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CENTRE OF MACHINE LEARNING FOR SOCIAL GOOD

What is Machine Learning for Social Good in Aotearoa?

- A white paper from the Centre of Machine Learning for Social Good





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Unuhia te rito o te harakeke, kei hea te kōmako e kō? Ui mai ki ahau, 'He aha te mea nui o te Ao?' Māku e kī atu, 'He tangata, he tangata, he tangata.'

If you remove the central shoot of the flaxbush, where will the bellbird find rest? If you were to ask me, 'What is the most important thing in the world?' I would reply, 'It is people, it is people, it is people.'¹

Executive Summary

The Centre of Machine Learning for Social Good (ML4SG) has been established to address pressing societal challenges through innovative applications of machine learning (ML). Despite ML's transformative impact across various industries, its application to social challenges—such as environmental conservation, public health, and social inequality—remains underutilised. The ML4SG aims to bridge this gap by fostering partnerships with not-for-profits and community organisations in Aotearoa, leveraging cutting-edge research and technology to create tailored solutions grounded in local values and needs.

Purpose and Vision

The goal of the Centre of Machine Learning for Social Good is to create technology that empowers organisations to make a difference. By designing solutions that are affordable, easy to use, and resilient, we can help these organisations focus on what they do best: creating positive change in their communities and beyond. In this way, technology becomes a partner in their mission, amplifying their impact while respecting their constraints.

The Centre is committed to advancing ML technologies that empower organisations to create positive societal change.

Framework for Collaboration

The Centre of ML4SG employs a participatory, five-stage collaboration framework:

- 1. Initiating Collaboration: Establishing trust and mutual understanding between stakeholders.
- 2. Framing Impact: Defining goals, aligning expectations, and evaluating the feasibility of ML applications.
- 3. **Research Design:** Creating innovative, cost-effective, and inclusive solutions tailored to partner needs.
- 4. **Develop and Verify Solutions:** Building prototypes and iterating based on feedback.
- 5. **Intervention:** Deploying and sustaining solutions, with a focus on organisational empowerment and training.

This iterative and community-centric approach ensures that solutions are both impactful and culturally appropriate.



Key Initiatives

The Centre of ML4SG is actively contributing to societal betterment through projects such as:

- Waiheke Stoat Reidentification Project: Using ML to assist conservation efforts by tracking invasive stoats threatening local biodiversity.
- **Our Voices:** Collaborating on a youth wellbeing initiative, leveraging ML to analyse complex longitudinal data and amplify the voices of underrepresented youth.

These case studies highlight the Centre's ability to create tailored, impactful solutions while fostering trust and collaboration with community partners.

Broader Impact

The Centre's work aligns with the United Nations Sustainable Development Goals, demonstrating ML's potential to address critical areas:

- Environmental Protection: Supporting biodiversity through Al-driven monitoring and conservation tools.
- Healthcare and Wellbeing: Enhancing access to personalized healthcare and mental health support.
- Social Equality: Combating poverty and inequality with data-driven interventions.
- Disaster Resilience: Leveraging ML for early warning systems and disaster preparedness.
- **Cultural Inclusion:** Ensuring Indigenous data sovereignty through culturally appropriate technologies.

Invitation to Collaborate

The Centre of ML4SG invites organisations from the health, environment, and social not-for-profit sectors to collaborate on projects that align with their mission of fostering social good through ML. By working together, the Centre aims to inspire innovation, amplify community impact, and contribute to a more equitable and sustainable future for Aotearoa.

For more information and partnership opportunities, please visit the Centre of ML4SG website: https://ml4sg.auckland.ac.nz/

This summary encapsulates the Centre's vision, framework, key initiatives, and broader societal impact, positioning The Centre of ML4SG as a leader in leveraging ML for social good.







Introducing the Centre of Machine Learning for Social Good

Advances in machine learning (ML) are increasingly being applied to address issues and increase efficiencies in numerous industries and are predicted to have even greater impact in coming years.² However, by comparison, progress in the application of ML technology to tackling social challenges-in the environment, in health and in addressing social issues-has been slower. We have established the Centre of Machine Learning for Social Good (ML4SG) to bridge this gap. Our goal is to help address real-world problems facing organisations that are working to benefit society by means of partnerships where the Centre can apply the latest research and ML technologies.

This whitepaper introduces the Centre of Machine Learning for Social Good (ML4SG) and provides a comprehensive overview of its mission, framework, and impact. It begins by exploring the potential of machine learning (ML) to address societal challenges and the Centre's commitment to fostering collaborative partnerships with not-for-profits and community organisations in Aotearoa. This report outlines a participatory five-stage collaboration framework designed to ensure impactful, culturally aligned, and sustainable solutions. Key case studies, including conservation efforts to combat invasive species and initiatives to improve youth wellbeing, illustrate the Centre's practical applications and success. Additionally, this whitepaper discusses the broader role of ML in supporting social good across healthcare, environmental sustainability, and disaster resilience, emphasising ethical considerations and te ao Māori values. We conclude with an invitation for your organisation to collaborate with the Centre in realising our shared desire for social impact through innovative, data-driven approaches tailored to the unique needs of Aotearoa.

² See for example PwC's "2025 AI Business Predictions" report: <u>https://www.pwc.com/us/en/tech-effect/ai-analytics/ai-predictions.html</u>





What is Machine Learning for Social Good?

Machine Learning for Social Good represents a transformative approach to addressing the complex and pressing challenges that society faces today. Machine learning is a field of study in artificial intelligence that can learn patterns from data and use these learned patterns to make inferences when presented with new information. It is used in many applications such as facial recognition, product recommendations, spam filtering and text prediction. Something is a social good if it contributes to community flourishing, with equitable outcomes for all. Efforts that benefit the environment also count as social goods; and indeed from a te ao Māori perspective, the wellbeing of people is inextricably tied to the wellbeing of the taiao.

One example of a set of global objectives to address pressing social challenges is The United Nations Sustainable Development Goals (SDGs). The 17 Sustainable Development Goals contained in the 2030 Agenda for Sustainable Development constitute a transformative plan for people, planet, prosperity, partnerships and peace.³ Machine learning can play an important part in the "data revolution" that the UN has recognised as an enabler for the SDGs. Machine learning has the potential to help build better tools and solutions, delivering positive social impact in areas like healthcare, the environment, education and beyond. The goal of our centre is to engage in cutting-edge machine learning research to create machine learning models to help address pressing problems in these domains for the benefit of our society. We understand that ML can help, but it's not a silver bullet: tackling these questions requires a concerted transdisciplinary effort across all sectors of society from the onset of a project.

A Vision for Technology in Social Good

The goal of the Centre of Machine Learning for Social Good is to create technology that empowers organisations to make a difference. By designing solutions that are affordable, easy to use, and resilient, we can help these organisations focus on what they do best: creating positive change in their communities and beyond. In this way, technology becomes a partner in their mission, amplifying their impact while respecting their constraints.

³<u>https://sdgs.un.org/2030agenda</u>



Why does Aotearoa need Machine Learning for Social Good?

To have a long term impact in Aotearoa, rather than simply adopting social good solutions developed internationally, we must develop solutions grounded in Aotearoa. As a nation with bicultural foundations, Aotearoa has a distinctive blend of cultural influences that include Māori indigenous values. We have seen evidence of the importance of basing projects in Aotearoa, such as Our Voices to learn about child health and well being in Aotearoa. It is similarly important to



ground our research here to deliver social good that is fit for purpose for Aotearoa. Aotearoa has a population of around 5.3 million people made up of Europeans, Māori, Pacific peoples, Asian and MELAA (Middle Eastern, Latin American and African). It is unique, with its own indigenous people, Te Tiriti o Waitangi, its own flora, fauna, and processes. There are cultural and ethical principles that are highly respected in Aotearoa such as Māori Data and Algorithmic Sovereignty principles and the need for consent and privacy.⁴

Our Process

The creation of knowledge fit for serving social good demands that researchers and scientists, along with iwi, community, and the general public decide together what kind of research should be carried out, how best to work together, and how that knowledge is applied. We believe that a genuine partnership between researchers and communities and their representatives is a force-multiplier for solutions to real-world problems. In this section, we describe the Centre's framework for collaborative development of ML for social good. An outline of the Centre of Machine Learning for Social Good's project collaboration framework is shown in *Figure 1*.

The framework follows a participatory and social impact-oriented research cycle which moves through specific iterative and reflexive steps using a co-creation and participative approach between researchers, domain experts, community organisations, government, NGOs. The five steps include: (1) Initiating Collaboration, (2) Framing Impact, (3) Research Design, (4) Develop and Verify the Solution and (5) Intervention.

The process is iterative, involving the stakeholders in every step. For a successful outcome, all stakeholders must be engaged at key decision and review points throughout the research process. Centre for ML4SG projects will have the broad dual aims of the developed solutions leading both to social change and to new scientific knowledge.





Uara/Values: Rangatiratanga, Whanaungatanga, Kotahitanga, Whakapapa, Manaakitanga, and Kaitiakitanga

Figure 1. ML4SG Collaboration Framework

Uara / Values Underpinning the Relationship

As shown in figure 1, the collaboration process must be underpinned and guided by community values (uara) and aspirations, including Rangatiratanga, Whanaungatanga, Kotahitanga, Whakapapa, Manaakitanga, and Kaitiakitanga:

Rangatiratanga The right to exercise authority and self-determination within one's own community.





- *Kaitiakitanga* Managing and conserving the environment as part of a reciprocal relationship, based on the Māori world view that humans are part of the natural world.
- Whakapapa Connection to and interconnection between communities and things.
- Manaakitanga Demonstrating reciprocity and respect between communities and those who work with them.
 - *Kotahitanga* Sharing a sense of purpose through unity, cohesion and capability building.
- **Whanaungatanga** A relationship through shared experiences and recognised responsibilities when working together which provides people with a sense of belonging.

In order to ensure that these values are met, these values may be embodied in a governance model that empowers a community voice and can give effect to partnership according to Te Tiriti o Waitangi.⁵

We now briefly describe the stages of the framework:

1. Initiating Collaboration

The first phase of initiating collaboration involves discussion between the Centre and NGOs, Community and Government organisations to identify potential collaboration. The Centre holds hui to share ideas and progress and this is also a forum to elicit ideas for potential projects. We also invite interested organisations or groups to get in contact with us for an initial discussion (see Our Invitation section below).

At the point of initial discussions, we are interested in establishing an understanding of the character and aims of each others' organisations as well as to develop a shared understanding of the challenge to be addressed, which includes the perceptions, expectations and priorities of both parties. This whakawhanaungatanga contributes to a shared understanding of how both parties relate to and may complement each other in achieving mutual goals.

⁵ For examples of governance arrangements giving effect to Te Tiriti o Waitangi partnerships, see the following report from the National Science Challenges: <u>https://resiliencechallenge.nz/outputs/te-tiriti-o-waitangi-partnerships-enhances-research-science-and-innovation/</u>



Through workshopping the initial project idea, a preliminary description of a project can be shaped and then refined in further stages. Expertise and resources that might lead to fruitful collaboration may be identified.

To address the challenges involved with setting up successful collaborations between ML researchers and application-domain experts, we have adapted guidelines that were derived for Al4SG projects to align with the Centre's vision. The Centre of ML4SG has run a series of multidisciplinary discussions at dedicated hui to bring together experts from a range of communities to discuss potential partnerships and projects. We have aligned our discussions with the guidelines.

Centre of ML4SG guidelines to be considered at the initial-discussion stage:

- **Partnership** Deep, long-term partnerships are required to solve large problems successfully. Partnerships are likely to start as a small pilot project, and based on that success over time lead to deeper partnerships.
- Maintaining Establishing and maintaining trust is key to overcoming trust organisational barriers. It is only through deep relationships that trust develops.

2. Framing Impact

The next stage is to hold discussions to refine our understanding of the challenge into a potential project. Projects that are a good fit with the centre will include the potential for social impact, alignment with community values in Aotearoa, use of ML, feasibility, scalability, data and responsibility. At the completion of this stage collaborators should be in a position to agree on responsibilities and measures of success. This ground work is key to the success of later stages of the project.

In some situations we may need to compare the possible benefits of a ML solution with the current non-ML solution to evaluate whether ML is appropriate. Where the gains are limited or the costs of maintaining the proposed solution are high, building an ML solution is not justifiable.

Centre of ML4SG discussion guidelines at the framing impact stage include:

Expectations of Expectations of what is possible with ML need to be wellgrounded. Aligning expectations of what can be achieved requires a deep understanding of the problem and possible solutions.





- **Well defined** Goals and use cases should be clear and well-defined. The **goals** solutions should meet the goals of the organisation and be fit for purpose.
 - Aligning incentives Planning needs to align incentives, and factor in the limitations of both communities. Incentives for organisations will include practical fit-for-purpose solutions that lead to social change while incentives for academics will include publications. Marrying the two can be challenging.
 - **Good data** Improving data readiness is key. Good data is essential for powerful ML solutions. The initial steps in any project will be assessing data availability and quality.
 - **Rights and** Data must be processed securely, with utmost respect for privacy human rights and privacy.

Clarifying expectations early in the project helps avoid surprises and ensures the project's success in the short- and long-term. Expectations include alignment on roles and responsibilities, dataset access and management, infrastructure availability and costs, where the code will live and who will maintain it long term.

Roles and responsibilities can be as simple as who are the points of contact through to ownership of the project in the long term, timing and forms of communication, and deliverables.

Dataset access involves identifying what data is available, and what data still needs to be gathered or acquired to make the project a success. There needs to be agreement on where the data will be stored through the development of the project and where it will be stored long term. Data is precious and must be treated with respect. Issues around data sharing, privacy and ethics must also be considered.

It is important to identify what infrastructure is available and what is needed, both for the training of models and for running the solutions, and how the infrastructure will be shared between the various parties. Any costs around new infrastructure, computing costs, software licences, cloud hosting etc. should be agreed. Professional standards around monitoring and auditing should be discussed. Where code will live, who will maintain it, and what rights the developers have to the solution are important. For example, can the developers publish the work, are they able to use the model as a base for another project, etc. Timelines, key steps and milestones, measures of success all need to be agreed upon.





3. Research Design

Once the responsibilities, expectations and measures of success have been agreed for the collaboration, the next phase is working together on the research design. Here the aim is to identify key questions and possible solutions.

Centre of ML4SG discussion guidelines at the research design stage:

- Solutions There is value in simple solutions. Part of the innovation is to design solutions that are no more complex than current solutions while being more efficient.
- **Reducing costs** Options for reducing the development cost of AI solutions should be explored. The projects must be fully costed and not lock stakeholders into ongoing licensing costs for example.
- **Inclusive and accessible** Applications of AI/ML need to be inclusive and accessible, and reviewed at every stage for ethics and human rights compliance. Social good organisations are often voluntary and public facing so can be open to public scrutiny.

Engineering the solutions must address the characteristics of social good organisations, which are often voluntary, and not for profit. There may not be large amounts of funding available for the latest hardware and software in these environments. As a result, any solutions that are designed must run either stand alone or across a heterogeneous computer network.

Ideally, solutions should not lock the organisation into ongoing costs, which can be the case for cloud computing and enterprise systems. The systems preferably should work out of the box and be intuitive to use to minimise demand for technical support within the organisation to set up software systems. No two social good organisations are exactly alike. Organisational missions, workflows, and data requirements can vary widely so a one-size-fits-all approach simply won't work. Therefore, solutions must be flexible and customisable, allowing organisations to tailor the technology to their specific needs. They should also be interoperable, integrating seamlessly with existing tools and datasets. This avoids locking organisations into proprietary ecosystems that can limit their options in the future.

Finally, the long-term success of any solution depends on sustainability. Opensource platforms offer not just cost benefits but also the support of global communities. These communities provide updates, troubleshoot issues, and continuously innovate, ensuring the solution remains relevant and effective.





4. Develop and Verify the Solution

A prototype is then developed according to the agreed criteria and processes. This would typically involve researchers and research students developing a prototype machine learning solution. When a working prototype is developed, the solution is then collaboratively verified in partnership to confirm that the agreed criteria are met. This may result in some refinements.

Sometimes the goal of the project is to develop a proof of concept system, which might form the basis for a more substantive future project. In other cases, the solution may be deployed (see the following step).

5. Intervention

If the goal is to implement a machine learning-based intervention, the next step is to engineer and deploy the solution. This step occurs in partnership with the organisation in order to assess whether it meets their organisational needs. This may involve some further refinements.

Beyond the technology itself, empowering organisations through training and knowledge-sharing is key. By equipping staff and volunteers with the skills to manage and adapt these systems, the solutions become more than just tools—they become integral parts of the organisation's mission.

These five steps are presented in a linear manner but-as mentioned earlier-the project is developed collaboratively and so the process may be iterative in practice, revisiting earlier steps as required.

ML4SG in Practice

In the following sections we describe two case studies from the range of projects that members of the Centre of ML4SG are working on to illustrate how we can make a contribution. We end this section by describing a range of areas that fall within the Centre's scope that show how ML is being applied to support social good initiatives. Our hope is that these examples stimulate your thinking about how we might assist in your organisation's efforts.





Case study 1: Waiheke Stoat Reidentification Project



The Centre of Machine Learning for Social Good (ML4SG) hosted its first National Hui which invited community leaders, non-profit organisations, and volunteer groups to discuss potential collaborations to solve real life challenges and issues under the context of Aotearoa. Through this hui, we were introduced to Te Korowai o Waiheke, a charitable trust aimed at making Waiheke Island predator free. They approached us with the problem of counting and tracking stoats on the island. Stoats are an invasive species that pose a huge threat to the native birds and other wildlife on the island. They are very elusive with high fertility rates, which makes eradicating them even more difficult. They have a number of camera traps around the island, capturing images as animals pass by. We saw this as an ideal opportunity to work with them, using machine learning to aid in this complex task.

Both centres have differences in expertise, thus requiring a transdisciplinary approach with close communication and collaboration to meet a shared goal. Our initial discussion comprised of carefully understanding the problem domain, while consolidating the expectations and knowledge on both sides. Investigations were done through online meetings and regular visits to their centre, which gave us useful information on their available resources and data. We started by investigating their current solution in monitoring stoats, which we found was labour intensive and errorprone. Furthermore, to provide intuition on what is computationally feasible, we presented a demo communicating what our solution entails, its improved performance and advantages. By working closely with Te Korowai o Waikehe, we managed to set a clear foundation for the project that is consistent with the expectations and perceptions of both centres. This collaborative process gave way to our final solution of creating a vision machine learning model to reidentify stoats on the island. In this case, identification is identifying an animal as a stoat, where reidentification is recognizing a specific stoat. Figure 2 provides an example of stoats of different IDs.



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Throughout the process of the project, we sought to maintain an active communication line between ourselves and Te Korowai o Waiheke. This allowed their volunteers to provide useful feedback from their domain experts. This helped in iteratively improving the model. We communicated our progress carefully and thoughtfully by sharing more intuitive information and avoiding any unnecessary complexities. For example, a visual interpretation of what the model 'sees' during inference was shown to further convince the volunteers of our results. There were still indications of doubt at the start, but as collaborations deepened and results showed evidence of success, it reinforced the trust between us. They provided us with many Waiheke stoat images to test our model. Not only was this beneficial in improving our approach but is also a strong sign of a well-built partnership with Te Korowai o Waiheke.



Stoat ID-50



Stoat ID-42

Figure 2. Unique stoat examples

This project aligned with ML4SG's mission in providing our knowledge and capabilities to solve real life problems. As such, besides the technical feasibility of the approach, we also considered the specific needs of Te Korowai o Waiheke. This means that the issues we faced were more grounded in real life and required careful compromise and critical problem solving. We placed our efforts towards the accessibility and sustainability of our model by providing a simple end-to-end GUI for the volunteers to use. Furthermore, the stoat data given to us was noisy with varying video resolutions, day and night variants, and limitations in Te Korowai o Waiheke's compute power and resources. This is far from the cleanliness and balance of standard datasets used in most scientific papers. Nevertheless, our approach gave optimal results in both accuracy and efficiency as well as outperforming other models that provide the same solution. We plan to publish these findings and continually expand in this scientific domain by creating a more generalised animal reidentification model.

ML4SG aims to provide solutions that are tailored to the needs of Aotearoa. By helping Te Korowai o Waiheke eradicate an invasive species that is detrimental to the ecology of Waiheke Island, we hope to make an impact in Aotearoa's environmental sustainability. Through this initiative, we were able to showcase our commitment to our mission and deliver specialised state-of-the-art solutions brought about by healthy communication and a shared goal.





Case study 2: Our Voices

The Centre for Machine Learning for Social Good (ML4SG) has partnered with Our Voices, a research initiative focused on understanding youth experiences in Aotearoa. Currently, there is a need to address the growing concern of a wellbeing gap among young people from diverse backgrounds. Tackling this issue is challenging due to the complexity and resources required for comprehensive data collection and longitudinal analysis. It also requires a focus on underrepresented groups who may face disadvantages from biases or gaps in service access. By working closely with young people, Our Voices aims to provide richer, child-centric analysis to inform future policy decisions and advance youth education and social work

Qualitative analysis has traditionally been the primary method for longitudinal studies and educational research, requiring rigorous data collection processes that can still be susceptible to biases and gaps in information affecting the analysis of findings. In order to deal with these issues in a scalable manner, Our Voices in collaboration with ML4SG, aims to introduce innovative ways in collecting and analysing longitudinal youth data. At the heart of their approach, an interactive and engaging app invited young participants to share their experiences in various themes such as identity, hobbies, school, family, and social life. They are provided options to answer by text, photo, video, or audio which are then collected and analysed by experts and further introduced to machine learning models. The app was iteratively improved by closely working with the youth participants to deliver the best and most comfortable experience for all. By utilising this rich unstructured data, researchers are able to uncover deeper information about youth experiences and wellbeing in a timely manner. This is in no way an approach to replace traditional analyses, rather it aims to supplement results by providing a different lens to pre-existing qualitative methods.

Alongside the wide array of qualitative research that forms parts of this initiative, the innovative introduction of machine learning has given researchers a fresh perspective in dealing with large-scale longitudinal data. Sometimes, participants may choose to opt out of a particular data collection, resulting in discontinuities and shifts in the data. This can lead to imbalances in group representation, where future results and evaluations are more reflective of those who provide consistent information compared to those who discontinued. Traditionally, it would require intensive expert attention to properly make unbiased inferences. While rigorous, it can be cumbersome and resource intensive. By leveraging machine learning algorithms particularly concept drift detection, new insights can be extracted from temporally imbalanced data, helping to mitigate biases and aid in expert analysis.





Additionally, researchers can triangulate missing data points using historical and current data patterns. Through this approach, Our Voices aims to ensure that no information is overlooked, valuing the experiences and input of all youth participants, even those who have not completed every component of the data collection.

ML4SG is closely working with the Our Voices researchers in iteratively improving data analysis and further aiding traditional qualitative methods. By analysing the model's outputs, researchers can validate model accuracy while also retrieving valuable insights from this approach. Importantly, they are able to fine-tune these ML models to perform within the Aotearoa context, accounting for the distinct experiences of the local youth demographic. This is made possible through extensive data collection alongside previous data collections undertaken by the Growing Up in New Zealand study. The speed and efficiency of these new methods offer significant value, especially compared to traditional approaches, which often rely on time-intensive data collection through questionnaires and case studies. Qualitative information gathered and analysed at this scale through this multi-modal approach has yet to be explored, thus creating potential in introducing these newer methods in the field of social science. Needless to say, the collaboration between ML4SG and Our Voices is mutually beneficial, creating a dynamic feedback loop that continually enhances both team's work.

The partnership between ML4SG and Our Voices demonstrated a transdisciplinary approach towards a shared goal of improving youth wellbeing in Aotearoa. In combining innovative techniques with traditional qualitative methods, the team aims to address the challenges of collecting and analysing longitudinal data, particularly in capturing the voices of underrepresented youth. By the end of this research programme, Our Voices aims to present these findings to the public and policymakers through an interactive museum exhibition, as well as publishing their findings and methods to the wider academic community. Ultimately, this initiative seeks to empower young people in Aotearoa, driving more inclusive and impactful solutions for their futures and wellbeing.



How ML is supporting Social Good efforts in Aotearoa

In New Zealand, the transformative power of **Machine Learning for Social Good (ML4SG)** is reshaping how we tackle pressing societal challenges. From the rugged landscapes of Aotearoa to its vibrant urban centers, researchers and practitioners are driving Al innovations that align with the country's unique needs and values.

Safeguarding Our Environment

New Zealand's biodiversity is a global treasure, yet it faces constant threats from invasive species and climate change. In response, AI technologies are revolutionising **biodiversity monitoring and conservation**. Projects like Predator Free 2050 are deploying cutting-edge machine learning tools to track and eliminate invasive predators, protecting native species like the kiwi and kākāpō.

Enhancing Healthcare and Wellbeing

Healthcare innovation is another cornerstone of ML4SG in New Zealand. In a country where access to specialised healthcare can be challenging, Al-driven **personalised medicine** is making healthcare more accessible and tailored. From predicting patient outcomes to optimising treatment plans, Al systems are helping clinicians deliver better care. On the public health front, machine learning models are vital for **disease outbreak prediction** and mitigation, particularly in remote and indigenous communities. Meanwhile, **mental health** tools, including chatbots and apps, are providing accessible and discreet support to those in need.

Strengthening Education and Workforce Development

Education, the cornerstone of societal progress, is benefiting from AI's ability to personalise learning experiences. Adaptive learning systems are being developed to meet individual learning needs, ensuring students thrive regardless of their background.

Building Resilience Against Disasters

Living in a geologically dynamic region, New Zealand faces the constant risk of natural disasters. Machine learning plays a pivotal role in **disaster prediction and resilience**, from early earthquake detection systems to flood risk modelling. Al-driven solutions are enhancing disaster preparedness and response, safeguarding lives and infrastructure.





Addressing Social Inequality and Inclusion

In the social sector, machine learning is driving initiatives to combat poverty, improve housing, and reduce inequalities. Data-driven tools are helping policymakers design effective interventions, ensuring resources reach those most in need.

Equally critical is the focus on **Māori Data Sovereignty**. As custodians of indigenous knowledge, Māori communities are collaborating with AI researchers to develop culturally inclusive technologies. These tools not only respect Indigenous rights but also empower Māori initiatives through data-driven insights.

Shaping the Future of Urban Living

Smart urban planning initiatives in cities leverage machine learning to enhance public transport systems, reduce traffic congestion, and optimise energy use. These innovations are creating more livable and sustainable urban environments.

Ensuring Ethical AI Governance

At the heart of all these efforts is a commitment to ethical AI. Researchers are exploring ways to enhance **AI transparency and fairness**, ensuring that machine learning systems are unbiased and trustworthy. Policymakers are actively shaping frameworks for responsible AI use, setting a global example for governance.

A Vision for the Future

New Zealand's ML4SG initiatives are a testament to the country's innovative spirit and deep-rooted commitment to social good. By embedding AI into critical domains, New Zealand is addressing local challenges and contributing solutions to global issues, fostering a more equitable, sustainable, and resilient future.





An Invitation

This white paper outlines a strategic framework to harness the power of machine learning for the betterment of Aotearoa. By investing in this initiative, we can foster a collaborative ecosystem where ML experts, domain experts and academics work together to develop innovative ML4SG solutions. We invite you to partner with us in identifying and translating research into tangible benefits for our communities. Together, we can inspire the next generation of ML talent to contribute to social good and address Aotearoa's pressing challenges, creating a brighter future for everyone.

If you work in the health, environment or social not-for-profit sectors and would like to discuss how ML could help address a particular problem, we are interested in talking to you. Please visit the Centre of ML4SG website for more information about how to contact us - <u>https://ml4sg.auckland.ac.nz/participate-in-research/</u>

For more information about Centre of ML4SG activities and updates about upcoming events and opportunities, please visit our website and join our email list: <u>https://ml4sg.auckland.ac.nz/</u>





A Roadmap for Machine Learning for Social Good in Aotearoa

- A white paper from the Centre of Machine Learning for Social Good

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