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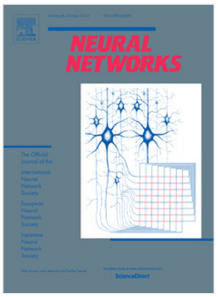

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Discovering space - Grounding spatial topology and metric regularity in a naive agent's sensorimotor experience

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Abstract

In line with the sensorimotor contingency theory, we investigate the problem of the perception of space from a fundamental sensorimotor perspective. Despite its pervasive nature in our perception of the world, the origin of the concept of space remains largely mysterious. For example in the context of artificial perception, this issue is usually circumvented by having engineers pre-define the spatial structure of the problem the agent has to face. We here show that the structure of space can be autonomously discovered by a naive agent in the form of sensorimotor regularities, that correspond to so called compensable sensory experiences: these are experiences that can be generated either by the agent or its environment. By detecting such compensable experiences the agent can infer the topological and metric structure of the external space in which its body is moving. We propose a theoretical description of the nature of these regularities and illustrate the approach on a simulated robotic arm equipped with an eye-like sensor, and which interacts with an object. Finally we show how these regularities can be used to build an internal representation of the sensor's external spatial configuration.

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