# Identifying Regions of Attraction in High Dimensional Systems

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**Abstract**

We consider the fundamental question of efficient and effective computations to identify the region of attraction (RoA) of a controller. This talk has three parts.

1. We discuss the use of finite lattices and partially ordered sets to characterize the gradient-like structure of dynamics, and as a consequence provides a language in which to discuss RoAs. We also describe efficient computational tools for low dimensional systems.

2. We describe recent work where we use an autoencoder to reduce high-dimensional control systems to low-dimensional systems, e.g., 2 dimensions, upon which the above mentioned computational tools can be applied. For both a 67-dimensional system (the Humanoid - corresponding to a bipedal humanoid robot attempting a stable standup gait) and a 96-dimensional system (TriFingerRobotHand - a dataset of 3 fingers pushing a cube towards a desired location) this approach identifies the RoAs with high precision and recall.

3. We discuss our current efforts to understand the success described in part 2. In particular, we are interested in whether treating problems of this nature as classification problems could lead to more efficient and reliable computational methods.

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