

## **PhD. Student in High Definition Collaborative Mapping (H/F) at Versailles (78)**

### **Description de VEDECOM**

Created in February 2014, VEDECOM is an Institute for Energy Transition ('ITE'), dedicated to individual, carbon-free and sustainable mobility, established as part of the French 'governmental plan, 'Investment for the future'. It contribute to the 'Autonomous vehicle plan', which was recently incorporated into the Solution for Future Industry Program alongside Eco-mobility; both of which are part 'Nouvelle France Industrielle', the government's plan to invigorate the country's industry.

The aim of VEDECOM is to become an operational player in terms of innovation, research and training applied to sustainable modes of transport and mobility, all the while generating business and creating jobs.

The Institute's 50 members, which comprise firms in the automotive and aerospace sectors, mobility ecosystem infrastructure and service operators, academic research bodies and Ile-de-France local authorities, work together in an unprecedented partnership.

### **Context & Objectives**

Accurate (<20cm) localization is a key factor towards enhanced safety for both autonomous and human-driven (aided by driver assistance systems) vehicles. It allows the vehicle to accurately position itself within its surroundings in order to avoid collision with static elements and with vehicles whose trajectory may cross the vehicle path.

Positioning using GPS-based guidance systems can only provide limited accuracy (4-20m) and while Real Time Kinematic (RTK) systems enhance significantly the GPS precision, the overall accuracy of such systems varies greatly depending on speed and possible obstruction of the signal path, especially in urban areas. These performances make these positioning systems not suitable to handle critical tasks such as collision prevention.

GPS are often completed with Simultaneous Localization and Mapping (SLAM) techniques that use on-board sensors (LIDAR or camera) to map the surrounding area while keeping track of the vehicle's position in this map. Using only SLAM techniques gives a position relative to the vehicle, but when it comes to exchanging positions between vehicles, these positions must be defined in the same frame of reference.

Working in an absolute reference frame makes it necessary to include external information such as GPS position of the vehicle and/or geo-localized anchor points (landmarks). This is why the major players in mapping data are currently working on building high definition maps of anchor points along the road network. As this process is a tedious and expensive task, it is therefore interesting to study a method that can compute geo-localized anchor points automatically and collaboratively using vehicle sensors.

In this context, this PhD thesis aims at proposing computer vision methods for high definition map generation based on a cost-effective collaborative approach where the map is automatically built using data sensed by passing-by vehicles and shared among them.

Given geo-localized anchor points such as the ones provided by infrastructure operators (street lights, road signs, etc...), vehicles passing by the area will compute new positions for these anchor points using on-board sensors (odometers, GPS and camera). Under the assumption that the error of these position samples is "well distributed" around the true value, the centralized processing of all the positions sent by the vehicles will allow to enhance the accuracy of the anchor point positions (convergence in distribution). Thus, the definition of the map generated by this method will increase with the number of vehicles passing by. Furthermore, the management of the anchor point database will require the proposition of methods to update and eventually delete elements when detecting discrepancy between vehicles' probings.

The Phd student will be a VEDECOM employee during the 3 years and work at VEDECOM's facilities in Versailles. Depending on the academic partner for this thesis, one or two days a week can be spent at the partner laboratory if it is located in Ile-de-France or one or two weeks per year if the partner is outside Ile-de-France.

### Requirements

- ✓ Master (University or engineer school) in image and signal processing
- ✓ English, French
- ✓ Scientific curiosity
- ✓ Autonomy
- ✓ Good programming skills C++ and Python
- ✓ Technical knowledge in at least one of these fields: image processing, SLAM techniques, data fusion.

### Complementary Informations

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| Type of contract  | <b>CDD 3 years</b> |
| Manager   | Aziz DZIRI         |
| Start   | September 2018     |
| Your profile matches? Send a CV to the following address : <a href="mailto:apply.26458-rNTT4d@apply-talentedetection.com">apply.26458-rNTT4d@apply-talentedetection.com</a> |                    |