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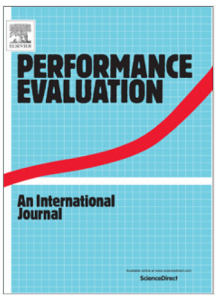

Moment-based availability prediction for bike-sharing systems

Cheng Feng, Jane Hillston, Daniël Reijsbergen

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Moment-based Availability Prediction for Bike-Sharing Systems

Cheng Feng[a,*], Jane Hillston[b], Daniël Reijsbergen[b]

[a] *Institute for Security Science and Technology, Imperial College London, London, UK*
[b] *LFCS, School of Informatics, University of Edinburgh, Informatics Forum, Edinburgh, UK*

Abstract

We study the problem of predicting the future availability of bikes in a bike station through the moment analysis of a PCTMC model with time-dependent rates. Given a target station for prediction, the moments of the number of available bikes in the station at a future time can be derived by a set of moment equations with an initial set-up given by the snapshot of the current state of all stations in the system. A directed contribution graph is constructed, and a contribution propagation method is proposed to prune the PCTMC so that it only contains stations which have significant contribution to the journey flows to the target station. Once the moments have been derived, the underlying probability distribution of the available number of bikes is reconstructed through the maximum entropy approach. We illustrate our approach on Santander Cycles, the bike-sharing system in London. The model is parameterised using historical data from Santander Cycles. Experimental results show that our model outperforms a time-inhomogeneous Markov queueing model with respect to several performance metrics for bike availability prediction.

Keywords: Bike-sharing systems; Availability prediction; PCTMC models; Moment analysis; Maximum entropy reconstruction

*Corresponding author
Email addresses: c.feng@imperial.ac.uk (Cheng Feng), jane.hillston@ed.ac.uk (Jane Hillston), dreijsbe@inf.ed.ac.uk (Daniël Reijsbergen)