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Creating and maintaining chemical artificial life by robotic symbiosis

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Abstract

We present a robotic platform based on the open source RepRap 3D printer that can print and maintain chemical artificial life in the form of a dynamic, chemical droplet. The robot uses computer vision, a self-organizing map, and a learning program to automatically categorize the behavior of the droplet that it creates. The robot can then use this categorization to autonomously detect the current state of the droplet and respond. The robot is programmed to visually track the droplet and either inject more chemical fuel to sustain a motile state or introduce a new chemical component that results in a state-change (e.g. division). Coupling inexpensive open source hardware with sensing and feedback allows for replicable real time manipulation and monitoring of non-equilibrium systems that would be otherwise tedious, expensive, and error-prone. This system is a first step towards the practical confluence of chemical, artificial intelligence and robotic approaches to artificial life.