greater than an integrity of the second appearance shape; and

completing the second appearance shape based on the first appearance shape to obtain the primary completed point cloud.

16. An apparatus for training a point cloud completion network, comprising:

a first acquisition module, configured to acquire a first sample point cloud;

a third determination module, configured to determine a sample probability distribution of the first sample point cloud using a preset probability generation network;

a first prediction module, configured to predict a complete shape of the first sample point

cloud based on the sample probability distribution to obtain a first predicted point cloud;

a first adjustment module, configured to adjust the first prediction point cloud based on the first sample point cloud by using a preset relationship enhancement network to obtain a second prediction point cloud;

a first training module, configured to adjust a network parameter of the probability generation network based on loss of the first predicted point cloud, and adjust a network parameter of the relationship enhancement network based on loss of the second predicted point cloud; and

a fourth determination module, configured to generate a point cloud completion network based on the probability generation network with the adjusted parameter and the relationship enhancement network with the adjusted parameter.

17. A computer storage medium having stored thereon computer-executable instructions, wherein the computer-executable instructions, when executed, are capable of implementing operations of the method of any one of claims 1 to 9; or wherein the computer-executable instructions, when executed, are capable of implementing operations of the method of any one of claims 10 to 14.

18. A computer device, comprising a memory and a processor, wherein the memory has stored thereon computer-executable instructions, the processor is capable of implementing operations of the method of any one of claims 1 to 9 when executing the computer-executable instructions on the memory; or, the processor is capable of implementing operations of the method of any one of claims 10 to 14 when executing computer-executable instructions on the memory.