Spotting sheep in Yorkshire: using eye-tracking for studying situation awareness in a driving simulator

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Abstract

The paper describes an experiment designed for the EASY (Effects of Automated Systems on safetY) project, in which the effect of highly automated driving on driver situation awareness was studied. Driving was either manual, with all manoeuvres controlled by the driver, or highly automated, where lateral or longitudinal control of the car was maintained by an 'automated system'. In both cases, drivers were requested to complete a number of secondary tasks during driving, such as answering questions over a mobile telephone or watching a video. Drivers' eye movements towards the sudden appearance of objects (sheep, police cars) at the side of the road were recorded, and used to infer situation awareness. This methodology was favoured over freeze frame techniques which interrupt the driving task. Whilst eye tracking is a well established technique, its use for interpreting visual attention in dynamic scenes is more problematic. This paper discusses the different analysis techniques used to investigate visual attention to events in a dynamic driving simulator environment, comparing frame by frame playback of video scenes with summary charts based on predefined areas of interest. Lessons learnt from each technique are outlined.

Introduction

Driving on the motorway automatically is technically feasible. Advanced Driver Assistance Systems (ADAS) taking care of lateral and longitudinal control are being tested by car manufacturers or are already on the market. ADAS can maintain longitudinal headway, avoid collisions (i.e. Adaptive Cruise Control combined with a Forward Collision Avoidance System), and support lane-keeping (automated steering to keep the vehicle in lane). If these systems are combined, driving takes place automatically and the driver does not need to do anything to keep control of the car, but acts as a 'supervisor'.

So what then will be the role of the driver? If the driver no longer has to steer or take care of the car's speed, will he/she engage in other tasks? Or will the driver become bored and drowsy? And will drivers still be aware of what is going on around them?