vti

FINDING A BETTER WAY

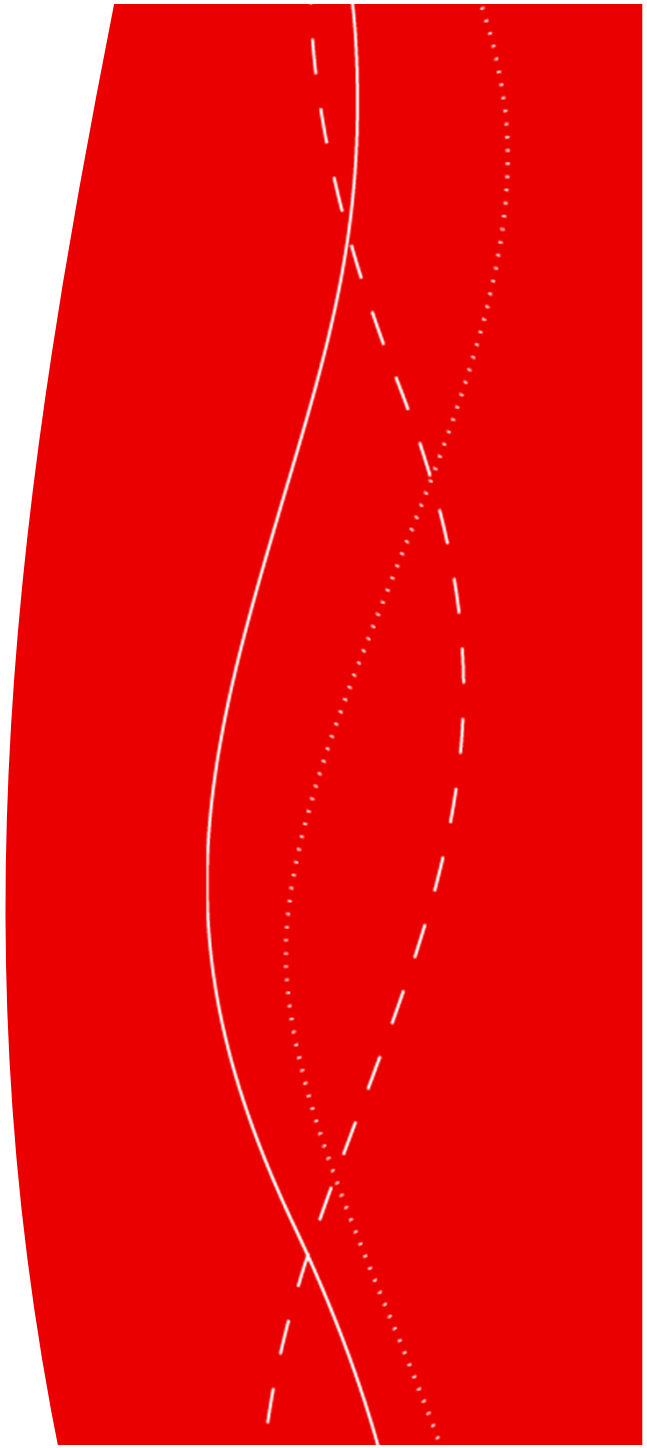
A Field Test of Eye Tracking Systems with One and Three Cameras

Christer Ahlstrom and Katja Kircher

Swedish National Road and Transport Research Institute (VTI)

Per Sörner

SmartEye AB



Introduction

- Advanced Driver Assistance Systems such as LDW and FCW are potential life savers
- Robustness, false warnings and resulting acceptance may be an issue
- Improvements can be achieved by integrating driver state information as a data source
- A key component in non-obtrusive driver state assessment is eye tracking

vti

Remote eye tracking

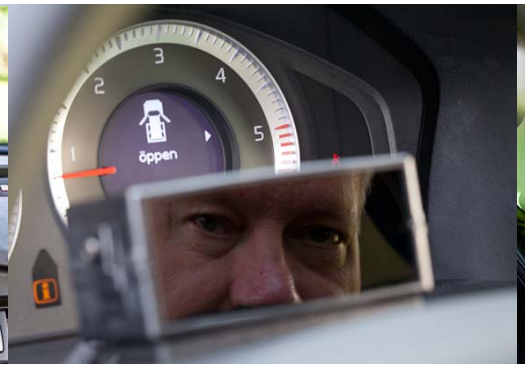
- To assess where a driver looks we need to measure his/her eye movements
- In a natualistic driving study or in everyday driving situations, the eye tracker needs to be remote
- Multi-camera systems have better performance, but …
- … the commercial use of eye trackers is limited to 1-camera systems
  - easier to fit into the cockpit
  - lower-priced
- However:
  - limited coverage -> tracking is lost for larger gaze angles
  - gaze direction assessment within a given coordinate system is not possible

vti

Aim and scope

- One-camera systems are often used in large-scale driving studies (e.g. euroFOT and SHRP2)
- We need to understand how one-camera systems perform in real-life conditions to be able to interpret the results

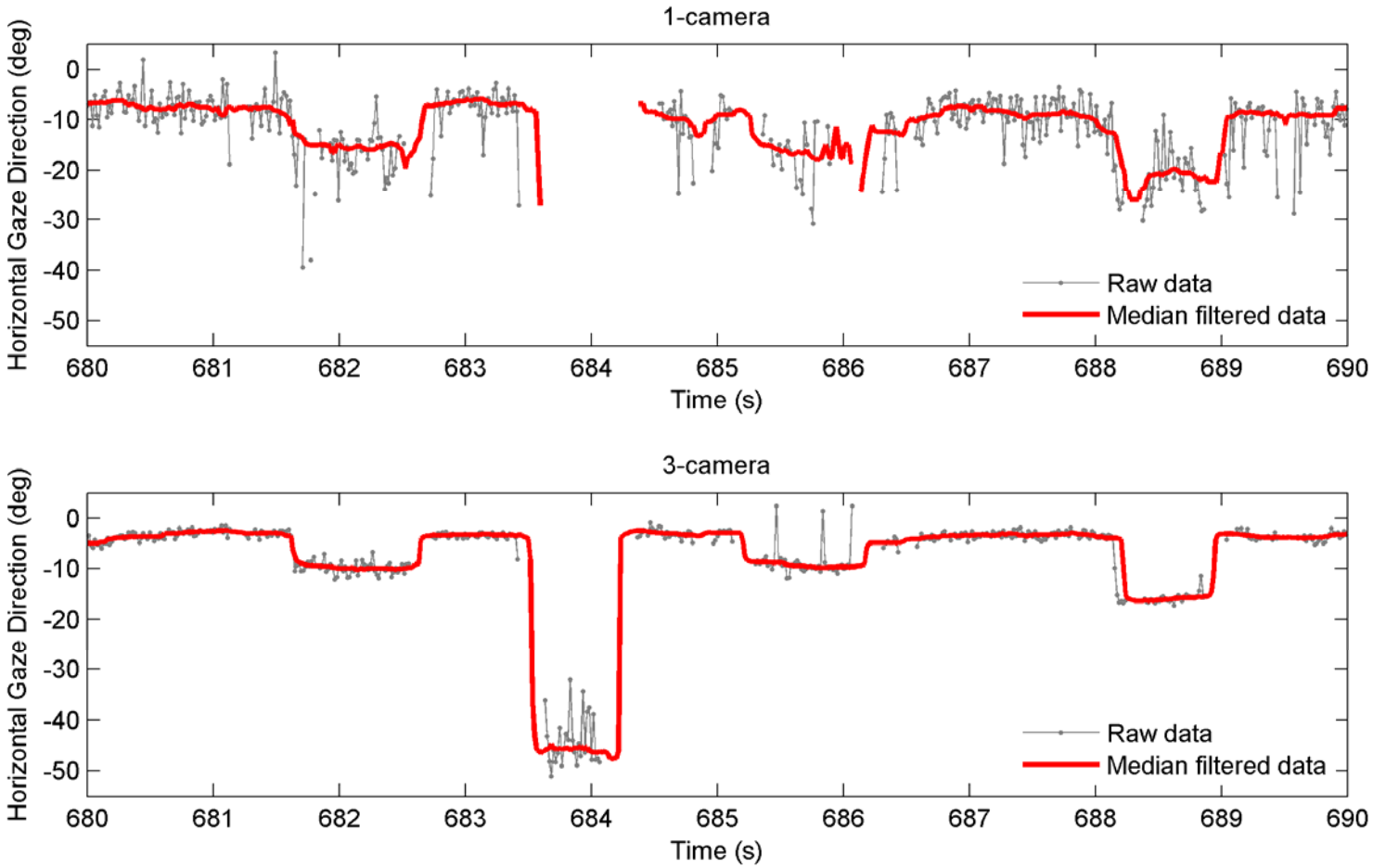
- Parallel acquisition of data from a high-end three-camera system and an embedded one-camera system intended for commercial use.
- Given the best possible prerequisites, how similar are data from the two systems?



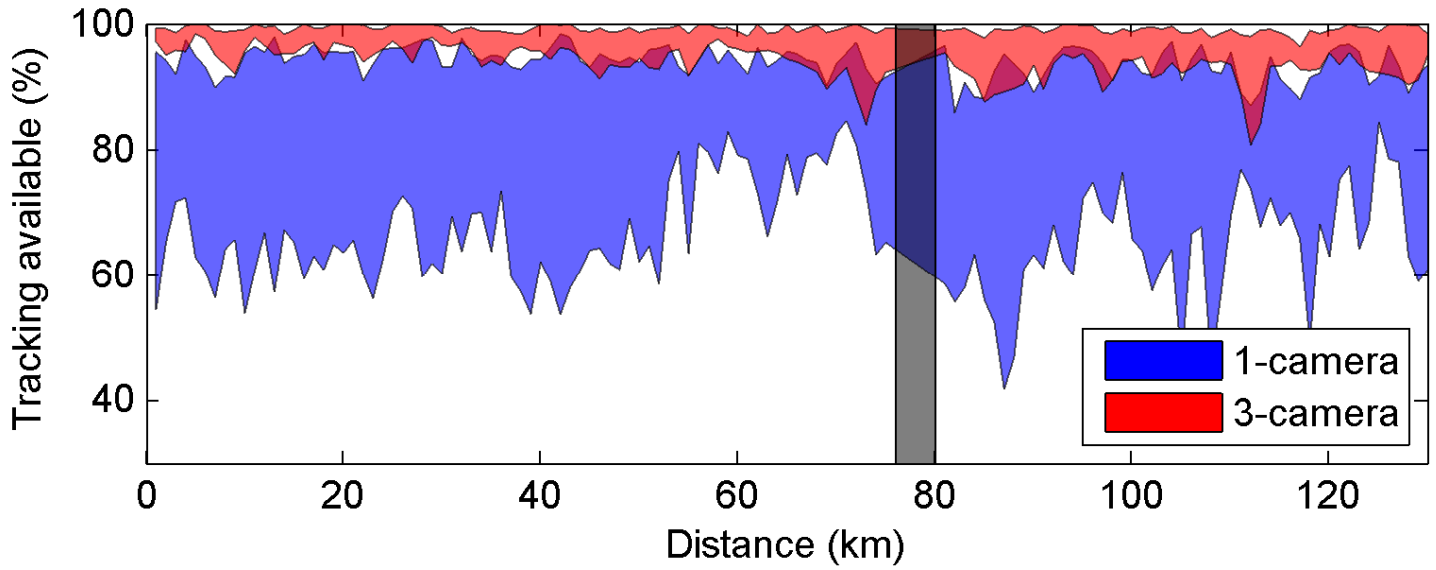
Methodology

- Eight women and ten men participated in the study, 30 – 60 years old
- 80 km section of the motorway E4
- No glasses, no make-up and no beard to avoid interference with the eye trackers
- Participants were not allowed to speak or engage in any other secondary task
- SmartEye experts set up the eye trackers before each trip

Results, example of raw data

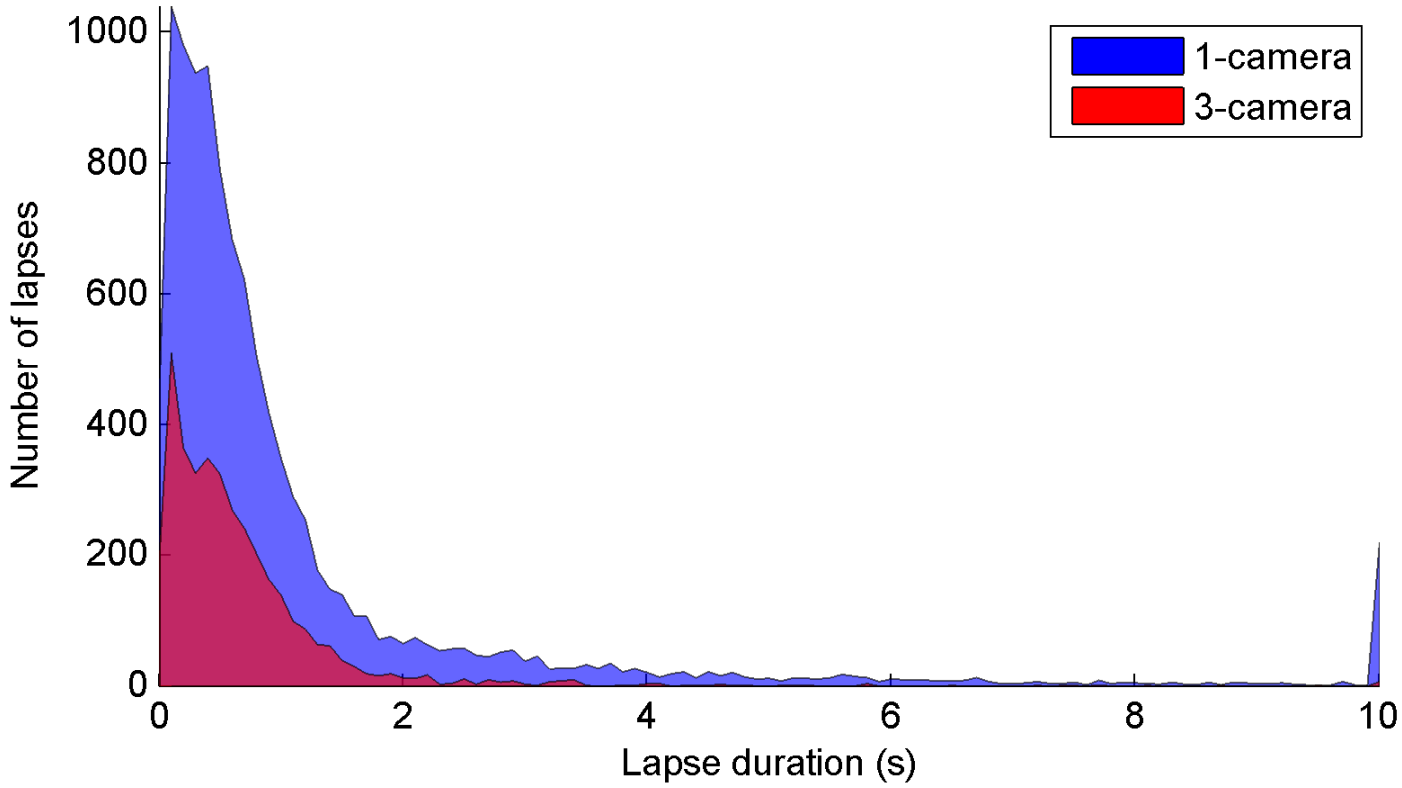


Results, available tracking



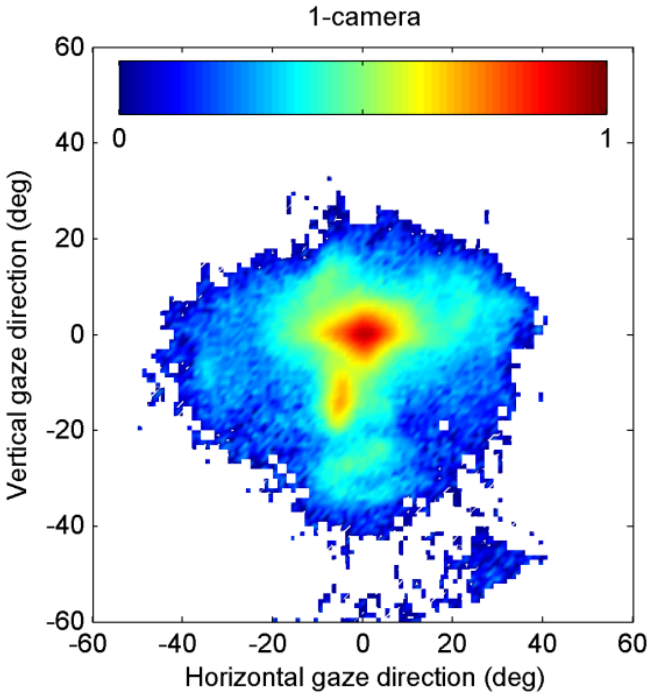
vti

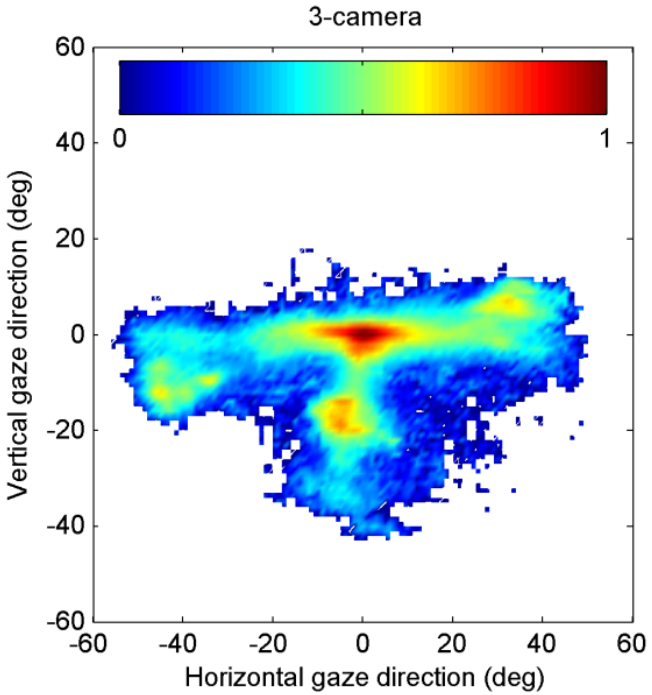
Results, missing data distribution



vti

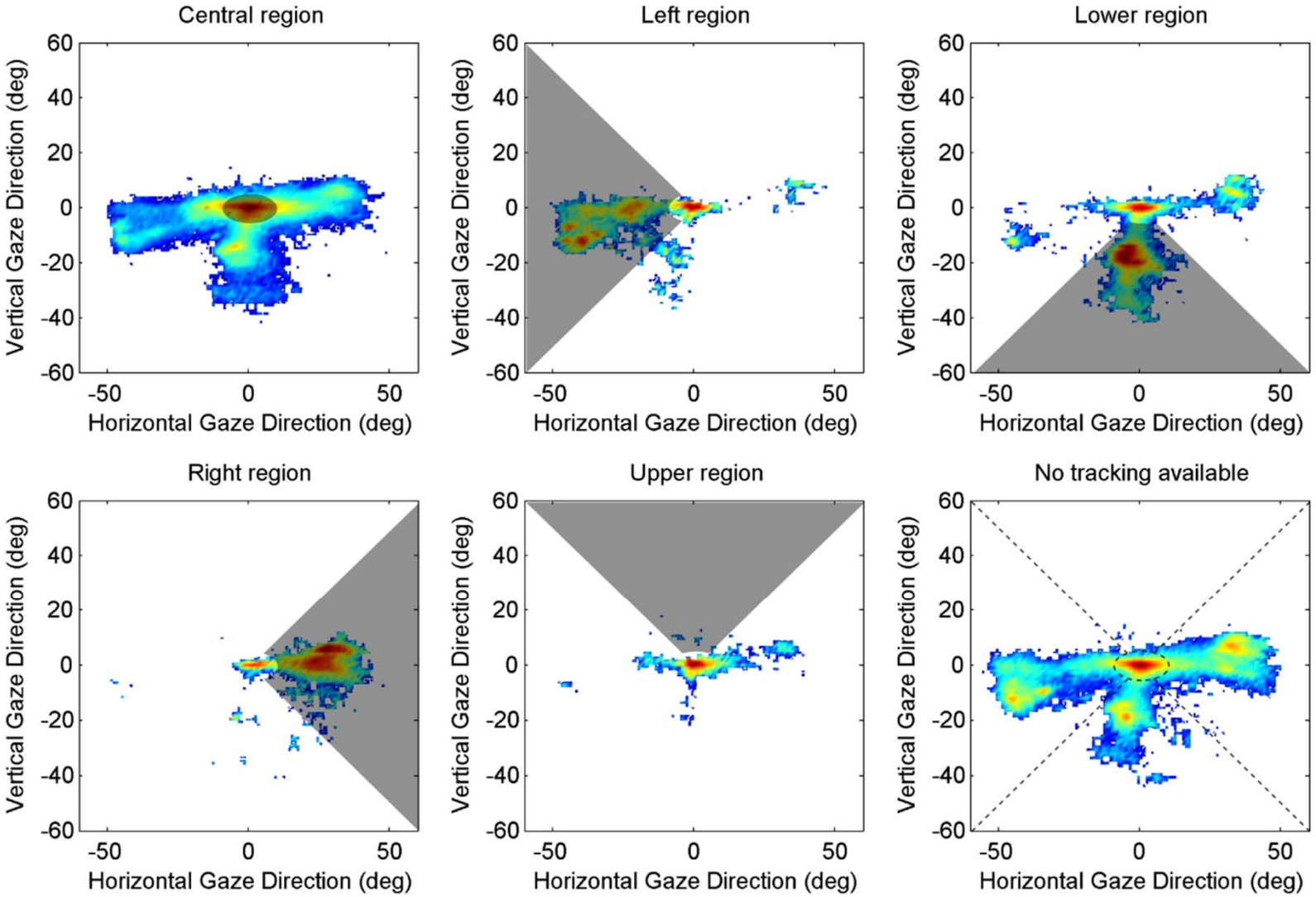
Results, data distribution





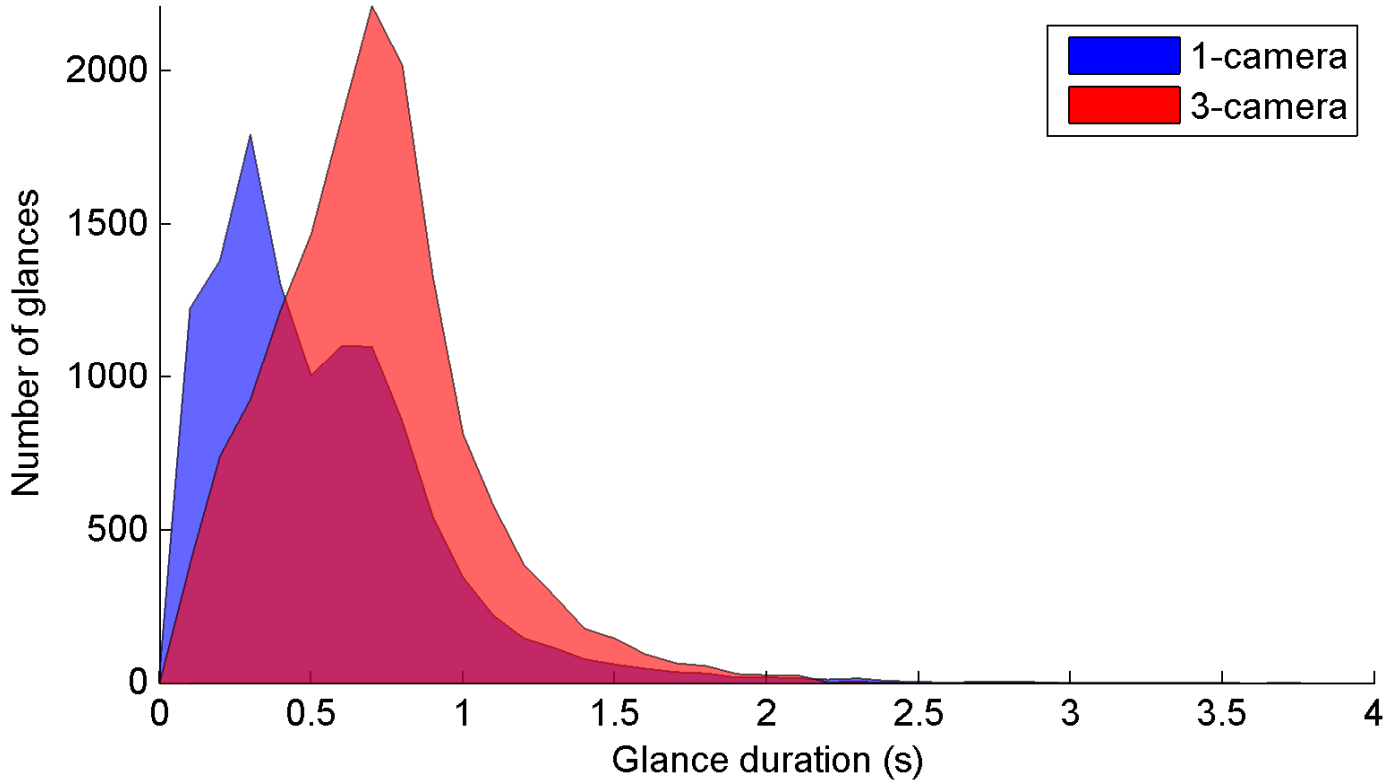
vti

Results, correspondance between systems



vti

Results, Glance duration



vti

Conclusions

- The 3-camera system shows better performance with respect to data availability, working envelope and accuracy
- Data from the 1-camera system often disagree with 3-camera data
- A big improvement for future 1-camera systems would be increased reliability and availability in the forward direction so that missing values can be interpreted as either a blink or a gaze outside the coverage of the camera with help of intelligent algorithms
- As of now, use of the 1-camera system requires special handling of lapses

Thank you for listening!

Dr. Christer Ahlstrom
christer.ahlstrom@vti.se
+46-13-204009

Dr. Katja Kircher
katja.kircher@vti.se
+46-13-204118

Per Sörner
per.sorner@smarteye.se
+46-31-606167

vti