When AI meetsd humanity for transportation

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Humanity is at the dawn of a digital revolution where Artificial Intelligence (AI) is poised to reshape the future of transportation with self-driving cars, delivery robots, and intelligent machines more broadly. To this end, a fundamental challenge is to develop machines that can not only perform intelligent tasks, but do so while co-existing with humans in the open world. Machines need to learn unwritten common sense rules, ethics, and comply with social conventions. Delivery robots should respect personal space, yield right-of-way, and ultimately "read" the behavior of others to effectively navigate crowded spaces.

While AI has made great progress in classifying images or playing games driven by well-defined set of rules, intelligent machines still lack common sense and the ability to make seamless, safe, moral and efficient decisions in crowded social scenes. To reach this ambitious goal, I propose empowering machines with a type of cognition I call socially-aware AI, i.e., systems equipped with perception and social intelligence. In other words, I aim to develop systems that have the capacity to i) understand human behavior and ii) effectively navigate and negotiate complex social interactions and environments. In this talk, I will present our latest works towards socially-aware transportation.

Routing vehicles and passengers in public transport networks

Prof. Dr. Francesco Corman, Eidgenössische Technische Hochschule Zürich

Public transportation is a key player in mobility issues within many relevant trends: growing urbanization, increased sustainability, increased safety, reduced car ownership,… The key feature of public transport is the fact that transportation is shared with others, and thus the path to origin and destination has to go only through some existing lines/services offered. Moreover, typical public transport technologies can operate only on

particular infrastructure, with very peculiar constraints, like tracks for railways.

This talk reviews the current state of the art in routing algorithm for railway vehicles, especially in the stringent scope of real time traffic management. There, resources to use for routing have very strong dynamic availability, i.e. the scheduling and routing problem are deeply interconnected. We present a series of algorithms and recent developments for this problem, and their performance.

We also study the complementary problem of routing passengers in the resulting transport services, and the impact that considering them might have in the scheduling and routing of vehicles. In fact, the type of information and route advice given to passengers interacts with the problem of rescheduling and rerouting trains over tracks and station resources, leaving much space for further research.

On some graph modification problems

Prof. Dr. Bernard Ries, Université de Fribourg

A typical graph modification problem aims to modify a graph G, via a small number of operations from a specified set S, into some other graph H that has a certain desired property, which usually describes a certain graph class G to which H must belong. In this way a variety of classical graph-theoretic problems is captured. For instance, if only k vertex deletions are allowed and H must be an independent set or a clique, we obtain the Independent Set or Clique problem, respectively.

Now, instead of fixing a particular graph class G, we fix a certain graph parameter π. That is, given a graph G, a set S of one or more graph operations and an integer k, we ask whether G can be transformed into a graph G' by using at most k operations from S, such that $\pi(G') \leq \pi(G)-d$ for some threshold $d \geq 0$. Such problems are called blocker problems, as the set of vertices or edges involved can be seen as "blocking" some desirable graph property (such as being colorable with only a few colors). Identifying the part of the graph responsible for a significant decrease of the parameter under consideration gives crucial information on the graph.

Blocker problems have been given much attention over the last few years. In this talk, I will give an overview of recent results on this topic.