

## Popular Science Summary

We humans have two eyes. Because of this, we can perceive depth. This is commonly called stereo vision. In the same way, imagine we had two cameras of which we knew the positions, we could then triangulate the position of objects present in both images. As it turns out, if we have enough images we do not need to know the position of the cameras. It is actually possible to determine both a 3D map of what is being photographed and also find where the images were taken. This problem is called Structure from Motion and is a central part of the field of Computer Vision. An example of what such maps could look like is shown in Figure 1. Notice that we do not get complete surfaces, but rather a lot of points in 3D space. This is commonly referred to as a point cloud.

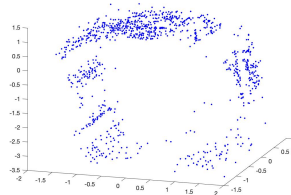


Figure 1: Example of a 3D map of a room. The four walls are what can be seen in the figure.

Usually, the images are collected by using a film camera which is moved around a path. Because of how the map is generated, if we walk in a closed loop the algorithm does not always recognize that a new point is the same 3D point as an old point. The algorithm then creates a second instance of the 3D point which is slightly shifted in space. This is called a Loop Closure problem. The goal for this thesis is to propose a method which solves a part of this problem. More precisely, this thesis is trying to find pairs of points which should actually be the same 3D point. The method requires searching for points which look very similar. However, just looking at similarity would result in too many false matches. Because of this, we propose to also filter for points which could be combined without altering the original map too much. As can be seen in Figure 2 the algorithm can successfully identify pairs which have been duplicated.

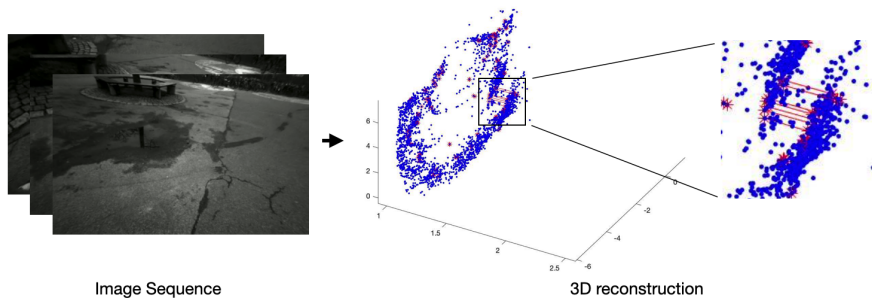


Figure 2: On the left side of this figure some example images from the image sequence are shown. On the right side of this figure is the 3D reconstruction shown together with the duplication caused by walking in a circle. The lines are drawn between points which the algorithm thinks should actually be the same point. Notice that there are red lines going between the duplicated part.