Smart Cities – Making Cities Livable and Sustainable

Siobhán Clarke[1]

Abstract: Given growing urban populations, it is clear we need to change our behaviour to better manage the sharing of increasingly constrained urban resources, such as the road network, energy, water, and so on. With an expected 70% of the world's population living in urban areas by 2050, pressure on resources and infrastructure in cities and communities around the globe is growing. Cities consume over two-thirds of the world's energy and account for more than 70% of global CO2 emissions. In an analysis of 13,000 cities published in 2018, the critical impact city dwellers have on overall carbon emissions is clear, and even more interestingly, it could be argued that city planning is hugely influential as it was found that roughly one third of an urban resident's footprint is determined by that city's public transportation options and building infrastructure [Mo18]. Pressure on city resources is clearly affecting quality of life, adversely impacting the environment and limiting economic growth.

Significant advances have been made in recent years relating to high-bandwidth network connectivity and highly-instrumented cities providing real-time information about the state of a city's resources. These technologies can be exploited to enable cities to work better. This talk explores how automation, using real-time decision-making, can play a part in assisting citizens in making better use of the resources available to them. The goal is not to take over citizens' lives, but to remove the onus on citizens to be constantly aware of potential opportunities for optimising resource sharing. In particular, the talk draws on our recent research, using examples from autonomous vehicles [MBL19], vehicle sharing [GC18] and energy demand-side management [Ma19].

References

[GC18] Golpayegani, Fatemeh; Clarke, Siobhán: Co-Ride: Collaborative Preference-Based Taxi-Sharing and Taxi-Dispatch. In (Tsoukalas, Lefteri H.; Grégoire, Éric; Alamaniotis, Miltiadis, eds): IEEE 30th International Conference on Tools with Artificial Intelligence, ICTAI 2018, 5-7 November 2018, Volos, Greece. IEEE, pp. 864–871, 2018.

[Ma19] Marinescu, Andrei; Taylor, Adam; Clarke, Siobhán; Serban, Ioan; Marinescu, Corneliu: Optimising residential electric vehicle charging under renewable energy: Multi-agent learning in software simulation and hardware-in-the-loop evaluation. International Journal of Energy Research, 43(8):3853–3868, May 2019.

[MBL19] Monteil, J.; Bouroche, M.; Leith, D. J.: $\mathcal{L}_2$ and $\mathcal{L}_\infty$ Stability Analysis of Heterogeneous Traffic With Application to Parameter Optimization for the Control of Automated Vehicles. IEEE Transactions on Control Systems Technology, 27(3):934–949, May 2019.

[1] Trinity College Dublin, Ireland siobhan.clarke@scss.tcd.ie

doi:10.18420/inf2019_02

[Mo18] Moran, Daniel; Kanemoto, Keiichiro; Jiborn, Magnus; Wood, Richard; Többen, Johannes; Seto, Karen C: Carbon footprints of 13 000 cities. Environmental Research Letters, 13(6):064041, jun 2018.