

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



I³D Lab

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The Intelligent Inclusive Interaction Design (I³D) Lab undertakes research in the field of human computer interaction, intelligent user interfaces and inclusive design. Being sponsored and student projects considered new interaction techniques for people with different range of abilities, automotive and military aviation environments. Previous research explored user modelling for people with wide range of abilities and developing new interactive systems involving eye gaze, head, hand and finger movement trackers. Present Projects include

1. IITAH, DST SERB Early Career Fellowship, Gov of India (2017-2020)
2. Reducing pilots' cognitive load by facilitating human machine interaction in military aviation environment by **Aerospatial Research and Development Board, MoD, India** (2017-2019)
3. A Smart Manufacturing Test Bed for Biomedical Devices by **Robert Bosch Centre for Cyber-Physical Systems** (2018-2023)

We have got a Best Paper Award at IEEE International Conference on Control, Instrumentation, Communication & Computational Technologies (ICCICCT-2016)

Useful Links

[I3D Course Lecture Notes](#)

[Geo-Tagging Forms](#)

[Download Embedded Simulator](#)

[Students' Handbook](#)

[How to write good research paper and give good research talk](#)

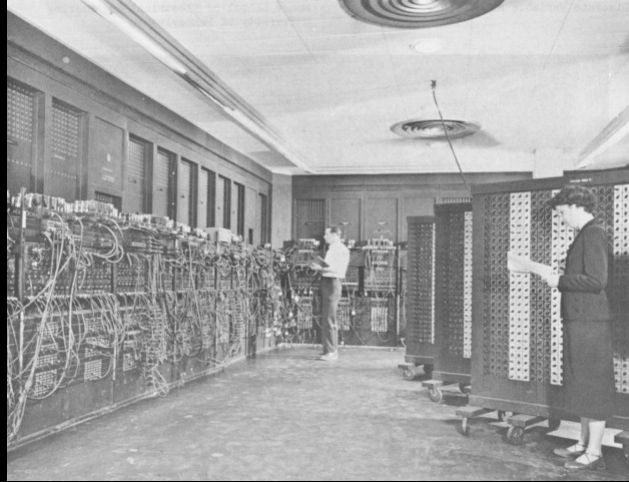
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Instructor's bio

- 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)
- MTech from IIT Kgp (2004 – 2006)

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Early computer - ENIAC



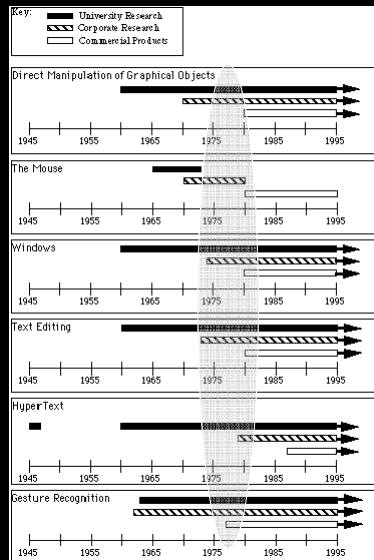
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IBM PC – 1980s



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Approx. time line (from Prof. B. Myers)



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Present status



Integration of TV and mobile devices



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



Smart Remote Controls



Second screen: Tablet PCs

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What we get



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What we get – usability evaluation



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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

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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

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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

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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

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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

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Applications

- Gaming Consoles
- Information Visualization
- Automotive Environment
- Aviation Environment
- Assistive Technology

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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

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Challenges

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

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