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Guest Editorial

Quality of Life Technology: Intelligent Systems for Better Living

This special issue presents selected papers on the Quality of Life Technology (QoLT). We define QoLT as intelligent systems that augment body and mind for self-determination for older adults and people with disabilities.[1] Ways to support people's ability to live independently are increasingly demanded throughout the world as demographics shift to an older society and the prevalence of disability increases. Creating and focusing technology to address quality of life concerns is a timely challenge for scientists, engineers, clinicians and society as a whole.

The topics covered included:

- Aging and Disability Services
- Human Awareness Technology
- Mobility Aids
- Assistive Robotics
- Human Activity Modeling
- Human-System Interaction
- Safe Driving Technology
- Privacy Issues

We have selected eight papers for this special issue.

The first paper, "Preferences and concerns for quality of life technology among older adults and persons with disabilities: National survey results" by Judith Matthews et al., reports on the results of a national, web-based survey of 1,610 adults with and without disability. The authors describe four families of engineered systems that could provide cognitive and physical support for personal and instrumental activities of daily living. They conclude that quality of life technology holds promise for helping adults with a wide variety of diagnoses and disabilities to deal with personal care, home management, and driving on their own.

The second paper, "Recognizing household activities from human motion using active learning and feature selection" by Liyue Zhao, Xi Wang and Gita Sukthankar, presents two techniques for improving the supervised classification of human activities from motion data. Namely, an active learning approach is used to improve sample efficiency, and intelligent feature selection to reduce training time. The authors showed that their conditional random fields (CRFs) method outperforms standard classifiers (K-NN, HMMs, and Bayesian networks), as well as SVMs trained with the raw features and SVMs with temporal filtering. These advances should facilitate the usage of human motion data in future home living assistance systems.

The third paper, "Towards automated models of activities of daily life" by Michael Beetz et al., describes automated probabilistic models of everyday activities (AM-EvA) for the perception, interpretation, and analysis of everyday manipulation tasks and activities of daily life. The authors present an integrated system for observing, analyzing and interpreting complex human activities at different levels of abstraction. A knowledge-based framework integrates methods for for human motion tracking, learning continuous motion models, motion segmentation and abstraction, and probabilistic reasoning. The authors' aim is that AM-EvA can help with the analysis of human action to assess their level of independence and to diagnose potential impairments.

[1] National Science Foundation Engineering Research Center on Quality of Life Technology Document, Carnegie Mellon and University of Pittsburgh, 2009.

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The forth paper, "Lessons learned designing multimodal ecological momentary assessment tools" by Brian French et al., contributes a set of design principles that can be applied for the development of real-time, mobile interview systems and an evaluation of Keystroke-Level Models (KLM) for six proposed input/output interaction modalities and platform combinations. The KLM predictions were within 3% to 20% of mean interaction times from 58 participants and 1608 complete questionnaires using six different modalities. The authors have extensively explored the use of multi-media platforms to answer questions about stress. In one experiment, 30 participants used different platforms. Each interview consisted of a series of stress-related questions, approximately 200 seconds in length, answered every 45 minutes. User input was collected through buttons and gestures. Outputs were either audio or video. Different platforms supporting the various input/output modalities, were evaluated. Retrospectively, they evaluated the various input/output modalities using "CogTool" – a tool used at CMU to evaluate user computer interactions. Once a screen mockup has been created, a designer can demonstrate the steps of a particular task by directly interacting with the series of screens that represent the user progressing through a task. As the demonstration proceeds, CogTool builds a model of the task that translated into a KLM-like language called ACT-Simple. A performance prediction and detailed trace of modelled behavior is produced. The CogTool simulation predicted user interaction time, typically within 10% of the actual measured human subject time. Surprisingly users were more efficient using buttons to respond rather than gestures, even though using buttons required both hands.

The fifth paper, "Seating virtual coach: A smart reminder for power wheelchair seat function usage" by Hsin-Yi Liu et al., describes the Seating Coach project helping power wheelchair users reduce the risk of chronic pressure sores by comparing auxiliary seating function use against a prescription of positions and their durations as established by a physical therapist. It can aid clinicians in tracking results from training and reinforces proper technique to reduce the incidence of injuries caused by improper power wheelchair use. A Wizard of Oz experiment was conducted where users made selections from a variety of feedback modalities and preferences to create a user interface. As an intelligent system, the Seating Coach can guide power wheelchair users in achieving clinician established goals for body positioning. It provides basic capabilities that can be used by the other QoLT systems, such as interacting with the user in a manner appropriate to their capabilities, inferring user capabilities from the data, indicating user compliance, and creating reminders to do past due activities. The results of a user study are presented. For example, speech was the most frequently selected modality for the reminding theme (23%) and beeping was the most frequently selected modality for the warning theme (24%).

The sixth paper, "Interaction between teachers and students with intellectual disability during computer-based activities: The role of human mediation" by Karen Bunning, Becky Heath and Andy Minnion, explores the role of human mediation in student use of information and communication technology (ICT) in the special needs classroom. The teaching staff dominated the ongoing communication, with a high proportion of their acts comprising 'initiating' moves and 'requestive' functions, as to attract attention and to trigger object action. A correspondence between the different turn types used by teachers (as defined by move and function) and the performance behavior of students was identified. The engagement and learning of people with intellectual disability is dependent, in part, on the facilitation strategies invoked by the teacher.

The seventh paper, "The value and acceptance of citizen science to promote transit accessibility" by Aaron Steinfeld et al., proposes that citizen science methods can engage riders with disabilities and others in improving public transportation accessibility by documenting and assessing problems and appropriate solutions throughout the system. The authors describe their findings on how riders prefer to report such observations through an experiment designed to compare the modalities of the Notes (text, audio) and Media (none, photo, video). The results from two user groups, those without disabilities and those using wheeled mobility devices, claim that text with photo should be supported and that use of video may not have additional value to end users.

The eight paper, "Lessons for the United States from countries adapting to the consequences of aging populations" by Mark Sciegaj and Richard Behr, reports on trends in nine counties that are responding to the consequences of an aging population and presents some lessons that are applicable to the United States. The authors report on three areas: presence of demographic transition, elder economic security, and provision of elder health and long-term care.

We would like to thank the authors of all submitted papers and the reviewers for their effort and contributions to this special issue, which will represent a

milestone in the evolution of quality of life technology. In particular, we would like to thank professors Cliff Brubaker, Rory Cooper and Takeo Kanade for their help and support throughout this project.

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