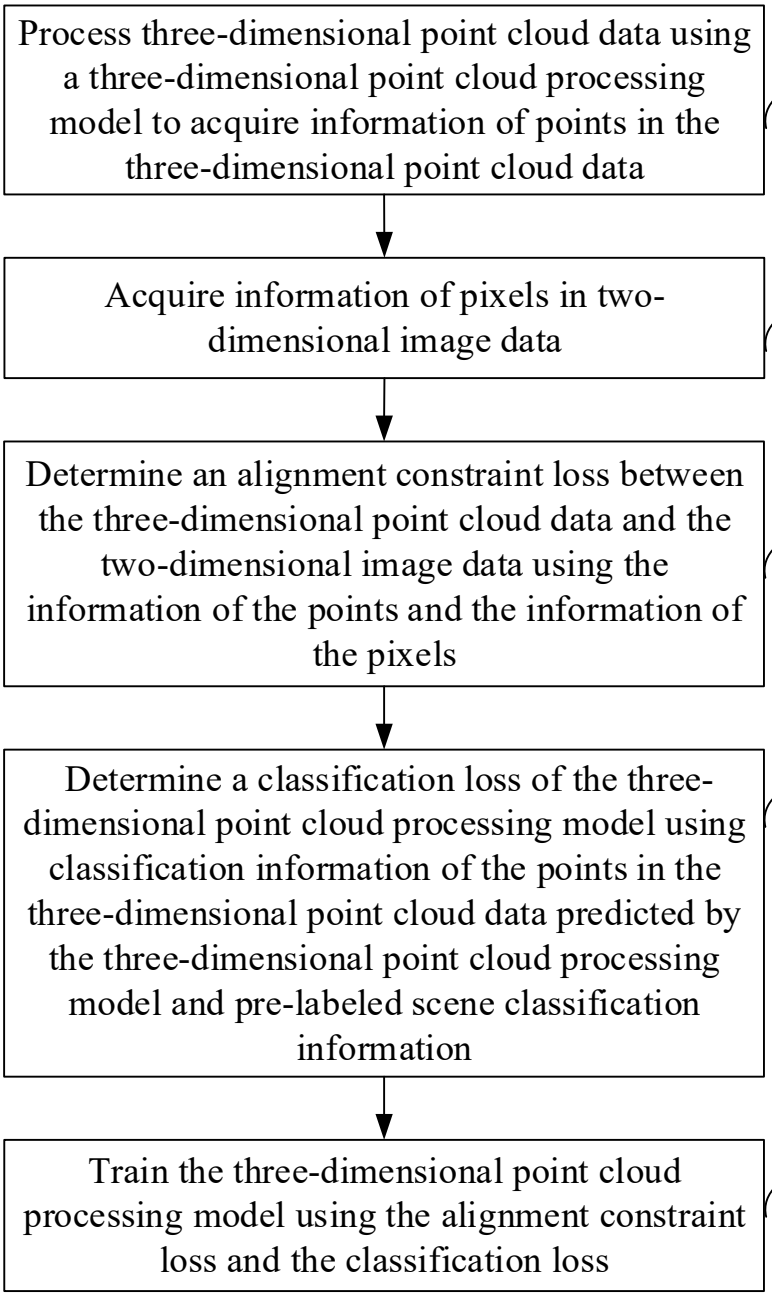
Process three-dimensional point cloud data using a three-dimensional point cloud processing model to acquire information of points in the three-dimensional point cloud data
S102
Acquire information of pixels in two-dimensional image data
S104
Determine an alignment constraint loss between the three-dimensional point cloud data and the two-dimensional image data using the information of the points and the information of the pixels
S106
Determine a classification loss of the three-dimensional point cloud processing model using classification information of the points in the three-dimensional point cloud data predicted by the three-dimensional point cloud processing model and pre-labeled scene classification information
S108
Train the three-dimensional point cloud processing model using the alignment constraint loss and the classification loss
S110

FIG. 1

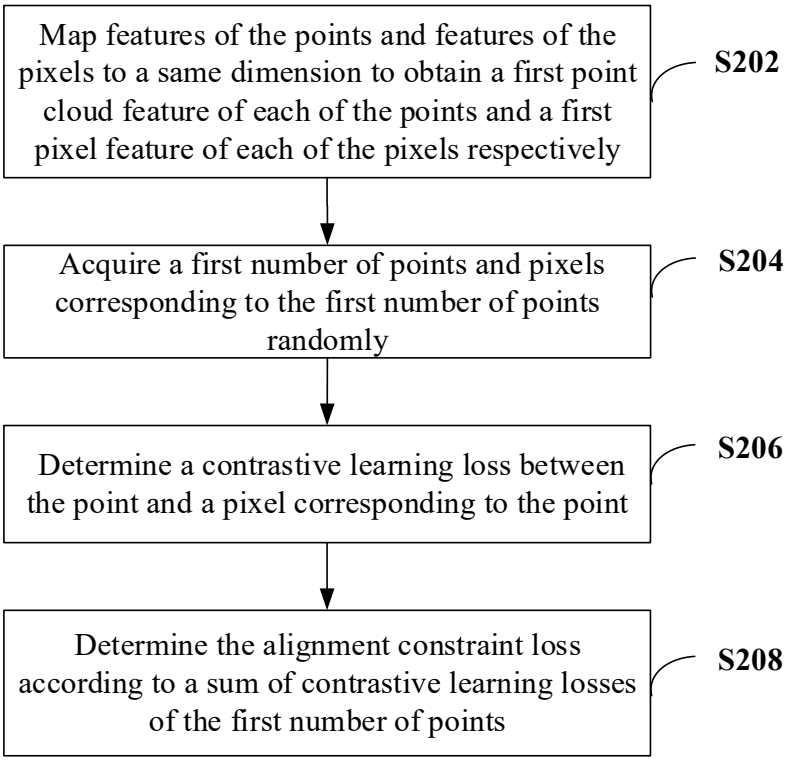
Map features of the points and features of the pixels to a same dimension to obtain a first point cloud feature of each of the points and a first pixel feature of each of the pixels respectively
S202
Acquire a first number of points and pixels corresponding to the first number of points randomly
S204
Determine a contrastive learning loss between the point and a pixel corresponding to the point
S206
Determine the alignment constraint loss according to a sum of contrastive learning losses of the first number of points
S208

FIG. 2

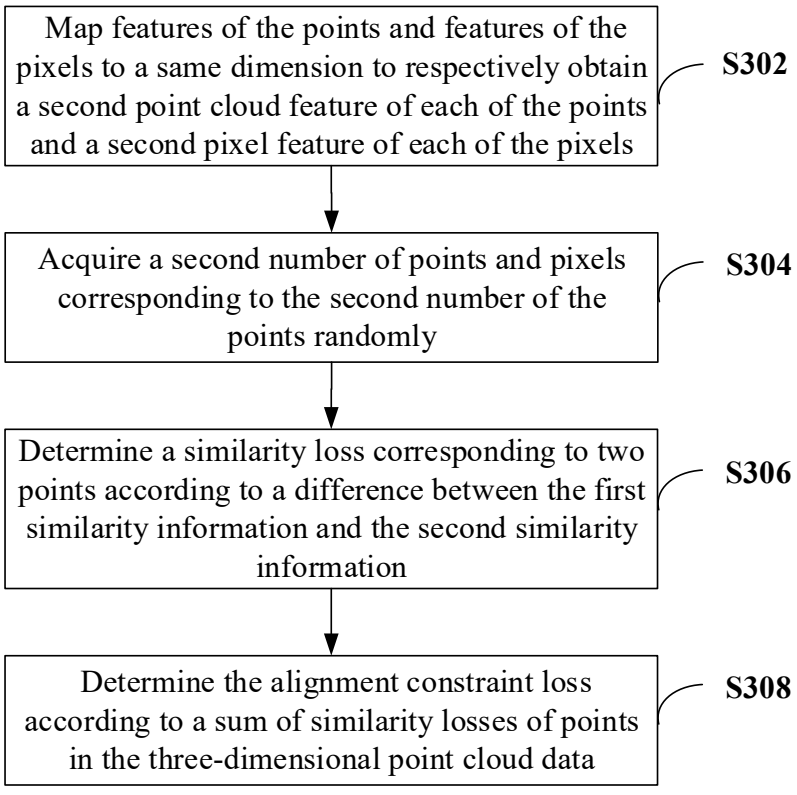
Map features of the points and features of the pixels to a same dimension to respectively obtain a second point cloud feature of each of the points and a second pixel feature of each of the pixels
S302
Acquire a second number of points and pixels corresponding to the second number of the points randomly
S304
Determine a similarity loss corresponding to two points according to a difference between the first similarity information and the second similarity information
S306
Determine the alignment constraint loss according to a sum of similarity losses of points in the three-dimensional point cloud data
S308

FIG. 3

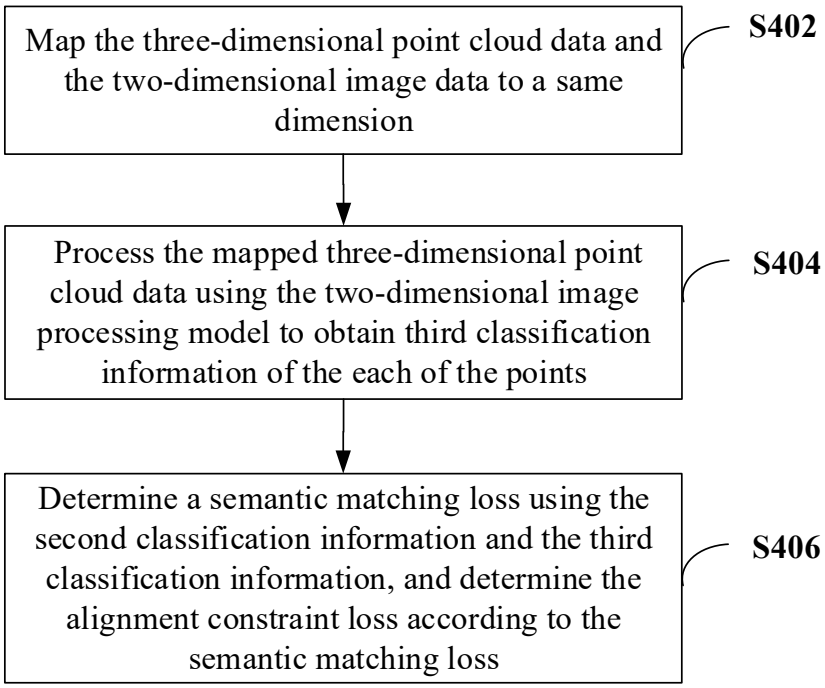
Map the three-dimensional point cloud data and the two-dimensional image data to a same dimension
S402
Process the mapped three-dimensional point cloud data using the two-dimensional image processing model to obtain third classification information of the each of the points
S404
Determine a semantic matching loss using the second classification information and the third classification information, and determine the alignment constraint loss according to the semantic matching loss
S406

FIG. 4

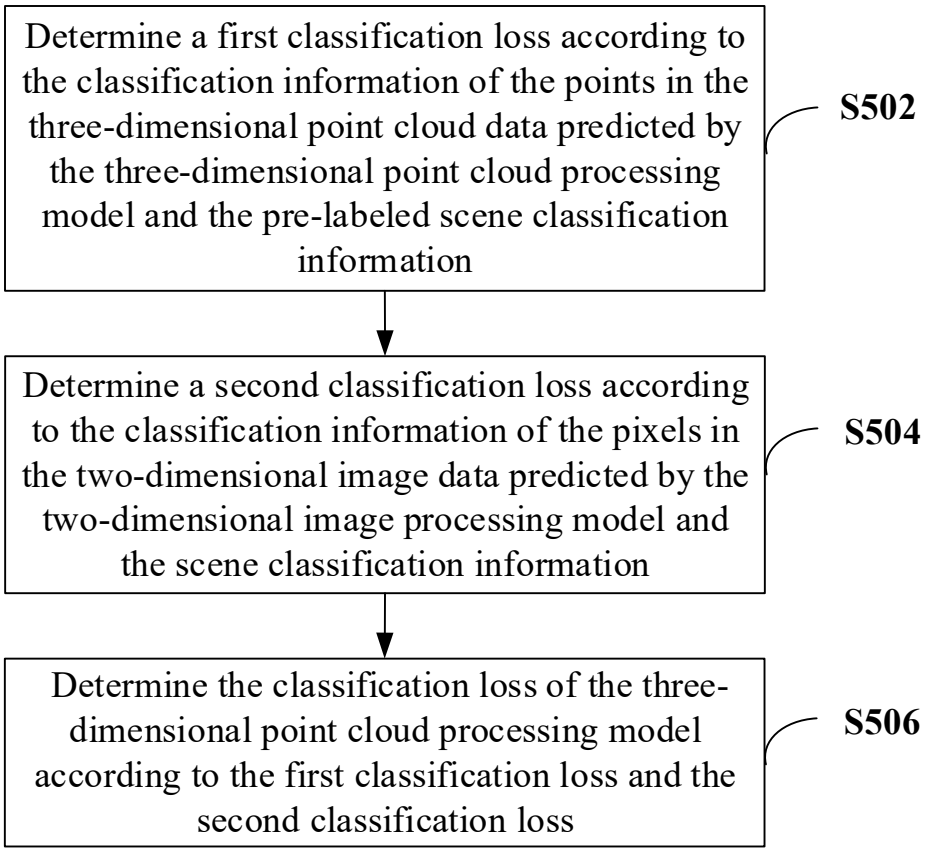
Determine a first classification loss according to the classification information of the points in the three-dimensional point cloud data predicted by the three-dimensional point cloud processing model and the pre-labeled scene classification information
S502
Determine a second classification loss according to the classification information of the pixels in the two-dimensional image data predicted by the two-dimensional image processing model and the scene classification information
S504
Determine the classification loss of the three-dimensional point cloud processing model according to the first classification loss and the second classification loss
S506

FIG. 5

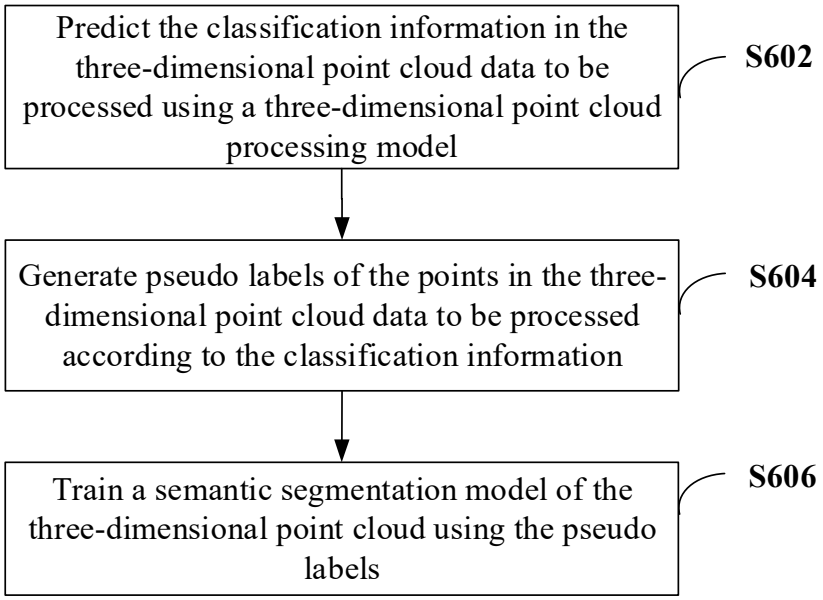
Predict the classification information in the three-dimensional point cloud data to be processed using a three-dimensional point cloud processing model
S602
Generate pseudo labels of the points in the three-dimensional point cloud data to be processed according to the classification information
S604
Train a semantic segmentation model of the three-dimensional point cloud using the pseudo labels
S606

FIG. 6

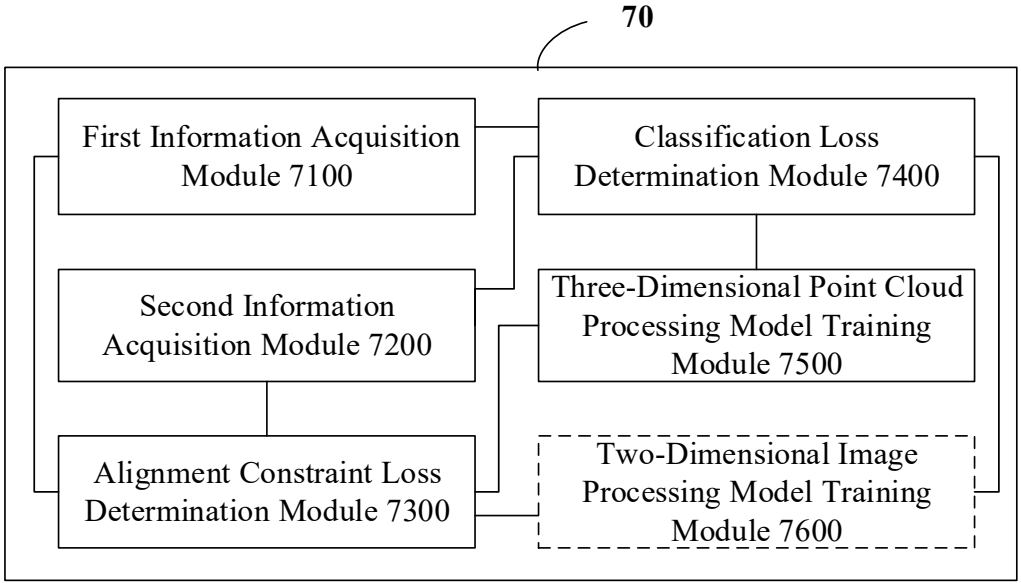

FIG. 7

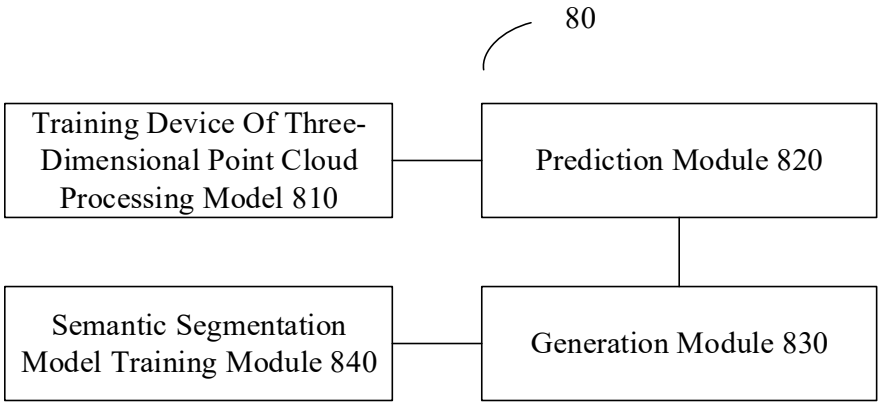

FIG. 8

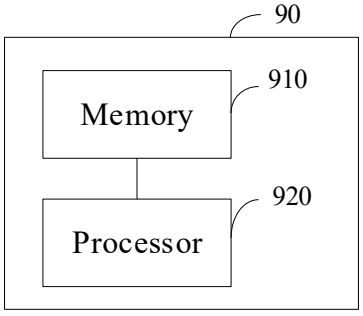

FIG. 9

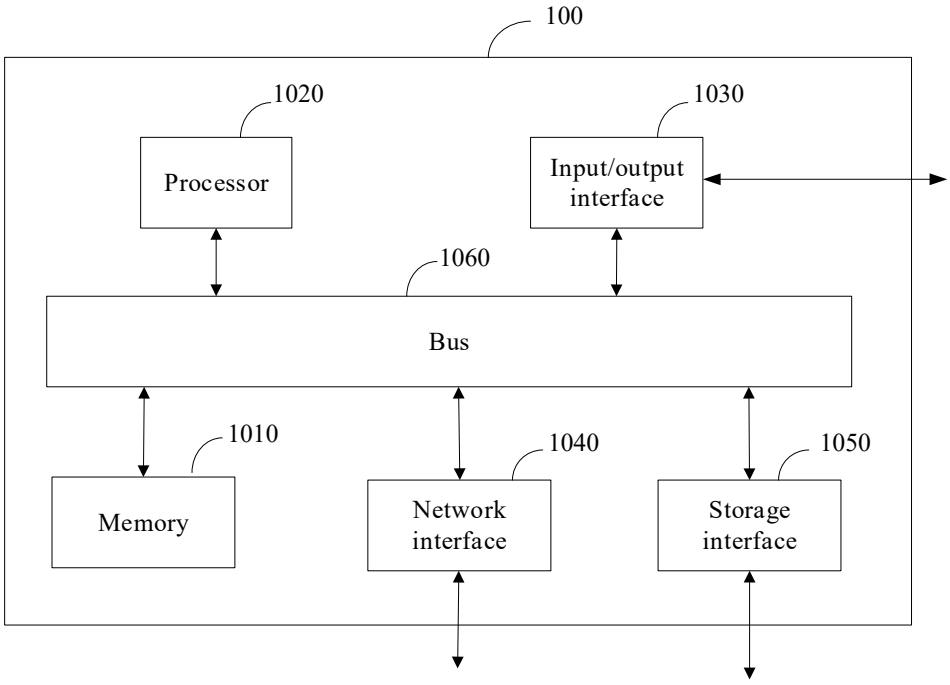
100
1020
Processor
1030
Input/output interface
1060
Bus
1010
Memory
1040
Network interface
1050
Storage interface

FIG. 10