A System for Building Semantic Maps of Indoor Environments Exploiting the Concept of Building Typology

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Abstract. Semantic mapping of indoor environments refers to the task of building representations of these environments that associate spatial concepts with spatial entities. In particular, semantic labels, like 'rooms' and 'corridors' are associated to portions of an underlying metric map, to allow robots or humans to exploit this additional knowledge. Usually, the classifiers that build semantic maps process data coming from laser range scanners and cameras and do not consider the specific type of the mapped building. However, in architecture it is well known that each building has a specific typology. The concept of *building typology* denotes the set of buildings that have the same function (e.g., being a school building) and that share the same structural features. In this paper, we exploit the concept of building typology to build semantic maps of indoor environments. The proposed system uses only data from laser range scanners and creates a specific classifier for each building typology, showing good classification accuracy.

Keywords: semantic mapping, building typology, line segment maps

1 Introduction

A *semantic map* of an environment provides human-level knowledge about its structure, for example about the type of the rooms. Automatic building of semantic maps by means of mobile robots has received significant attention in the last years (e.g., [1, 2]). Usually semantic maps are built by starting from metric maps, which represent the physical structure of environments (e.g., the locations of obstacles), and by labeling specific areas (e.g., as 'kitchen' or as 'bathroom'). The knowledge embedded in a semantic map could be exploited in several robotic tasks; for example in a domestic scenario, a semantic map could be used by a robot to find an object or to reason about what actions can be performed in a specific room (e.g., kitchen, bedroom). The labeling is often performed by a classifier that has been previously trained and that is fed with data coming from a metric map and from robot sensors. To the best of our knowledge, no approach attempts to exploit information on the typology of the buildings in classifying places of indoor environments.

In this paper, we contribute in this direction by proposing a semantic mapping system for indoor environments that considers the concept of building typology. The *building typology*, as studied in architecture [3], denotes a set of buildings that have the same