From Cellular Automata to Agent-based Models: Addressing Urban Issues

The complexities of our modern world brought forth problems which are increasingly difficult to solve. Using various forms of microscopic modelling, we seek to address two issues in urban systems. We investigated the maximum vehicular flow rate achieved by different strategies undertaken to process large amount of traffic, namely, parallel expansion - or lane-expansion - and serial expansion – in the form of a multi-point tollbooth. By proposing a novel combination of serial and parallel expansions, optimal efficiencies are achieved via different configurations based on the processing time. The problem of bus bunching can be found in every bus system. Using a discrete model, the quantitative dynamics of bus bunching was evaluated analytically. A bus-bunching agent-based model known as the Empirically-based Monte-Carlo Bus-network (EMB) model is proposed to study NTU's Shuttle Bus System. Using the EMB model, three classes of intervention strategies - holding, no-boarding and centralized-pulsing - were studied.