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NUS National University of Singapore

NGS RESEARCH OPPORTUNITY

Singapore Institute for Neurotechnology
(www.sinapseinstitute.org)

The Singapore Institute for Neurotechnology (SINAPSE) brings together engineers and scientists to focus on bio-inspired solutions to important engineering problems.

Swarm Robotics and Collective Intelligence

Ph.D. Research Description

Collective intelligence is shared or group intelligence that emerges from the collaboration, collective efforts, and competition of many individuals and appears in consensus decision-making. It is a form of universally distributed intelligence, constantly enhanced, coordinated in real time and resulting in the effective mobilization of skills.

Collective intelligence is related to swarm robotics, which is a new approach to the coordination of multi-robot systems. It is hypothesized that a desired collective behavior emerges from the interactions between the robots and interactions of robots with the environment.

The research of swarm robotics is to study the design of robots, their physical body and their controlling behaviors. It is inspired but not limited by the emergent behavior observed in social insects, called swarm intelligence. Relatively simple individual rules can produce a large set of complex swarm behaviors. A key-component is the communication between the members of the group that builds a system of constant feedback. The swarm behavior involves constant change of individuals in cooperation with others, as well as the behavior of the whole group.

We are looking for highly motivated individuals to do research in the areas of Intelligent and Swarm Robotics. The fundamental question we want to answer is: How can a collective of miniature robotic agents work together to solve large and complex problems that an individual robot or node cannot successfully resolve itself?

During the course of this PhD research topic you will gain expertise in several of the key areas that interest you the most.

- Artificial Intelligence
- Subsumption architecture
- Self-organization in animal societies
- Control and interactions between artificial systems and living organisms (human–robots interactions)
- Optimization
- Social networks
- Path planning techniques
- Mechatronics
- Learning algorithms
- Cloud computing

Candidates are encouraged to look up what the list of keywords mean and their relevance to collective intelligence and swarm robotics.

The National University of Singapore is one of the top 25 universities in the world, 6th worldwide (1st in Asia) in Electrical & Electronic Engineering and offers internationally competitive compensation. Source: 2014 QS World University Rankings.

To apply, please contact Prof. Nitish Thakor (Director of SINAPSE) at **sinapsedirector@gmail.com** or Dr. Sunil Kukreja (Head, Neuromorphic Engineering & Robotics) at **sunilkukreja.sinapse@gmail.com**.

Centre for Life Sciences
28 Medical Drive #05-COR, Singapore, 117456 Tel: (65) 6601 3406 Fax: (65) 6873 3905
Website: www.sinapseinstitute.org
Company Registration No: 200604346E