

Dr Hussein Dia
F.ASCE, F.ITE, F.IEAust

Research Interests and Specialisation

My main research interests and specialisation is in the smart transport (Intelligent Transport Systems - ITS) and the wider smart and self-healing infrastructure fields:

- Smart transport systems including network management and safety systems, travel information, communications and control, freight efficiency, rail technology, emergency management, cooperative mobility (vehicle-to-vehicle and vehicle-to-infrastructure systems), and public transport systems
- Development and evaluation of predictive analytics, network optimisation, operational research, artificial intelligence and multi-agent smart algorithms for self-healing infrastructure and network management and control
- Development and evaluation of pollutant emissions and fuel consumption models for use in traffic simulation and assessment of ITS impacts
- Traffic modelling and simulation of ITS and complex dynamic applications. Proficiency in state-of-the-art traffic modelling tools ranging from analytical control to sophisticated micro and meso-simulation, and macro models

Research Awards

- 2005 Best Paper Award. Intelligent Vehicles and Road Infrastructure Conference (IVRI '05), 16-17 February 2005, Melbourne, Australia
- 1999 Best Paper Award. 11th Mini-Euro Conference on Artificial Intelligence in Transportation Systems and Science, 2-6 August 1999, Helsinki, Finland.
- 1995 Monash University Civil Engineering Department Scholarship, VicRoads Sponsorship
- 1993 Monash University Graduate Scholarships 1993-1997 (only 100 offered annually across University)

Key Research Grants

<i>Year</i>	<i>Grant (Investigators)</i>	<i>Funding</i>	<i>Source</i>
2002	Intelligent Transport Systems Research Laboratory (Dia, Vlacic, Tay and Hidas)	\$655,000	Australian Research Council Linkage Infrastructure
2002	Drivers Behavioural Response to Information (Horberry, Wallis and Dia)	\$60,000	Australian Research Council Linkage Project
2000	Modelling Dynamic Driver Behaviour using Intelligent Agents (Dia)	\$34,500	Queensland Department of Main Roads
2000	Modelling the Environmental Impacts of Intelligent Transport Systems (Dia)	\$17,772	University of Queensland Early Career Researcher
1999	Short-Term Traffic Forecasting using Neuro-Genetic Techniques (Dia)	\$23,500	Queensland Department of Main Roads
1999	New Staff Member Research Start-up Fund (Dia)	\$9,960	University of Queensland

Research Contributions

I have made the following contributions in my areas of research:

- Published more than 100 papers and technical reports in the field of Intelligent Transport Systems (ITS), Simulation and Modelling of complex systems, network operations and Transport Engineering. This includes 4 Book Chapters, 17 Journal Papers, 74 conference papers (includes internationally refereed conferences), and more than 20 technical reports.
- During my 10-year tenure at the University of Queensland in Brisbane, I attracted more than \$2m in research grants, contract research and professional development programs covering ITS and simulation and modelling. This includes an Infrastructure Grant from the Australian Research Council (\$655,000) which resulted in the establishment of the ITS Research Laboratory at the University of Queensland. The Laboratory is now recognised as a major research facility in ITS and simulation and modelling in Australia, and provides the research infrastructure and training needed for developing, testing and evaluating transport technologies
- Received 211 citations in the Web of Science and 755 citations in Google Scholar (as of 16-Jan-2013)

My research contributions in the ITS and transport modelling fields include:

Research Summary

- **Development of dynamic driver behaviour models.** The simplicity and accuracy of the agent-based algorithms, compared to conventional driver behaviour models, provides a means for determining the critical factors that influence drivers' behaviour and modelling their decisions under the influence of traffic information.
- **Microscopic traffic simulation and the development of agent-based car following models.** This research demonstrated for the first time the feasibility of developing Neugent (neural agent) car following algorithms for modelling the longitudinal interaction of vehicles in a traffic simulator. The Neugent model results clearly showed better replication of field car following behaviour than conventional models.
- **Development of adaptive agent-based algorithms for traffic signal control.** In this research, multi-agent algorithms are used to coordinate signalised intersections along a study corridor. Each single intersection is modelled as a local autonomous controller equipped with local optimisation model. The results from this research showed superior performance to fixed time control and provided better throughput across the intersections.
- **Automated Incident Detection.** Automatic early detection of accidents on freeways to facilitate prompt dispatch of emergency services to victims and the injured. Dr Dia's PhD thesis research on developing neural network incident detection architectures resulted in the implementation of these algorithms in a number of traffic control centres in Australia. In addition to their safety benefits, these systems have also been found to improve the efficiency of the freeway facility by around 40 per cent.

Publications

Hussein has published the following:

- 2 Theses on Intelligent Transport Systems and Transport Operational Research Topics
- 4 Book chapters on Intelligent Transport Systems
- 17 Journal papers on Intelligent Transport Systems and Traffic Simulation and Modelling
- 74 Conference papers on Intelligent Transport Systems, Traffic Simulation, Traffic and Transport Engineering
- 20 Technical Reports

Please refer to the attached CV for the full list of publications.

Research Impacts

The impact of Hussein's work is demonstrated by the status of six of his publications as shown below:

1. *Dia, H. (2002). An Agent-based Approach to Modelling Driver Route Choice Behaviour under the Influence of Real-time Information. Transportation Research Part C, 10(5-6). Special Issue on Intelligent Agents in Traffic and Transportation, pp 331-349.*

This paper established for the first time the feasibility using intelligent agents to develop driver route choice models under the influence of travel information. These models have now been shown to extend the capabilities of microscopic traffic simulators and improve their reliability, credibility and applicability to modelling ITS applications. The standing of this work is highlighted by its publication in a Tier 1 journal and its listing in international databases like the Web of Science, Ei Compendex, Melvyl, Scirus and TRIS online (TRB). The paper is also listed in Google Scholar.

2. *Dia, H. (2001). An Object-oriented Neural Network Approach to Short-term Traffic Forecasting. European Journal of Operations Research, 131(2), pp 253-261.*

This work initiated the development of short-term traffic forecasting models using a special class of object-oriented neural network algorithms. The models were successful in predicting travel times up to 15 minutes into the future with a 95% accuracy which was unmatched by other algorithms in the literature. The standing of this work is highlighted by its publication in Tier 1 journal and listing in international databases. The publication was derived from conference paper which received Best Paper Award at the Conference on Artificial Intelligence in Transport Systems, Helsinki, Finland.

3. *Dia, H. and Rose, G. (1998). Development and evaluation of neural network freeway incident detection models using field data. Transportation Research-C, 5(5). Special Issue on the Applications of Neural Networks in Transportation, pp. 313-331.*

This paper developed and evaluated the performance of neural network incident detection models based on field data collected from Melbourne Freeways. The models showed a higher performance compared with the models that were available in the mid 1990s. The standing of this work is highlighted by its publication in a Tier 1 journal and its listing in international databases.

4. *Panwai, S. and Dia, H. (2005). Comparative Evaluation of Microscopic Car Following Behaviour. IEEE Transactions on Intelligent Transportation Systems, 6(3), pp 314-325.*

This paper is a first attempt in the literature to provide a comprehensive evaluation of car following models implemented in leading microscopic traffic simulators. The standing of this work is highlighted by its publication in a Tier 1 journal and its listing in international databases. Hussein co-authored this paper with his PhD student Sakda Panwai

Research Summary

5. *Dia, H. and Panwai, S. (2007). Modelling drivers' compliance and route choice behaviour in response to travel information. Special issue on Modelling and Control of Intelligent Transportation Systems, Journal of Nonlinear Dynamics, Volume 49, Number 4, September, 2007 (Springer).*

This paper addressed commuters' route choice behaviour in response to traveller information. The data used in this study was obtained from a field behavioural survey of drivers that was conducted on a congested commuting corridor in Brisbane, Australia. Agent-based neural network models (Neugents) were used to analyse the impacts of socio-economic, context and information variables on individual behaviour and propensity to change route and adjust travel patterns.

6. *Panwai, S. and Dia, H. (2005). A Reactive Agent-Based Neural Network Car Following Model. Proceedings of the 8th International IEEE Conference on Intelligent Transportation Systems, September 13-16, 2005, Vienna, Austria, pp. 326-331.*

This paper presented a novel approach for car following models using reactive agent techniques for mapping perceptions to actions. The results showed that the model outperformed the Gipps and Psychophysical family of car following models. The standing of this work is highlighted by its acceptance and publication in the proceedings of the International IEEE Conference on Intelligent Transportation Systems (ITS), which is now recognised as the premier international conference on ITS. The paper acceptance rate to this conference was 67 percent. The standing of this paper is also evidenced by its listing in international databases like Ei Inspec and IEEE Xplore. The paper is also listed in Google Scholar with 3 citations (March 2010). Hussein co-authored this paper with his PhD student Sakda Panwai.

Most Cited Publications and Journal Impact Factors

Publication	SCI Journal Impact Factor	5-Year Impact Factor	No of Citations Web of Science	No of Citations Google Scholar
	2011	2011	16-Jan-2013	16-Jan-2013
Dia, H. (2001). An Object-oriented Neural Network Approach to Short-term Traffic Forecasting. <i>European Journal of Operations Research</i> , 131(2), pp. 253-261. (Elsevier)	1.815	2.277	59	141
Dia, H. (2002). An Agent-based Approach to Modelling Driver Route Choice Behaviour under the Influence of Real-time Information. <i>Transportation Research Part C</i> , 10(5-6). Special Issue on Intelligent Agents in Traffic and Transportation, pp 331-349. (Elsevier)	1.957	2.284	57	139
Dia, H. and Rose, G. (1998). Development and evaluation of neural network freeway incident detection models using field data. <i>Transportation Research-C</i> , 5(5). Special Issue on the Applications of Neural Networks in Transportation, pp. 313-331. (Elsevier)	1.957	2.284	40	99
Panwai, S. and Dia, H. (2005). Comparative Evaluation of Microscopic Car Following Behaviour. <i>IEEE Transactions on Intelligent Transportation Systems</i> , 6(3), pp 314-325. (IEEE)	3.452	2.748	39	116
Dia, H. and Panwai, S. (2007). Modelling driver's compliance and route choice behaviour in response to travel information. <i>Nonlinear Dynamics</i> , 49(4), pp 493-509. (Springer)	1.247	1.346	8	26
Panwai, S. and Dia, H. (2007). Neural Agent Car-Following Models. <i>IEEE Transactions on Intelligent Transportation Systems</i> . Volume 8, Issue 1, pp. 60-70. (IEEE)	3.452	2.748	8	22

Google Scholar Citations: <http://bit.ly/Ys28zJ>

Web of Science Citations: <http://www.researcherid.com/rid/B-1542-2008>

Research Summary

Contract Research

<i>Year</i>	<i>Contract Research</i>	<i>Value</i>
2006	Development and Evaluation of Freeway Travel Time Forecasting Models. Client: QDMR	\$100,000
2006	Evaluating the Impacts of Incidents. Client: QDMR	\$50,000
2006	Evaluating the Impacts of Traffic Strategies in Reducing Incident Impacts. Client: QDMR	\$50,000
2006	Simulation of the Impacts of Heavy Vehicle Restrictions. Client: QDMR	\$29,755
2006	Simulation of the Impacts of Arterial Incidents. Client: QDMR	\$9,820
2006	Development, Calibration and Validation of Pacific Motorway Traffic Simulation Model. Client: QDMR	\$ 49,115
2005	Development, Calibration and Validation of the Gold Coast Traffic Simulation Model. Client: QDMR	\$53,020
2005	ITS Strategy for South Coast Hinterland District: Situation Analysis. Client: QDMR	\$9,900
2005	Comparative Evaluation of Environmental Emissions Models using Traffic Simulation. Client: CSIRO	\$36,720
2004	Scoping Study- Machine Vision Applications in Transportation. Client: CSIRO	\$9,900
2004	Drive Cycle Data Collection (Austroads Strategic Routes in Brisbane): Second National In-Service Emissions Study. Client: University of South Australia.	\$8,250
2004	Scoping Study- Performance Evaluation of Traffic Control Systems Using Traffic Simulation. Client: Brisbane City Council	\$ 10,890
2003	Signal Coordination Benefits – Analysis of Travel Time and Speed Surveys. Client: QDMR	\$8,090
2003	Evaluation of Traffic Signal Control Systems for Brisbane. Client: Brisbane City Council	\$ 20,364

Research Student Supervision

To date, I have supervised and graduated a number of higher research degree students including (4) PhD and (3) Master students. I had also supervised the honours theses for more than 40 students. I am currently an external supervisor for a PhD student at the Queensland University of Technology

Doctoral and Masters Research Students

<i>Name</i>	<i>Degree</i>	<i>Research Topic</i>	<i>Award Date</i>
Dr Noppakun Boongrapue	PhD	Development and evaluation of neural network environmental emissions models	Feb 2010
Dr Sakda Panwai	PhD	Modelling driver behaviour under the influence of traffic information	Feb 2007
Dr Suphasawas Nigarnjanagool	PhD	Development and evaluation of agent-based adaptive traffic signal control systems	Feb 2007
Dr Caroline Sutandi	PhD	Performance evaluation of advanced traffic control systems in a developing country	Sep 2006
Mr William Gondwe	Masters	Evaluation of incident management benefits on integrated arterial/motorway road networks	Dec 2008
Ms Kim Thomas	Masters	Incident detection on arterials using neural network data fusion	Mar 2005
Mr Nick Cottman	Masters	Modelling the impacts of Intelligent Transport Systems using microscopic traffic simulation	Sep 2003

Please refer to CV for details of the undergraduate honours thesis supervision