An Empathic Robotic Tutor in a Map Application (Demonstration)

Amol Deshmukh[1], Aidan Jones[2], Srinivasan Janarthanam[1], Helen Hastie[1], Tiago Ribeiro[4], Ruth Aylett[1], Ana Paiva[4], Ginevra Castellano[2,3]
[1] School of Mathematical and Computer Sciences, Heriot-Watt University, Edinburgh, UK
[2] School of Electronic, Electrical and Computer Engineering, University of Birmingham, UK
[3] Department of Information Technology of Uppsala University, Sweden
[4] GAIPS, INESC-ID and Instituto Superior Tecnico, Lisboa, Portugal
a.deshmukh@hw.ac.uk

ABSTRACT

In this demonstration, we describe a scenario developed in the EMOTE project [2]. The overall goal of the EMOTE project is to develop an empathic robot tutor for 11-13 year old school students in an educational setting. The pedagogical domain we demonstrate here is to assist students in learning and testing their map-reading skills typically learned as part of the geography curriculum in schools. We demonstrate this scenario with a NAO robot interacting with the students whilst performing map-reading tasks in the form of a game on a touch-screen device.

Categories and Subject Descriptors

I.2.9 [**Artificial Intelligence**]: Robotics

General Terms

Human Factors, Algorithms, Theory

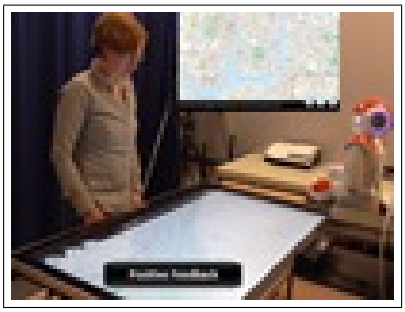
Keywords

Robotic Tutors, Human-robot interaction, Empathy

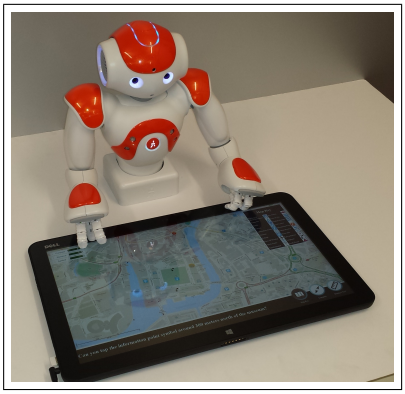
1. INTRODUCTION

The work demonstrated here takes place in the context of the EU project EMOTE [1] (EMbOdied-perceptive Tutors for Empathy-based learning), which has the overall goal of developing artificial tutors that have the perceptive and expressive capabilities to engage in empathic interactions with learners in school environments, grounded in psychological theories of emotion in social interaction and pedagogical models for learning facilitation.

Previous studies on robotic companions in real-world classroom environments [3] have shown that robotic platforms are promising tools for experimental learning. We hypothesise that a robot tutor that is able to detect the user's affective state and respond appropriately will result in increased motivation and better learning outcomes. In order to test these empathic strategies, we are developing two scenarios that we intend to take into schools to perform long-term studies, a one to one tutoring scenario and a group learning scenario.



(a) Using a large touch table



(b) Using a tablet computer

Figure 1: The EMOTE map application

Here we demonstrated the ono to one tutoring scenario. Specifically, we will demonstrate a map task scenario, where the robotic tutor—a Nao torso robot—supports the learner to complete an art trail on a map application installed on a large touch-screen device (1). These tasks have been designed to allow the learner to develop map reading skills concentrating on directions, distance and map symbols.

The objective is to obtain clues that help the student to place a new exhibit at the end of the existing art trail. In each task, the learner is asked to find a feature based on its symbol, distance from current location and direction.

The robot tutor's behaviour is grounded in empathic and

[1]http://www.emote-project.eu/

Appears in: *Proceedings of the 14th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2015), Bordini, Elkind, Weiss, Yolum (eds.), May 4–8, 2015, Istanbul, Turkey.*

pedagogical strategies, building on previous work described in [1]. The robot assists the learner using pedagogical actions such as prompts, pumps, splices based on task performance, historical skill levels, and time in task. It also monitors learner's levels of valence and arousal which are used to adapt the use of pedagogical actions. If the learner is in a state of low valence and arousal, which indicates a state of tiredness or boredom the behaviour of the robot will be to entertain and engage the learner. If the learner has positive valence which covers states where the learner is happy or relaxed then the amount of pedagogical actions will be reduced. In other states the pedagogcial actions will be delivered as normal.

This interactive demo using a large tablet and the NAO will allow attendees (one user at a time) to complete the art trail through interacting with the robot and select the correct location for a new landmark based on clues found in the trail.

2. ARCHITECTURE

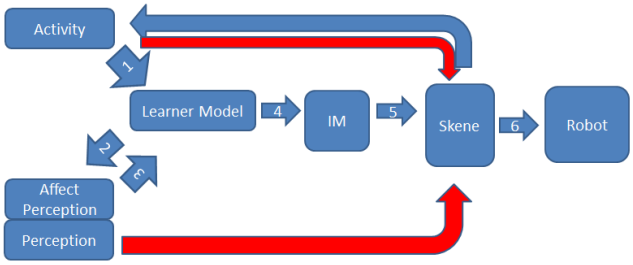


Figure 2: Architecture of the system

Figure 2 explains the architecture components and the data flow between the modules in the system.

- An event happens in the activity (Map application), the activity evaluates this and sends a message to the learner model.
- The learner model passes this information to the affect perception module so that it has context that may be relevant to the affect of the learner.
- The Affect Perception module uses this activity context (and the continuous data it has access to from the perception module) to update the affective states. The Affect Perception module sends the affective state message to the learner model.
- The learner model combines the information in to the current state of the learner and provides this the Interaction Manager (IM).
- The IM uses the activity context, skill levels and the affective states to select an appropriate next high-level system action or pedagogical tactic.
- The Skene [4] module transforms the high-level action specification into a concrete set of words and behaviours for the Robot to perform.
- Skene also uses low level information to gaze at the learner and map locations on the touch-screen device (red arrows).

The set-up that will be deployed in a school for a long-term study to explore empathic behaviour up consists of the Nao robot and a large (55") touch-screen table (1a). However, given the logistical challenges in transporting a full-size touch table, this scenario will instead be demonstrated with a small touch-enabled 18" tablet and the NAO robot, (1b), which will be brought to the event. A demo video can be seen at `http://www.macs.hw.ac.uk/~amol/emote/Scenario1-MapApplication-Final.mp4`

3. ACKNOWLEDGEMENTS

This work was supported by the European Commission (EC) and was funded by the EU FP7 ICT-317923 project EMOTE. The authors are solely responsible for the content of this publication. It does not represent the opinion of the EC, and the EC is not responsible for any use that might be made of data appearing therein.

3.1 Additional Authors

Mary Ellen Foster[1], Lee J. Corrigan[2], Fotios Papadopoulos[2], Eugenio Di Tullio[3], Pedro Sequeira[3].
[1] School of Mathematical and Computer Sciences, Heriot-Watt University, Edinburgh, UK
[2] School of Electronic, Electrical and Computer Engineering, University of Birmingham, UK
[3] GAIPS, INESC-ID and Instituto Superior Tecnico, Lisboa, Portugal.

REFERENCES

[1] P. Alves-Oliveira, S. Janarthanam, A. M. Candeias, A. Deshmukh, T. Ribeiro, H. Hastie, A. Paiva, and R. Aylett. Towards dialogue dimensions for a robotic tutor in collaborative learning scenarios. In *Proceedings of Ro-Man 2014*, 2014.

[2] A. Deshmukh, G. Castellano, A. Kappas, W. Barendregt, F. Nabais, A. Paiva, T. Ribeiro, I. Leite, and R. Aylett. Towards empathic artificial tutors. In *Proceedings of the 8th ACM/IEEE International Conference on Human-robot Interaction*, HRI '13, pages 113–114, 2013.

[3] I. Leite, G. Castellano, A. Pereira, C. Martinho, and A. Paiva. Modelling empathic behaviour in a robotic game companion for children: An ethnographic study in real-world settings. In *Proceedings of HRI 2012*, pages 367–374, 2012.

[4] T. Ribeiro, A. Pereira, E. Di Tullio, P. Alves-Oliveira, and A. Paiva. From Thalamus to Skene: High-level behaviour planning and managing for mixed-reality characters. In *Proceedings of the IVA 2014 Workshop on Architectures and Standards for IVAs*, 2014.