Traffic And Capacity Analytics For Major Ports

ABSTRACT

The Indian Railways has a capital base of about Rs. 100000 crores and is often referred to as the lifeline of the Indian economy because of its predominance in transportation of bulk freight and long distance passenger traffic. The network criss-crosses the nation, binding it together by ferrying freight and passengers across the length and breadth of the country. So there occurs the congestion the ports.Our objective is to reduce the congestion in ports.

1.) Analyzing congestion interdependencies of ports and container ship routes in the maritime network infrastructure

Events such as prolonged congestion in ports or unavailable ship routes in the maritime network often initiate cascading congestions that block transportation and/or disrupt services over wide areas. Existing traffic flow analysis methods lack the ability to understand the cascading effects of delays in ship routes or how to reduce overall delays in greater maritime areas. Dependency risk graphs have been proposed as a tool for analyzing such cascading events using dependency chains. This paper proposes a risk-based interdependency analysis method capable to detect large-scale traffic congestions between interconnected ports and ship routes in the maritime network and provide solutions to improve flow. Presented dependency risk chains of ports along with graph theory help us analyze ship routes and detect ports that are affected most when other major ports are congested in the maritime network, detect the causes of bottlenecks and provide valuable info in relieving delays across container ship routes. We apply the proposed method on historical container ship routing data provided by the MarineTraffic company that maintains a comprehensive maritime database worldwide for more than 6 million users monthly. This application-oriented, interdisciplinary effort culminated in a prototype tool able to analyze the historical data for container ships in the entire global maritime network and detect congestion dependencies. The tool can be used to identify key shipping routes or ports that: (i) are prone to delays, (ii) greatly affect the overall maritime network due to position, connections and risk of congestion, and/or (iii) get affected the most by delays in previous route legs.

2.) Modeling and Forecasting Vehicular Traffic Flow as a Seasonal ARIMA Process: Theoretical Basis and Empirical Results

This article presents the theoretical basis for modeling univariate traffic condition data streams as seasonal autoregressive integrated moving average processes. This foundation rests on the Wold decomposition theorem and on the assertion that a one-week lagged first seasonal difference applied to discrete interval traffic condition data will yield a weakly stationary transformation. Moreover, empirical results using actual intelligent transportation system data are presented and found to be consistent with the theoretical hypothesis. Conclusions are given on the implications of these assertions and findings relative to ongoing intelligent transportation systems research, deployment, and operations.

3.) Arterial Traffic Flow Prediction: A Deep Learning Approach with Embedded Signal Phasing Information

Accurate and reliable prediction of traffic measurements plays a crucial role in the development of modern intelligent transportation systems. Due to more complex road geometries and the presence of signal control, arterial traffic prediction is a level above freeway traffic prediction. Many existing studies on arterial traffic prediction only consider temporal measurements of flow and occupancy from loop sensors and neglect the rich spatial relationships between upstream and downstream detectors. As a result, they often suffer large prediction errors, especially for long horizons. We fill this gap by enhancing a deep learning approach, Diffusion Convolutional Recurrent Neural Network, with spatial information generated from signal timing plans at targeted intersections. Traffic at signalized intersections is modeled as a diffusion process with a transition matrix constructed from the green times of the signal phase timing plan. We apply this novel method to predict traffic flow from loop sensor measurements and signal timing plans at an arterial intersection in Arcadia, CA. We demonstrate that our proposed method yields superior forecasts; for a prediction horizon of 30 minutes, we cut the MAPE down to 16% for morning peaks, 10% for off peaks, and even 8% for afternoon peaks. In addition, we exemplify the robustness of our model through a number of experiments with various settings in detector coverage, detector type, and data quality.

4.) A method for risk modeling of interdependencies in critical infrastructures

Failures in critical infrastructures may be hazardous to population, economy, and national security. There can be strong interdependencies between various infrastructures, but these interdependencies are seldom accounted for in current risk and vulnerability analyses. To reduce probability and mitigate consequences of infrastructure failures, these interdependencies have to be assessed. The objective of this paper is to present a method for assessing interdependencies of critical infrastructures, as part of a cross-sector risk and vulnerability analysis. The method is based on a relatively simple approach applicable for practitioners, but may be extended for more detailed analyses by specialists. Examples from a case study with the Emergency Preparedness Group of the city of Oslo, Norway, are included.

5.)Spatial characteristics of transportation hubs centrality and intermediacy

Centrality and intermediacy are identified in this article as spatial qualities that enhance the traffic levels of transportation hubs, and hence indicate which places are strategically located within transportation systems. The local, regional, national, continental or hemispheric centrality of a city has a fundamental impact on the city's own size and function and on its traffic-generating powers. Intermediacy, while it may reflect a natural geographical ‘in betweenness’, is a spatial quality that needs to be defined in the specific context of contemporary or prospective transportation systems and networks. Intermediate places can be given extra traffic if they are favoured by transport carriers as connecting hubs or relay points in the system. Passenger traffic data at US airports and container traffic at US and foreign seaports are used to illustrate these concepts of strategic commercial location. In many instances we are able to differentiate between true origin-destination and connecting traffic, giving a rough idea of the comparative contributions of the centrality and intermediacy factors to the traffic totals. It is no surprise that all large transportion hubs possess, at some scale and to some degree, both locational attributes — centrality and intermediacy.

References:

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