Enhanced Gaze Interaction Using Simple Head Gestures

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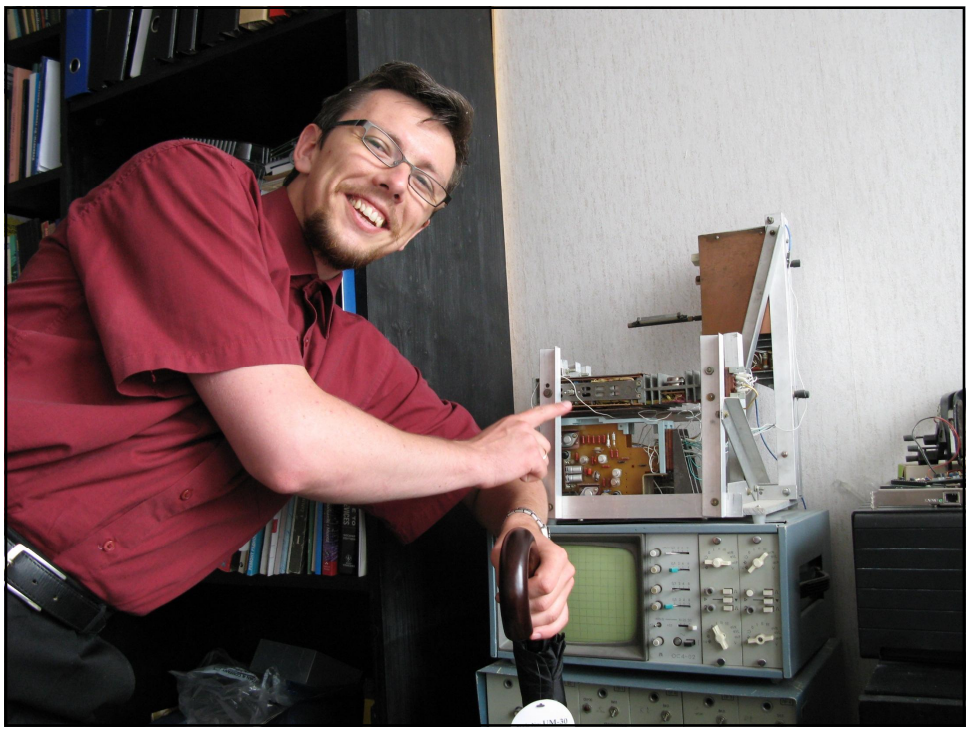

Contents

- Introduction
  - Motivation
  - Related work
- Head gesture detection
- Experiment
  - Method
  - Results
- Conclusion
- Future work

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Introduction: Motivation

- Alternative selection method
  - Simple fix for the Midas gaze problem
  - Allows keeping the gaze fixed on target
  - Fairly quick
- Useful for multimodal applications
  - Fairly easy and natural for mainstream apps
  - Can be implemented by gaze tracker alone

Introduction: Related Work

- Lin et al. 2007; Tan and Rong 2005
  - Different hardware for gaze and head detection
- Mardanbegi, Hansen, and Pederson, 2012. Eye-based head gestures. *Proc. ETRA '12*
  - Similar idea
  - Different implementation
    - Head-mounted vs remote tracker
    - Different algorithm and data handling and method for head gesture detection

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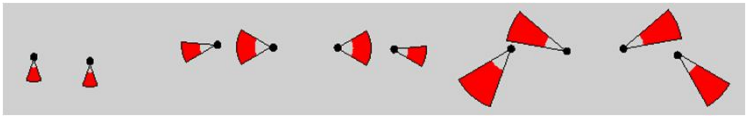
Head gesture detection (1/2)

- Head gestures to be detected (& potential action)
  - Nod (select)
  - turn left, turn right (navigate left/right)
  - Tilt left, tilt right (mode switching)
- Exploit EPcw (Eye Position in camera view)
- Range-based algorithm
  - Search for EP_{CW} patterns of movements within set direction, amplitude & duration

Head gesture detection (2/2)

- Each gesture is defined by EPcw movement
  - Angle & amplitude within certain time interval
- Actual thresholds (ranges) were defined by real data recordings from a pilot study
- Note: uncontrolled body/head movements may result in false positives but those movements are typically fairly slow.
  Eye movements cause very small EPcw, no risk for confusion.



Experiment: Method

- 11 participants (6 experienced in gaze interaction with dwell, 5 novices)
- 1 session, 15-20 minutes
- Tobii T60, 1280*1024
- Practice
  - Instructed for small amplitude and high speed
  - Saw feedback on eye position
  - 2-4 trials per gesture

Experiment: Task

- Nod, turn left/right, or tilt left/right as shown by the icon (50*50 pixels)
- Icon position changed randomly in 20 locations on the screen
- One trial per gesture per location

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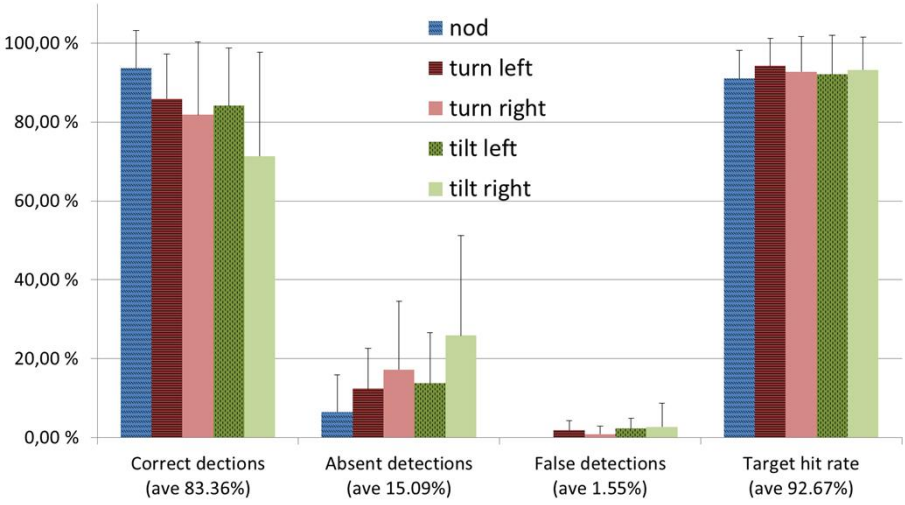
Experiment: Results (1/3)



Experiment: Results (2/3)

- Nodding was best detected
- Some participants tended to overshoot
  - May improve with practice
- The right eye was sometimes lost for right-directed gestures
  - Lighting and positioning may have an effect

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Experiment: Results (3/3)

- Participants felt it is *"probably possible"* to use nodding for frequent tasks.
- Experienced participants felt nodding could replace dwell for certain tasks.
- Participants felt other gestures could be used for occasional task, such as navigation or mode switching.

Conclusions

- Gaze pointing combined with head gestures shows high potential for hands-free interaction
- It is easy and "cheap"
  - An eye tracker can detect both
  - Possible with a fairly simple algorithm
    - Nodding detection rate: 93% (comparable with HMM)
- With reasonable results
  - Nodding could replace dwell-time selection
    - If dwell > 700 ms

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Future work

- Compare with dwell time
- Improve the algorithm (amplitude and interval) to better suit each user
- Study its applicability in different contexts
  - Potentially useful in more natural, transient interactions in pervasive and mobile environments

Thank you!

- Special thanks to Poika Isokoski and to members of the TAUCHI Visual Interaction research group.

- Any questions?
- Detailed, technical questions to Oleg.Spakov@uta.fi ☺