Learning Omnidirectional Locomotion Using Dimensionality Reduction

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Abstract: We consider the problem of omnidirectional quadruped locomotion: moving a four-legged robot along any arbitrary path while turning in any arbitrary manner. The contributions of this work are two-fold. First, we present the first omni-directional controller based on the "trot" with parameters learned specifically for all directions of motions. Second, we present a novel method for learning from a combination of an (inaccurate) simulator and a real robot. Our approach uses a number of perturbations to the simulator and applies the reduced rank regression algorithm to derive a small number of basis functions that span the main axes of variations in the space of controllers. This results in a low-dimensional parameterization of the controller than can be trained rapidly on the real robot using only a small amount of data. We present a successful application of these techniques to the task of learning omnidirectional locomotion of the real quadruped robot.