

Applied Artificial Intelligence Institute

Annual Progress Report 2020



Date: 1 June 2021

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Introduction

Our Year in Review

The pandemic has challenged the way we live and work and continues to disrupt much of the world. Despite this, the Institute has been hard at work, with improvements in outcomes and a continued drive to build on the collaborative partnerships that have been developed so far.

2020 was a great year for A²I² considering the disruption that COVID-19 placed upon us. We were all saddened to have to endure the numerous deaths in the state of Victoria and the severe lockdown that was placed upon our state.

We are very proud of the undertaking of all A²I² staff to continue producing outcomes of a high quality even though we were working remotely for most of last year. It's a testament to the increase in grant funding in \$1.8M from the previous year, to the tune of \$5.7M in 2020. Our publications have continued to rise and we have also seen an increase in the number of Higher Degree by Research (HDR) students.

In 2020, we were proud to launch the Defence Applied AI Experiential CoLab, a collaboration between A²I² and the Defence Artificial Intelligence Centre. Greater detail on the CoLab is covered in the projects section of this report.

The Australian Research Council Industrial Transformation Research Hub for Digital Enhanced Living (ARC Research Hub for Digital Enhanced Living, or 'The Hub') continued to support our partners throughout these difficult times that we faced in 2020. We ran a very successful online national conference for PhD students with our partner at the Auckland University of Technology. Associate Professor Roopak Sinha ran this virtual conference from New Zealand.

During 2020 we focused on providing well-being support to staff, students and partners, especially those who were on their own without any family or partners close to them. Despite facing many challenges, The Hub continued to outperform its research outputs and we managed to also gain a new partner in Cancer Council Victoria.



**Alfred Deakin Professor
Svetha Venkatesh**

Australian Laureate Fellow,
Co-Director
Applied Artificial Intelligence Institute



Professor Kon Mouzakis

Co-Director
Applied Artificial Intelligence Institute

In response to the outbreak of COVID-19, A²I² and The Alfred were proud to collaborate and develop the Pandemic intervention Monitoring System (PiMS). This remotely monitoring the vital signs of those who had acquired the virus and used algorithmic triaging to provide medical assistance to people in need. PiMS was trialled in the state of Victoria and in 2021 has since been implemented in the state of Hawaii, USA.

Working in the health field remained a primary focus for the Institute with funding from the Medical Research Future Fund for two major projects. Firstly, Applied Artificial Intelligence Research in Health - Optimising Treatments in Mental Health Using AI, and secondly, Developing a Comprehensive Care Pathway for Those at Risk of Suicide But Not in Care - The Under the Radar Project. These projects have been developed in collaboration with the Black Dog Institute.

Our work at the Institute received industry recognition with two awards for the year. The Australian Financial Review Higher Education Awards recognised the Institute's work on AllPlay when A²I² won the Community Engagement Award. The Institute also won the Victorian iAward for the Avatar project as part of the collaboration with Dementia Australia.

The ARC Laureate Program had another successful year. Several publications were featured in premier ML conferences and journals, partner grants were obtained with MRRF and Defence and new partnerships were established. One of the program's successful projects was to accelerate trials to determine the best strategy for GP's prescribing exercise scripts with Professor Steven Allender's team at the Global Obesity Centre.

A²I² in Waurin Ponds has now shifted into new facilities. The staff are delighted with the space and the opportunities it provides for teaming and collaboration. We are continuing to work in exciting new advances in human machine teaming and algorithmic assurance.

For details on all of our projects and successes throughout 2020, we hope that you can easily find them in this annual report.

Highlights

Overview

At A²I², we value true collaboration. Over the past year more than thirty-five partners have collaborated with us on a broad range of industry projects.

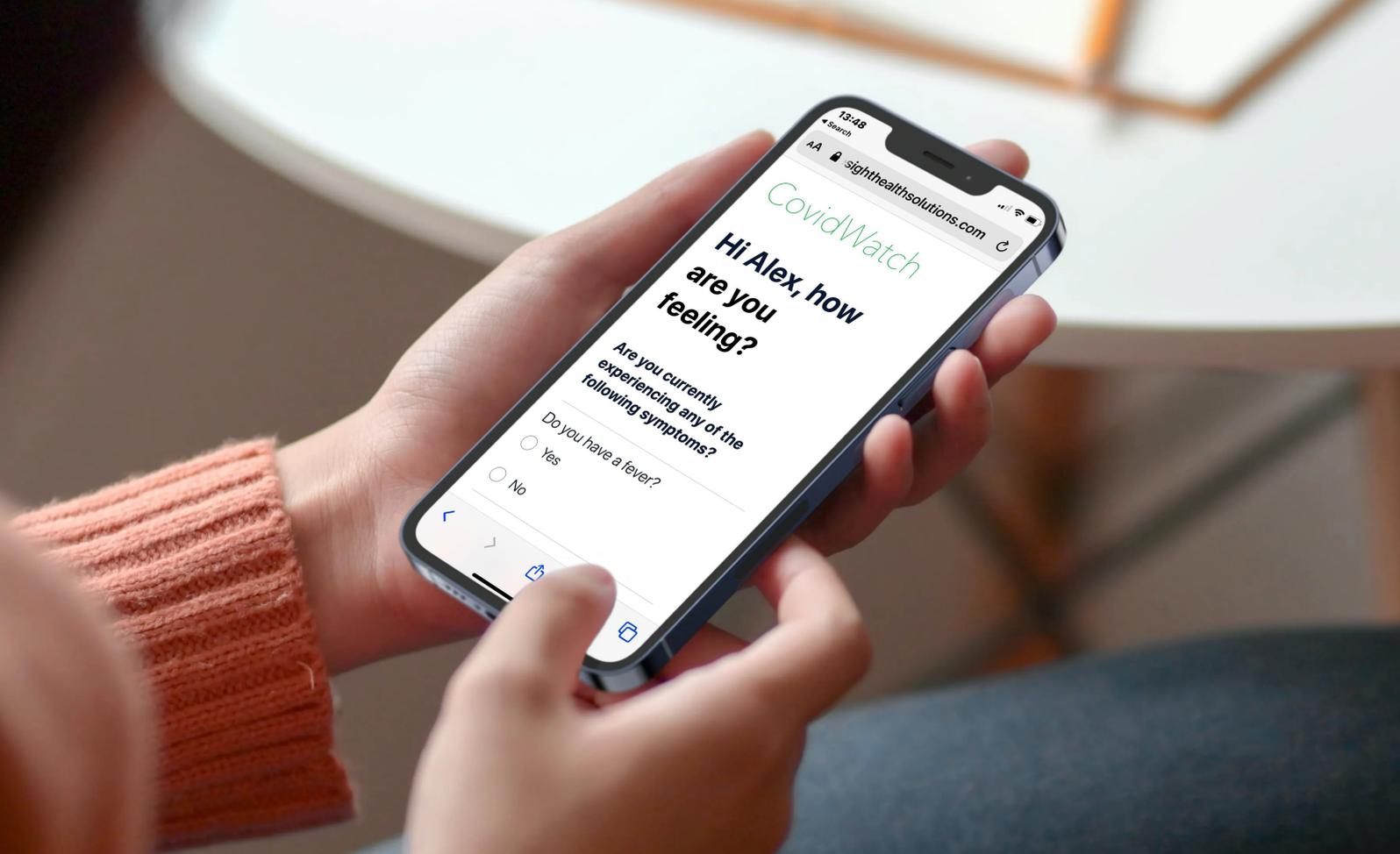
We work closely with a variety of clients to help produce great outcomes. Over time we have found that the closer the bond between us and our partners, the better the outcomes. We look for regular contact, shared ideas, working together whenever possible, regular work reviews, joint publications and joint conference presentations.

Strong collaboration is a vital element of bringing great minds together to solve problems faced every day. Our partners are an important part of our research. We bring tools, techniques and expertise but we rely on our partners who are the subject matter experts to provide the detail about the specific context.

Partnerships are important as we try to translate research into tangible outcomes that have a real impact in the world around us and will therefore always be part of the research culture in A²I².

Major 2020 Partners





Alfred Health

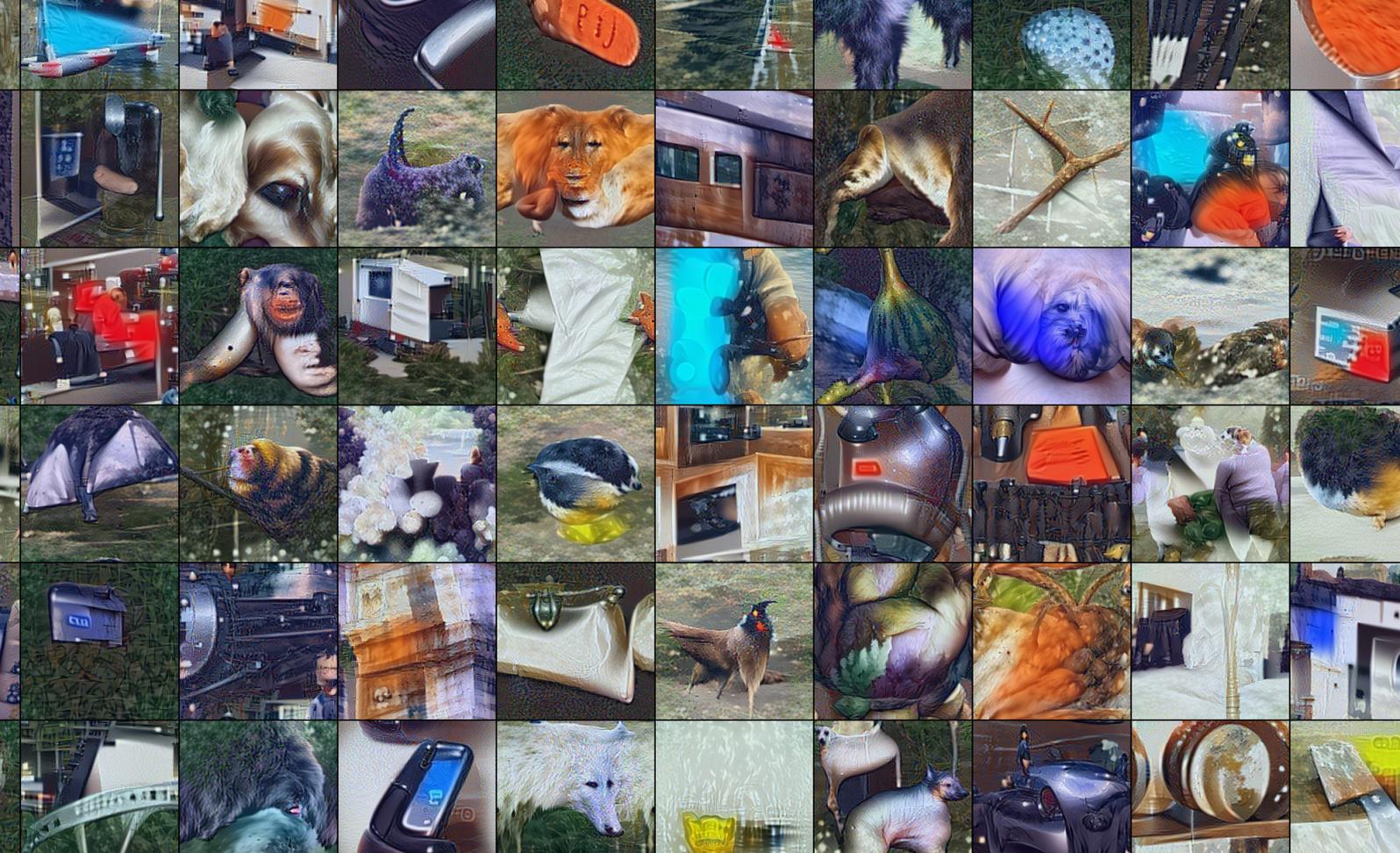
PiMS: Our Pandemic Response

What is PiMS?

People who test positive for COVID-19 are encouraged to self-isolate; and often can recover at home. However, there is a critical need at population scale to monitor and provide medical attention proactively to those that need it most. The Pandemic intervention Monitoring System (PiMS) is a low-cost, scalable remote monitoring tool that tracks patient vital signs and uses algorithmic triaging. The system supports home-based care, reducing hospital presentations. This project is a collaboration between the National Trauma Research Institute, Alfred Health and A²I².

Global Trials in Progress

PiMS was run as a pilot study with patients enrolled at Alfred Health and Monash Health during the critical stages of the pandemic in the greater state of Victoria. It has since been implemented and is in operation within the state of Hawaii, USA, branded as *CovidWatch*. We look forward to sharing more information throughout the rest of 2021 about this ongoing project.



Department of Defence

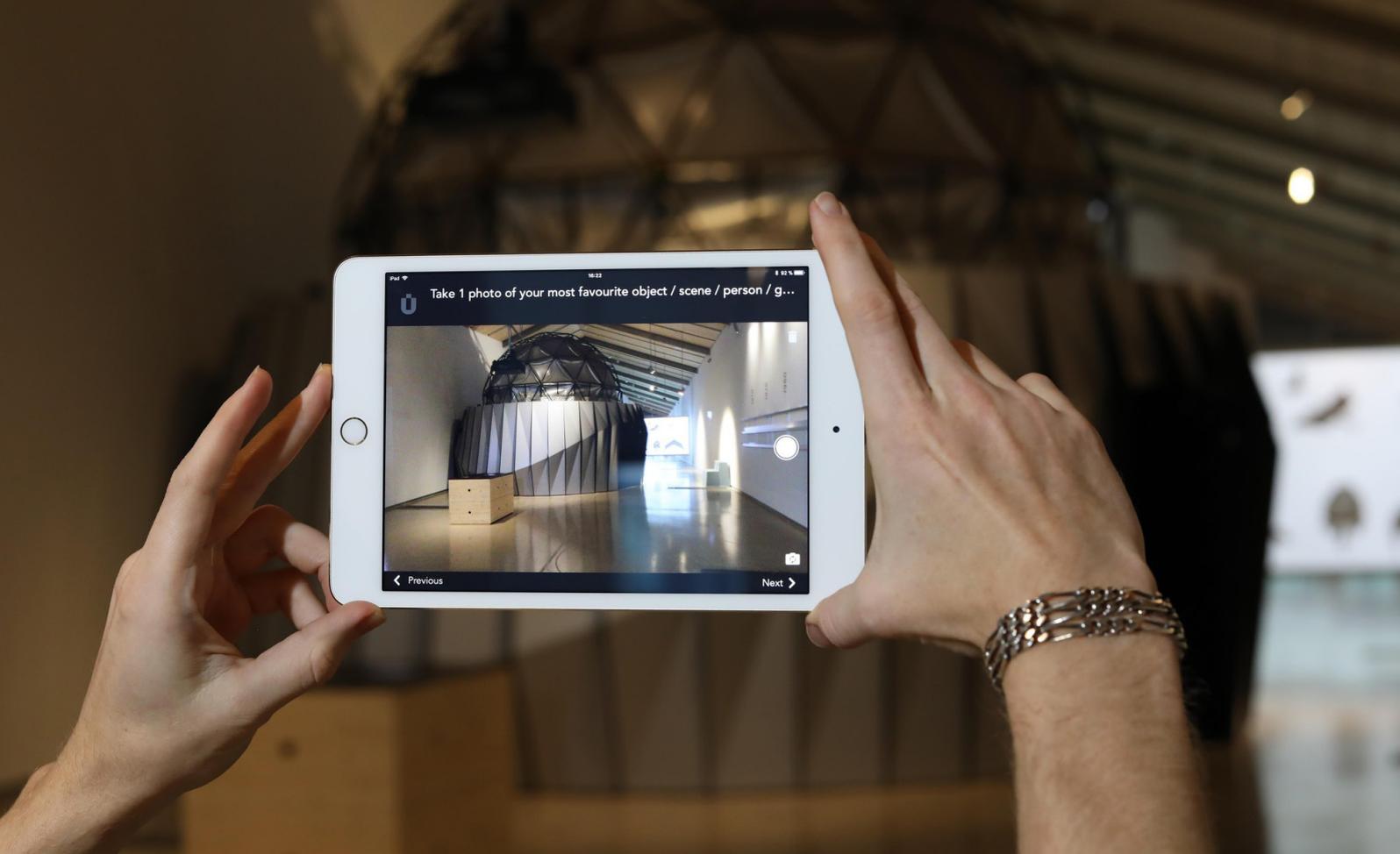
Defence AI CoLab

What is CoLab?

The Defence Applied AI Experiential CoLab is a new collaboration between A²I² and the Defence Artificial Intelligence Centre (DAIC). This partnership aims to solve complex problems and grow advanced AI skills and experience across Defence. The CoLab helps identify and accelerate the application of AI solutions for Defence problems in a high-tempo, agile and collaborative project environment. In addition to technology acceleration, the CoLab delivers educational seminars on fundamental AI technologies for Defence and runs hands-on coding workshops to improve AI literacy across Defence.

Highlights from 2020

Drawing from the deep technical expertise of A²I² to facilitate technology acceleration, the CoLab delivered a groundbreaking project in 2020. This sought to find ways to ensure artificial intelligence software that normally runs large supercomputers can function on smaller portable systems that can be deployed in the field. Using techniques such as compression and distillation, large enterprise-scale deep learning models have been transferred to smaller capacity-limited (i.e. edge) hardware with minimal loss in either accuracy or processing speed.



École Polytechnique Fédérale de Lausanne (EPFL)

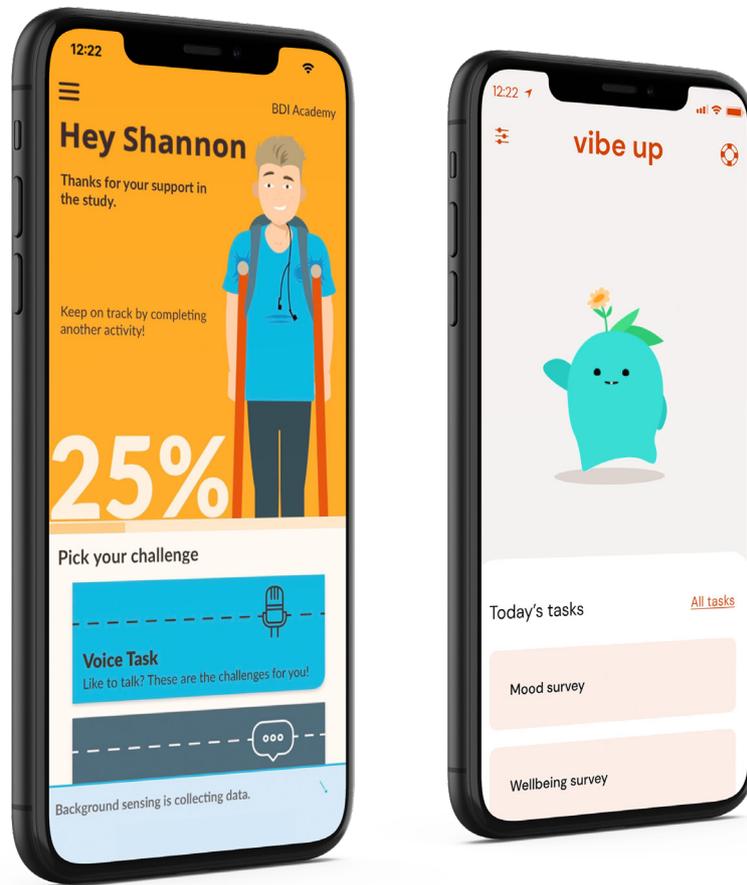
muse Expands

What is muse?

Detailed feedback empowers change, yet this is often a challenge to gather. In the museum realm, muse aims to cross this barrier and change the way visitor feedback is obtained. This is achieved by providing visitors with an interactive tablet app that is used to record real-time subjective experiences. The muse project was initiated at Laboratory for Experimental Museology (eM+), EPFL, in Switzerland and co-developed with A²I². Qualitative feedback is translated into quantitative insights which are elegantly presented in a central analysis tool, designed by the team. This project is made possible by Migros Pioneer Fund, is supported by EPFL and involved collaboration with Design Factory Melbourne.

Expansion

muse was deployed for the Winter at Tantora arts festival in Al-Ula, Saudi Arabia from December 2019 to March 2020. It engaged with 6,000 respondents across five surveys with 120 data points, resulting in 1,200 pages of reports. After the initial success of a trial period within eight museums in Switzerland, muse is now in the process of expanding and will be implemented across a further twenty-four Swiss museums.



Black Dog Institute

Collaborative Projects

Future Proofing Study

In 2020, Black Dog Institute launched a mental health study on a scale that the world has never seen before. Implemented across 400 schools, the Future Proofing Study will engage with up to 20,000 Year 8 students over the next five years as they develop into adulthood. The study aims to discover the triggers of youth mental illnesses and how smartphones can be used to deliver preventive interventions. Together we are working toward improving the wellbeing of young people and establishing a strong foundation for adulthood.

Conductor

Building on the success of the Future Proofing Study, we also commenced development of Conductor, a platform that enables researchers to conduct research studies in a more efficient way. Conductor forms the basis for two major studies: *Beating the Afternoon Slump* and *Vibe Up*. Via a smartphone application, this 'proof of concept' experiment is being trialled to show how AI can deliver personalised interventions to fatigued office workers to 'Beat the Afternoon Slump'. *Vibe Up* builds upon this and utilises the platform to help reduce depression, anxiety and stress for university students by identifying a suitable intervention. We look forward to sharing more information about Conductor in 2021.

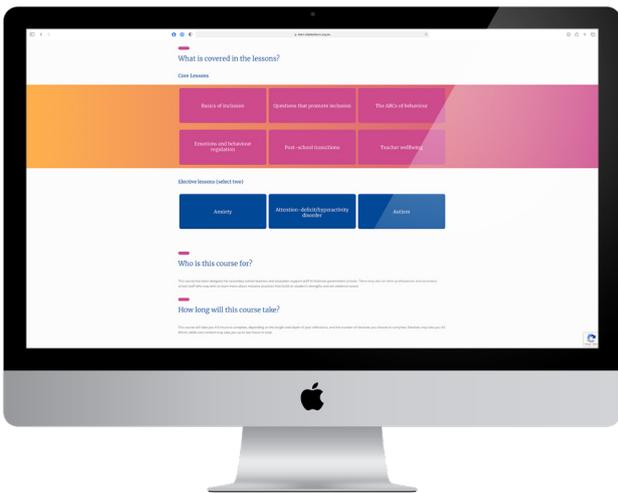
AllPlay Learn Wins Award

What is AllPlay Learn?

AllPlay is a worldwide collaborative effort initiated by Deakin University that creates inclusive environments for children living with disabilities. A²I² built AllPlay Learn, an online resource that delivers professional learning courses to educators of all levels.

AFR 2020 Award Winner

At the prestigious Australian Financial Review Higher Education Awards, AllPlay won the Community Engagement Award. This accolade only reinforces the importance of AllPlay's world-leading initiative.



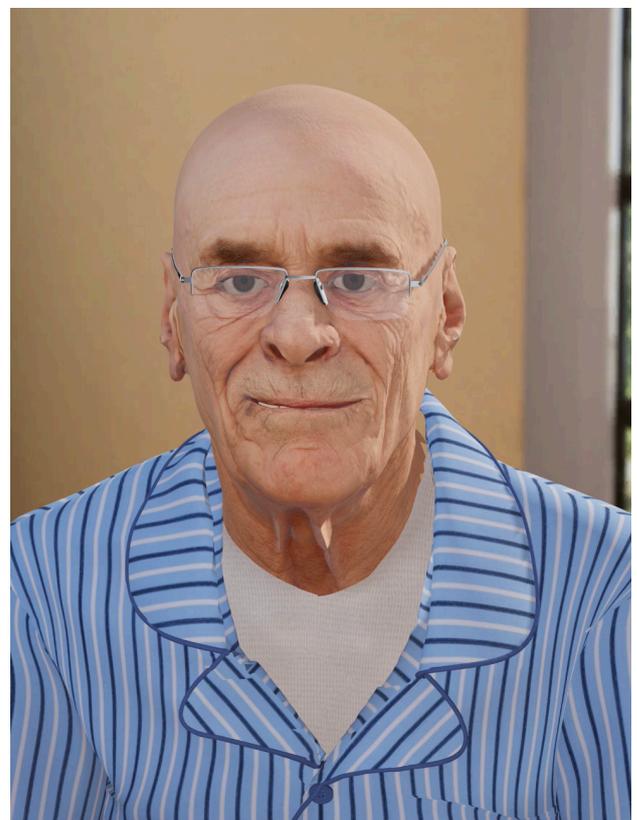
Talk With Ted Wins iAward

What is Talk With Ted?

In collaboration with Dementia Australia, A²I² created *Talk With Ted*, an industry-leading digital training avatar. *Talk with Ted* has been designed to educate nurses on delivering the best standard of care for people living with dementia. A trial with carers highlighted that the avatar helps carers better understand the behaviours of people living with dementia as well as the importance of practicing good communication skills.

Award-Winning Technology

The innovation and hard work behind *Talk With Ted* was bestowed with a Victorian iAward in late 2020, winning the category for Not-For-Profit and Community Solution of the Year.



Pattern Analysis for Accelerating Scientific Innovation

This ARC Laureate project aims to discover ways of using artificial intelligence to accelerate new discoveries with the goal of making products and processes faster, cheaper and better. Highlights for 2020 include:

GLOBE Collaboration

In 2020, A²I² and Deakin University's Global Obesity Centre (GLOBE) initiated a medical trial designed to provide accurate information and allocate the study's resources in a cost-effective manner. A top priority of medical trials is to determine the true behaviour of treatments under study as precisely and accurately as possible without incurring high costs. Our trial allocated resources in an efficient manner, enabling a greater number of treatment options to be considered without adding exorbitant costs.

Medical Trial with GPs

GLOBE set out to find ways to encourage GPs to have more conversations with patients about physical activity. A study was launched with a number of clinics around the Geelong and Bellarine areas where a set of eight strategies were trialled. A²I² developed an algorithm that used ongoing trial data to schedule appropriate strategies for testing each week based on perceived effectiveness. Thanks to the optimised scheduling, less promising strategies were excluded from the trial relatively early, allowing GLOBE to collect data from more effective strategies. This data showed that getting patients to fill in a survey on their exercise habits was a great way to initiate conversations with the GP about physical activity.

Algorithmic Assurance

What is Algorithmic Assurance?

Our research in this field aims to provide a tool that assures developers that the algorithms they use will follow their human or other 'gold standard' closely. Algorithmic assurance efficiently evaluates the way algorithms model the decisions of a human or an expensive resource.

2020 Highlights

The assurance framework developed a solution for a new setting: compare an algorithm to multiple reference points. With this new assurance framework, users of machine learning systems can compare their system against a variety of benchmarks simultaneously and find out which benchmark the system deviates from the most.

Appendix

Appendix F: Awards

Recipient

Applied Artificial Intelligence Institute/Dementia Australia

ARC Hub for Digital Enhanced Living/Applied Artificial Intelligence Institute/Black Dog Institute

Deakin University/Deakin University School of Psychology/Deakin Child Study Centre

Dr Thai-Hung Le

Dr Thommen Karimpanal George

Award

Winner, Not-For-Profit and Community Solution of the Year, Victorian iAwards 2020, for “Ted the AI Avatar Living with Dementia”

Winner, Cause Award, Elastic Search Awards 2020, for InSTIL

Winner, Community Engagement Award, AFR Higher Education Awards 2020, for AllPlay Learn

Alfred Deakin Medal for Doctoral Thesis (Round 1, 2020), for the Doctoral Thesis entitled “Memory and Attention In Deep Learning”

Alfred Deakin Postdoctoral Research Fellowship 2020, “Learning Transferable Domain Priors for Safe and Efficient Reinforcement Learning”

Applied Artificial Intelligence Institute

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