Harnessing Technology for Aging-in-Place
John K. Friesen Conference
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Panos Nasiopoulos

- PPFH lead investigator
- Director of ICICS
- Dolby Professorship in Digital Multimedia
- Director of the Master of Software Systems program
- Formerly CTO and then President and CEO of Daikin US
  - inventor of all software components of DVD technology
• Rethinking Sustainability:
  – Sustainability should enhance the well being of Canadians
  – Abrupt behavioural modification is not the solution
Key to Realization

• Develop new technologies that are
  – User-friendly across multiple generations
  – Affordable
  – Allow for seamless transition as technologies evolve and users age
Benefits to Canada and Beyond

- The resulting solutions will be transferable to different types of
  - Dwellings: houses and apartments
  - Business environments: offices and retail
- Complements UBC's "Campus as a living lab" initiative
An ICICS – TELUS Initiative

• Institute for Computing, Information and Cognitive Systems at UBC
  – Facilitates collaborative, multidisciplinary research among roughly 200 faculty and 1000 graduate students in the faculties of Applied Science, Arts, Commerce, Education, Forestry, Medicine and Science at UBC
An ICICS – TELUS Initiative

• TELUS
  – A leading, telecommunications company in Canada providing a wide range of communications products and services
  – TELUS, team members and retirees have contributed $211m to charitable and not-for-profit organizations and volunteered 3.7m hours of service to local communities since 2000
Project Engagement Model

ICICS – TELUS Initiative

Sierra Wireless
Guard RFID

NZ Technologies
Qualcomm & LG
The Team

- 24 professors and 37 graduate students
  - Electrical and Computer Engineering
  - Computer Science
  - Medicine
• Meanwhile: reconfigurable demonstration lab in ICICS building
Some PPFH Themes

- Communications / Sensing
- Energy Management
- Health & Wellness
- Home Operations, Digital Media
Research Themes

• Communications / Sensing
(1) Interference Management for Femtocells in Smart Home
(2) Multimedia Content Delivery using Millimeter Wave (mm-wave) in Smart Home Networks
Research Themes

• Energy Management
Non-Intrusive Load Monitoring

Intrusive

- Insert monitor between appliance and wall plug

- Expensive
- Inconvenient
- Unreliable

Solution!
Why Load Monitoring?

Allows us to sense information about how a building uses energy and to communicate this valuable information to those who need it.

People friendly:
- Inexpensive and convenient
- Empowers people by helping them understand their energy use

Planet friendly:
- Helps people reduce overall energy consumption
- Provides researchers with information needed to design more sustainable buildings and appliances
Wireless data and Power Transfer

- **Radiative versus Inductive Coupling:**

  - **Long range**
  - Suitable for data transfer
  - Poor power transfer efficiency

  - **Short range**
  - Suitable for both data and power transfer
Energy-Efficient Power Transfer

- **Inductive Coupling:**

Witricity wireless power over distance concept
Research Themes

• Health and Wellness
Activity Recognition

- Image sequence
- Feature extraction
- Pose, action and object estimation
Food Item Recognition

- Diet support system with smart phone / fridge

Proposed feature learning framework

Food image → Superpixels segmentation → K-RBM based unsupervised feature learning → Pairwise feature vector → SVM Classification
Testing and validation experiment

- Accurately estimate heart-rate (even with head movements)
- Improved accuracy and robustness compared to existing alternatives
Smart Wheelchair

- Trials in local long-term care facilities with cognitively impaired older adults
- Try to understand
  - What user interface allows for intuitive shared motion control?
  - What sensors and algorithms are needed to support shared control?

RGBD camera (front facing)
RGBD camera (back facing)
face webcam
wheelchair joystick
galvanic skin response sensor
Wiimote (accelerometer)
Odometers
laser rangefinder
Smart Wheelchair Goals

- Adaptive levels of support based on evolving user capabilities and desires
- Inexpensive, unobtrusive modifications to existing mobility platforms

Where's the Kinect?
Research Themes

Home Operations, Digital Media & Quality of Experience
Situation, Environment & Context

SOME INTERESTING FINDINGS:

- Creativity
- Recycling symbol
Social Presence

PHYSICAL PRESENCE

IMPLIED PRESENCE
High Dynamic Range Video Eye Tracking Dataset

Data collected from eye tracking study. (a) Frames from sequence *playground*, (b) fixation density maps.
Thank you