Latent Goal Analysis: Learning goals and body schema from generic rewards

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I. INTRODUCTION

Goals are abstractions of high-dimensional world states that express intelligent agents’ intentions underlying their actions. Goals are considered to organize the behavior of both humans and robots. For instance in robot planning as well as motor control goals describe the desired outcome of future actions. Goals are a fundamental concept also in neuroscience and psychology, e.g. in formulations of internal models [1], motivation psychology [2], or teleological action understanding [3].

We recently argued [4] that the achievement semantics of goals point out an immediate need for an evaluation of the own action’s effect (see Fig. 1). In hand-eye coordination this evaluation, or rather its learning, is often referred to as self-detection [5] or body schema [6]: the position needs to be localized e.g. from vision data. Goals are only useful when this “ground-truth” position is available. Indeed, there very relation allows for versatile motor control as well as self-supervised motor learning. Due to the vital relation between both, we argue to learn them within a joint framework. Yet, how could an agent learn such goal systems in which goals, body-schema, and their relation are identified?

II. LATENT GOAL ANALYSIS

Our main interest is the fully autonomous learning of goal systems, which disqualifies learning from an external supervised learning signal. Also unsupervised learning does not seem appropriate. While several approaches have shown the learning of body-schemas from just signal statistics, purely descriptive statistics can not account for the desire or intention that is inherent to the achievement of goals. Therefore we suggest to learn both goals and self-detection from a reward learning signal, which could be generated by intrinsic motivation measures.

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REFERENCES