Vision-Based Footstep Localization for Rough Terrain Locomotion

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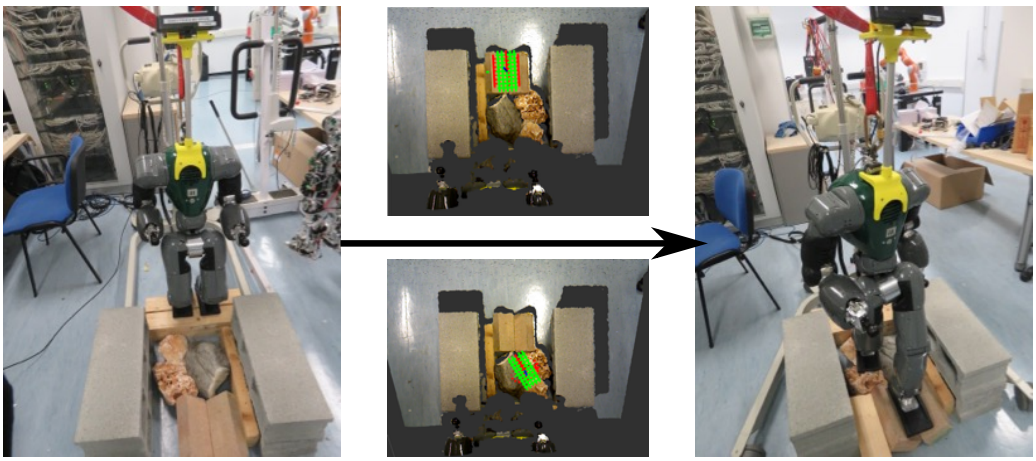
Abstract

One of the main challenges in legged robot locomotion is the localization of footstep contacts in rough and rocky outdoors environments [1]. Sparsity of foothold affordances is one of the main advantages of robots with limps over the other types of robotic systems [2]. We present a 3D perceptual localization and mapping system for modeling, localizing, and mapping sparse local surfaces in rough terrain based on 3D curved patches of the size and shape of the robot's foot [3]. Range sensing has been used to reconstruct the environment and fit a set of patches to the close-by surfaces. Then a contact analysis between the foot and the environment patch takes place, giving a set of good contact footholds [4]. This set of contacts could potentially be fed to a graph-based footstep planner in a higher level locomotion module. We present some real-time experimental foot placements (i.e. stepping) results on rough terrain for a mini-biped (RPBP) and a half-size (COMAN) humanoid robot using different trajectory planning methods. The whole system has been implemented as the Surface Patch Library (SPL), with code available on our website [5].



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