

Best of Business AI

CSIRO case study



You may not know that Australia's national science agency, the Commonwealth Scientific and Industrial Research Organization (CSIRO), is responsible for some of the inventions you use every day and probably take for granted. As an innovator for more than one hundred years, CSIRO has contributed groundbreaking research across numerous fields, including technologies for batteries, telescopes, and WiFi. Its purpose is to solve Australia's, and the world's, greatest challenges through innovative science and technology.

CSIRO has around a thousand researchers working on AI and data science projects, more than any other organization in the country. They are using AI to solve challenging problems like fighting bushfires, reducing plastic pollution, protecting the Great Barrier Reef, and managing biodiversity. They also work with industry partners to apply AI, such as helping manufacturers use computer vision technologies on the factory floor.

Last year, CSIRO and Microsoft began a new partnership designed to accelerate critical research in AI and Machine Learning and apply it to issues ranging from illegal fishing to plastic waste.

AI in action: Stopping plastic pollution with machine vision

One of the first research projects in the collaboration has been the development of an AI system to identify and monitor litter along rivers, using Microsoft's Azure cloud computing services and computer vision.

Each year as much as 12 million tons of discarded plastic ends up in rivers and oceans around the world, threatening wildlife everywhere. CSIRO has undertaken an effort to quantify and track plastics in Australia's waterways to provide the insights needed to inform waste management and policy changes that will help stop plastic pollution at the source. This is no easy task in a country with a vast coastline and system of rivers.

The most common method for monitoring litter relies on humans doing on-the-ground visual counts. This process is labor-intensive. It is also challenging to monitor many locations simultaneously or over extended periods.

To overcome this challenge, CSIRO has installed cameras over rivers to capture video and photos of plastic pollution in the water. Then, they use Microsoft's AI tools to analyze the footage to quantify plastic items in the water and identify the different types of plastic—whether it's water bottles or takeout containers or any other sort of plastic refuse. The solution also captures specific details of the type, size and label of the item. CSIRO researchers worked with Microsoft's Syntetics team to develop a training dataset which was a game changer for processing real-world data. The dataset now contains more than 6,100 images with 14,500 identified items. The items are labelled across more than 30 categories including plastic bottles, packaging, beverage cans, paper and plastic cups.

According to Dr. Britta Denise Hardesty, Senior Principal Research Scientist in CSIRO's Oceans and Atmosphere team, using AI "gets a much better and faster understanding of the extent of rubbish in our environment than we could have with one person sitting at a computer manually capturing and processing the data."

Applying AI makes the research scalable and enables CSIRO to monitor rubbish in larger and more remote areas. The near real-time insights into where, how much, and what types of plastic pollution are out there helps waste management target resources for cleanup and intervention efforts in the places that need it

most. The data captured using AI will help identify litter hot spots, improve waste management approaches, and inform decision-making to tackle plastic waste and reduce environmental harm.

The technology is being used to monitor waterways in Hobart, but is also being applied internationally in Dhaka, Bangladesh and London, UK. The team aims to expand the project to other areas, since it has proven to be a cost-effective and efficient way to capture vital information on plastic pollution.

Other highly successful initiatives at CSIRO include using machine vision and sound interpretation models to detect illegal fishing activities, a project led by Dr. Chris Wilcox, Principal Research Scientist with CSIRO's Oceans and Atmosphere team. Another effort is using AI to analyze data collected from drones flying over Kakadu National Park to deliver insights to park rangers who are managing biodiversity. What unites each of these use cases is vast amounts of data that would be impossible to transform into insights without aid from AI technologies.

Establishing the right approach to drive AI success

Securing funding

CSIRO receives funding from the national government and also generates revenue by working with industry partners. CSIRO is a unique organization, in that its purpose in solving Australia's greatest challenges also requires it to work with industry – in fact it's what the 'I' in CSIRO stands for. CSIRO works collaboratively with industry partners on research as well as turning science into real-world solutions, helping them advance and leverage science and technology in their endeavors.



Strategy

Choosing the right technology approach

CSIRO makes a conscious effort to ensure AI is the right solution before beginning an AI project. As Jon Whittle, Director of Data61, a specialist digital technology and data sciences arm of CSIRO, explains, "I see a lot of people thinking 'How can I apply AI?' when that's the wrong place to start. You actually, really, need to start on the problem that you're trying to solve." So, CSIRO asks itself "What problem am I trying to solve?" and importantly, "Is AI the right solution for this problem?"



Strategy

Once CSIRO has established that the problem is right for the application of AI, their next step is to choose the right AI approach to solve it. CSIRO researchers tackle a wide range of challenges across environmental science, health and biosecurity, manufacturing, resources, and renewables, to name a few. An AI project could be suited for off-the-shelf AI solution or something more innovative and custom-designed. AI experts help determine what would work best.

Creating a managed data ecosystem

An AI model is only as strong as the data it is trained on. CSIRO recognized that having a strong data strategy would help streamline the AI development process. With that in mind, they are working on connecting siloed data from across the organization with their "Managed Data Ecosystem" program. The program aims to improve interoperability between datasets, and data science methods, so users can easily find and work on multiple datasets and models, no matter what department they originally came from. It will establish new technology platforms, including access to Microsoft Azure, paired with a "digital workbench" so that data and AI approaches are reusable and scalable across all science disciplines. This will be supported with new data policies and processes, and a "Digital Academy" to provide learning pathways to enable greater uptake of AI across the organization. When data scientists and CSIRO partners have access to the data they need, AI outcomes will be stronger.



Scale

Enabling a culture of collaboration

AI development is more successful when data scientists and researchers are able to collaborate with peers across the organization. CSIRO has worked to not only enable collaboration but make it a key element of its culture. In addition to its staff, CSIRO collaborates with researchers at Australian universities, as well as across industry and government. According to Dr. Whittle, this collaboration is taking place daily: "We have various mechanisms in place to ensure collaboration across the different disciplines and tackle silos or walls between those disciplines."



Culture

A culture of collaboration enables AI efforts to be driven by a diversity of voices. According to Dr. Hardesty, the organization is "bringing in a diversity of perspectives, a diversity of approaches, and a diversity of skillsets to tackle some of the biggest challenges today." This is a simple equation: More perspectives equal more opportunities for success.

Putting the right mechanisms in place

CSIRO has established a number of new Future Science Platforms (FSPs) as an investment in science to underpin innovation. The FSPs are programs designed to provide researchers with resources and opportunities to explore new scientific areas. They are multi-year, multi-disciplinary investments which bring CSIRO and its collaboration partners together to work on big ideas that shift the needle.



Strategy

One of the established FSPs is the [Machine Learning and Artificial Intelligence](#) (ML/AI) FSP which will receive a \$19 million investment over four years to work on a portfolio of projects that target AI-driven solutions for areas including food security and quality, health and wellbeing, sustainable energy and resources, resilient and valuable environments, and Australian and regional security.

The ML/AI FSP is the first to work across the whole of CSIRO, building cross-disciplinary projects that apply AI and ML to explore fundamental questions about conceptual and data-driven research applications. The areas of research the FSP undertakes are organized into "activities," developed through a comprehensive series of cross-business unit workshops, and led by "activity leaders."

These activities tackle questions such as: how do we use machine learning to improve a scientist's ability to generate and learn from scientific data? Where can we exploit genomic information in plant and animal breeding? How can we provide explainable AI for decision-making to protect the Great Barrier Reef? Ultimately, the solutions, platforms, and people trained through the platform will create a new capability within CSIRO to address core research challenges for the benefit of Australia.

Applying AI responsibly

Importantly, CSIRO has put effort into ensuring the responsibility of their work with AI. They recognize, for instance, that biased data can lead to discrimination by the AI system. According to Dr. Whittle, "The onus is on us to actually make sure that we explain properly what AI can do, what it can't do, where it's appropriate to use it, where it's not appropriate to use it, what the potential drawbacks or dangers of using AI are, especially if you're going to use them in government services." With that in mind, CSIRO worked with the government to develop Australia's AI Ethics Framework, a set of eight principles that determine how to develop and deploy AI responsibly. They have worked to translate this into concrete techniques that guide their own AI development and deployment.



Responsibility



Dr. Britta Denise Hardesty

Senior Principal Research Scientist in CSIRO's Oceans and Atmosphere team



Jon Whittle

Director of Data61, digital technology and data sciences arm of CSIRO

Further reading: CSIRO, with the Department of Industry, Science, Energy and Resources developed a [national AI roadmap](#) for Australia.

Learn how other companies have used AI successfully on the [Best of Business AI site](#) and the [AI Business School](#). The AI Business School includes modules on:



Defining an AI strategy



Enabling an AI-ready culture



Responsible AI



Scaling AI in your organization



Enabling business users with AI

AI Business School

Learn tips and strategies for leading in the age of AI with our online class

