

Understanding data accidents for traffic safety

Supervisors: [Maria Laura Delle Monache](mailto:ml.dellemonache@inria.fr) , CR, Necs Team, Inria
[Julyan Arbel](mailto:julyan.arbel@inria.fr), CR, Mistis Team, Inria

Application type: Master Internship

Email : <mailto:ml.dellemonache@inria.fr>, <mailto:julyan.arbel@inria.fr>

Team : [NeCS](#), [Mistis](#)

About Inria and the job

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

NeCS is a joint project-team from Inria Grenoble – Rhône Alpes Center and GIPSA lab at University of Grenoble. This team is focused on Networked Controlled Systems. The research field of Networked Controlled Systems deals with feedback systems controlled over networks with applications to traffic, electrical networks, etc.. Mistis is a joint project-team from Inria Grenoble – Rhône Alpes Center and LJK laboratory at University of Grenoble. This team is focused on developing statistical methods for applications.

Job offer description:

Traffic congestion is a major concern in the modern society in terms of loss of productivity, waste of time, pollution and city noise management. Two main quantities are used to describe traffic flow on a network: traffic density and average speed of cars.

This internship focuses on understanding from real traffic data the behavior of traffic in the moments preceding an accident. The general approach is to use novel statistical techniques in order to learn traffic characteristics that can be used to develop new traffic models. The research teams combine expertise in traffic modeling, control and Bayesian parametric and nonparametric statistics. We will use



Bayesian approaches to (supervised) classification and (unsupervised) clustering in order to respectively predict collision occurrences and discover traffic patterns.

In particular, we are interested in understanding if certain particular road conditions can be linked to generation of accidents. A non-negligible part of the risk in vehicular traffic is due to individual behavior such as the driving style or the level of attention, which have a strong impact on the resulting traffic flow. It is necessary to understand if there are certain traffic situations that can cause the onset of these risks. There is a substantial lack of models dedicated to the joint simulation of traffic flow and safety issues. With this internship, we would like to understand from data if there exists a particular link between speed and density of cars at which collisions are more likely to occur.

We intend to make use of raw sensor data collected on the Rocade Sud in the framework of the Grenoble Traffic Lab (https://gtl.inrialpes.fr/data_download), using data for different days of the week and different day time.

The sensor data consists of these quantities collected every 15 seconds:

- Volume: Number of vehicles that passed the sensors position in the last 15 seconds
- Occupancy: The proportion of time that the sensory was “occupied” by vehicles in the last 15 seconds.
- Speed: Average speed of the vehicles that have passed the sensor position in the last 15 seconds.

Missions:

The main focus of the intern will be to assess the two tasks of collision prediction and pattern learning by classification and clustering. Several learning algorithms will be considered, from Bayesian classification procedures, Naive Bayes to deep learning procedures with the aim to enable prediction of collision occurrences. The intern will perform model-based clustering in a Bayesian nonparametric setting, where data sharing common sensor features will be grouped together.

Skills and profile

The ideal candidate will have expertise in statistical methods, machine learning and data science. Experience in transportation systems is considered a plus.