Intelligent Assistive Technology: The Present and the Future

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Abstract. Recent advances in two areas of computer science—wireless sensor networks and AI inference strategies—have made it possible to envision a wide range of technologies that can improve the lives of people with physical, cognitive, and/or psycho-social impairments. To be effective, these systems must perform extensive user modeling in order to adapt to the changing needs and capabilities of their users. This invited talk provides a survey of current projects aimed at the development of intelligent assistive technology and describes further design challenges and opportunities.

Keywords: Assistive technology.

1 Intelligent Assistive Technology

The world's population is rapidly aging: by 2050, the percentage of people worldwide over the age of 60 is expected to double (to 21.4%), and the percentage of those over the age of 85 will quadruple (to 4.2%) [1]. While many adults will remain healthy and active for their whole lives, older adults have higher rates of disabilities—physical, cognitive, and/or psycho-social—than do younger people. There has thus been growing interest in developing assistive technology that can help older adults and others with impairments to remain more autonomous for longer periods of time. Recent advances in two areas of computer science—wireless sensor networks and AI inference strategies—have been particularly important in the development of such technology. This talk surveys intelligent assistive technology, focusing on technology targeted to people with cognitive impairment. Such systems must perform extensive user modeling to adapt to their users' changing needs and abilities, and the hope is that UM researchers will be interested in contributing to their design.

In general, current assistive technology for cognition (ATC) has three main goals: providing *assurance* to a user and her caregiver of her safety and well-being; helping a user *compensate* for her impairment; and/or providing continual *assessment* of a user's level of functioning. To achieve these goals, most ATC systems use sensors to monitor a user and obtain information about her location, level of activity, performance of daily activities, etc. Because the information provided by such sensors is noisy, methods of reasoning under uncertainty, such as Hidden Markov Models or Dynamic Bayes Nets are employed to interpret the sensor data. Examples of this work include [2,3,4].

C. Conati, K. McCoy, and G. Paliouras (Eds.): UM 2007, LNAI 4511, pp. 5–6, 2007.

Sensed information can be used in assurance systems, to provide alerts when deviations from normal patterns of activity are detected (e.g., [5]), or it can be subject to further analysis and inference within compensation or assessment systems. The former assist people in navigating, managing a daily schedule, completing multi-step tasks, locating objects, and so on. Examples include Autominder [6], which uses AI planning technology to track the activities that a user is expected to perform, and then uses machine learning to induce strategies for interacting with a user when the expected activities have not been performed on time, and Coach [7], which models plan-tracking and reminding as a Markov Decision Process. Less work has been done to date on assessment systems, but an interesting example uses variations in walking speed as an early indicator of potential cognitive decline [8].

Obviously, this is just an extremely brief introduction, highlighting a handful of systems as illustration of ATC. More complete surveys can be found in [9,10].

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