DRIVER‘S ATTENTION EVALUATION USING NON-LINEAR DATA ANALYSIS

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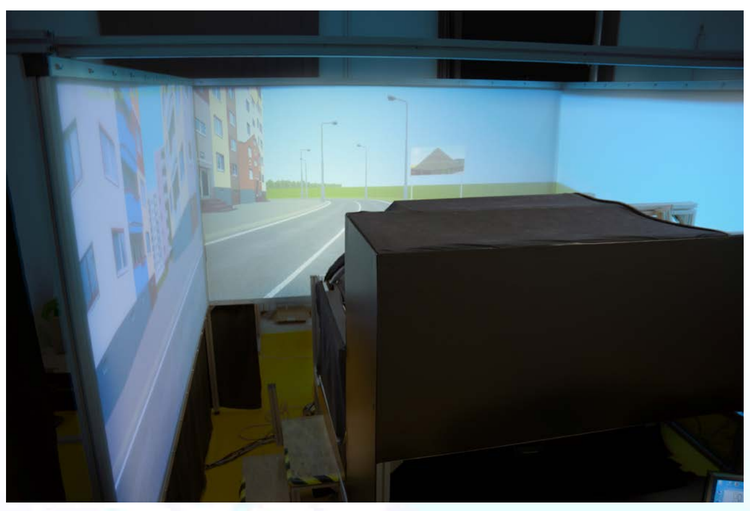
INTRODUCTION

Driver drowsiness detection is one of primary targets of driving safety research. This contribution focuses on question whether limited visibility and driver drowsiness causes chaotic behavior. Both drowsiness and attention research measurements are based on data from driving simulator. These data are analysed using visual non-linear recurrent analysis for chaotic behavior detection. Research was also focused on vehicle trajectory and establishment whether limited visibility and drowsiness leads to chaotic character of vehicle trajectory. Results of both experiments are compared.

Tired driver is dangerous driver

DATA MEASUREMENT

Data was obtained from 20 drivers using advanced vehicle simulator. The cave-type simulator was based on Škoda Octavia II car. Whole driver‘s field of view except mirrors was covered with 3×1080p@60fps projection surface. Recorded data consists of time, position and rotation of vehicle and other minor parts (lights switches etc.) every 8 ms.



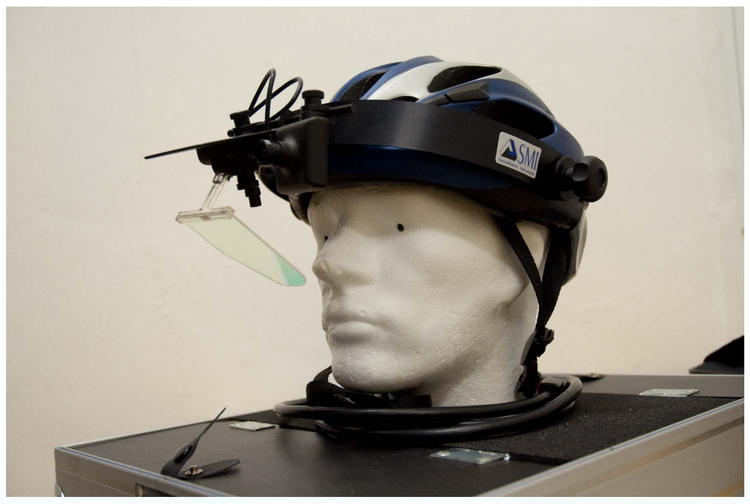
Škoda Octavia II simulator visualisation system

Driver‘s position in advanced simulator

meters, then 20 meters and final drive was with unlimited (>10 km) visibility. Althought the route was same it was too complex to be remembered while driving in fog. Testing road was 5.2 km long with cca 25 curves and also with few slopes. Width of the road was standard 7.5 meters (3.25 per lane).

Experimental route (unlimited visibility)

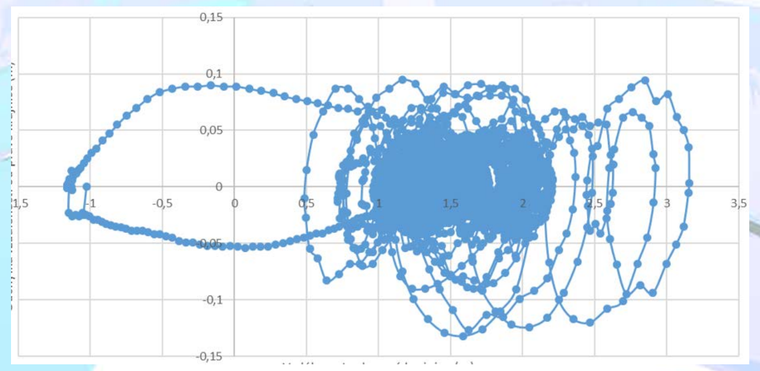
Another recorded data was obtained from eye tracking device (SMI headmounted eye tracking). Data was analysed in Bc. thesis concearning fields of view and important orientation points while driving through curves in fog.



SMI headmounted eye tracking device

ANALYSIS

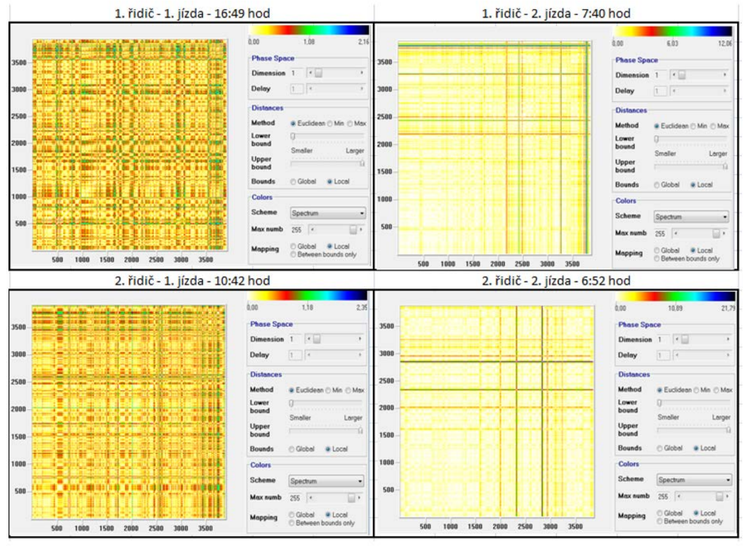
For every 80 ms was calculated distance from center of the lane. These figures was then use as data for reccurency analysis.



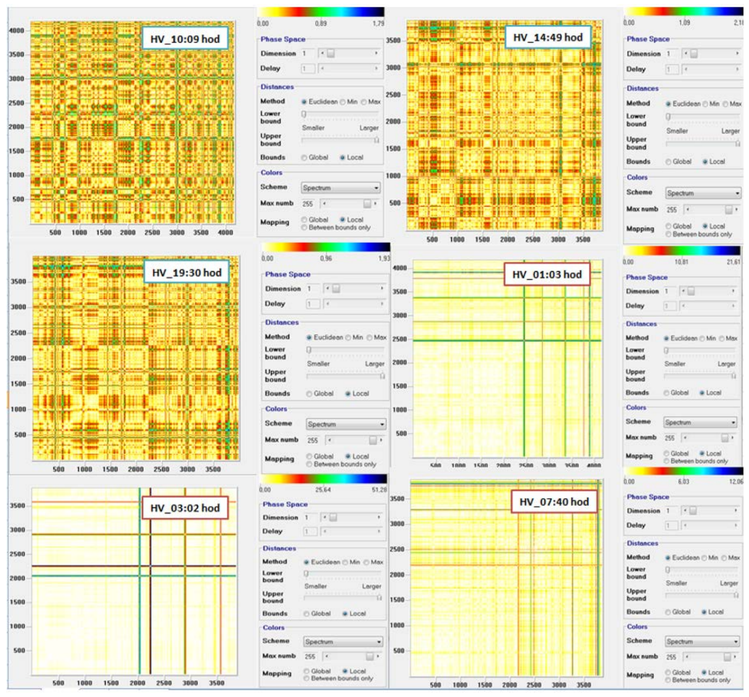
Driver 1 movement (unlimited visibility)

X-axis: distance from right white line [m]; Y-axis: right white line margin [m]

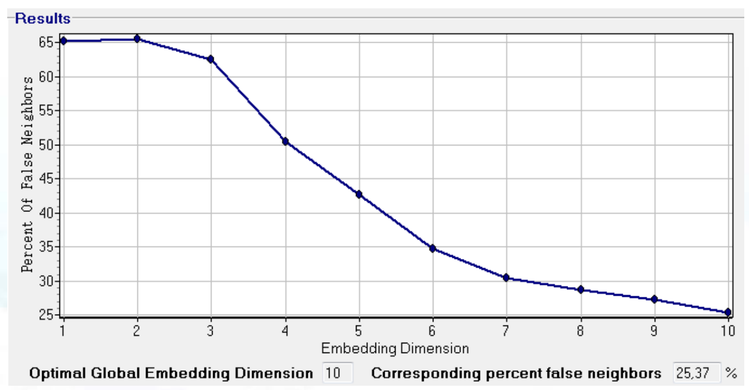
Analysis results show that driver who is not tired shows much more deterministic behavior in trajectory. More the driver is tired the more chaotic behavior occures. Importantly, limited visibility had no effect on chaotic behavior.



Fresh (left) and tired (right) drivers in reccurency analysis



One driver‘s proces of getting tired



Embedded dimension and corresponding false neighbours

CONCLUSION

It was proved that driver drowsiness could be detected from vehicle trajectory and chaotic behavior analysis using non-linear reccurent analysis. It opens up new possibilities of tiredness detection using data obtained from steering.

DRIVING SCENARIOS

Every driver drove three times with different visibility due to fog. First time the fog was thickest with visibility ~10

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