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Vision-based Gaze Estimation and its Applications

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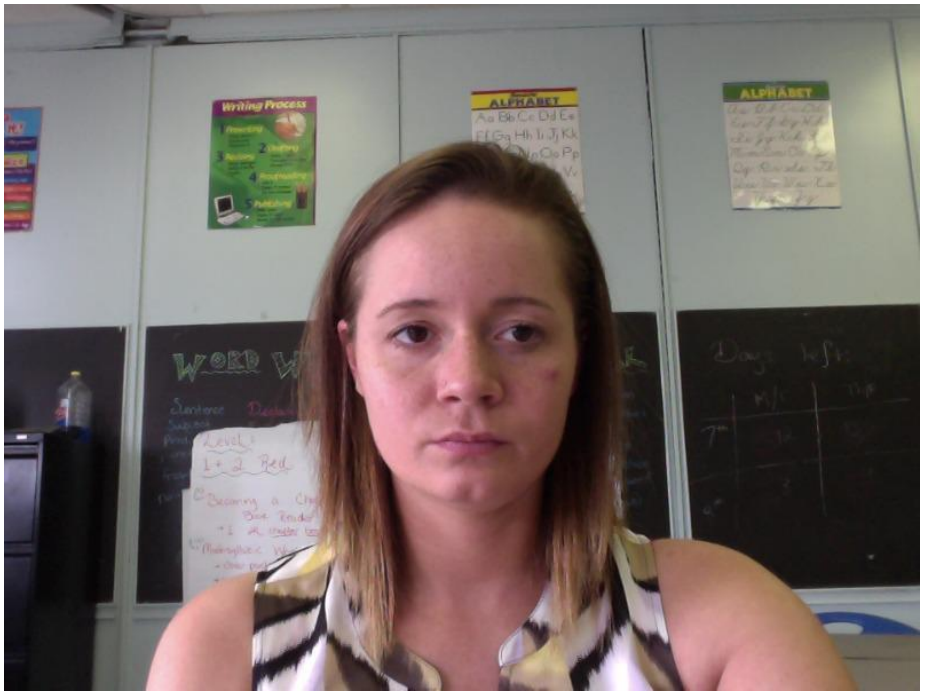
Where on the computer screen is the person looking at?



Applications

- Assistive technologies
- Marketing research
- Advanced user-machine interaction
- Entertainment, computer games, etc.

Student project in 2015 (Luka Hrabar and Ela Marušić)

Two approaches to gaze estimation

- The geometric approach
- Appearance-based approach

  (user-specific, cross-user)

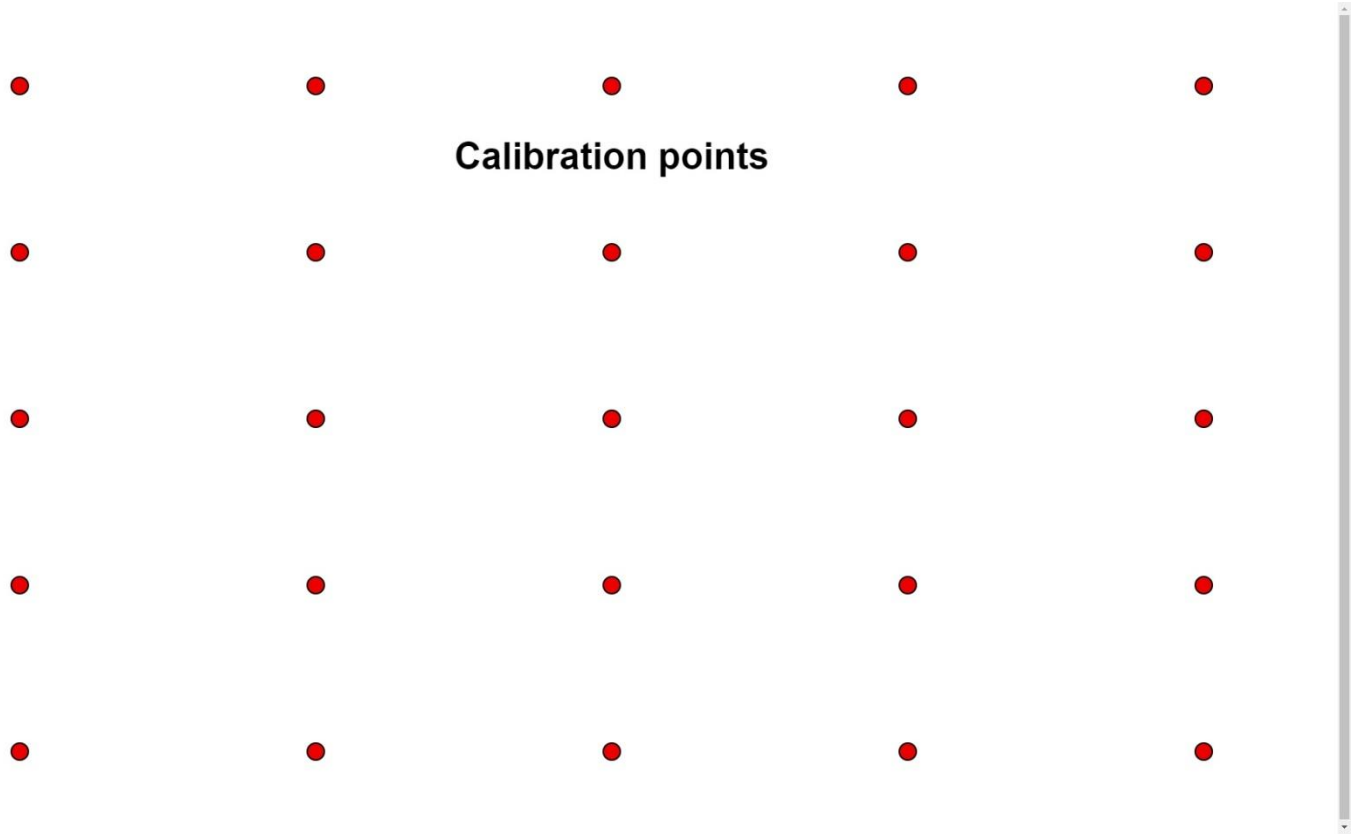
Two approaches to gaze estimation

- Gaze estimation as a regression problem
- Construct a function F such that F(E)=(x, y)
- (x, y) are on-screen gaze coordinates
- E is an eye image

Appearance-based gaze estimation

- Assumption: a training/calibration set is given
  - (eye and face images with annotated ground-truth gaze locations)
- Use **kriging for function estimation**
  - (https://en.wikipedia.org/wiki/Kriging)

How to gather calibration data



How to gather calibration data?

Geometrical methods

- Based on geometrical features of the eye such as contours, eye corners, and reflections
- Such methods potentially generalize better due to "smarter" priors
- Examples:
  - Observe the iris as an ellipse to estimate gaze direction by ellipse shape
  - Estimate the gaze direction as a vector from the eyeball center to the iris center

Some results

- Antun Aleksa, diploma thesis
- A cross-user system

Average angle errors			
Method	Average pitch error	Average yaw error	Total
Geometric method	12.1349°	6.5677°	9.3513°
Appearance-based method (BRT & SVR)	12.2037°	8.2444°	10.2241°

Conclusions

- A cross-user system can give a rough estimate of gaze directions
- Sufficient for some applications
- User-specific systems (with calibration) are potentially much more accurate
- Hardware solutions (Tobii)