



“Application of deep reinforcement learning for perimeter metering control”

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Meeting Link: <https://umich.zoom.us/j/95590276501> (Passcode: NGTS)

Abstract:

Various perimeter control strategies have been proposed for urban traffic networks that rely on the existence of well-defined relationships between network productivity and accumulation, known more commonly as network Macroscopic Fundamental Diagrams (MFD). Most existing perimeter control strategies require accurate modeling of traffic dynamics with full knowledge of the network’s MFD. However, such information is generally difficult to obtain and subject to error. This talk describes recent efforts to alleviate this using deep reinforcement learning for networks made up of two unique regions. The proposed methods are completely model free in that they do not require knowledge of the network’s MFD. The algorithm learns the consequences of different control actions over time and uses this information to obtain optimal control policies under different situations. Results from numerical experiments show that the proposed method: (a) can stably learn perimeter control strategies under various types of environment configurations; (b) can consistently outperform the state-of-the-art, model predictive control (MPC); (c) demonstrates sufficient transferability to a wide range of traffic conditions and dynamics in the environment; and, (d) exhibits great potential for practical implementation. Furthermore, integration of limited knowledge of congestion dynamics can improve the algorithm considerably, allowing it to be applied on larger, more complicated network structures.

Bio:

Dr. Vikash V. Gayah is an associate professor in the Department of Civil and Environmental Engineering at The Pennsylvania State University (joined 2012). He received his B.S. and M.S. degrees from the University of Central Florida (2005 and 2006, respectively) and his Ph.D. degree from the University of California, Berkeley (2012). Dr. Gayah’s research focuses on urban mobility, traffic operations, traffic flow theory, traffic safety and public transportation. Dr. Gayah currently serves as an editorial advisory board member of Transportation Research Part C: Emerging Technologies and Accident Analysis and Prevention, an editorial board editor of Transportation Research Part B: Methodological, an associate editor for the IEEE Intelligent Transportation Systems Magazine (an international peer-reviewed journal), a handling editor for the Transportation Research Record and is a member of the Transportation Research Board’s Standing Committee on Access Management (ACP60) and Traffic Flow Theory and Characteristics (ACP50), where he serves as a paper review coordinator and the committee research coordinator. He has been recognized with multiple awards for his research and teaching activities, including the Gordon F. Newell Award for Excellence in Transportation Science, New Faculty Award by the Council of University Transportation Centers, multiple Transportation Research Board outstanding paper awards (including the Cunard, Fred Burggraf and D. Grant Mickle awards), and Faculty Early Career Development (CAREER) Award by the National Science Foundation.