Construction and validation of an attentional framework based on CONAIM

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Abstract
This project proposes the construction of an attentional framework based on CONAIM capable of integrating and treating the information provided by multiple sensors for mobile and autonomous robotics applications.

Key words:
CONAIM, cognitive robotics, attentional system.

Introduction
The continuous development of robotics and the increase of its applications, has endowed robots with a large amount of sensors and actuators, aiming to enhance the comprehension of the world. Therefore, an enormous quantity of data, sometimes redundant, is produced. By using CONAIM [1] (Conscious Attention-based Integrated Model) which is a formal model for machine consciousness based on an attentional schema for human-like agent cognition, we may filter the incoming data towards a more manageable format. In this context, this project proposes the construction of the attentional system software framework described on the CONAIM model, presented on Figure 1, capable of integrating a modality of sensors that are available for mobile and autonomous robotics applications. A case study was defined in order to validate the framework and the tests were carried out on the V-REP [2] simulator.

Results and Discussion
In order to obtain a solid base for the framework's development, a initial model of the system was designed and it consisted on information gathered regarding the variety of sensors that could be used by mobile robots and which characteristics of those are relevant in the attentional process. A class diagram, that is an essential part for designing the framework, was prepared representing the sensors hierarchy and the elements involved in the attentional processes.

To execute the experiments and to validate the system, a robotics simulator was adopted. The V-REP [2] simulator has a variety of mobile robots models, as well as sensors and actuators, which are important to the validation of the framework. It also has compatibility with several languages (Java, C++, Matlab, Python...), providing a client/server connection through a Remote API that allows us to manage the simulation and even the simulator remotely.

By successfully connecting to the Server through the Remote API, we were able to read the data provided by the sensors (sonars, laser and monocular camera) and to process them by creating objects that are updated constantly. This information is then used by the feature extraction, saliency and attentional objects to select the data that should be passed to higher levels of the application.

Figure 1. CONAIM model (Conscious Attention-based Integrated Model) – The blue outline shows the attentional system that is focus of this research.

A case study for evaluating the system should involve:
- Create instances of sensors with different characteristics and dimensions
- Extract exogenous features from these sensors
- Integrate them to find the saliency map over time

The OpenCV API was used in order to perform the low level filtering associated with the attentional system. The framework was programmed in Java, and results have showed that it can support the multiple instances created for an attentional system that follows CONAIM.

Conclusions
Experiments have showed that it is possible to implement an attentional framework based on CONAIM that can extract saliency from sensors.

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