Artificial Intelligence in Medicine xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Artificial Intelligence in Medicine

journal homepage: www.elsevier.com/locate/aiim

Activities suggestion based on emotions in AAL environments

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ARTICLE INFO

Article history:
Received 7 January 2017
Received in revised form
13 November 2017
Accepted 15 January 2018

Keywords:
Emotional agents
Ambient intelligence
Multi-agent systems
Agent-based simulation
Ambient assisted living

ABSTRACT

The elderly population is increasing and the response of the society was to provide them with services directed to them to cope with their needs. One of the oldest solutions is the retirement home, providing housing and permanent assistance for the elderly. Furthermore, most of the retirement homes are inhabited by multiple elderly people, thus creating a community of people who are somewhat related in age and medical issues. The ambient assisted living (AAL) area tries to solve some of the elderly issues by producing technological products, some of them dedicated to elderly homes. One of the identified problem is that elderly people are sometimes discontent about the activities that consume most of their day promoted by the retirement home social workers. The work presented in this paper attempts to improve how these activities are scheduled taking into account the elderlies' emotional response to these activities. The aim is to maximize the group happiness by promoting the activities the group likes, minding if they are bored due to activities repetition. In this sense, this paper presents an extension of the Cognitive Life Assistant platform incorporating a social emotional model. The proposed system has been modelled as a free time activity manager which is in charge of suggesting activities to the social workers.

1. Introduction

Elderly population suffer from complicated medical conditions and require much attention from an array of people, like doctors, nurses, family and caregivers, among others. Although currently is very difficult to provide medical assistance to all of them, efforts are being made to increase the number of services available to them. The assisted people resort to one or more of the following support systems: home health agencies, nursing homes, hospices, residential care communities and adult day service centres. For instance, in the USA annually 8357100 people receive one type of these support systems, being the home health agencies the most used service [1]. Also, the current number of people that need long-term care are about 6.3 million [2], with tendency to increase sharply in the next years. This long-term care is designed to help people with mild to severe cognitive or physical disabilities that affects 68% of people aged 65 and older [3].

In 2050 it is expected the doubling of people receiving long-term care in relation to the year 2000 figures, meaning that at least 27 million people are expected to be receiving assistance and some experts project even higher numbers due to the current growth of population [4]. The issue with the presented values is that social security and governments have said that they lack the funds to support everyone, even if there are services available to everyone of them, which turns into a heavy monetary investment to a person with prices ascending from 12000 Euros annually.

Thus, they have to be cared and assisted and that usually is attributed to the family, informal caregivers. The issue with resorting to them is that they are usually time constricted and may be unable to care for a person with severe disabilities. This results in severe complications both to the elderly as well as the family or friends, resulting in a enormous strain to them, physically and more importantly psychologically [5]. For instance, in Portugal the latest surveys show that there are more than 49 thousand bedridden people at their family houses without access to proper medical assistance; and that there are 110355 people dependent of others to perform their activities of daily life (ADL)[6].

Another choice is the nursing home care, which usually welcomes people with 75 years and older or with less age if they present health problems [7]. These places and services provide constant attention and appropriate medical services to its users. Furthermore, the nursing home facilities are equipped with technological resources or can be easily upgraded to receive new devices if it is necessary. Moreover, in light of the technological advances

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https://doi.org/10.1016/j.artmed.2018.01.002
0933-3657/

Table 1
PAD initial values for the 20 agents used in the simulation scenarios.

Agent Id	Pleasure	Arousal	Dominance
Agent 0	0.444	0.049	0.337
Agent 1	0.6289	0.0093	0.399
Agent 2	0.3241	−0.3217	0.1789
Agent 3	0.3293	−0.0465	0.0613
Agent 4	0.2831	−0.4496	0.4533
Agent 5	0.3091	−0.1296	0.3238
Agent 6	0.5204	−0.0080	0.3128
Agent 7	0.5638	0.0093	0.1798
Agent 8	0.3103	−0.4316	0.3543
Agent 9	0.6560	0.1153	−0.0146
Agent 10	0.2873	−0.4906	0.1833
Agent 11	0.3794	0.2289	0.2069
Agent 12	0.3088	−0.0377	0.0877
Agent 13	0.1070	−0.0416	0.0389
Agent 14	0.86431	−0.1456	0.5213
Agent 15	0.5598	0.0093	−0.0142
Agent 16	0.5584	−0.0960	0.4138
Agent 17	0.6161	−0.0036	−0.1379
Agent 18	0.6550	−0.2007	−0.0820
Agent 19	0.2031	−0.2866	0.3234

the nursing homes have been implementing Ambient Intelligence (AmI) systems aiming to improve its users everyday life [8–10].

The AmI aimed to revolutionize the way that the home environments (and environments in general) were managed by introducing perception and action features into common household devices, all of this in beneficence of the people living under those environments. The information captured by the sensors systems available can be used to develop a context state, where more intricate considerations about the environment can be achieved opposed to a simpler reaction system that only responds directly to each sensor data.

Humans are complex so the environments that surround them are too. Technological systems have a hard time accompanying this complexity, and while there are significant developments, considering every variable of the real world is still very much impossible. The best effort of the available technology is to provide the environments with sensors and computing power able to consider direct human interaction, alas decision processes. Decisions should be the outcome of the composite status of the perceived environment, where one factor (or sensor) is more important than the other, and the response to the desires of the people who inhabit the environment is paramount to the utility functions of the system. One of the AmI goals is to consider, above all, the environment users preferences [11,12].

The advances of the AmI are already considerable and growing, due to the interest of the scientific community and the private sector [13]. For instance, there are already devices available to be bought of the shelf, able to be integrated into an AmI platform. The impulse of the governments and even the European Union through special funding to agile the active ageing and to promote solutions that should be accomplished in the near future to comply with the crescent number of elderly people that the statistics present. One of the main issues that nowadays most of the available projects and products have is the lack of re-usage and interoperability, meaning that the features that they provide cannot be extended and the devices are certainly unable to communicate if they are from different brands. It is pressing the need of integration in AmI projects, which some projects are now addressing but the results are new and without much testing [14].

Not only are there issues in terms of the architecture, but in the concept too. Only very recently there were projects that used real input from the users to conceive the project, while most of the development has taken little consideration the opinion of the people that will be using the final product. This has lead to a poor adoption of the project's resulting products and to maintain the general distrust on these type of projects.

One of the proposed solutions is making questionnaires to the target users about their needs and wants, producing a dataset of the general features that are needed by the general target population [15,16].

One of the unexpected outcome was the inclusion of emotions and the psychological state at the same level as physical problems by the people questioned. Therefore, we must assume that comfort is not only provided by the ailment of physical conditionings but also by the psychological state, as elder depression is a serious state that affects a large number of persons and has the ability to affect the physical state [17]. It is then imperative that the AmI projects

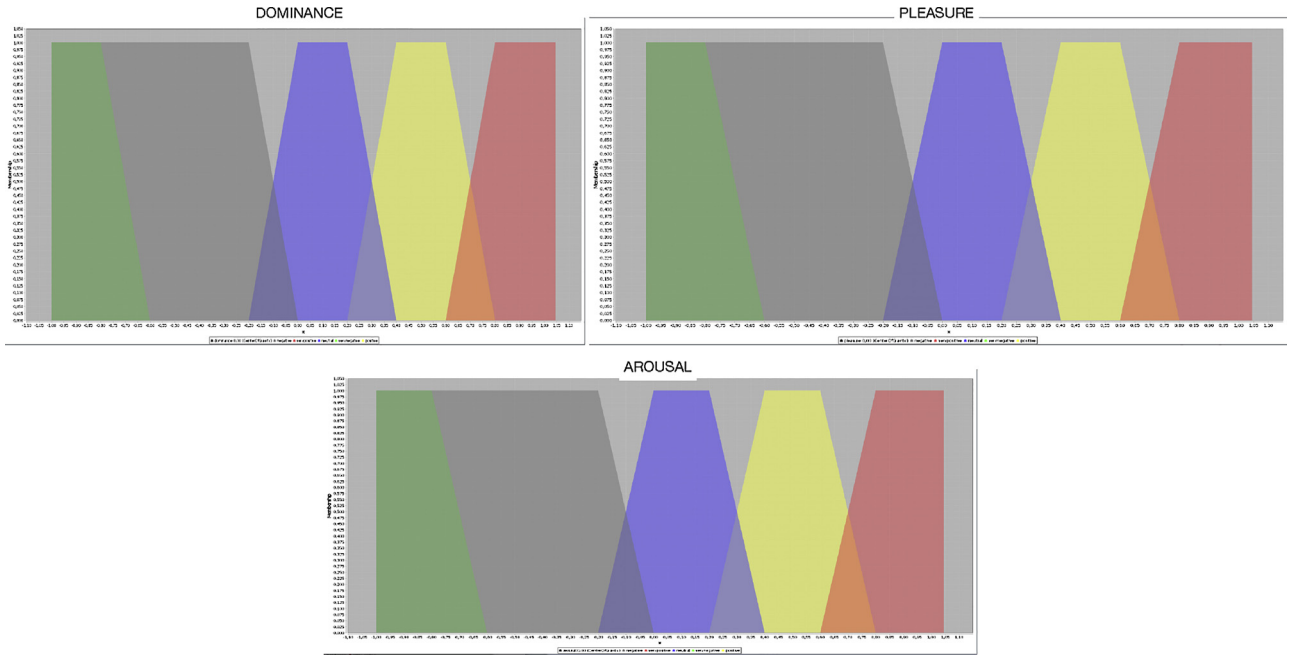

Fig. 1. Example of the fuzzy logic function employed in the emotion recognition of each PAD value.

Please cite this article in press as: Costa A, et al. Activities suggestion based on emotions in AAL environments. Artif Intell Med (2018), https://doi.org/10.1016/j.artmed.2018.01.002