

EVALUATION OF THE PERFORMANCE OF AN EXPERIMENTAL SOMNOLENCE QUANTIFICATION SYSTEM IN TERMS OF REACTION TIMES AND LAPSES

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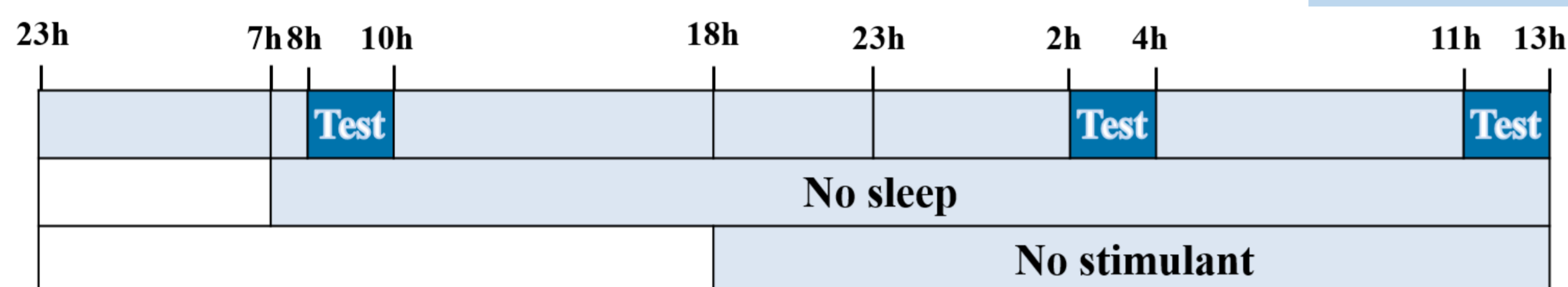
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Objective

Somnolence is known to be a major cause of various types of accidents [1], and ocular parameters are recognized to be reliable physiological indicators of somnolence [2]. We have thus developed an experimental somnolence quantification system that uses images of the eye to automatically determine a level of somnolence on a numerical scale.

The aim of this study is to show that the level of somnolence determined by our system is well related to the level of performance of subjects accomplishing three reaction-time tests in different sleep deprivation conditions.

Data acquisition



- 27 participants (12 M, 15 F, mean age of 24.3 years, range of 19-32 years)
- Test = reaction time (RT) test (duration of 15 minutes)
- Approved by ethics committee.

Our somnolence quantification system



Acquisition

Images

Extraction

Parameters

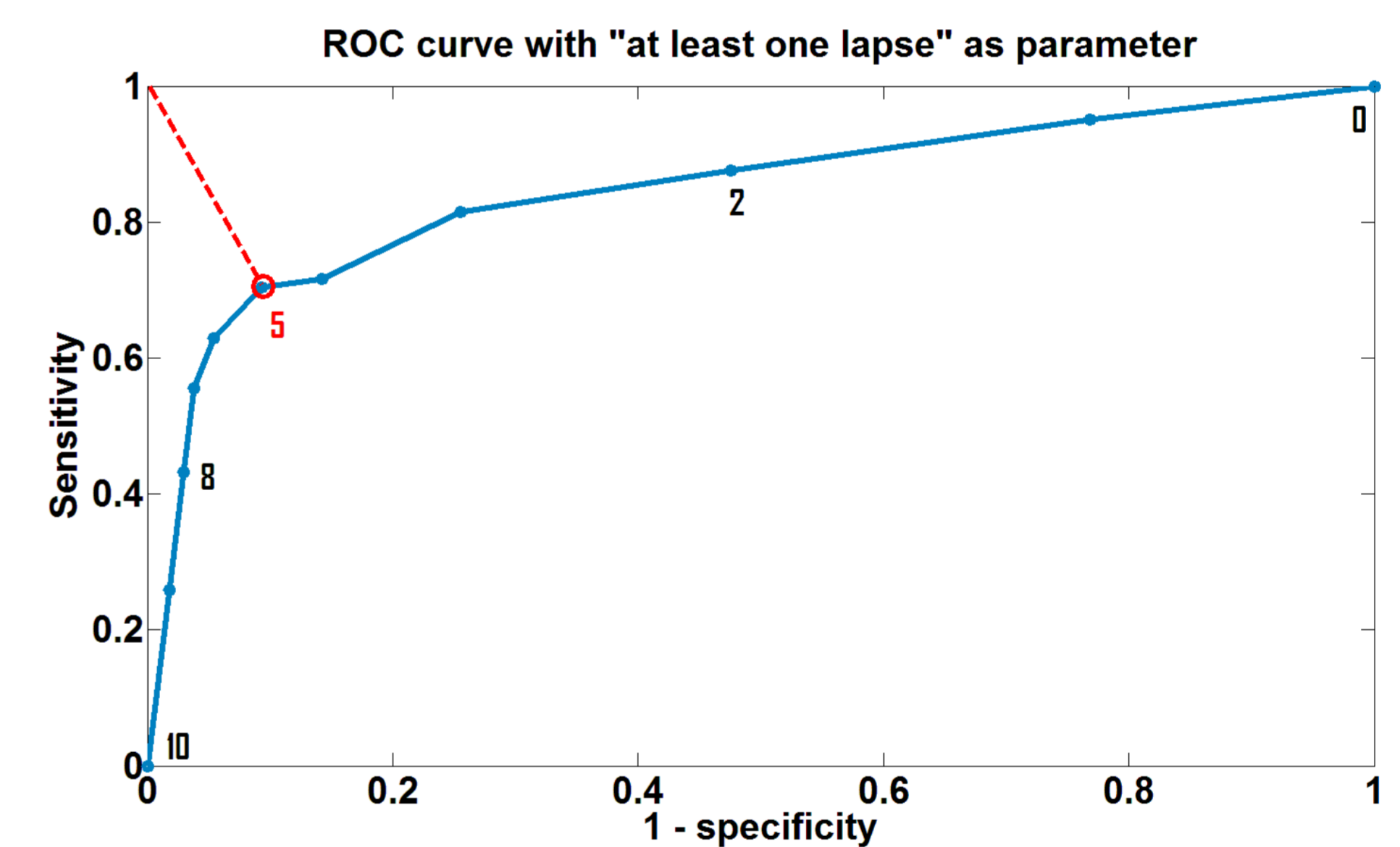
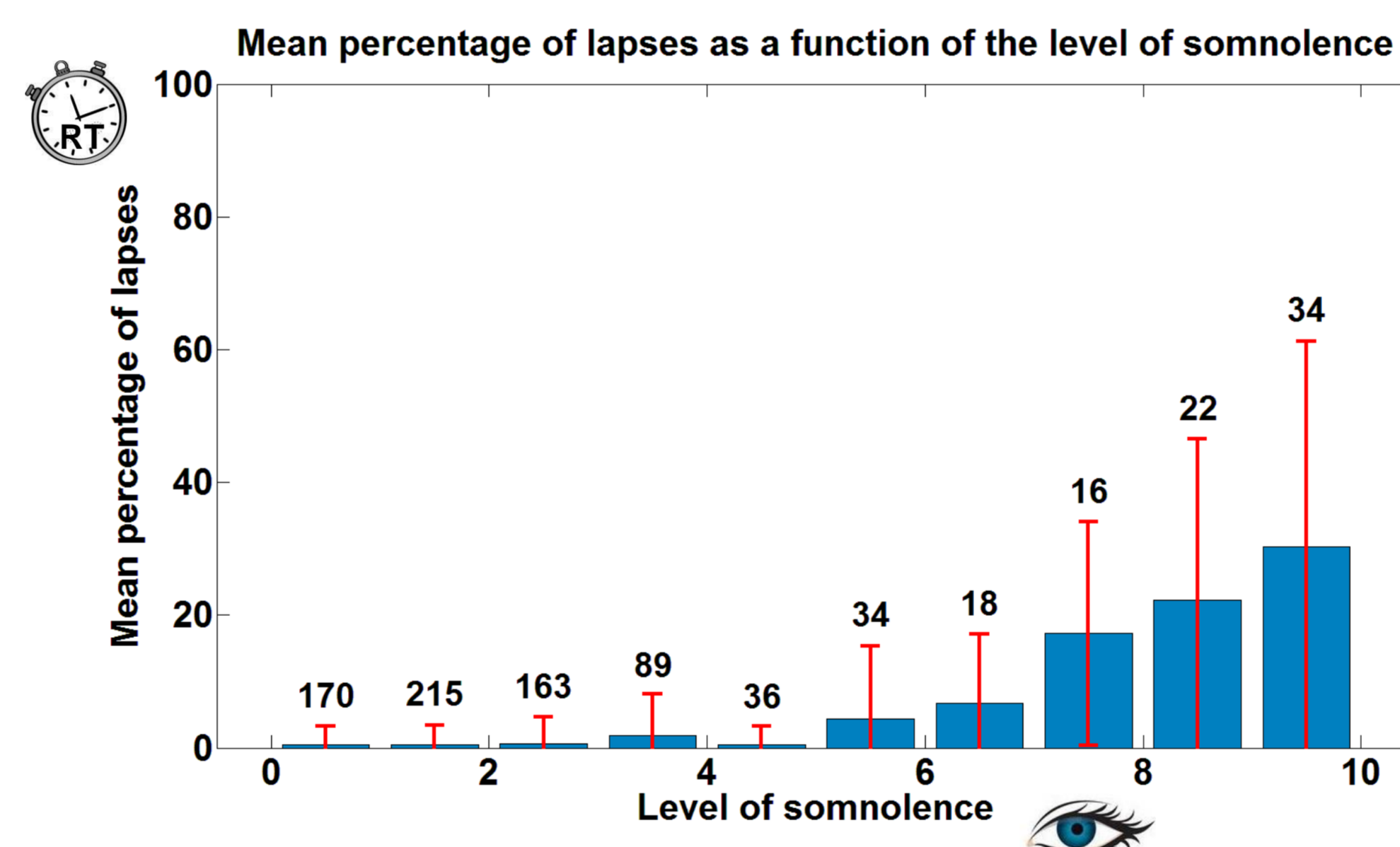
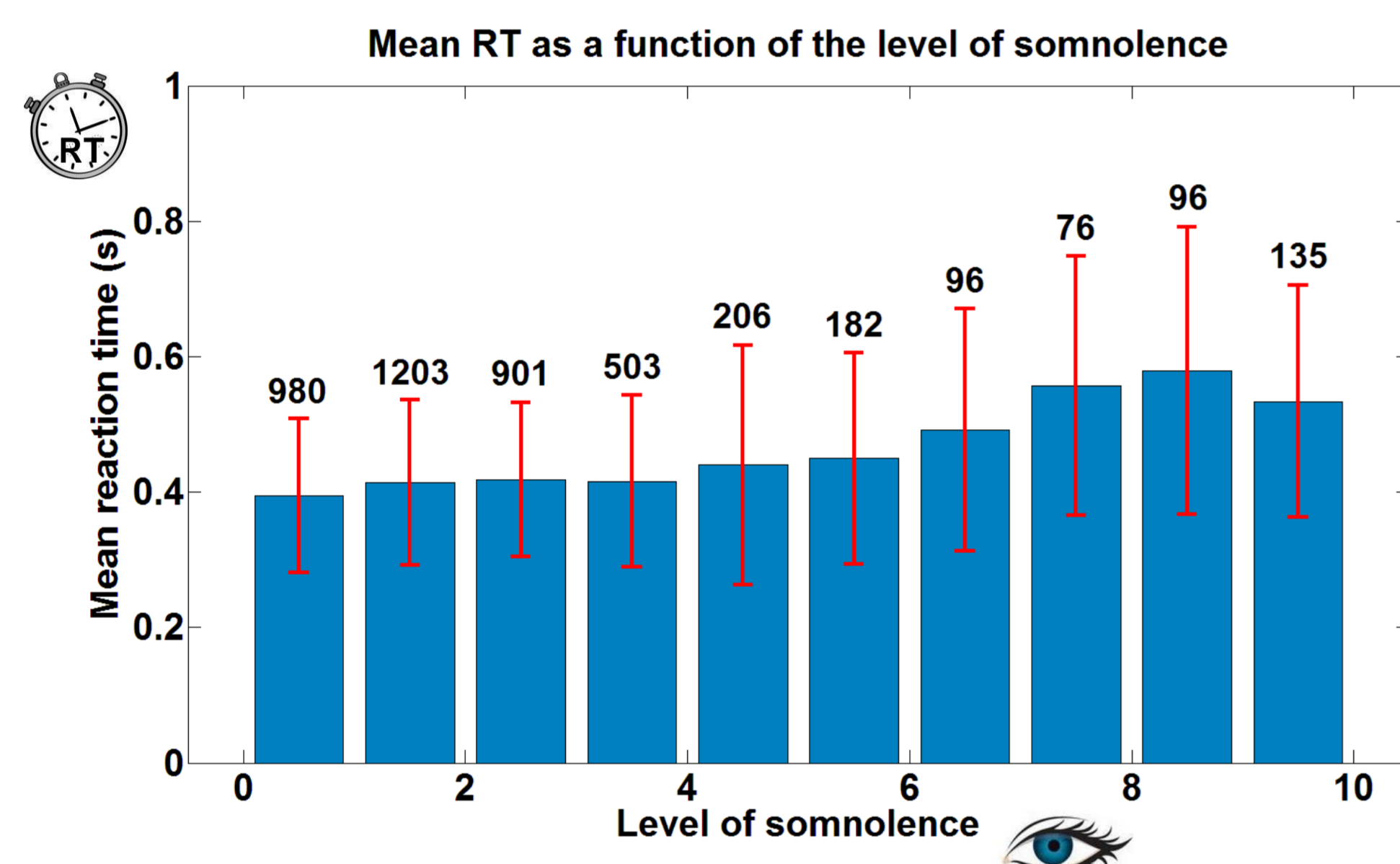
Conversion

Level of drowsiness

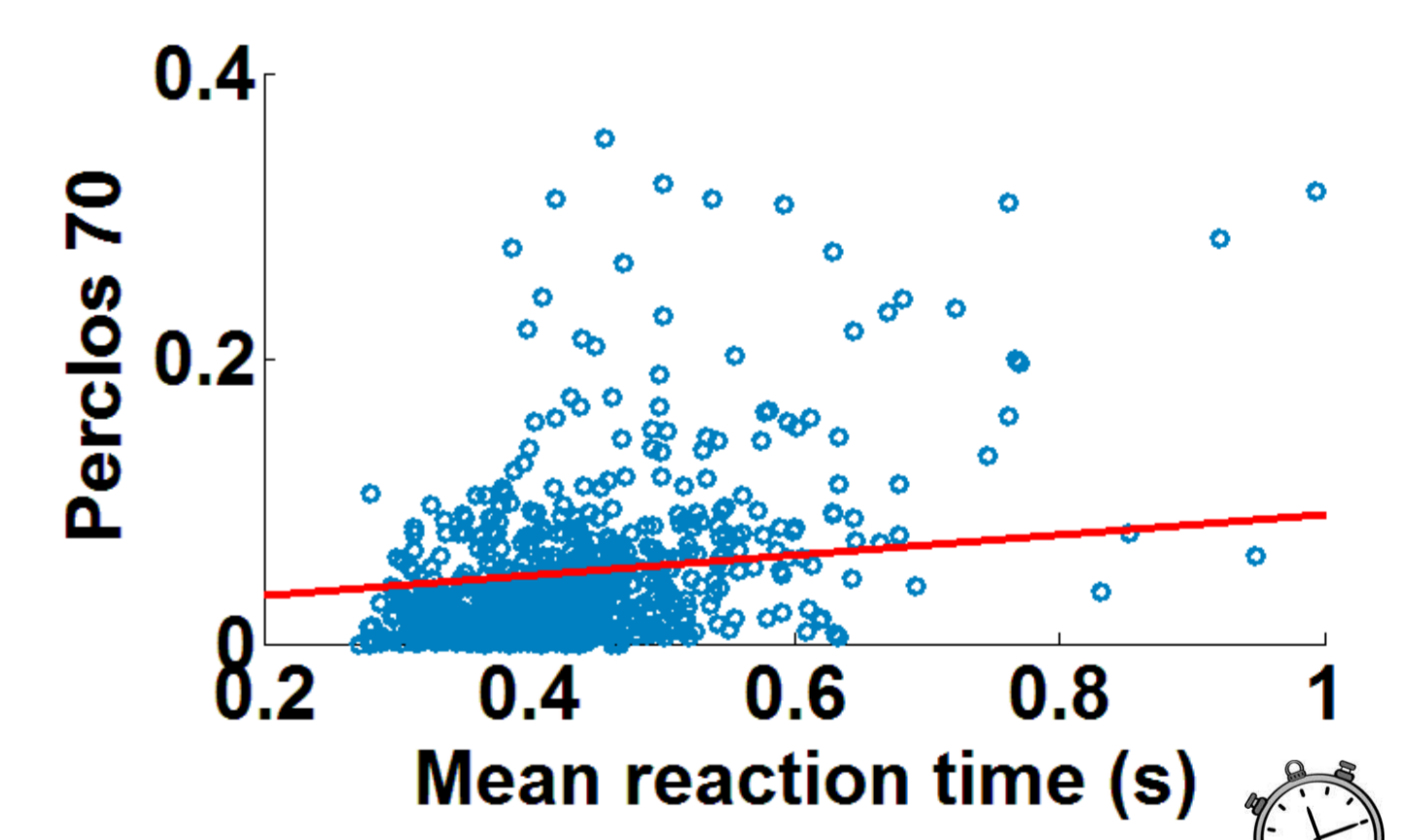
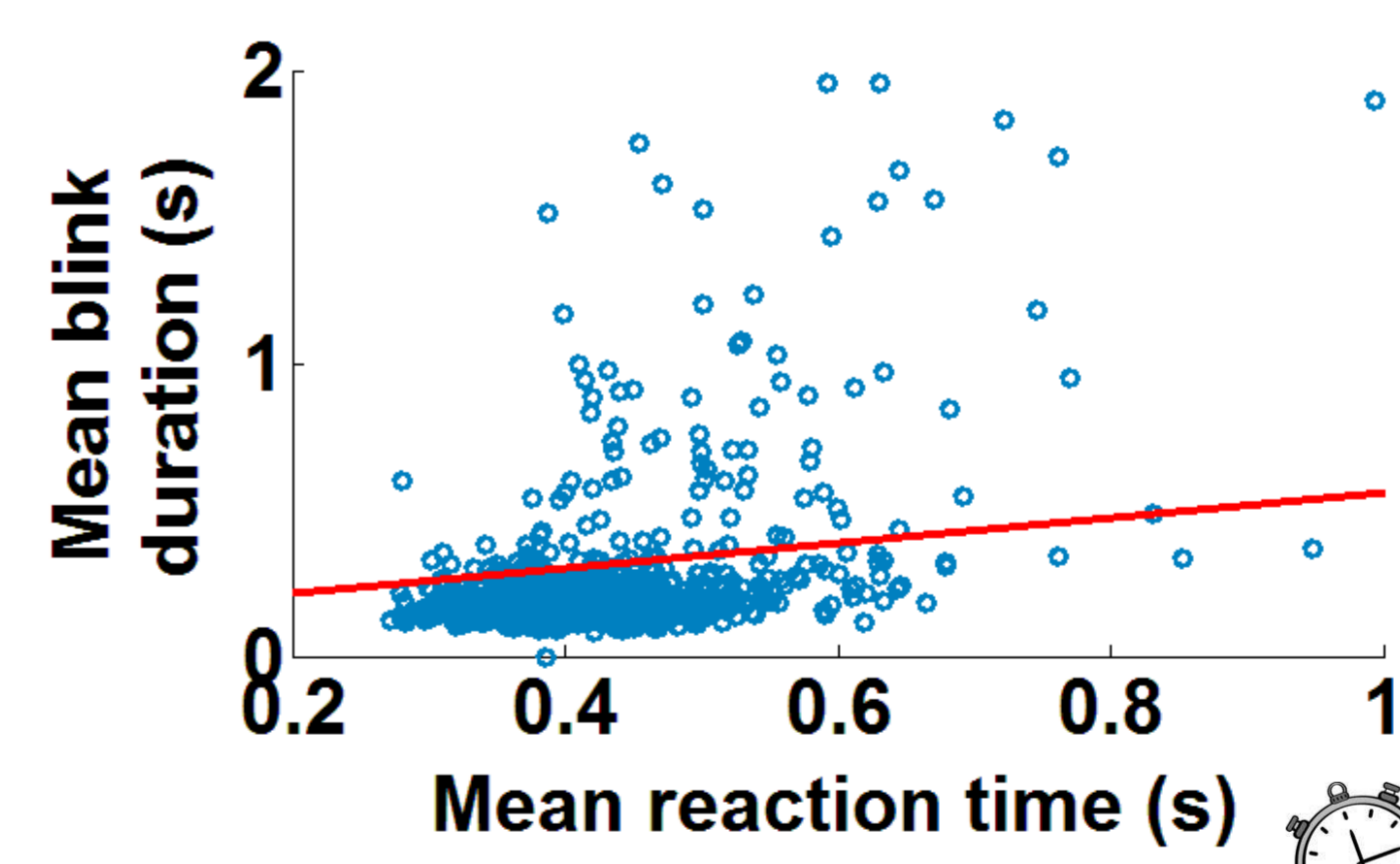
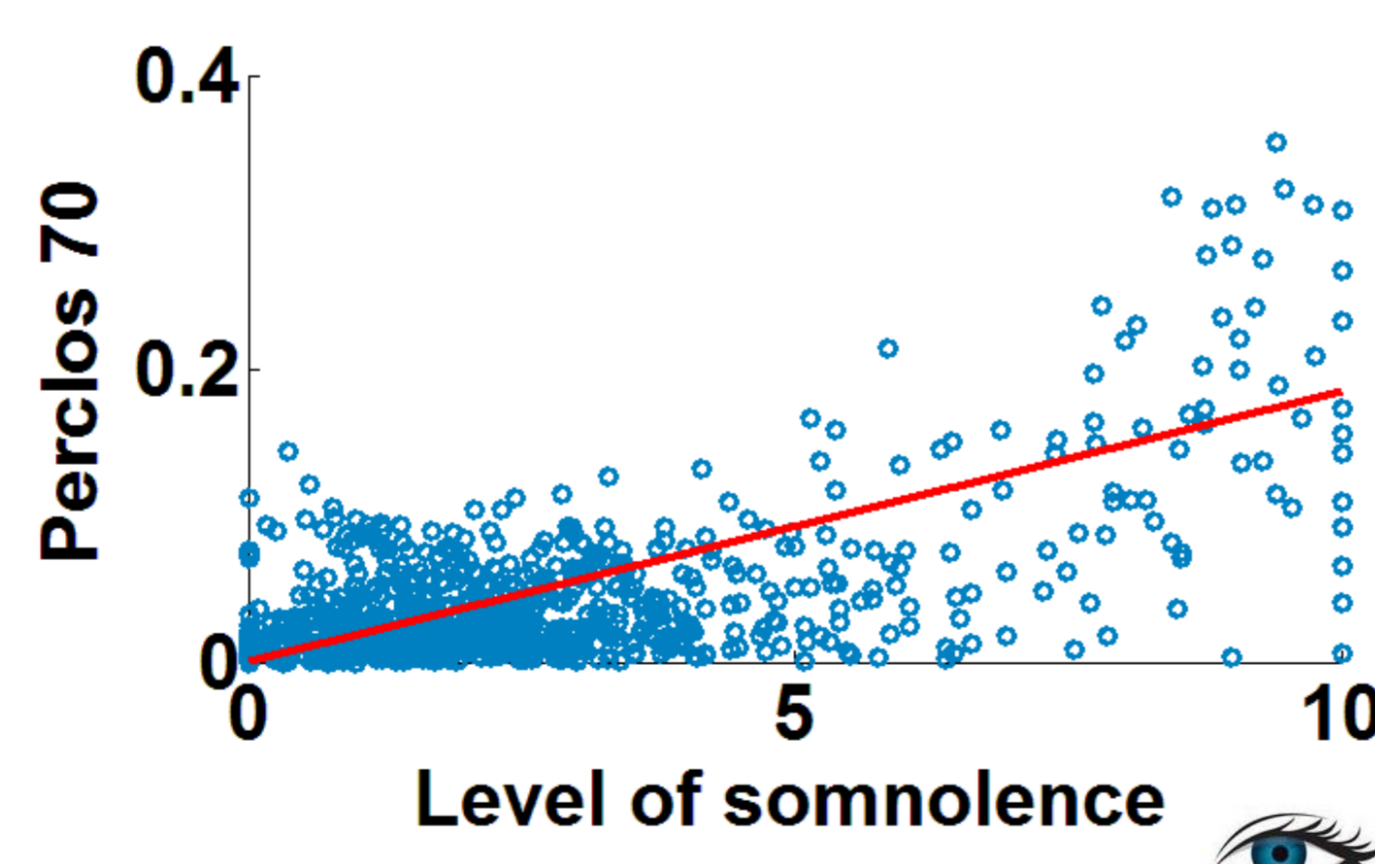
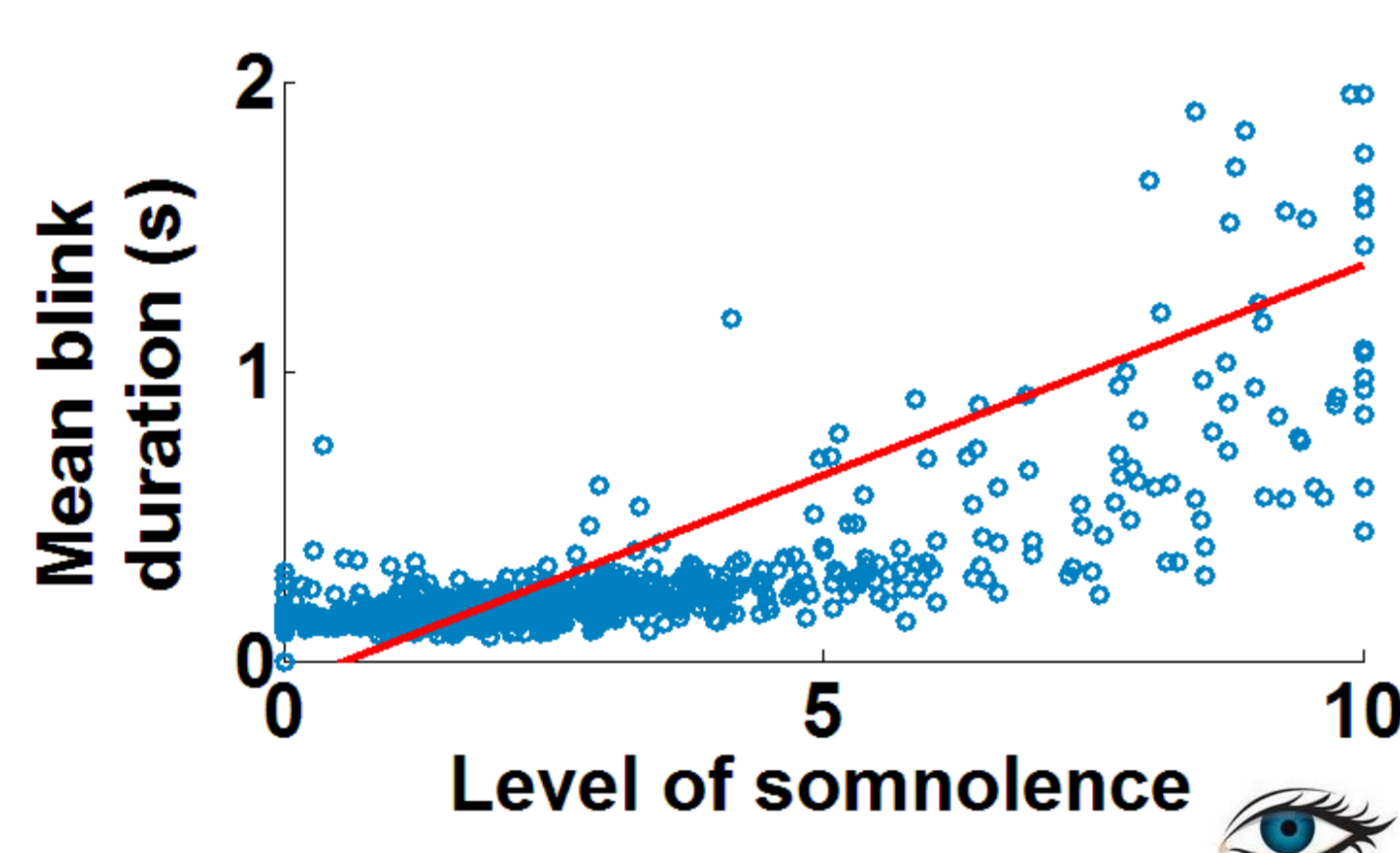
Results (1)

For each minute of test, we computed:

- mean reaction time
- percentage of lapses (lapse = RT > 2s or no answer)
- level of somnolence (determined by our system).



Results (2)



Conclusion

The level of somnolence determined by our system based on images of the eye is well "correlated" with the level of performance of a subject accomplishing a task. We have indeed shown that, in the case of a reaction-time task,

- mean reaction times and percentages of lapses increased with levels of somnolence determined by our system;
- a threshold of 5 on our scale of somnolence (from 0 to 10) is the best for predicting lapses.

Our somnolence quantification system has thus significant potential for predicting performance decrements due to somnolence and, ultimately, for preventing somnolence-related accidents.

Acknowledgments

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References

- [1] Association de Sociétés Françaises d'Autoroutes, "Somnolence au volant – Une étude pour mieux comprendre," juin 2010.
- [2] R. Schleicher, N. Galley, S. Briest, and L. Galley, "Blinks and saccades as indicators of fatigue in sleepiness warnings: looking tired?" *Ergonomics*, Jul. 2008, vol. 51, pp. 982-1010.