Gazelle
Mobile Eye-tracking for Sports

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ABSTRACT
In collaboration with the Institute of Sport Science (IPSW) at the University of Bern, the microLab research group at the HuCE institute develops an outdoor eye-tracking system with scene overlay. Due to its field of application, system miniaturization and processing speed are the key elements of this project.

SYSTEM & FACTS
The main features of the Gazelle system include:
▶ High mobility for the use in practical sport settings
▶ Calibration-free setup due to 3D eye modeling.
▶ High frame rate for scene and eye video

EYE MOVEMENTS IN SPORTS
Currently, mobile eye-tracking systems are used in quasi-static environments, for example in studies for product marketing in the supermarkets. Moreover current eye tracking systems restrict the field of view and have a poor wearing comfort. Those facts make eye-trackers hardly usable in outdoor sport environments.

OUR CONCEPT
Eye tracking systems analyze the pupil movements and combine them with a scene image to visualize the wearer’s gaze path. The challenge in optical systems is finding the best possible camera angle with respect to the eye, without limiting the field of view. Our concept is based on safety glasses for sports, in which we integrate miniature cameras. These cameras allow a direct view on the eyes from inside of the glasses. In addition, the ambient light at visible spectrum is canceled out resulting in an increased gaze tracking stability and thus better system robustness under challenging light conditions.

REQUIREMENTS FOR A NEW SYSTEM
To be able to compare the results obtained in lab conditions to real sports situations, the cooperation project aims to develop a highly mobile eye-tracker suitable for outdoor competitive sports.
Light weight as well as compactness in addition to lower risk of injury are the core requirements to the new eye-tracking system. In addition, the athlete wearing the device should in no way be influenced by the eye-tracking system.

Figure 1: Starburst algorithm for pupil tracking

Figure 2: A mountain biker wearing a state-of-the-art third party eye-tracker which is not appropriate for sports

Figure 3: Our current Gazelle glasses prototype. The miniature cameras are fully integrated in the frame.

Figure 4: The new Gazelle system concept

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