



Towards a Model Based on Agents for the Detection of Behavior Patterns in Older Adults Who Start Using ICT

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Abstract. In this article, we present a proposal to develop a model based on agents, which allows the detection of the patterns that make up the behavior of older adults, who have been influenced by the use of new information and communication technologies. The model describes the iterations of four agents: Adult Agent, Detector Agent, Content Agent and Agent Activity; these interactions together with their knowledge base will result in the identification of possible risk factors to minimize them and increase the protective that allow mental activation and active aging. The protective derived from the correlation between energy and motivation, have guided the behavior of the adult towards better integration with society.

Keywords: Agent-based model · Protective and risk factors · Mental activation

1 Introduction

We live in the information age and the complex technological advances that gradually force people to interact with different tools and interfaces to the point of turning them into a necessity. Some of these new technologies have interaction with other systems that may involve human-computer activities, Artificial Intelligence is present in them, there are specific examples of this, we can mention a vacuum cleaner that runs its activity independently, homes with integrated technology, business applications for prediction, and devices for pattern recognition, among others. In the health area, there are also complex systems to support activities to diagnose diseases, monitor patients, etc. It is important to consider the mental health of a sector of the population, that of the elderly, who are affected positively or negatively by technological advances. Is it possible to think of a school environment that allows detecting patterns of behavior so that it can recommend content and activity to strengthen the protective factors and reduce the risk factors? With the simulation of an artificial environment and the characteristics that are planned in the question can be detected risk situations and those that support the generation of certain behavior in adults, this environment should be

composed of agents with roles, rules and interactions defined, allow constant feedback and adapt them to new situations.

2 Background

Artificial Intelligence (AI) has been busy creating software to perform operations comparable to those performed by the human mind, as well as learning or logical reasoning [1]; In addition, interest in the development of this type of software has grown in recent years to achieve the incorporation into devices of a knowledge similar to that of a human being; On the other hand, AI provides a broad set of methods, techniques and algorithms that can be included in different applications from different fields and has extended research in knowledge directions such as medicine, biology, engineering, education, health, financial, videogames, among others, which are a clear example of the intervention that AI has in daily activities [2].

The area of health and medical care is a very favorable environment for the implementation of AI, through the technology of agents, given the knowledge that is required and at the same time has, where you can give a very precise interaction and attend technical as well as social aspects [3], for the acquisition and generation of knowledge. There are a variety of fields in the medical industry that involve medical support systems, some examples are systems that diagnose diseases, systems that recommend treatment, systems for examining patient history, and support from palliative care units [4]; The development of multi-agent systems has gradually become a key point for this type of health services and applications, particularly for assisted living, diagnosis, physiological tele-monitoring, intelligent hospital, and intelligent emergency applications [5].

On the other hand, the implementation of this type of systems ventures into more specific areas as proposed by [6], when the use of a multi-agent system dedicated to detect and examine the environmental components, to achieve and prevent a person is affected by diabetes, obesity or cholesterol by controlling the diet of people with health problems [6]; Another case is that presented by [7], which focuses on the use of agent technology to support human autonomy in recovery and improvement of cognitive and motor abilities.

As in the previous cases, there are other topics of interest in the health field, such as mental health in a specific sector of the population, that of the elderly. As a precedent, the aging process in them leads to a decrease in learning and memory, to the appearance of diseases such as depression and changes in attitude or lack of motivation, as well as loneliness and isolation [8]. It is worth mentioning that, somehow, little by little, the technological advance was isolating them, provoking negative behavior or suffering and diseases. Now, you can create an overview of the proposal that is the subject of this article, present a model based on agents that allows the detection of the patterns that make up the behavior of older adults, who have been influenced by the use of new technologies of Information and communication, supported by agent technology, the captured data can be analyzed to identify the factors that affect it at that moment and generate a particular behavior.

3 State of the Art

3.1 Agents

For the conceptualization of the agent, you can find descriptions in different bibliographies, such as the following one where you define it as anything capable of perceiving your environment based on sensors and acting in the same environment; makes decisions at a given moment based on the perceptions they have at that moment [9]; an agent is a software component that has autonomy and behaves like a human agent, working for some clients in, searching from their perspective, solving a certain problem. In a multi-agent system, agents may decide to cooperate for mutual benefit or compete to serve their interests; they are autonomous, social and reactive [10].

The term perception, applied in the context of agents, is used to indicate that they receive inputs at any moment, that is, it provides information to the agents about the environment where they live. Russell and Norvig et al. [9], indicates that perception originates in the environment through sensors that capture some aspect of it and is converted into an input for the agent itself to diagnose factors based on their decision.

3.2 Agent Based Model

A model can be visualized as a theoretical scheme of a system or a complex reality that is elaborated to facilitate its understanding and the study of its behavior [11]. On the other hand, simulation consists in representing something, pretending or imitating what it is not [12]. As for computer simulation, it is a part of modeling that tries to find analytical solutions where the prediction of behavior is allowed from parameters and conditions [13].

The modeling and simulation of complex systems from the point of view of the complexity sciences is focused on addressing the emergence of properties from the interaction between a large number of agents [14], the major advances of these systems are focused on Mathematics and computation, it should be mentioned that modeling and simulation from the perspective of thought, are known as artificial societies or agent-based modeling, as [14] cites [15].

The agent-based models (MBA) belong to a movement of social simulation, constitute an artificial society [16] composed of autonomous decision-making entities called agents [17], act in a self and sufficient manner in their environment to meet the objectives of its design [18]. MBA are identified by the following four assumptions: autonomy, independence, obey or follow simple rules, and are adaptive [19]. In the health scenario, the multi-agent system can have different roles to improve the physical and mental state of patients [20], due to their ability to react to situations detected in their environment.

3.3 Older Adults

As we age, our body undergoes various changes in its form, psychological and social functioning, which are generated by age-specific changes and accumulated wear. During the normal aging process, the speed of learning and memory decrease.

This deterioration is caused by disuse, disease, behavioral factors, psychological factors and social factors, rather than by aging itself [8].

The social environment that surrounds older adults has changed aggressively in recent decades. Technological advances have caused a radical change in the forms of production, dissemination, and acquisition of knowledge, [21]. Even, the forms of communication have changed influenced by these advances.

There are studies that reveal that a large percentage of this population needs help to carry out processes that were born in order to simplify and not complicate; in the absence of someone to support them, they are postponed by society [22], they can be affected by various factors that impair physical and mental health, they can be classified as risk factors and protective factors.

There are some characteristics that generate greater vulnerability in individuals, being potentially influential and/or favorable to provoke a behavior, they are called risk factors; On the other hand, there are characteristics that counteract the effects of risk factors, discouraging or preventing the appearance of problems, which have been called protective factors [23].

For the proposal, social isolation, fear, passivity, depression, low self-esteem, cognitive deterioration is observed as risk factors. On the other hand, the protective factors that can support the change in the physical and mental health of the elderly include motivation, better communication, greater social contact, mental activation, sense of belonging, and feeling useful.

A group of professors from the Faculty of Accounting and Administration, designed a course aimed at older adults, in which the activities are focused on students know the information and communication technologies (ICT). The course focuses on understanding the general concepts of computing, practicing with the different Windows accessories, preparing Word documents and using the Internet to make inquiries and communicate via email.

4 Modeling the Pattern of Behavior in Older Adults

Represent the real world through a model, simulate an artificial environment based on rules to obtain results and define actions, and in this case, through modeling and simulation of a school environment is intended to achieve the detection of behavior patterns in older adults.

4.1 Definition of the Agents of the Model

In the context of older adults in the classroom, the proposed model is composed of the following agents:

- AdultAgent represents the Elderly, who has different attitudes identified as protective factors and risk factors, required to determine the action to be followed.
- DetectorAgent, this agent personifies the Instructor, whose activity consists of detecting the risk factors and protective factors to assign the appropriate content, generating the one that will be stored in their knowledge base.

- ContentActivitiesAgent, represents the Activities and Content agent is responsible for receiving the content request, performs the search in the content and activities database to deliver it to the DetectorAgent.
- ActivityAgent receives is responsible for obtaining the requests and sending them to ContentActivitiesAgent, also, of these continually verifying the status of the environment.

4.2 Description of the Suggested Model

Agents can use their perceptions based on the extraction of characteristics, by detecting a small number of particulars in their input and send them directly to their main agent program to respond reactively to them or combine them with other information [10] to allow artificially experimenting on the system.

In this proposal, as shown in Fig. 1, it is described that from the detection of behavior patterns of older adults, who have been influenced by the use of ICT, an action will be taken through the agents. The interactions of the agents showed: AdultAgent, DetectorAgent, ContentActivitiesAgent and ActivityAgent Activity, the interactions in conjunction with the knowledge base will result in the identification of possible risk factors and increase the protective factors derived from the correlation between energy and motivation to guide the behavior of the adult.

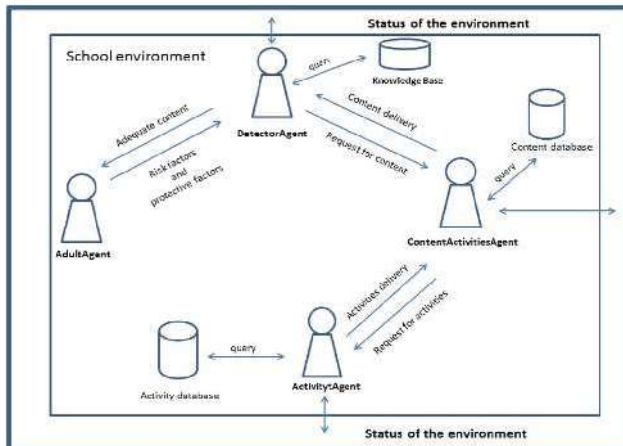


Fig. 1. Model proposal

4.3 Interaction Between Agents

Each one of the agents of the model has its activities defined, but within the environment, it is essential to establish the interactions that will be given to fulfill the objective. These interactions are listed below:

1. The AdultAgent contributes to the environment the risk factors and the protectors.
2. The Detector Agent detects risk factors and protective factors.

3. The Detector Agent consults the knowledge base and receives results.
4. The DetectorAgent, with the results obtained, makes a content request to the ContentActivitiesAgent.
5. The ContentActivitiesAgent receives the content request.
6. The ContentActivitiesAgent queries the content database, once it has the result based on the request of the DetectorAgent, it asks the ActivityAgent for the activity correlated with the content.
7. The ActivityAgent queries the activity database, once it has the result, sends the activity to ContentActivitiesAgent.
8. The ContentActivitiesAgent sends the content and activity to Detector Agent.
9. The DetectorAgent receives results and updates the knowledge base based on the correlation.
10. The DetectorAgent delivers the content, the activity to the AdultAgent, according to the factors detected in the environment.

The agents DetectorAgent, ContentActivitiesAgent and ActivityAgent updated at all times when reviewing the state of the environment in order to have a constant feedback.

5 Conclusions

The use of this systems in complex situations such as the one that is deepened can be used as tools to conceive artificial environments to act and make decisions, since the characteristics of agent technology are attractive and ideal to model and simulate in an environment where it is possible to predict, there is learning, and there is constant feedback.

The proposed aims to find solutions that allow the detection of an action based on certain rules and parameters to achieve the prediction of behavior. This model contains the interactions between the agents, the knowledge base, the database and constant feedback of the state of the environment to allow guiding the behavior of the elderly.

To be updated through courses, in this case, the designed for older adults, allows participants to know the information and communication technologies, also, to focus on establishing a communication link with the current society and enabling mental activation and the increase in a positive attitude.

With the future development will result in the identification of attitudes and possible risk factors in order to minimize them, and increase the protective factors that allow the physical and mental activation derived from the correlation between energy and motivation, guiding the behavior of the older adult towards a better integration with society, an improvement in health.

6 Future Works

The presented work is a proposal designed to detect patterns of behavior. The future works contemplated include the formalization of each of the agents to understand their properties, represent beliefs, desires and intentions of the agents, define the tuples of the agents, implement the knowledge base based on fuzzy logic Type 1 and Type 2 and define the rules of fuzzy inference.

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