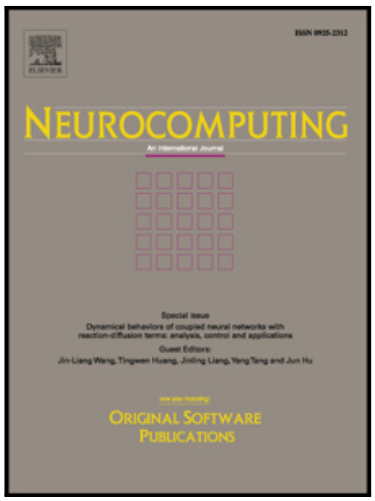

Grounding the Experience of a Visual Field through Sensorimotor Contingencies

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PII: S0925-2312(17)30749-X
DOI: 10.1016/j.neucom.2016.11.085
Reference: NEUCOM 18373

To appear in: *Neurocomputing*

Received date: 5 July 2016
Revised date: 3 October 2016
Accepted date: 18 November 2016

Please cite this article as: Alban Laflaquière, Grounding the Experience of a Visual Field through Sensorimotor Contingencies, *Neurocomputing* (2017), doi: 10.1016/j.neucom.2016.11.085

Grounding the Experience of a Visual Field through Sensorimotor Contingencies

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Abstract

Artificial perception is traditionally handled by hand-designing task specific algorithms. However, a truly autonomous robot should develop perceptive abilities on its own, by interacting with its environment, and adapting to new situations. The sensorimotor contingencies theory proposes to ground the development of those perceptive abilities in the way the agent can actively transform its sensory inputs. We propose a sensorimotor approach, inspired by this theory, in which the agent explores the world and discovers its properties by capturing the sensorimotor regularities they induce. This work presents an application of this approach to the discovery of a so-called visual field as the set of regularities that a visual sensor imposes on a naive agent's experience. A formalism is proposed to describe how those regularities can be captured in a sensorimotor predictive model. Finally, the approach is evaluated on a simulated system coarsely inspired from the human retina.

Keywords: autonomous systems, developmental robotics, sensorimotor contingencies, predictive processing, sensorimotor learning, human-like vision

1. Introduction

Autonomy in robotics relies on sensory data processing to capture information about the world and adapt to it. Although the influence of machine learning has been growing more important in the last decades, traditional approaches to this problem of data processing involve significant manual design from engineers that build the robot. Consequently the resulting techniques for artificial perception appear rigid and constrained for tractability. Each of these specialized algorithms is applicable to only a small set of tasks, with potentially limiting inbuilt biases from the designer. While acceptable for well-defined processes, such as industrial manufacturing, the potential need for a large degree of human involvement makes such methods inadequate as a source of long-term

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