Dynniq Nederland B.V.

1. type of projects / description of the project/tasks/brief of the role

EU-funded R&D projects. Two main projects are:
- MAVEN http://adas.cvc.uab.es/maven/
- XCycle http://www.xcycle-h2020.eu/

2. duration of the internship (8 weeks, 6 months, 12 months)/ hours of work

We expect 4-6 months. This also depends on the requirement and the programme of the university.

3. level of knowledge for a specific area (awareness, educational experience, working experience)

We expect that the students are in the domain of e.g. electrical engineering, mathematics, computer science or civil engineering, who are interested in traffic management and control. Excellent programming expertise is required.

4. payment

Around EUR 500 per month (based on the expertise), including local travel costs.

5. number of internship positions

For the moment, we have five assignments (see below).

6. language requirements

Fluent in English

7. medical and labor insurance costs (covered by the company / covered by the university)

We expect that the students are from the EU Member States. Medical and labour insurance costs are coved on the monthly payment.

8. Location (Town / Area)

Dynniq Nederland B.V.
Basicweg 16
3821 BR Amersfoort
The Netherlands

Students can mainly work at their universities, and travel to our office for meetings (based on the agreement with the supervisors) at least once a month. For students outside The Netherlands, we can cover flight/train ticket costs once per month. For Dutch students we can cover their travel costs to vist one of other business units (in e.g. the UK, Finland or Croatia), or one European conference.

9. Industry /Sector

Dynniq is very active in two sectors: 1) ITS (Intelligent Transport Systems) and 2) Energy

10. Study Stream

The supervises will guide each student to fulfil the assignment (see some topics below). We also intend to improve creativity, team work and social communication skill of the students.

11. Undergraduate/Postgraduate

We prefer postgraduate.

12. Skill Requirements

Excellent programming skill is required (any computer language). Students may have different background e.g. electrical engineering, mathematics, computer science and civil engineering (including traffic/transport engineering).

Assignments of Dynniq

1) Automated parameter tuning and sensitivity analysis for optimal traffic light control

Problem description
Our traffic light controller ImFlow uses an adaptive cost-based optimization method, which relies on assigning costs to various events (stops, delays, downstream intersection delays, public transport delays etc.), other intersection-specific parameters such as the minimum green phase duration and finally algorithm-specific parameters such as the maximum planning horizon. All of these are chosen in an arbitrary manner. We would like to get more insight in what is a good/optimal way to set these parameters.

Assignment
The student will design heuristic and/or algorithmic methods to choose appropriate parameters and perform sensitivity analysis with respect to selected (or all) parameters. For the purpose of parameter tuning, the student can also use existing tuning packages, such as the irace package. The evaluation of effectiveness of the algorithm will be performed in the open-source simulation environment SUMO on several real-world intersections. An interface between SUMO and ImFlow is available and will be provided. This assignment requires moderate programming skills.

Information:
Thesis supervisor (university):
Co-supervisor (Dynniq): Robbin Blokpoel / Aleksander Czechowski / Meng Lu
Contact: Dr. Meng Lu

2) Comparison of traffic light control algorithms

Problem description

Our adaptive traffic light control algorithm ImFlow employs a real-time discrete optimization method based on the forward dynamic programming (Kim, Park, Baek 2005). In recent publications in the field of intelligent transportation systems one can find a vast amount of other optimal control methods, e.g. gradient descent, tabu search, reinforcement learning, etc. We would like to get an insight on how our optimizer performs against some of them.

Assignment
The student will re-implement a simplified version of the forward dynamic programming algorithm for traffic light control as described in (Kim, Park, Baek 2005) in a programming language of his choice. In addition the student will implement one simple algorithm (e.g. vehicle actuated, longest queue first) and one advanced algorithm of his choice (such as the ones described in the problem statement). Then, the student will connect the algorithms to the open-source simulation package SUMO via the TracI interface and perform comparison on a simple intersection to compare the total delay time.
This assignment requires moderate programming and mathematical skills. Some affinity with optimal control is preferred. The scope of this research is quite broad, so the project can accommodate several students, and may last for longer than 6 months.

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3) Prediction of time to green for actuated control

Problem description
In the Netherlands 33% of controllers will have speed advice in the future. However, most intersections are still running very unpredictable actuated control algorithms. Can we make a good prediction for example based on historical data and data of the last cycles? A lot of data is available at Dynniq, but for analysis it has to be read in a program in order to draw conclusions applicable to the research. Then an algorithm should be designed to predict time to green, which can be tested on more data as years of data is available from 100+ intersections in the Netherlands.

Assignment
The student will work on data-based prediction algorithms of time to green for actuated traffic light control.

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Contact: Dr. Meng Lu

4) Impact assessment of predictable green phase for bicycles

Problem description
We stabilize the prediction in an adaptive traffic light control algorithm (ImFlow) and give green wave with speed advice based on that. We currently tried this on one artificial network, but we would like to try on multiple typical traffic situations (e.g. busy intersection, isolated intersection, dense network 200m between intersections).

Assignment
The student will work on performing the simulations in more typical situations. Based on the results algorithm improvements should be made to increase applicability.

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5) Queue measurement enhancements with autonomous vehicles

Problem description
Our adaptive traffic light control algorithm ImFlow currently has queue prediction based on entry loops at approx.. 200-500m upstream of the intersection. One problem is that the detectors are not 100% accurate and we don't know the future turn direction. Moreover, certain intersections are missing the entry link detector, so the queue size need to be estimated based on the traffic intensity, measured by detectors closer to the intersection. Cooperative and autonomous vehicles transmit CAM (Cooperative Awareness Message) to indicate their position. This information could help us improve the queue measurement and therefore result in better control strategies.

Assignment
The student will work on algorithms to integrate CAM data into our queue estimation models. This assignment should be carried out in simulation, a framework with coupling to the SUMO simulator is already available. The position of the vehicle from this framework can be used as input to an algorithm to calculate an enhanced queue measure. There is also an interface available to ImFlow to inject queue measurements, so the improvement in control performance can be tested. This assignment requires moderate programming skills.

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