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****Please read accompanying guidance notes****

Department	School of Engineering and the Built Environment
Supervisors	Greg Fountas, Achille Fonzone
Funding Status	Funded PhD Project (Worldwide)
Application Deadline	14/04/2022
Project Title	Climate Change and Travel Choices: Bridging Statistical Inference and Artifical Intelligence

PROJECT DESCRIPTION

The emergence of novel data collection technologies and methods has paved the way for the widespread use of "big data", which can better inform decisions in transport planning, operations and policy. Real-time data, naturalistic and sensor data, or even social media and app data constitute just a few examples of such new sources of granular information.

The high dimensionality of the big data poses significant challenges in their analysis and modeling. However, their use is now more imminent than ever, especially considering the profound impact of climate change and the behaviour change that is underway to foster a sustainable, net-zero future of the transport sector.

Over the last few years, the rise of Artificial Intelligence (AI) methods has brought unprecedented capabilities in efficiently handling and processing large and disparate datasets, with their use typically resulting in high forecasting accuracy. However, the long-debated "black-box" components of various AI approaches set profound restrictions in their ability to unravel causality effects from the analysis of "big data", thus leading to low explanatory power and limited application potential.

In contrast, the traditional statistical and econometric methods and their recent extensions have proven more efficient in identifying relationships between observed or latent factors, thus providing a better understanding of the underlying phenomena and processes. However, the complexities underpinning their estimation process impose significant barriers to their convergence, especially in cases of large and disparate datasets.

This PhD project seeks to develop a hybrid data analysis framework, which will integrate AI techniques and statistical and econometric methods to explain and predict the potential shift in travel choices with a view to reduce climate change. Such a framework is expected to provide a decisive step towards resolving the main dilemma transport analysts and researchers face in the selection process of the most appropriate data analysis approach: "What should my model do? Predict the extent of change or explain the factors determining the change"? This PhD program will seek to answer the previous question with a resounding "Both".

The successful candidate will join the Transport Research Institute (TRI) of Edinburgh Napier University, the Scotland's largest and longest established transport research group. You will join an experienced research team of researchers that enjoy what they do and aim to improve the life of people around them with their work. You will be part of an ambitious University, rapidly climbing the international rankings, and enjoy the vibrancy of a world renowned city like Edinburgh. You will develop skills that can be useful for your career, within or outside academia.

Academic qualifications

A first degree (at least a 2.1) ideally in Civil Engineering or Transport or Computer science or Statistics/Econometrics/Applied Mathematics or Data Science with a good fundamental knowledge of data analysis and statistical methods.

English language requirement

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IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental knowledge of statistical and econometric methods and/or artificial intelligence and machine learning for data analysis.
- Competent in computer programming (e.g., Python, R, Matlab)
- Knowledge of transport analysis and modelling.
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Previous experience in data collection for social research and integration of disparate "Big Data" sources

Indicative Bibliography	Mannering, F., Bhat, C.R., Shankar, V., Abdel-Aty, M., 2020. Big data, traditional data and the tradeoffs between prediction and causality in highway-safety analysis. Analytic methods in accident research, 25, 100113. Brathwaite, T., 2018. The Holy Trinity: Blending Statistics, Machine Learning and Discrete Choice, with Applications to Strategic Bicycle Planning (Doctoral dissertation, UC Berkeley). Washington, S., Karlaftis, M.G., Mannering, F. Anastasopoulos, P., 2020. Statistical and econometric methods for transportation data analysis. CRC press. Fountas, G., Anastasopoulos, P.C., Boyle, L., 2019. Opportunities and Challenges in Statistical Analysis of Transportation Data: Where We Are and Where We Are Going. TRB Centennial Papers. Sifringer, B., Lurkin, V. and Alahi, A., 2020. Enhancing discrete choice models with representation learning. Transportation Research Part B: Methodological, 140, pp.236-261.
Funding notes	This project may be funded by a scholarship of the School of Engineering and Built and Environment. Please see School-funded PhD scholarships - RESEARCH AND INNOVATION (napier.ac.uk) for information on the scholarships and how to apply for them.
Enquiries	For informal enquiries about this PhD project, please contact Click here to enter text.
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process

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