Australian Government

National Health and Medical Research Council

NHMRC

SAPPHIRE

Application Report

Application Details	
Grant Opportunity:	2020 Ideas Grants
Application ID:	2002025
Application Title:	Pathways to health: advancing bicycling as an active mode of transport
Chief Investigator A:	
Administering Institution:	Monash University
Grant Duration:	4 years

Contents

Participating Institutions

Participating Institutions	
Participating Institution	**Department**
Monash University	School of Public Health and Preventive Medicine
University of Melbourne	
University of New South Wales	
University of New South Wales	
University of British Columbia	
Simon Fraser University	
Arizona State University	

Is this application using services provided by a research facility?   No
If yes, see separate attachment for details

Does this research proposal include an Aboriginal and/or Torres Strait Islander health research or capacity building component?   (no response)

Funding Sources

Funding Sources	
Funding is sought from the following organisation(s):	
NHMRC	False
Cancer Australia and Funding Partners	False
Cancer Councils	False

Synopsis

Synopsis

Cycling, as an active mode of transport, is critical to providing easy and affordable physical activity as part of everyday life, and has profound physical and mental health benefits. Despite these benefits, the number of people commuting by bicycle in Australia and many other countries is low. The key barrier to increased cycling participation is how safe someone feels when riding a bicycle. It is well known that the provision of safe and connected cycling infrastructure is critical to overcoming this barrier. However, effective decision making on where to invest cycling infrastructure for the greatest impact cannot be achieved in the absence of cycling exposure data (defined as bicycle volume data on individual street segments). The absence of this cycling exposure data has crippled our ability to improve safety and advance cycling for health.

Through cutting edge statistical and machine learning modelling, we will develop a universal platform for city-wide modelling of cycling exposure. For the first time, we will provide a detailed understanding of which infrastructure types lead to the largest injury reductions, and where we need to implement infrastructure to enhance cycling participation and safety.

We anticipate the proposed project will lead to improved safety for cyclists, lower injury rates, greater equity and a substantial increase in the number of people riding bikes, therefore realising the potential for huge gains in population and environmental health.

Research Team

Research Team			
Role	**Investigator**	**Primary Institution**	**Will CI be based in Australia?**

Relevant Background and Expertise:

Associate Investigators		
Name	**Primary Institution**	**Position**
Prof Xiaojun Chang		Associate Investigator

Relevant Background and Expertise:
Dr Xiaojun Chang is a Senior Lecturer and ARC DECRA Fellow in the Faculty of Information Technology, Monash University. Dr Chang has focused his research on utilising deep learning techniques to process multiple signals from different data sources for automatic content analysis. His specific research interest is to develop structured machine learning models for computer vision and multimedia tasks. He mainly investigates how to explore the information contained in videos and develop the advanced artificial intelligence systems.

His team has won multiple prizes from international grand challenges. For example, he won the first place in the TrecVID 2019 - Activity Extended Video (ActEV) challenge, which was held by National Institute of Standards and Technology, US. He has more than 100 scientific publications, ten of which have been ESI highly cited papers. Since his PhD graduation in 2016, he has received competitive funding total $2.8M ($0.8M as leading CI), including 1 ARC DECRA fellowship, 1 US Defense Advanced Research Projects Agency (DARPA) grant, and 5 industry grants, focusing on advancing deep learning techniques. He has supervised 2 research fellows, 6 PhD students (5 current, 1 completed), 8 minor thesis students.

In collaboration with CI Beck, Dr Chang has developed a computer vision technique to automatically count cyclists in real-time, from CCTV streams. This is a significant step forward in being able to efficiently and rapidly expand capabilities in counting cyclists. In this project, he will work with CI Beck and the Victorian Department of Transport (DoT) to implement these models on DoT CCTV streams.

Prof Hai Vu		Associate Investigator

Relevant Background and Expertise:
Professor Le Hai Vu is a Professor in Transport Engineering and Leader of Intelligent Transport Systems (ITS) research at Monash University. Professor Vu is internationally recognised for his research in monitoring, modelling and design of complex transportation networks. Prof. Vu is a recipient of the 2012 Australian Research Council (ARC) Future Fellowship as well as the Victoria Fellowship Award for his research and leadership in ITS. He has extensive expertise in transportation network and demand modelling, with a particular focus on AI, machine learning and data analytics for transportation applications. Professor Vu also leads a large body of work on the infrastructure required to enable and operate intelligent transport systems and smart cities.

Professor Vu has published over 180 peer reviewed articles in leading transport and machine learning journals. He has secured over $6.5M dollars in research funding (including $5.5M from ARC). He has supervised 17 PhD students to graduation and currently leads a team of 15 researchers. Professor Vu's research is highly cited and has contributed to the modelling and designing of efficient algorithms in both data and transport networks.

Professor Vu has extensive expertise in the application of machine learning methods to transportation modelling. He will provide oversight for the machine learning modelling in Aim 2.3 and co-supervise the PhD candidate with CI Beck.

Total Budget Summary

Total Budget Summary					
Summary of Total 'Salary' per year					
Year 1 ($)	**Year 2 ($)**	**Year 3 ($)**	**Year 4 ($)**	**Year 5 ($)**	**Total Salary ($)**
$	$306,026	$162,349	$133,566		$601,941
Summary of total 'Other Research Costs' (ORC) per year					
Year 1 ($)	**Year 2 ($)**	**Year 3 ($)**	**Year 4 ($)**	**Year 5 ($)**	**Total ORC ($)**
$62,660	$0	$0	$0	$0	$62,660
Summary of total 'Equipment' per year					
Year 1 ($)	**Year 2 ($)**	**Year 3 ($)**	**Year 4 ($)**	**Year 5 ($)**	**Total Equipment ($)**
					$0
Total Requested Budget					
Year 1 ($)	**Year 2 ($)**	**Year 3 ($)**	**Year 4 ($)**	**Year 5 ($)**	**Total Budget ($)**
$62,660	$306,026	$162,349	$133,566	$0	$664,601

Salary Request Summary

Salary Request Summary						
Position Function	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
CIA Ben Beck Salary (PSP 5) – (0.4 FTE for Years 1-4) PSP5	$ 33%	$40,207 40%	$40,207 40%	$40,207 40%		**$120,620**
Postdoctoral research fellow (PSP 4) - Monash University (1.0 FTE for Years 1-4) PSP4	$ 100%	$93,359 100%	$93,359 100%	$93,359 100%		**$280,077**
Postdoctoral research fellow (PSP 3) - University of Melbourne (1.0 FTE for Year 1) PSP3	$ 100%	$ 0%	$ 0%	$ 0%		**$**
Postdoctoral research fellow (PSP 4) - UNSW (1.0 FTE for Year 2) PSP4	$ 0%	$93,359 100%	$ 0%	$ 0%		**$93,359**
Research assistant (PSP 2) - Monash (0.7 FTE for Years 1 and 2) PSP2	$ 70%	$50,317 70%	$ 0%	$ 0%		**$50,317**
Postgraduate student – PhD (0.5 FTE at PSP 1 for Years 1,2,3) PSP1	$ 50%	$28,784 50%	$28,784 50%	$ 0%		**$57,567**

$	$306,026	$162,349	$133,566	$601,941

Salary Request

Salary Request	
Position Function	**Justification**
CIA Ben Beck Salary (PSP 5) – (0.4 FTE for Years 1-4) PSP5	Successful completion of this project will require strong leadership. CIA Beck will have overall responsibility for the project, including overall project management, overseeing data management, ethical approval, participant recruitment, the collaborative involvement of all investigators and relationships with partner organisations. CIA Beck is an internationally-renowned cycling safety expert and has significant expertise in cycling, spatial analyses, modelling and leading large teams. He has established strong collaborative relationships with all partner organisations and is uniquely positioned to provide strong leadership. Therefore, salary support is requested for CIA Beck at 0.4 FTE for the duration of the project. As CIA Beck's ARC DECRA Fellowship ends on March 8 2021, a fractional weighting of 80.6% has been applied to the requested salary in Year 1.
Postdoctoral research fellow (PSP 4) - Monash University (1.0 FTE for Years 1-4) PSP4	An experienced postdoctoral research fellow (PSP 4) with spatial data and spatial statistics skills (particularly Bayesian statistics) is sought for the duration of the project. The Research Fellow will be supervised by CI Beck at Monash University and will manage ethics applications, coordinate the preparation of spatial and travel survey data, and oversee the collection of the GPS route data. They will take responsibility for data in Aim 2, will be responsible for the development of the spatial statistical model in Aim 2.3, and with CI Beck, lead the analysis for Aim 3. They will work closely with and be strongly supported by all CIs. They will also be supported by a Research Assistant (detailed below) who will support the preparation and cleaning of spatial data and GPS data.
Postdoctoral research fellow (PSP 3) - University of Melbourne (1.0 FTE for Year 1) PSP3	A postdoctoral research fellow (PSP 3) with experience in deep learning and/or the use of imagery data will be employed to work with CIs Stevenson and Nice for the duration of Aim 1 (Year 1) at the University of Melbourne. The preparation of large volumes of satellite imagery data and other imagery data requires a significant time commitment. The postdoctoral research fellow will prepare all data and work with CI Nice to implement the computer vision deep learning algorithm.
Postdoctoral research fellow (PSP 4) - UNSW (1.0 FTE for Year 2) PSP4	An experienced post-doctoral research fellow (PSP 4) with experience in route choice modelling is required to develop and implement the model in Aims 2.1 and 2.2. This position will be 1.0 FTE in Year 2, reflecting the anticipated timelines for the collection and preparation of data in Year 1. They will work closely with CIs Pettit, Saberi and Leao at UNSW. The specific skill set needed for this modelling requires an experienced post-doctoral research fellow.
Research assistant (PSP 2) - Monash (0.7 FTE for Years 1 and 2) PSP2	Given the depth of spatial data required for this project, one Research Assistant (PSP 2) is required to coordinate the collection of GPS route data, and clean and prepare both the GPS route data and other spatial data. This will include road infrastructure and traffic volume data, land use data, travel survey data, Strava data, weather data, Census data and bicycle count data. They will work closely with the Monash University postdoctoral research fellow and CI Beck. The position is for 0.7 FTE in Years 1 and 2 to reflect the significant data demands in the first two years of the project.
Postgraduate student – PhD (0.5 FTE at PSP 1 for Years 1,2,3) PSP1	A postgraduate student stipend is requested to support a PhD candidate in Years 1, 2 and 3. Specifically, the student will focus on the development of the machine learning model in Aim 2.3. Given that model development is planned in Year 3, this will give the student sufficient time to be able to develop relevant skills and methodologies that will form the initial studies of the PhD thesis. They will then apply these approaches to Aim 2 data. Given the novelty of these models as applied to bicycle volumes, it is anticipated that the work will be of high-impact. The student will be closely supervised by CI Beck,

Saberi and Sayed and Al Vu. Al Vu leads Intelligent Transport Systems (ITS) research at Monash University and is an internationally recognised expert in the application of machine learning/deep learning in transport modelling. As per NHMRC guidelines, this has been costed for a PSP 1 at 0.5 FTE.

Other Research Costs Summary

Other Research Costs Summary						
Item	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
IT infrastructure - Victorian DoT ITS division	$22,138	$0	$0	$0		**$22,138**
App development to collect cycling GPS routes	$39,990	$0	$0	$0		**$39,990**
Bureau of Meteorology data	$532	$0	$0	$0		**$532**
	$62,660	**$0**	**$0**	**$0**	**$0**	**$62,660**

Other Research Costs

Other Research Costs	
Item	**Justification**
IT infrastructure - Victorian DoT ITS division	For the analysis of CCTV data (Aim 2), we are required to implement IT infrastructure within the Intelligent Transport Systems unit of the Victorian DoT. This equipment requires extensive graphical processing to handle large amounts of video data in real-time (beyond the capabilities of current DoT infrastructure). Therefore, budget is requested to hire a video analytic server ($1,174.16/Month) and video router server ($670.59/Month) from DoT's IT provider over 12-months of data collection.
App development to collect cycling GPS routes	In Aim 2.1, we require the capture of detailed GPS route data from cyclists. Previous mobile phone applications that had this capability (such as Bicycle Network's 'Riderlog' app) are no longer supported. We will leverage CI Stevenson's iOS and Android application that accesses GPS coordinates and maps individual motor vehicle trips and develop the app in a format specific for cyclists. The development of this cycling-specific iOS and Android app has been quoted at $39,990.
Bureau of Meteorology data	We require 12 months of historical temperature and rainfall data to inform Phase 3 modelling. The Bureau of Meteorology provide gridded spatial datasets of historical data for $266 per data item (total $532).

Equipment Request Summary

Equipment Request Summary						
Item	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
						$0

Equipment Request

Equipment Request	
Item	**Justification**