Evolving synthetic pain into an adaptive self-awareness framework for robots

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Abstract
In human–robot interaction, physical contact is the most common medium to be used, and the more physical interaction occurs, at certain times, the higher possibilities of causing humans to experience pain. Humans, at times, send this message out through social cues, such as verbal and facial expressions in which requires robots to have the skill to capture and translate these cues into useful information. The task of understanding human pain concept and its implementation on robots plays a dominant factor in allowing robots to acquire this social skill. However, it is reported that the concept of human pain is strongly related to the concept of human self-awareness concept and cognitive aspects with complex nerve mechanisms, hence, it is crucial to evolving appropriate self-awareness and pain concepts for robots. This paper focuses on imitating the concept of pain into a synthetic pain model, utilised in justifying the integration and implementation an adaptive self-awareness into a real robot design framework, named ASAF. The framework develops an appropriate robot cognitive system—“self-consciousness” that includes two primary levels of self-concept, namely subjective and objective. Novel experiments designated to measure whether a robot is capable of generating appropriate synthetic pain; whether the framework’s reasoning skills support an accurate synthetic pain acknowledgement, and at the same time, develop appropriate counter responses. We find that the proposed framework enhances the awareness of robot’s body parts and prevent further catastrophic impact on robot hardware and possible harm to human peers.

Introduction
As the number of robots application in various areas of human life grows, it is inevitable to see more collaboration...