Comments on :

"Multirobot Simultaneous Localization and Mapping Using Manifold Representations"

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Abstract

The main purpose of this paper is to demonstrate that the use of Manifold representations is well suited for Multirobot SLAM. But this paper makes no attempt to cover all aspects the manifold representation outlined above.

I. Introduction

Manifold representation is an higher dimention space based map who is described by:

- self-consistence
- A robot can ever go back to a previous location
- A physical location can be represented several times
- We can delay loop closure for ever (consequence of self-consitence)

II. Methods

They are adapting maximum likelihood estimation (MLE) [2], [3] and global map alignment [2]. They are using local "patchs" of terrain, who are concretized by meshes of scanned terrain. Each patch has is own local coordinate system. Then a set of relations between patchs pose is made for obtaining global map. MLE is used here for finding that set of relations. Data association can be delayed, until they can be made with high confidence. They are not adding already scanned parts to the map (no progressive enhancement). They are using robots as unambigous landmarks for loop closure. It's a centralized approach. Robots wheren't autonomous at the publication's date.

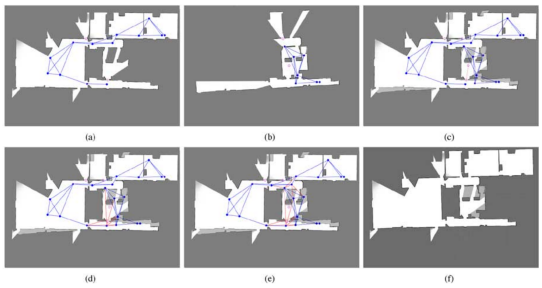

Figure 1: *Map construction process*

III. Results

As we can see in the figure 1, the obtained map count a lot of occlusions, but it's mainly due to the exploration algorythm used. The map precision is quite good, but no measurment have been done yet.

*A thank you or further information

IV. Discussion

i. Current state

For now the algorythm is global, centralized. The whole process is really sensitive to communication. The map is not enhanced after first scan, I really don't like that fact.

ii. Possibles enhancements

A decentralized approach can be something like that :

- each robot have is own version of "global" map.
- adding patches is a local process made by each robot.
- when several robots encounter, they merge their map with loop closure
- after merging, they continue to notify reachables robots while adding patchs
- Depending on the density of the data used (point cloud, landmarks etc) it can be possible to save previous versions of the map in the same spirit than a version manager like git. It can help to find more accurate map later.

References

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[2] F. Lu and E. Milios, "Globally consistent range scan alignment for environment mapping", *Autonomous robots*, vol. 4, no. 4, pp. 333–349, 1997. [Online]. Available: http://link.springer.com/article/10.1023/A:1008854305733 (visited on 05/10/2017).

[3] J. S. Gutmann and K. Konolige, "Incremental mapping of large cyclic environments", in *1999 IEEE International Symposium on Computational Intelligence in Robotics and Automation, 1999. CIRA '99. Proceedings*, 1999, pp. 318–325. DOI: 10.1109/CIRA.1999.810068.