



Project title	Forecasting and monitoring traffic network flows
Principal supervisor	Catriona Queen
Second supervisor	Karen Vines
Discipline	Statistics
Research area/keywords	Multivariate time series forecasting, Bayesian dynamic models, graphical models
Suitable for	Full time students (project would be suitable for a part time student only if the student were able to work on the project as part of their day job)

Project background and description

Congestion on roads is a worldwide problem causing environmental, health and economic problems. On-line traffic data can be used as part of a traffic management system to monitor traffic flows at different locations across a network over time and reduce congestion by taking actions, such as imposing variable speed limits or diverting traffic onto alternative routes. Reliable short-term forecasting and monitoring models of traffic flows are crucial for the success of any traffic management system: this project will develop such models.

Forecasting and monitoring the traffic flows at different locations across a network over time, is a multivariate time series problem. This project takes a Bayesian approach to the problem, using dynamic graphical models. These models break the multivariate problem into separate, simpler, subproblems, so that model computation is simplified, even for very complex road networks. Dynamic graphical models have been shown to be promising for short-term forecasting of traffic flows (as described in the references listed below), but issues still remain before the models can be used for an on-line traffic management system in practice.

Minute-by-minute traffic flow data at a number of different locations at the intersection of three busy motorways near Manchester, UK, are available for the project (kindly supplied by the Highways Agency in England: <http://www.highways.gov.uk/>). The project will involve theoretical developments in statistical methodology, as well as a large amount of practical work requiring good statistical programming skills: current software for these models is written in R.

Background reading/references

- Anacleto, O., Queen, C.M. and Albers, C.J. (2013) 'Multivariate forecasting of road traffic flows in the presence of heteroscedasticity and measurement errors.' *Journal of the Royal Statistical Society Series C*, 62 (2), 251-270. Available at http://statistics.open.ac.uk/2011_technical_reports.
- Anacleto, O., Queen, C.M. and Albers, C.J. (2013) 'Forecasting multivariate road traffic flows using Bayesian dynamic graphical models, splines and other traffic variables' *Australian and New Zealand Journal of Statistics*, 55 (2), 69-86. Available (under the previous title of 'Enhancing on-line multivariate flow forecasts for road traffic networks') at http://statistics.open.ac.uk/2012_technical_reports.