Road-side maintenance via multi-objective optimisation

Université de Lorraine

Name of the hosting institution in France: Université de Lorraine
Name of the host laboratory / research team: ERPI – Equipe de Recherche sur les processus Innovatifs
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Website: https://erpi.univ-lorraine.fr
Name of the supervisor: Mauricio Camargo
Function: Professeur des Universités
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Internship offer

Topic of the internship (title): Road-side maintenance via multi-objective optimisation
Proposed dates of the internship: Start 01/09/2022, End 01/01/2023

Scientific and academic objectives of the internship:
The road network is constantly growing, with over 25 million new roads expected to be built by 2050. This expanding road network has significant ecological impacts: habitat loss and fragmentation, light and noise pollution, chemical pollution of air and water, direct mortality of wildlife due to vehicle collisions. However, given the importance of roads in our society, mitigation of these negative impacts seems to be the most realistic solution. Roadsides represent an opportunity to mitigate these impacts, as by their location and composition they are able to provide several ecosystem services. However, for safety reasons, these roadsides have to be maintained regularly, which has negative impacts on the ecosystem: destruction of plant and animal habitats, modification of the environment by soil enrichment, reduction of the number of mowing tools, reduction of pollinating insect populations, weakening of biodiversity. As a result, roadsides play a less important role in mitigating the impacts of the road network. Therefore, through their collaboration, the ERPI laboratory and NOREMAT are seeking to develop sustainable roadside management solutions. The current projects concern the design of an innovative management tool consisting of an evaluation of the economic, social and environmental impacts of the management practices implemented by territorial managers and the design of an ecological mowing unit that should minimize the impacts of maintenance (soil preservation, fauna and flora, energy consumption reduction). These two projects are closely linked, as the innovative mowing unit must be able to feed the tool with important and relevant information from the territory. Thus, in situ information from the maintenance machines will provide the necessary information. Thus, in situ information from the maintenance machines will provide the necessary information. Therefore, the objective of the research internship project is to apply various multi-objective optimisation algorithms in order to detect the best route of executing the roadside mowing every year by considering several aspects:
- Minimising the travel distance along the road
- Minimising mowing time
- Minimising costs
- Minimising CO2 emissions
- Minimising waste
- Minimising the number of mowing units.
The student will have to implement several optimisation algorithms that can satisfy the targeted objectives by using real data sets collected from a French territory.

Industrial partner

Name: Noremat – Accopilot
Role of the industrial partner in the internship project: Co-supervision
Main contact: M. Christophe Bachmann

Australian partner

Name of the Australian partner institution: University of Technology Sydney
Lab/department/team involved in the collaboration: Future Mobility Lab / Faculty of Engineering and IT / School of Computer Science
Main contact in the Australian partner institution: Dr. Simona Mihaita
Function: Senior Lecturer
Email: adriana-simona.mihaita @uts.edu.au

Outside of this ongoing collaboration, will students from other Australian universities be considered by the hosting institution in France? Yes

Expected profile of applicant

Level of study: Bachelor / Master Degree
Discipline: Computer Sciences
Prerequisite knowledge, qualities and skills: Strong Programming skills, analytical thinking
Other specific eligibility criteria: English and/or French ; remote work from Australia for Noremat/France