Opinion

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2022.46.007285

Essential 'Human' Features of the Cyber-Physical Nurse

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ARTICLE INFO

Received: September 01, 2022

Published: September 07, 2022

Citation: Maya Dimitrova. Essential 'Human' Features of the Cyber-Physical Nurse. Biomed J Sci & Tech Res 46(1)-2022. BJSTR. MS.ID.007285.

ABSTRACT

The paper presents an opinion on the approach to endowing humanoid robots with 'essential' features for use in healthcare. The essential 'human' features of the cyber-physical nurse are defined on three levels of analysis - physical, social and/or psychological. It is argued that the deployed algorithms, beyond the physical level, have to perform on the social level of analysis, acting as high level synthetic sensors, not existing in nature, but mimicking complex subjective phenomena such as 'affection' detection.

Keywords: Cyber Physical Nurse; Healthcare; Essential Features; Synthetic Sensors; Affection Detection

Introduction

A cyber-physical 'nurse' is an emergent technological entity to support care in present day hospitals and nursing homes. It is important to outline its essential 'human' features in order to make it resemble a human nurse, and at the same time, relieve her from heavy, difficult and harmful tasks (Li [1]). 'Nurse' is a well established category of a helping profession, essential in every treatment and rehabilitation centre as well as in home care. A category is being deJined, according to (Mervis [2]), by its deep, essential features, whereas evident features, like feathers of a bird, for example, are called 'characteristic' for not 'being essential' to the bird category. In a similar way it is a challenging task to attempt and define the humanoid robot as an emergent category. If we imagine the 'perfect' robotic nurse, it will probably be a cyber-physical agent, who is best described as 4P - 'pleasant, patient, polite and powered'. The ability to lift and help the patient is one of the essential features of the nursing profession ('powered'). In addition to it, the other 'essential feature' of the nurse therefore, is defined as being capable of displaying empathy in its communication with the patient ('pleasant, patient, polite') (Pepito, et al. [3]).

Levels of Analysis of the Behaviour of the Cyber-Physical Nurse

The interaction with a humanoid robot can be analysed on three levels in parallel - physical, social and/or psychological. The physical level analysis is based on understanding the interactions in the physical world. It is possible to implement algorithms, which predict behaviour in response to behaviour (Dimitrova [4]). A nurse assistant robot RoNA is described in (Hu, et al. [5]). RoNA is a robotic nurse with enhanced manipulator abilities being able to lift the patient and help with tasks of moving the body in space during rehabilitation. The social abilities of the robot are more limited. The social level analysis has to be based on understanding features of the social dynamics during the interaction, which is a more complicated diagnostic task on behalf of the artificial intelligence algorithms of the robot than predicting behaviour in response to behaviour. A popular social robot used in healthcare is Pepper, as

described, for example, in (Van der Putte D, et al. [6]). Pepper can take the task of interviewing the patients and, in this way, relieving the human nurse to focus on caring for the emotional needs of the patients. The important aspect is to implement algorithms imitating pleasant and polite attitude to the patient., since the humanoid robot does not get bored or irritated by the response of the patient. At the same time it can perform face and emotion recognition and, based on this, predict behaviour in response to attitude. Why is it inappropriate to implement a psychological level of analysis? This issue was discussed in (Dimitrova [7]): "The psychological level of 'predicting behavior in response to opinion', in our view, is the "uncanny" case.

Whenever people react as if they feel that the behavior of the robot is guided not just by attitude (social level), but by opinion (psychological level), by some kind of awareness like the one produced by a 'gaze sensor', we expect to observe the 'uncanny valley' phenomenon. Robots need synthetic sensors like the 'gaze sensor' but they need not reinstate situations where the human 'gaze sensor' is on. They can rather reinstate feelings of positive attitude, friendliness, trust and compassion. Special questionnaires, distinguishing feelings close to perception of attitude from perception of opinion in human-robot interaction need to be designed to explore the validity of this hypothesis (p. 2)". Patients in hospitals and care centres are being constantly monitored by surveillance systems integrated in the physical environment, including in robotic systems. When speaking of robots acting intelligently like humans, it was proposed in (Jamisola [8]) to endow them with the ability to 'feel the gaze' of a person by the robot, very much the way the human feels that someone is staring at them.

This would make the interaction more contextually relevant, according to the author. Elaborating on this idea, it was proposed in (Dimitrova, 2016) to deploy a number of similar high level synthetic sensors, not existing in nature, but mimicking complex subjective phenomena such as 'affection' detection in the patient (p. 27). Why affection? It is a fundamental feeling, which is not a basic emotion, but a high level emotional state of the human subject, which develops throughout the lifetime and underlines the relations of the patient, especially in old age, with their closest people - family and friends. It is important to maintain the memory and understanding of the state of affection in order to boost the overall effect of the rehabilitation. Social robots have to be able to deal not only with possible outbursts of negative emotions on behalf of the patient, but, more importantly, to invoke memories of affectionate moments of their life. The design of such a sensor is not an easy engineering task, yet it is possible to achieve it and to endow the cyber-physical nurse with it. This ability would be an 'essential' characteristic feature of the cyber-physical nurse of the future.

Conclusion

This opinion article argues in favour of the design of high level synthetic sensors, not existing in nature, but mimicking complex subjective phenomena such as 'affection' detection for implementation in humanoid robots for healthcare. These sensors form essential features of the sociality of the care robots in order to help the patients improve better and faster during medical treatment and rehabilitation. Especially important would be the 'affection detection' to bring the emotions of the patient to a positive state by the cyber-physical system.

Acknowledgement

This work has received support from the Research Fund of Bulgaria for project No КР-06-ПН57/28, Methodology for determining the functional parameters of a mobile collaborative service robot assistant in healthcare (2021-2024).

Conflict of Interest

No.

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ISSN: 2574-1241

DOI: 10.26717/BJSTR.2022.46.007285

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