Título: **Speed Prediction applied to Dynamic Traffic Sensor Networks and Road Networks**

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Resumo:

Most urban road networks are nowadays equipped with sensors monitoring traffic in real-time. The huge amount of historical sensor data collected constitutes a rich source of information that can be used to extract knowledge useful for municipalities and citizens and to contribute to the realization of intelligent transportation systems. In this work, we are interested in exploiting such data to estimate future speed in traffic sensor networks. Building effective speed prediction models in large cities poses important challenges that stem from the complexity of traffic patterns, the number of traffic sensors typically deployed, and the evolving nature of sensor networks. Indeed, sensors are frequently added to monitor new road segments or replaced/removed due to different reasons (e.g., maintenance). Exploiting a large number of sensors for effective speed prediction requires smart solutions to collect vast volumes of data and train effective predictive models. Furthermore, the dynamic nature of real-world sensor networks calls for solutions that are resilient not only to changes in traffic behavior, but also to changes in the network structure. We study three different approaches in the context of large and dynamic sensor networks: local, global, and cluster-based. The local approach builds a specific prediction model for each sensor of the network. Conversely, the global approach builds a single prediction model for the whole sensor network. Finally, the cluster-based approach groups sensors into homogeneous clusters and generates a model for each cluster. We provide a large dataset, generated from ~1.3 billion records collected by up to 272 sensors deployed in Fortaleza, Brazil, and use it to experimentally assess the effectiveness and resilience of prediction models built according to the three aforementioned approaches. The results show that the global and cluster-based approaches provide very accurate prediction models that

prove to be robust to changes in traffic behavior and in the structure of sensor networks, which, in turn, includes the cold start problem. We also propose and evaluate the global approach to perform accurate speed predictions in Road Networks even in segments not covered by traffic sensors. Our Road Network predictions rely on the aggregation of speed-related features obtained from trajectory datafrom vehicles in Fortaleza.

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