Surface Patches for Rough Terrain Perception

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Abstract

Attaining animal-like legged locomotion on rough outdoor terrain with sparse foothold affordances—arguably a primary use-case for legs vs other forms of locomotion—is a largely open problem. New advancements in control and perception have enabled bipeds to walk on flat or uneven indoor environments. But tasks that require reliable contact with unstructured world surfaces, for example walking on natural rocky terrain, may need new perception and control algorithms. We introduce an approach to 3D perception that uses range sensing to identify, model, and perceptually validate sparse curved surface patches in the environment. We present a bio-inspired system that uses a range sensor augmented with an inertial measurement unit (IMU) for automatically finding patches, intended to provide a reasonable set of choices for higher-level footfall selection. Recordings of human subjects traversing rocky trails were analyzed to give a baseline of the patch properties including orientation, curvatures, and location. Our system finds statistically similar patches in real time.