A Prediction Model for Algorithm Selection in Solving Combinatorial Optimisation Problems.

Lead Research Organisation: [Lancaster University](#)
Department Name: Mathematics and Statistics
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Abstract

[Funding details](#)

The main objective of this project is to develop a model to predict which from a set of algorithms is most suitable for solving different instances of combinatorial optimisation problems. A large number of Tesco operations, such as delivery planning, vehicle routing problems and distribution systems, involve combinatorial optimisation. This model will be designed to meet the requirements of such problems large-scale retail problems. While these problems have been widely studied, the decision about which algorithm performs best on a particular instance, or class of instances is still unresolved.

Problems can be characterised using different features, and we will model the relationship between such features and the performance of different heuristic algorithms. We will also explore these models for problems with dynamic features that change with time.

The project will develop new analysis methods to help explain the performance of the algorithms for different problem instances. The techniques developed will be able to explain to decision-makers under which conditions we can expect those algorithms to provide trustworthy solutions and when we may expect that the solutions provided to be infeasible or of low quality.

In partnership with Tesco.

Planned Impact

This proposal will benefit (i) the UK economy and society, (ii) our industrial partners, (iii) the wider community of non-academic employers of doctoral graduates in STOR, (iv) the scientific disciplines of statistics and operational research and associated academic communities, (v) UK doctoral students in STOR, and (vi) the CDT students themselves.

Below we outline how each of these communities will realise these benefits:

(i) The UK economy will gain a competitive edge through a significant increase in the supply and diversity of

doctoral STOR professionals with the skills required to undertake influential, responsible and impactful research, and who have been trained to become future leaders. Our goal is that our future alumni who enter industry assume leading roles in realising the major impact that STOR can make in achieving effective data driven decision-making. Our existing alumni are already starting to achieve this. A wider societal benefit will accrue from research contributions to EPSRC Prosperity Outcomes, e.g. to the UK being a Productive and Resilient Nation.

(ii) Our industrial partners will particularly benefit from the skills supply identified in item (i), as likely employers of STOR-i graduates. They will further benefit from teaming with a community of leading edge STOR researchers in the solution of substantive industrial challenges. Mechanisms for the latter include doctoral projects co-supervised with industry, industrial internships, engagement in research clusters and industrial problem-solving days. Our training programme will give students the skills they need to ensure that research is conducted responsibly and that outcomes are successfully communicated to beneficiaries. The value that our industrial partners place on working with STOR-i can be seen through the pledged cash support of £1.7M.

(iii) A wider benefit will accrue from the employment of STOR-i graduates, equipped as described in items (i) and (ii), across non-partner public and private sector organisations. The breadth and depth of training provided by the CDT will enable students to quickly make a difference in these organisations, using their research skills to affect significant change.

(iv) The STOR academic community will benefit from methodological advances and from the increase and diversity in the supply of STOR researchers who value, and have experience of, collaborative research. Our alumni will be leaders in 21st Century Statistics with a strong culture of, and training in, reproducible research and a focus on achieving impact with excellence. Our recruitment strategy will further benefit this community in achieving a healthier supply of high-quality doctoral candidates from diverse backgrounds. Our research internship programme gives top mathematically able individuals from across the UK an experience of STOR research and has been shown to increase applications for STOR PhD programmes across the UK.

(v) Elements of the STOR-i programme will benefit the wider community of UK doctoral students in STOR. Using financial support from our industrial partners, we will continue our National Associate Scheme. This will provide up to 50 UK STOR doctoral students with funding and access to elements of STOR-i's training programme. An annual conference will provide opportunities for learning, networking and sharing research progress to members of the scheme.

(vi) STOR-i students will benefit from a personalised programme that will support each individual in fully achieving their research leadership potential, whether in academia or industry. Students will be given the tools and opportunities to develop research and broader skills that will enable them to achieve maximum scientific impact for their work. Our current alumni provide strong evidence that these future graduates will be extremely employable.

Student:

Danielle Notice

Period of Study:

Sept 21 - Sept 25

Funder:

EPSRC

Project Status:

Active

Project Category:

Studentship

Project Reference:

2608381

Research Topic:

[Unclassified](#)

Organisations

- [Lancaster University (Lead Research Organisation)](#)
- [Tesco (United Kingdom) (Student Project Partner)](#)

People	ORCID iD

[Danielle Notice (Student)](#)

Publications

The following are buttons which change the sort order, pressing the active button will toggle the sort order
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Studentship Projects

Project Reference	Relationship	Related To	Start	End	Student Name
[EP/S022252/1](#)			30/09/2019	30/03/2028	
[2608381](#)	Studentship	[EP/S022252/1](#)	30/09/2021	29/09/2025	[Danielle Notice](#)

Data

[The Data](#) on this website provides information about publications, people, organisations and outcomes relating to research projects

APIs

A set of REST [API's](#) enable programmatic access to the data. Refer to the application programming interfaces [GtR](#) and [GtR-2](#)

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