The Rhythms of Head, Eyes and Hands at Intersections
Sujitha Martin, Akshay Rangesh, Eshed Ohn-Bar and Mohan M. Trivedi
Laboratory for Intelligent and Safe Automobiles
University of California, San Diego (http://cvrr.ucsd.edu)

Motivation
Understanding and modeling the complex coordination of head, eyes and hands in the intelligent vehicle space is important for reasons including, but not limited to, activity recognition [1], intent prediction [2], and driving style recognition [3]. Towards a mixture of intent prediction and driving style recognition, this work models the coordination of head, eyes and hands at stop controlled intersections [4].

Research Objective
Understanding and modeling the coordination of head, eyes and hands at stop controlled intersections from naturalistic driving data via:

- Robust and reliable vision-based feature extraction
- Temporal modeling
- Data driven machine learning

References

Spatio-Temporal Modelling

- **Naturalistic driving dataset collection:** synchronized capture of sensors looking-in and looking-out, multiple drivers driving in urban environment, and segmenting events at stop-controlled intersections

- **Extracting reliable features:** eye movements, head pose and hand location respective to the wheel from purely vision sensors looking in at the driver

- **Data driven processing:** construction of features using temporal pyramids and using the random forest algorithm to extract optimal feature subset, where optimal features reveal when and what cue is most relevant for representing the preparatory motions.

Results and Discussion

- **This study analyzes the temporal interplay between three modalities: head, eyes and hands of driver**

- **Preparatory motions at intersections range in the order of a few seconds to a few milliseconds**
  - Eye based cues play an important role at a very early stage
  - Head based cues are most useful in terms of predictive power
  - Hand based cues towards the end

- **Future work includes incorporating other information sources (e.g. vehicle dynamics, external camera sensors)**