Post-doc Proposal – Spring 2017

Cooperative vehicle perception to support autonomous driving

Post-doc Advisors: Franck DAVOINE, CNRS researcher, Veronique CHERFAOUI, Associate Professor and Thierry DENOEUX, Professor. Emails: firstname.lastname@hds.utc.fr – Heudiasyc Lab., CNRS-UTC, **Compiègne, France. https://www.hds.utc.fr**

Context of the study: The candidate will be based in the Heudiasyc laboratory in Compiègne (40 minutes by train from central Paris). Heudiasyc is a joint laboratory with CNRS – the National Center for Scientific Research – and the Université de Technologie de Compiègne. Heudiasyc fosters interdisciplinary research on information science and technology including machine learning, uncertain reasoning and mobile robotics. In 2011, the laboratory was awarded a project of excellence on «Control of Technological Systems of Systems» (Labex MS2T http://www.labexms2t.fr), funded by the "Investment for the future" national program. The laboratory has strong relations with the automotive industry and advanced international academic research teams on intelligent vehicles.

The successful candidate will join the Challenge Team DAPAD of the Labex, which involves 10 researchers and several Master and PhD students, focusing on Cooperative perception to support autonomous driving. He/she is expected to take an active role in the project, focusing on real driving scenarios with a fleet of four instrumented vehicles.

Post-doc description: Today, driver assistance systems have entered the market, with successes like adaptive cruise control and lane-keeping assistance. Despite these successes, much research and development efforts are still necessary to achieve autonomous driving with complex automated tasks such as, e.g., overtaking and lane changing, crossing intersections, etc. The development of such systems relies on multi-sensory perception functions, communication, information processing, automatic and adaptive learning.

Intelligent vehicles have variable capabilities in terms of self-localization, perception of the driving environment or prediction of trajectories of other road users. They can take advantage of perceptual or intentional information exchanged with other road users (such as vehicles, pedestrians or bicycles) via wireless communication, to augment their field of view and situational awareness of the dynamic traffic scene. Furthermore, vehicles can exploit additional information provided by roadside units, by the infrastructure, or high-level context given by digital maps. In this context, "V2X" communication can be seen as a supplementary virtual sensor.

⇒ In collaboration with the DAPAD team members, the post-doc is expected to contribute to the definition, development and evaluation of a cooperative perception system in which the ego-vehicle will (1) perceive the scene with its own sensors, and (2) combine its local perception with raw or preprocessed information received from other road users and from the infrastructure. The construction of an efficient global fusion module requires a good model of uncertainty in the ego-vehicle perception, but also in the broadcasted information (transmission latency and range, timestamps, data correlation, association and fusion, etc.).

Besides a closed test track, Heudiasyc laboratory hosts a fleet of instrumented autonomous vehicles dedicated to experiments, developments and integrations of technologies for autonomous driving. Tests and evaluations will be carried out through different scenarios (such as crossroads, overtaking or roundabout) involving three to four vehicles, in close collaboration with DAPAD team members working in the field of machine learning, driving scene perception with Lidar, radar as well as cameras, V2X communication, uncertainty modeling and distributed information fusion in vehicular ad hoc networks.

Keywords: Machine Perception, Machine Learning (including Deep Learning), Distributed Data Fusion, Uncertainty Reasoning.

Start and Duration: As soon as possible from March 2017, the position is for one year with possibility of an extension, pending funding.

How much will you earn? Monthly net salary ~ 2100€ (potentially higher with some teaching activities). Affordable housing easy to find in Compiegne.

your profile: PhD degree (preferably in Computer Science or Applied Mathematics). Solid programming skills; the project involves programming in C, C++, Matlab, Python… Solid mathematics knowledge (especially linear algebra and statistics). Creative and highly motivated. Fluent in English, both written and spoken. Prior knowledge in the areas of computer vision or machine learning is a plus.

Documents required to apply: Send to franck.davoine@hds.utc.fr
Curriculum vitae; A statement of research experience and interests; A motivation letter; At least two references or recommendation letters.

Some references:

Rudy Bunel, Franck Davoine and Philippe Xu. Detection of Pedestrians at Far distance. In Proceedings of the IEEE International Conference on Robotics and Automation, Stockholm, Sweden, May 16-21, 2016.

Philippe Xu, Franck Davoine, Jean-Baptiste Bordes, Huijing Zhao, Thierry Denoeux. Multimodal Information Fusion for Urban Scene Understanding. Machine Vision and Applications, Springer, 27(3), Pages 331-349, 2016.

Philippe Xu, Franck Davoine, Hongbin Zha, Thierry Denoeux, Evidential calibration of binary SVM classifiers, International Journal of Approximate Reasoning, Elsevier, Volume 72, Pages 55-70, May 2016.

Javier Radak, Bertrand Ducourthial, Veronique Cherfaoui, Stephane Bonnet. Detecting road events using distributed data fusion: experimental evaluation for the icy roads case, IEEE Intelligent Transportation Systems Transactions, 17, 1, 2016.

Philippe Xu, Franck Davoine, and Thierry Denœux, Evidential combination of pedestrian detectors, BMVC - British Machine Vision Conference, Nottingham, UK, Sept. 1-5, 2014.

Nicole El Zoghby, Veronique Cherfaoui, Thierry Denoeux. Evidential Distributed Dynamic Map for Cooperative Perception in VANets. IEEE intelligent Vehicles Symposium 2014, Dearborn, Michigan, USA, 2014.

Latest news about us: 1) In Journal of CNRS: **https://news.cnrs.fr/articles/should-driverless-cars-also-be-borderless**
2) We successfully participated to the Grand Cooperative Driving Challenge (GCDC'16) in The Netherlands, May 28-29, 2016. **http://www.gcdc.net/en/event-en**