Bavarian research & innovation

FORBIAS

Research Cooperation for Bioinspired Assistant Systems

THE ARTIFICIAL EYE: NATURE AS MODEL FOR TECHNICAL PERCEPTION

In millions of years biological systems have developed effective principles for perception and control. Providing robustness against various kinds of noise and disturbances they are superior to technical systems so far. The sensor "eye" for example achieves great success by working close together with other sensors, in particular the sense of balance and actors like the ocular motor function. Sensors and actors are coupled by the information processing in the brain. By analysing biological systems in detail FORBIAS derives new principles for designing technical applications.

Video-Oculography: The eye is illuminated with infrared light and recorded on video via a semi-permeable mirror (left). From the video images eye movement is determined (right).

Scientists of FORBIAS develop for instance a mobile measurement device for human eye movements (video-oculography) with the objective to control and stabilize a head mounted camera system: Human egomotion is already compensated in the measured gaze direction. Hence a video camera, controlled like that, achieves the same image stability as the human eye. A high performance gaze control system for the camera is therefore required. A camera, which records exactly what the human eye looks at, enables reporting in a spontaneous manner. It could serve as documentation for educational purpose, e.g. during surgeries. Psychological research can also benefit from accurate measurements of voluntary and involuntary human eye movements, e.g. for the evaluation of ergonomic design or advertising.

Another major issue in FORBIAS is the construction of a vehicle camera system taking nature as model. In order to stabilize gaze, a technical sensor is developed to record the vehicular movements, equivalent to the human sense of balance. Such a vehicle camera will enhance robustness of driver assistance systems, e.g. automatic distance control. New fields of application could be gained with the vehicle camera and further functionalities could be implemented, thus providing additional safety and comfort in future automobiles.

Spokesperson:
Prof. Dr.-Ing. Georg Färber
Technical University Munich

Managing Director:
Dipl.-Ing. Stephan Neumaier
Institute for Real-Time Computer Systems
Technical University Munich
Arcisstraße 21, 80333 München
Phone (0 89) 2 89-2 35 50
Fax (0 89) 2 89-2 35 55
E-Mail info-forbias@rcs.ei.tum.de
Internet www.abayfor.de/forbias

Representative:
Prof. Dr. med. Dr. h.c. Thomas Brandt
Neurological Clinic (Ludwig-Maximilians University Munich)

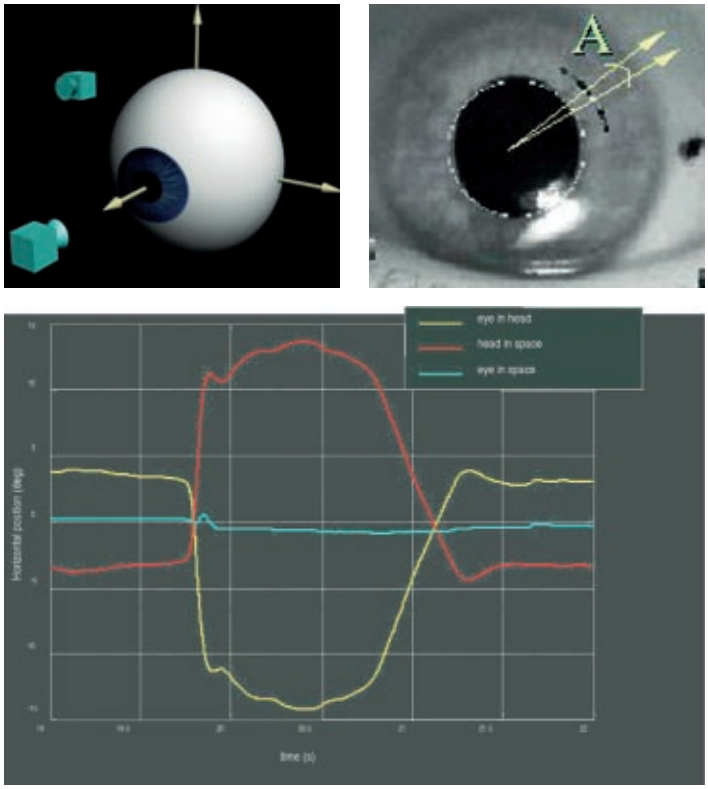
Funded by the Bavarian Research Foundation.

RESEARCH TOPICS

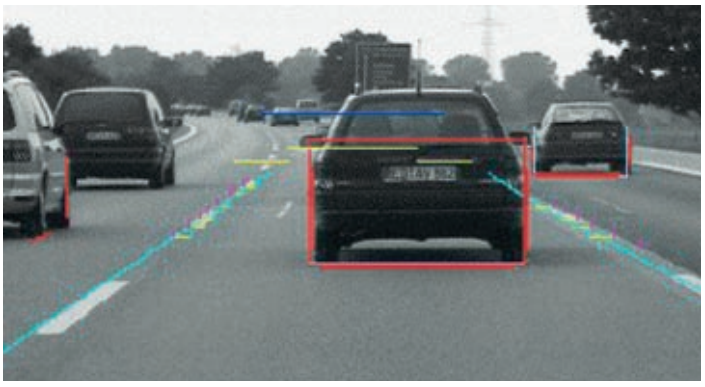
Systems: gaze controlled head mounted camera
bioinspired vehicle camera
Components: technical sensor for balance control
mobile video-oculography
gaze control unit
Application: robust interpretation of motion scenes

Cooperation:

- Technical University Munich:
  Institute for Real-Time Computer Systems
  Prof. Dr.-Ing. Georg Färber
  Institute of Ergonomics
  Prof. Dr. rer. nat. Heiner Bubb
  Institute for Applied Mechanics
  Prof. Dr.-Ing. Friedrich Pfeiffer
  Prof. Dr.-Ing. Heinz Ulbrich
- Ludwig-Maximilians University Munich:
  Neurological Clinic
  Prof. Dr. med. Dr. h.c. Thomas Brandt
  Prof. Dr. med. Ulrich Büttner
  Prof. Dr. med. Michael Strupp
  Dr.-Ing. Stefan Glasauer
  Dr.-Ing. Thomas Eggert
  Dipl.-Phys. Erich Schneider
- University of the German Federal Armed Forces, Munich:
  Prof. Dr.-Ing. Ernst Dickmanns



Schematic configuration for the gaze controlled head mounted camera (top left). Video Oculography: Detection of pupil and eye markers by image processing (top right). Plot of the position of head and eye in space during the vestibulo-ocular reflex for human gaze stabilization (bottom).



View of the vehicle camera: Detection of lane markers and cars ahead by image processing.

Industrial Partners:
Faser-Optik Henning GmbH, Allersberg; EUROCOPTER Deutschland GmbH, München; Audi AG, Ingolstadt; BMW Group, München; Siemens VDO, Regensburg; Continental TEMIC ADC, Lindau; seleon GmbH, Freiburg; 40° C Filmproduktion GmbH, München

Economic Applications:

- mobile video-oculography and head mounted camera
  - reporting, documentation
  - psychological research
- consumer head mounted camera
- video-oculography for surveillance
  - attention of driver
  - alarm call service
- low-cost sensor for balance control
- bioinspired video sensor
- robust driver assistance system
  - distance control
  - curve speed assistance
  - collision warning
  - lane keeping