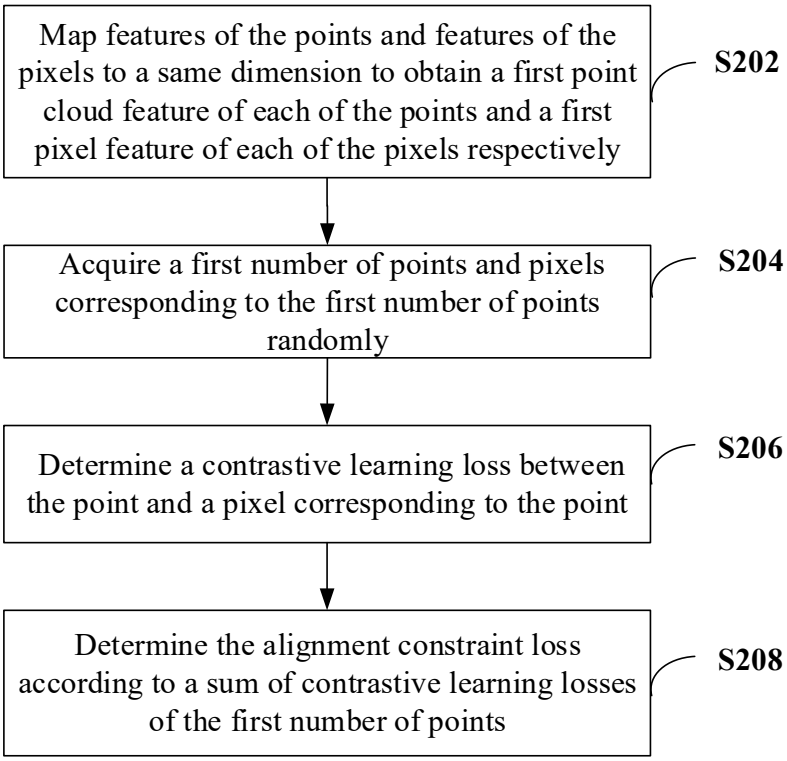

Map features of the points and features of the pixels to a same dimension to obtain a first point cloud feature of each of the points and a first pixel feature of each of the pixels respectively
S202
Acquire a first number of points and pixels corresponding to the first number of points randomly
S204
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

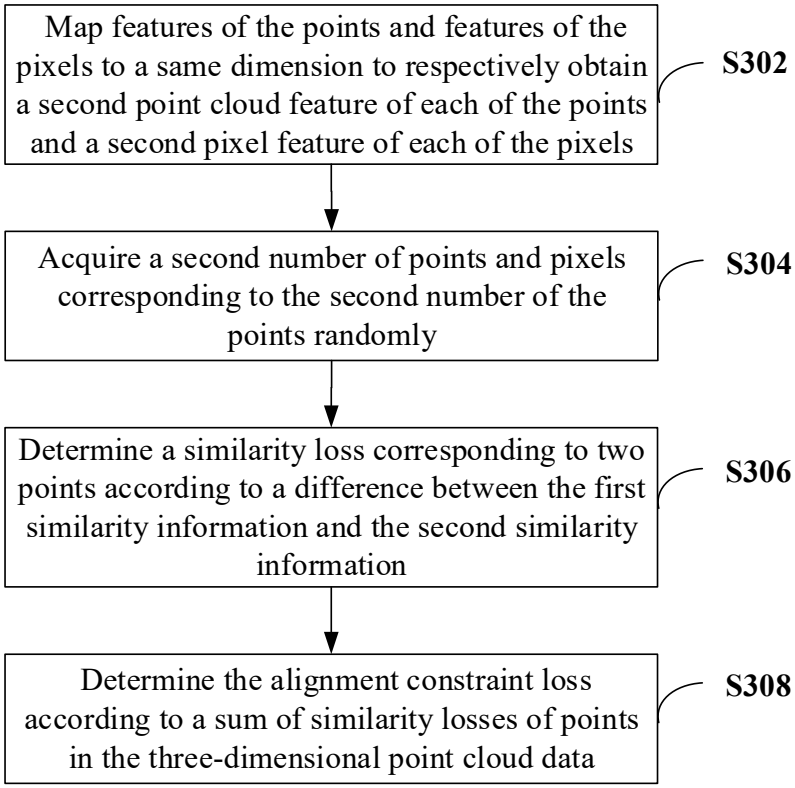

Map features of the points and features of the pixels to a same dimension to respectively obtain a second point cloud feature of each of the points and a second pixel feature of each of the pixels
S302
Acquire a second number of points and pixels corresponding to the second number of the points randomly
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

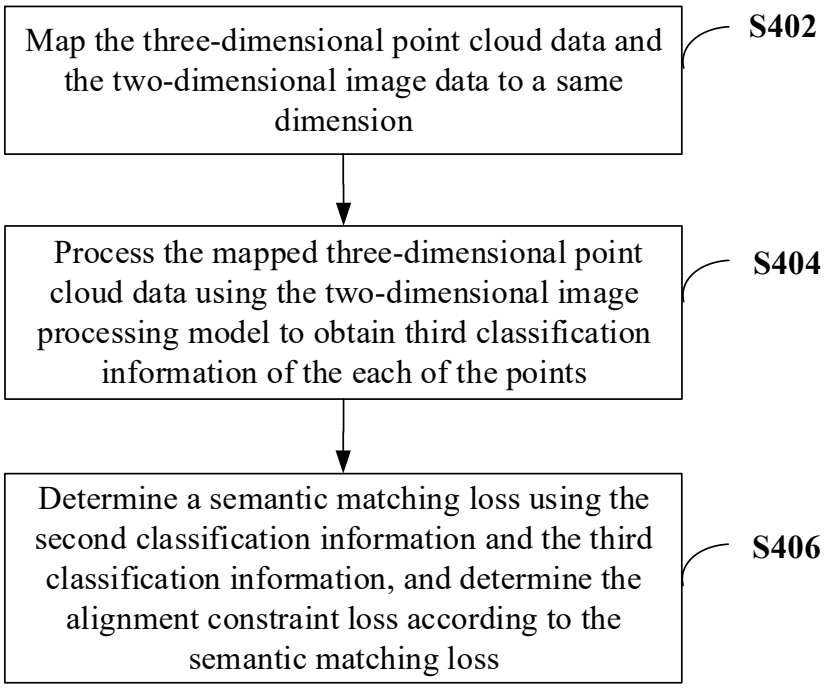

Map the three-dimensional point cloud data and the two-dimensional image data to a same dimension
S402
Process the mapped three-dimensional point cloud data using the two-dimensional image processing model to obtain third classification information of the each of the points
S404
Determine a semantic 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