CS446 Project Proposal

Siting Chang, schang13

I. Project description

In this project, I would like to survey papers with topics related to human driving behavior recognition.

Intelligent vehicles is an interesting and popular topic. One distinguish example is Google's driverless car. Beyond designing autonomous cars, it would be more appealing if cars could be personalized.

What I mean by personalized is that a car could learn its drivers' preference through his behaviors, such as lane changing behaviors and speed adjusting behaviors, during their driving so that later the car could serve the driver in a more customized fashion.

Although it may be true that driverless car, some day, would be widely adopted and no "human drivers" would exist anymore, we argue that people still have their own preferences on how a car should behave. For example, senior people may prefer lower driving speed compared to young drivers, cautious drivers tend to keep larger distance between cars. It would be ideal that driverless cars would take personal preferences into consideration when driving on road. Therefore, it is necessary to learn drivers' behaviors and preferences.

In order to achieve the goal of obtaining and integrating drivers' preferences into driving assistance, a car needs to be trained by the driver to recognize his driving patterns and decision making preferences in order to be able to mimic or reproduce drivers' activities in the same situation. This requires a significant amount of machine learning.

There have been researches performed, but not limited to, in the following topics:

- Security:
  - Human driving behavior could be learned to prevent car theft.
  - Drunk drivers could be detected based on their driving behavior.
  - Distraction detection could be identified based on drivers' behavior.
- Intelligent driving:
  - Lane changing behavior could be modeled and used to make lane changing recommendation.
  - Modeling drivers' preference on driving speed.
  - Drivers' route preference is also being studied.

I would like to proceed the project by doing a literature review on the methods and algorithms used to learn drivers' behavior and explore their applications.

A list of interesting papers are: [7], [6], [1], [11], [3], [10], [8], [5], [2], [9], [12], [4]

References

[1] Hilary Buxton. Learning and understanding dynamic scene activity: a review. *Image and Vision Computing*, 21(1):125 – 136, 2003.

[2] Shinko Yuanhsien Cheng and M.M. Trivedi. Turn-intent analysis using body pose for intelligent driver assistance. *Pervasive Computing, IEEE*, 5(4):28–37, Oct 2006.

[3] HannahM. Dee and SergioA. Velastin. How close are we to solving the problem of automated visual surveillance? *Machine Vision and Applications*, 19(5-6):329–343, 2008.

[4] N. Kuge, T. Yamamura, O. Shimoyama, and A. Liu. A driver behavior recognition method based on a driver model framework. *SAE Technical Papers*, 2000. cited By (since 1996)2.

[5] J.C. McCall and M.M. Trivedi. Driver behavior and situation aware brake assistance for intelligent vehicles. *Proceedings of the IEEE*, 95(2):374–387, Feb 2007.

[6] J.C. McCall, D.P. Wipf, M.M. Trivedi, and B.D. Rao. Lane change intent analysis using robust operators and sparse bayesian learning. *Intelligent Transportation Systems, IEEE Transactions on*, 8(3):431–440, Sept 2007.

[7] Xiaoning Meng, Ka Keung Lee, and Yangsheng Xu. Human driving behavior recognition based on hidden markov models. In *Robotics and Biomimetics, 2006. ROBIO '06. IEEE International Conference on*, pages 274–279, Dec 2006.

[8] Thomas B. Moeslund, Adrian Hilton, and Volker Krger. A survey of advances in vision-based human motion capture and analysis. *Computer Vision and Image Understanding*, 104(23):90 – 126, 2006. Special Issue on Modeling People: Vision-based understanding of a persons shape, appearance, movement and behaviour.

[9] N. Oliver and A.P. Pentland. Graphical models for driver behavior recognition in a smartcar. In *Intelligent Vehicles Symposium, 2000. IV 2000. Proceedings of the IEEE*, pages 7–12, 2000.

[10] Maja Pantic, Alex Pentland, Anton Nijholt, and ThomasS. Huang. Human computing and machine understanding of human behavior: A survey. In ThomasS. Huang, Anton Nijholt, Maja Pantic, and Alex Pentland, editors, *Artifical Intelligence for Human Computing*, volume 4451 of *Lecture Notes in Computer Science*, pages 47–71. Springer Berlin Heidelberg, 2007.

[11] C. Piciarelli, C. Micheloni, and G.L. Foresti. Trajectory-based anomalous event detection. *Circuits and Systems for Video Technology, IEEE Transactions on*, 18(11):1544–1554, Nov 2008.

[12] Esra Vural, Mujdat Cetin, Aytul Ercil, Gwen Littlewort, Marian Bartlett, and Javier Movellan. Drowsy driver detection through facial movement analysis. In Michael Lew, Nicu Sebe, ThomasS. Huang, and ErwinM. Bakker, editors, *HumanComputer Interaction*, volume 4796 of *Lecture Notes in Computer Science*, pages 6–18. Springer Berlin Heidelberg, 2007.