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Robótica Computacional

Arquiteturas de controle

O que foi isso?

Elephants Don't Play Chess

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Rodney A. Brooks was born in Adelaide, Australia. He studied Mathematics at the Flinders University of South Australia and received a Ph.D. from Stanford in Computer Science in 1981. Since then he has held research associate positions at Carnegie Mellon University and the Massachusetts Institute of Technology and faculty positions at Stanford and M.I.T. He is currently an Associate Professor of Electrical Engineering and Computer Science at M.I.T. and a member of the Artificial Intelligence Laboratory where he leads the mobile robot group. He has authored two books, numerous scientific papers, and is the editor of the *International Journal of Computer Vision*.

There is an alternative route to Artificial Intelligence that diverges from the directions pursued under that banner for the last thirty some years. The traditional approach has emphasized the abstract manipulation of symbols, whose grounding, in physical reality has . rarely been achieved. We explore a research methodology which emphasizes ongoing physical interaction with the environment as the primary source of constraint on the design of intelligent systems. We show how this methodology has recently had significant successes on a par with the most successful classical efforts. We outline plausible future work along these lines which can lead to vastly more ambitious systems.

1. Introduction

Artificial Intelligence research has foundered in a sea of incrementalism. No one is quite sure where to go save improving on earlier demonstrations of techniques in symbolic manipulation of ungrounded representations. At the same time, small AI companies are folding, and attendance is well down at national and international Artificial Intelligence conferences. While it is true that the use of AI is prospering in many large companies, it is primarily through the application. to novel domains of long developed techniques that have become passé in the research community

What has gone wrong? (And how is this book the answer?!!)

In this paper we argue that the *symbol system hypothesis* upon which *classical AI is* base is fundamentally flawed, and as such imposes severe limitations on the fitness of its progeny. Further, we argue that the dogma of the symbol system hypothesis implicitly includes a number of largely unfounded great leaps of faith when called upon to provide a plausible path to the digital equivalent of human level intelligence. It is the chasms to be crossed by these leaps which now impede classical AI research.

But there is an alternative view, or dogma, variously called *nouvelle AI, fundamentalist AI,* or in a weaker form *situated activity* [1]. *It is based on the physical grounding hypothesis*. It provides a different methodology for building intelligent systems than that pursued for the last thirty years. The traditional methodology bases its decomposition of intelligence into functional information processing modules whose combinations provide overall system behavior. The new methodology bases its decomposition of intelligence into individual behavior generating modules, whose coexistence and co-operation let more complex behaviors emerge.

In classical AI, none of the modules themselves generate the behavior of the total system. Indeed it is necessary to combine together many of the modules to get any behavior at all from the system. Improvement in the competence of the system proceeds by improving the individual functional modules. In nouvelle AI each module, itself generates behavior, and improvement in the competence of the

[1] Note that what is discussed in this paper is completely unrelated to what is popularly known as *Neural Networks*. That given, there are nevertheless a number of aspects of nouvelle AI approaches which may be of interest to. people working in classical neuroscience.

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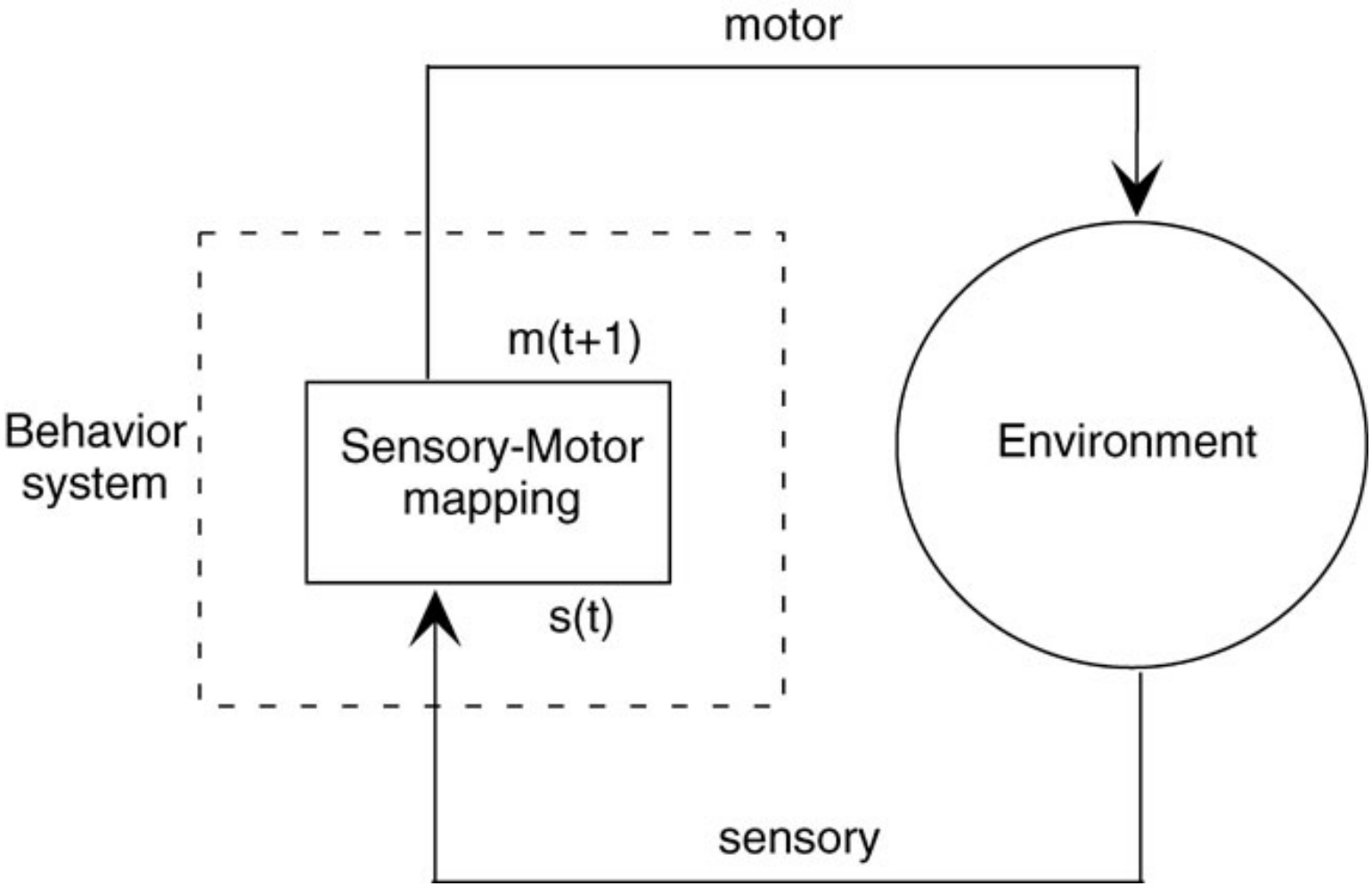
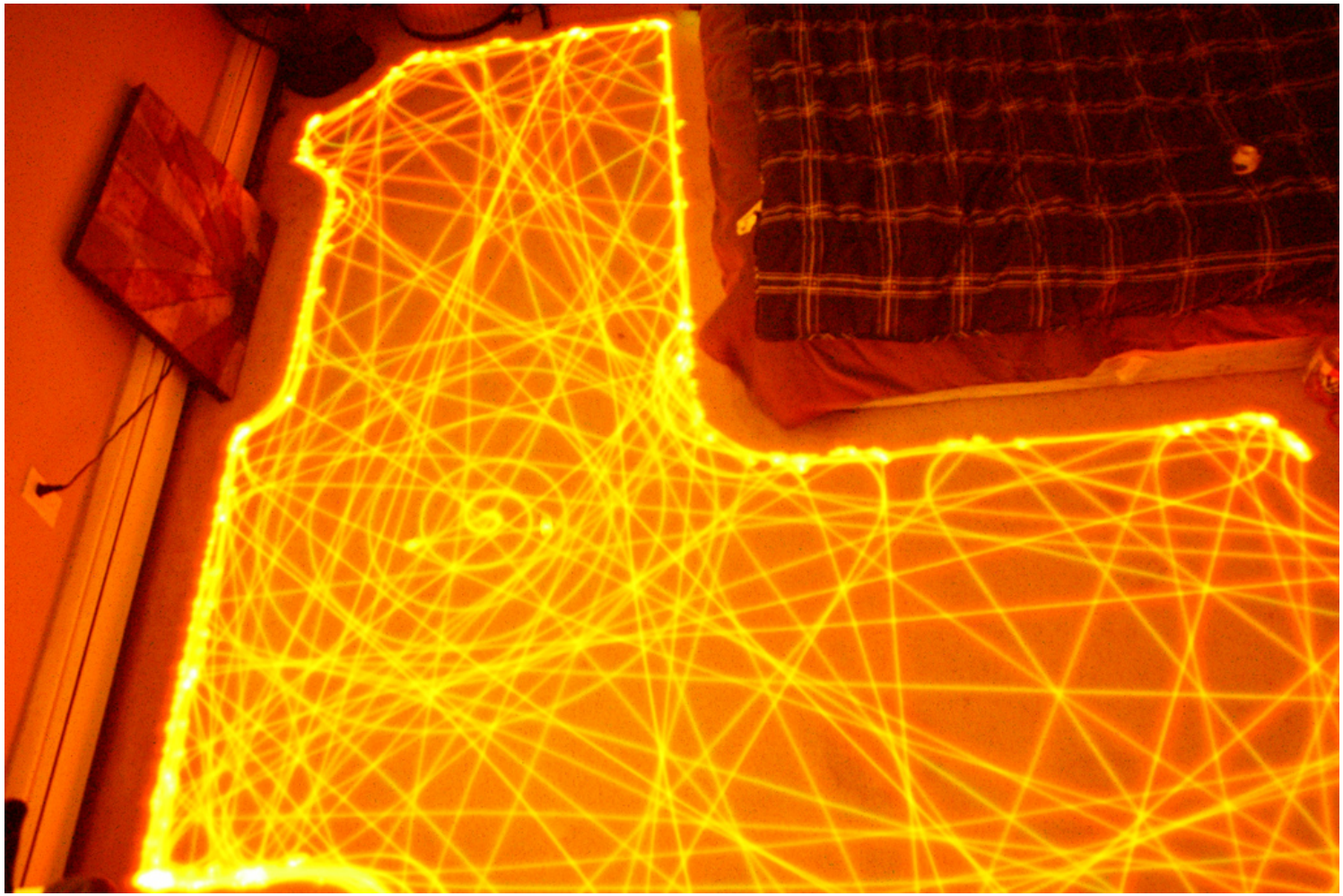
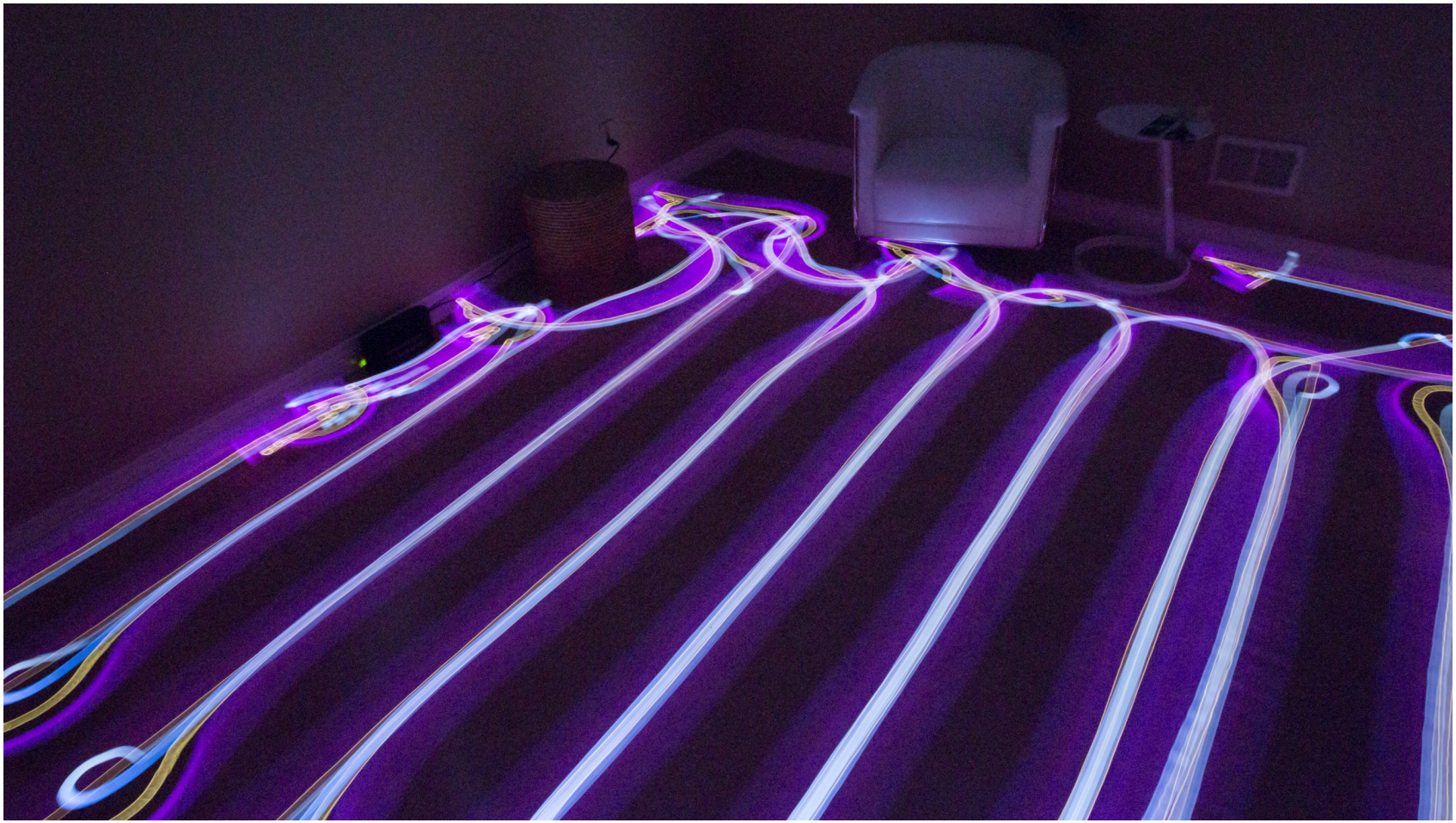
O que os robôs fazem



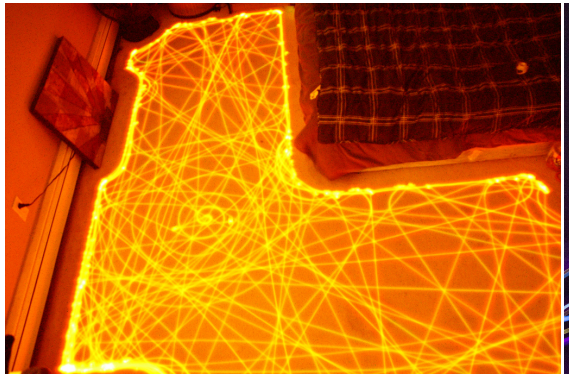
Trajetória A

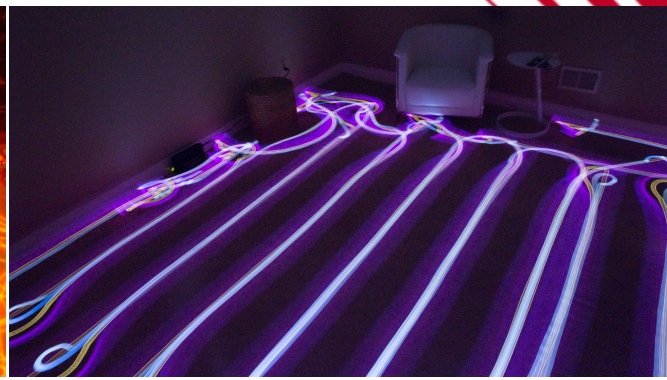


Trajetória B



Alternativas





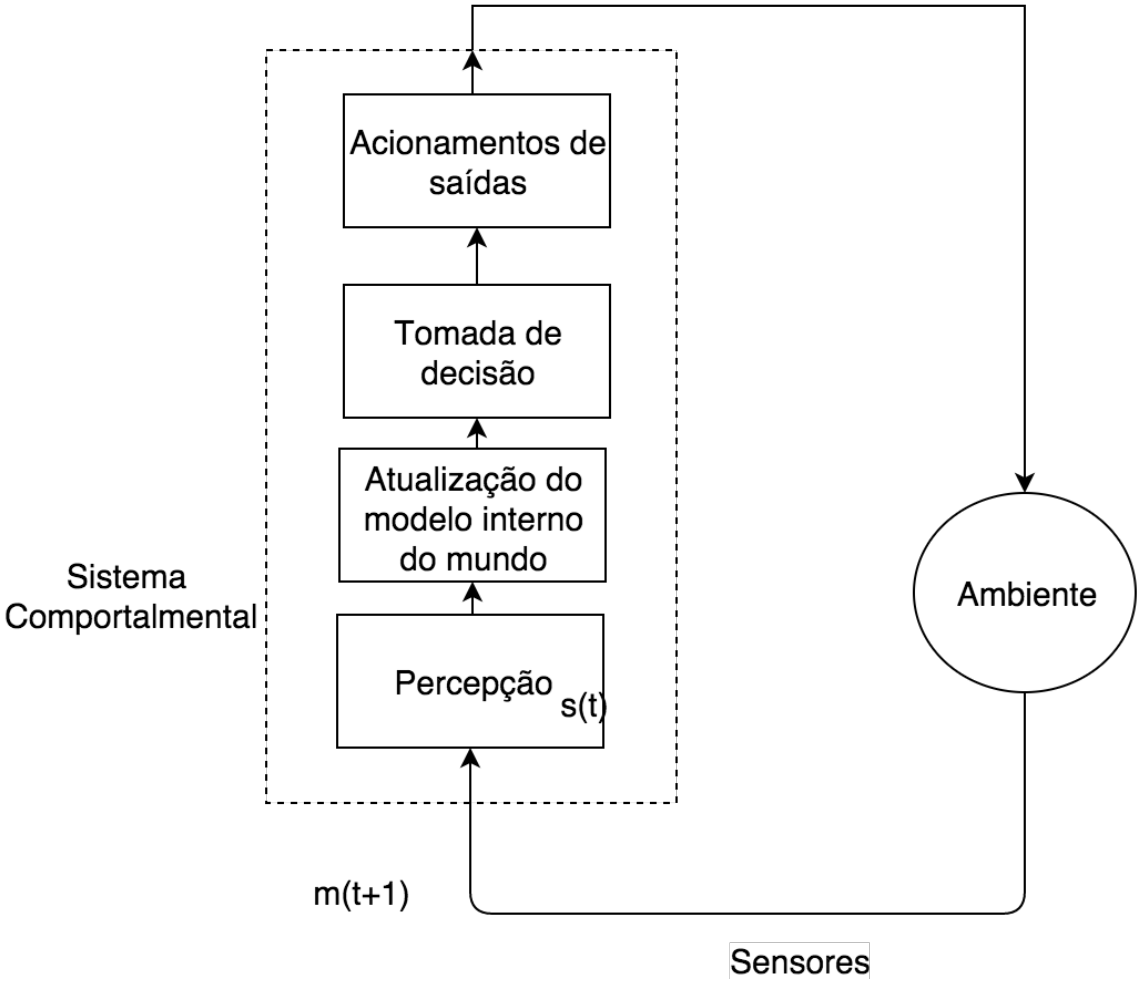
A. A trajetória A é um exemplo de IA clássica

B. A trajetória B é um exemplo de ”nova” IA

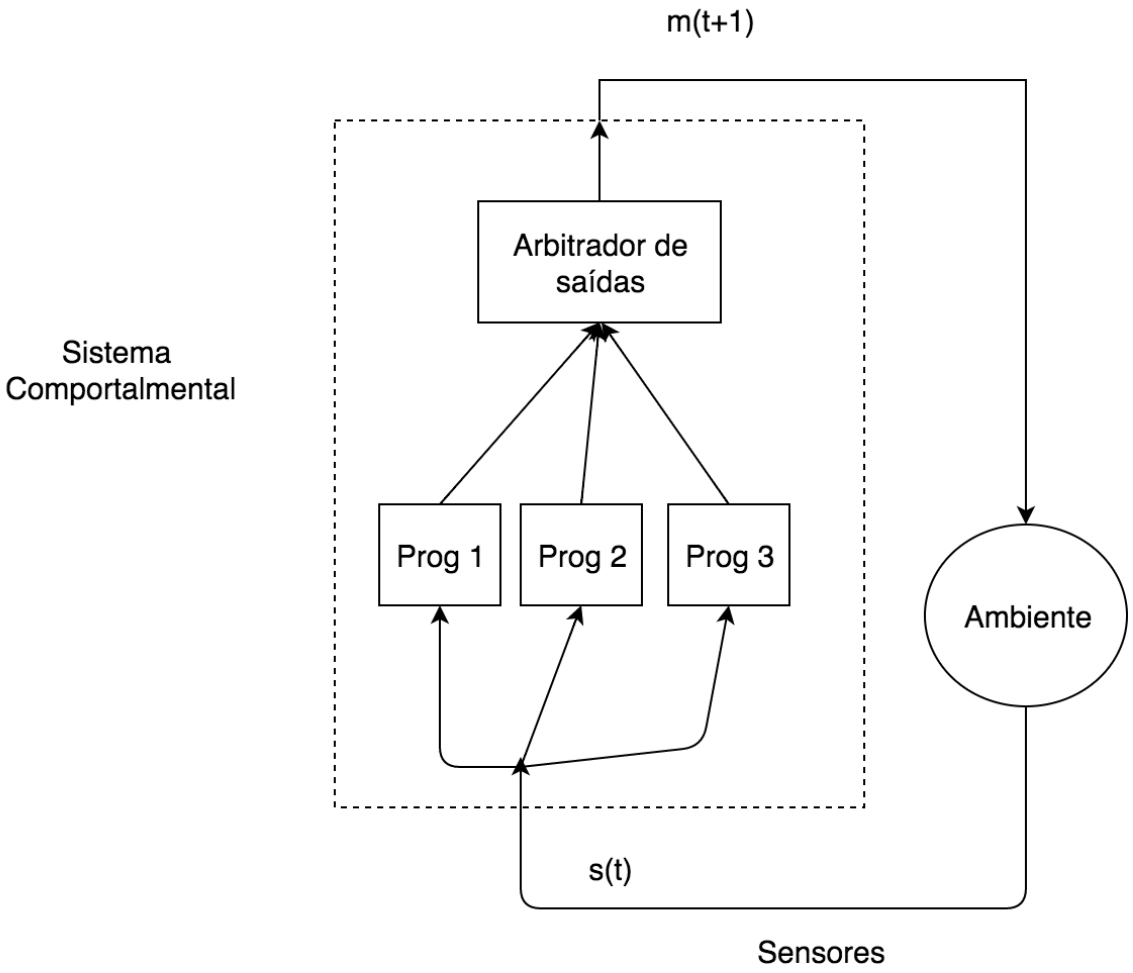
C. O robô da trajetória A tem algum tipo de mapa interno da sala

D. O robô da trajetória B tem um tipo de mapa interno da sala

Arquitetura cognitiva 1



Arquitetura cognitiva 2



Sobre arquiteturas cognitivas

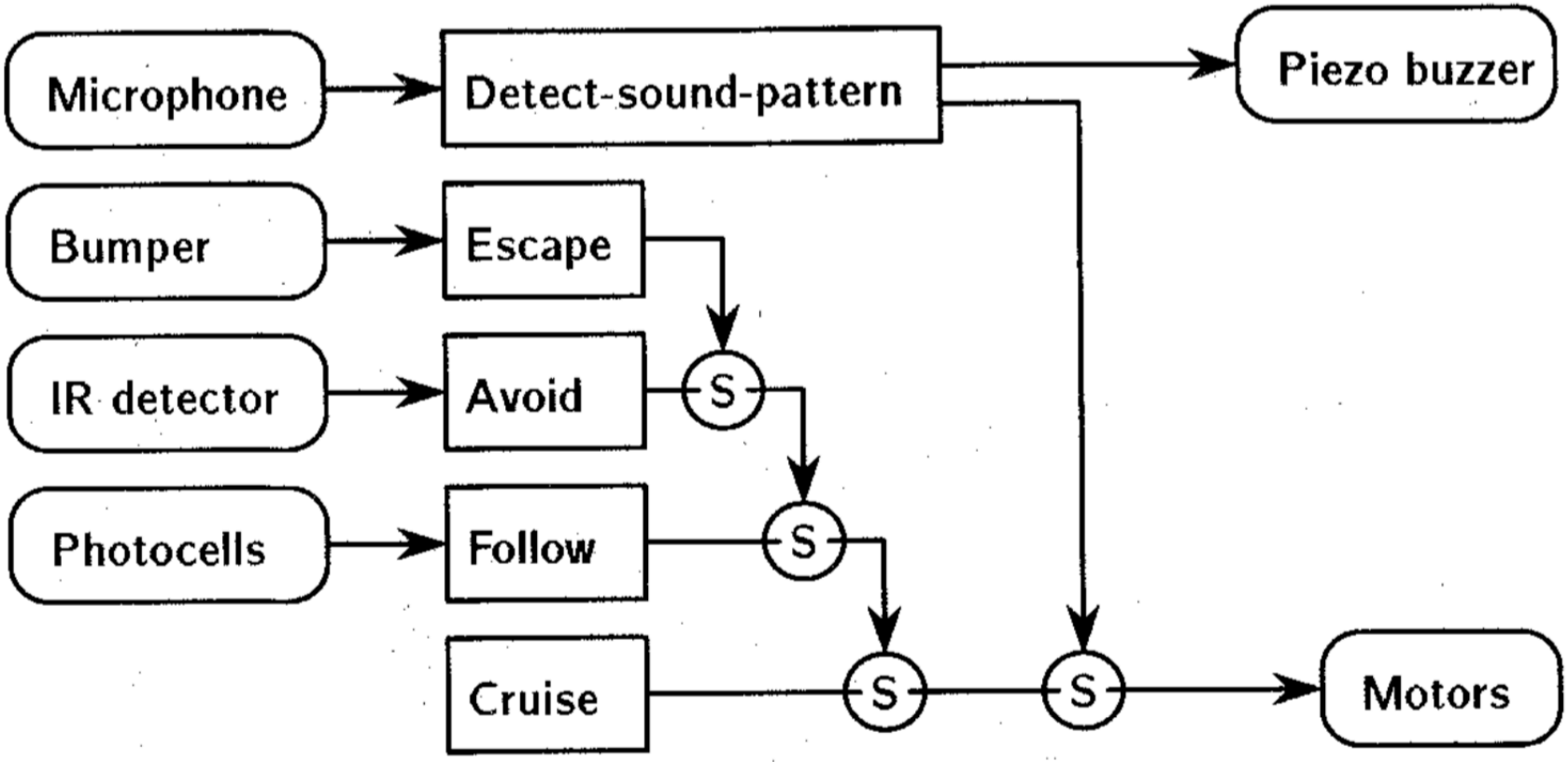
A. A arquitetura cognitiva 2 representa melhor uma abordagem coerente com a hipótese do sistema de símbolos

B. A arquitetura cognitiva 1 representa melhor a abordagem de IA chamada de atividade situada

C. Os robôs feitos em Acionamentos Elétricos são um exemplo de IA clássica

D. Modelos internos que representam o mundo são típicos da IA clássica

Exemplo Subsumption



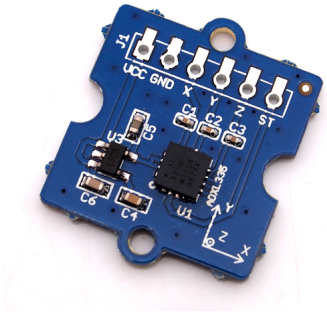
Shakey – Stanford Research Institute

https://youtu.be/qXdn6ynwpiI?t=747

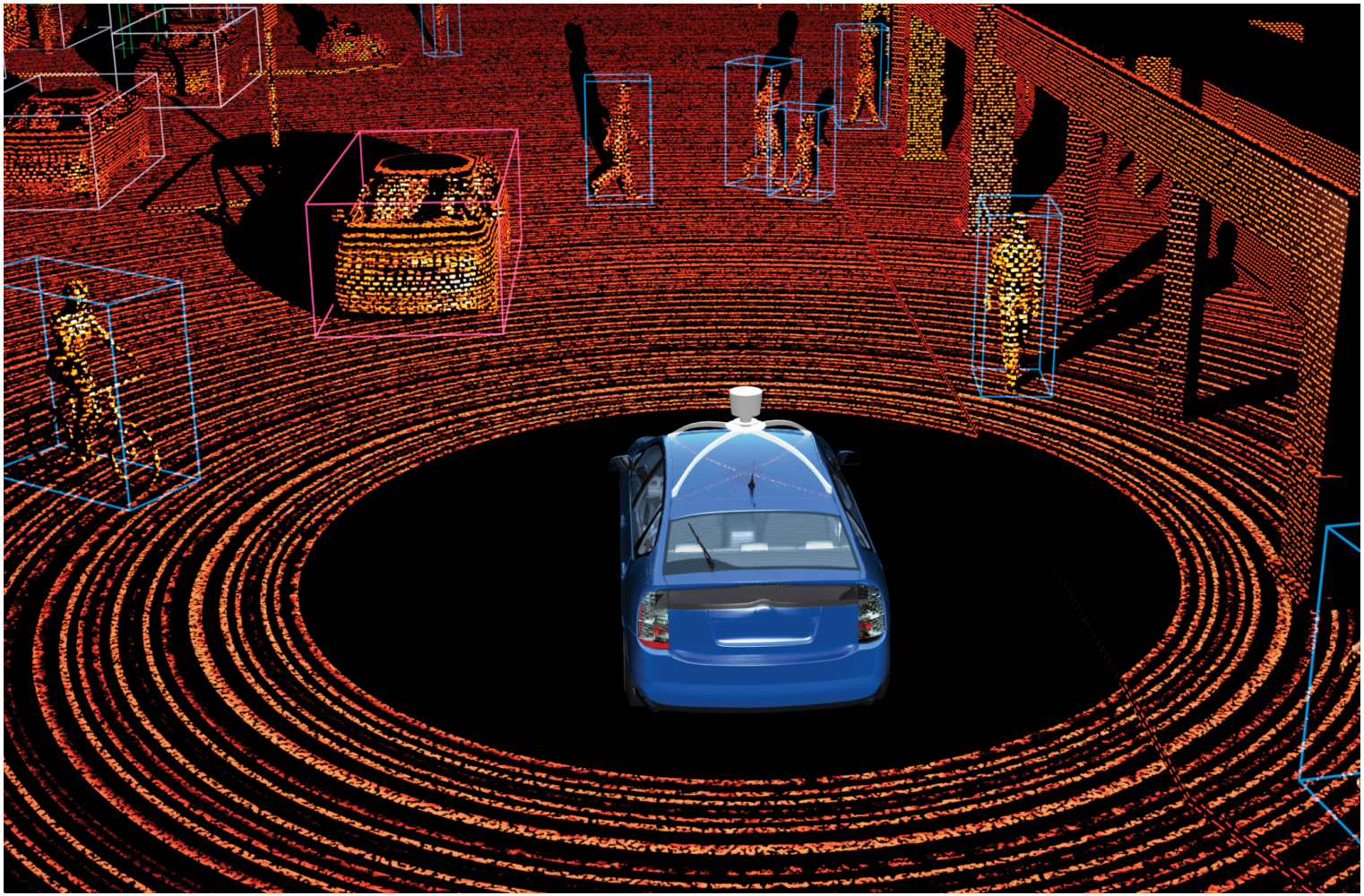
Robótica atual: Clássica + ”Nova”

Lógica e probabilidade aproximaram as abordagens da robótica

Sensores melhores ajudaram a eliminar incertezas



Melhores sensores



LIDAR do Google Car

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Conciliação

Sensores + probabilidade conciliaram as visões da IA clássica e da IA baseada em comportamento

https://www.youtube.com/watch?v=_qiLAWp7AqQ

Curiosidades

Este livro é um clássico sobre como fazer um robô Subsumption DIY

Mobile Robots, Inspiration to Implementation

Está fora de catálogo, alguém o enviou ao Github

https://github.com/Shne/LEGOLAB/blob/master/Mobile%20Robots%20Inspiration%20to%20Implementation%20-%20Flynn%20and%20Jones.pdf

Próximos passos

Entenda o tutorial de como escrever publishers e subscribers em Python

http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber(python)

Leia os capítulos 1 e 2 de ”A Gentle Introduction to ROS”

https://cse.sc.edu/~jokane/agitr/agitr-letter-pubsub.pdf