Multimodal Interaction

Introduction

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Indian Institute of Science
CPDM

- More than 100 years old
- initiated iit, nit and iiser systems in india
- Only Indian university in the top 100 ranking
- Only Indian university in the top 10 small (<5k students) universities
- Centre for product design and manufacturing
  - Oldest design school in India
  - Pioneered in design research
  - Set up incubation centre for productization
Instructor’s bio

- Assistant Professor at Indian Institute of Science

- Senior Researcher at Cambridge University (2010 - 16)
  - Worked with Technicolor, BT, BAE Systems, JLR

- Vice Chairman at ITU-T FG Smart TV and WG Coordinator at ITU –T FGAVA (2011 – 2013)

- PhD form Cambridge University (2006 – 2010)

Early computer - ENIAC

IBM PC – 1980s
Approx. time line (from Prof. B. Myers)

Present status

Integration of TV and mobile devices

Gesture control and speech recognition (e.g., Microsoft's Kinect)

Smart Remote Controls

Second screen: Tablet PCs
What we get

What we get – usability evaluation
Aim of the course

• Basic knowledge of multimodal interaction
• Exposure to state-of-the-art eye gaze, hand, head, finger movement and EEG trackers
• Developing new input modalities tracking eye gaze, hand, finger, head movement of users
• Multimodal fusion algorithms
• Validating new input modality
• Data analytics relevant to multimodal interaction

Course structure – Day 1

• Introduction to Multimodal Interaction
• Why Multimodal – A case study of developing multimodal framework from EU GUIDE project
• Hand / Finger movement tracking technologies
• Demonstration of Hand / Finger movement tracking
  ------Lunch Break-----------
• Setting up computers for software development
• Software development using MS Kinect and LeapMotion
Course structure – Day 2

• Basics of Signal Processing and Multimodal Fusion Techniques
• Introduction to Eye Gaze and Head Movement Tracking
• Demonstration of Eye Gaze and Head Movement Tracking

--------Lunch Break----------

• Software Development using Tobii EyeX to control a pointer on a graphical user interface
• Introduction to direct voice input and Microsoft Speech SDK

Course structure – Day 3

• Introduction to Brain Computer Interface
• Demonstration of Emotiv Insight Dry Electrode EEG Tracker
• Experiment design and data analytics for validating Multimodal Interaction

--------Lunch Break----------

• Developing a multimodal program for pointer control tracking both eye gaze and finger movement
• Mock user study and data analytics
• Conclusion
What is Multimodal Interaction

• More than one input or output modalities

• Combining more than one modalities together into a single input
  • Mouse plus Eye Gaze movement

• Rendering output in more than one modality
  • Screen plus Spoken Text

Applications

• Gaming Consoles

• Information Visualization

• Automotive Environment

• Aviation Environment

• Assistive Technology
Advantages over unimodal systems

• Easier to use; Less training
• Robust, flexible
• Preferred by users
• Faster, more efficient
• Supports new functionality
• Applies to many different environments and form factors that challenge GUI, especially mobile ones

Challenges

• Mismatch in latencies
• Different ranges of (in)accuracies of sensors
• Simultaneous input – setting precedence
• Quality of multimodal input or output