Visual Navigation and 3D Mapping for Assistive Robots

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Description

Developing a fully autonomous robot that can navigate in a priori unknown environments is difficult due to challenges that span dynamics modeling, on-board perception, localization and mapping, trajectory generation, and optimal control. One way to approach this problem is to generate a globally consistent geometric map of the environment, and use it to compute a collision-free trajectory to the goal using optimal control and planning schemes. However, the real-time generation of a globally consistent map tends to be computationally expensive, and can be challenging in textureless environments or in the presence of transparent, shiny objects, or strong ambient lighting. Alternative approaches employ end-to-end (deep) learning to side-step this explicit map estimation step. However, such approaches tend to be extremely sample inefficient and highly specialized to the system they were trained on.

The goal of this research project is to design a visual navigation and mapping solution that leverages both techniques in order to enable the generation of smooth robot assistant behaviors such as following a designated end-user, go to a goal location and so on.

References

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