Robots that mind the gap

Robots have always been considered as a display of human technological advancement and evolution. Biologically inspired robots that mimic the characteristics of biological systems such as social insects emphasises the fact that nature offers the ideas and people transform them into technology.

Robots perform tasks such as displacement, exploration or object transportation under different environments and operating conditions. In search of a high degree of mobility, versatility and robustness, researchers used the social insect metaphor and the self-assembling and self-reconfiguration abilities displayed when they transport objects or build nests as a model. This led to the design and implementation of robotic systems composed of swarms of robots that interact and cooperate to reach their goals.

A swarm-bot is a self-assembling and self-organizing artifact, composed of several mobile robots (called s-bots) that can operate both autonomously and as a group. The system as a whole can dynamically self-assemble into different structures to perform certain tasks and then de-assemble into its s-bots components as necessary.

Coordinated motion is a basic ability that the swarm-bot should display. Since the swarm-bot is composed of a number of independent entities, they have o coordinate their actions in order to move coherently across the environment. In this direction, each s-bot is provided with a traction sensor placed at the turret-chassis junction.

The traction sensor detects the direction and the intensity of the traction force that the turret exerts on the chassis. The traction sensor integrates all the pulling/pushing forces created by the movement of the connected s-bots. In this way, it provides an indication of the average direction toward which the swarm-bot is trying to move as a whole in relation to the direction in which the individual s-bot's are trying to move.

Extensive experiments have been carried out for the evolution of artificial neural networks capable of controlling the behaviour of such swarm-bots in a coordinated manner. The results are promising since they demonstrate that the evolved s-bot controllers exhibit obstacle avoidance behaviour. Furthermore they were proved to be robust in varying terrain roughness or in the resence of moderately sized holes.

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