Strategy
2023–2026

NORA.ai

Vision.
Mission.
Ambition.

Developing artificial
intelligence to benefit
humanity and the
world we live in.

Table of contents

Foreword by the Chairperson and CEO

Klas H. Pettersen
CEO, NORA

Inge Jonassen
Chairperson, NORA

Human intelligence has greatly contributed to our species' success and dominance on Earth. We live in a time where intelligence is created artificially, further advancing the driver of our species' success factor. The rapid growth of our species has also brought with it a number of challenges we are currently facing.

An intelligent approach to these challenges, with smart and trustworthy tools and algorithms, will be crucial for continued and increased well-being. AI will be a critical component in the green and digital transitions, together referred to as the twin transition, for achieving the United Nations' sustainability goals, and AI is, of course, important for security policy and tackling new crises such as a new pandemic.

Artificial intelligence is a complex, highly competitive and truly interdisciplinary field. Projects often require collaboration and considerable resources. In NORA, we believe that we are stronger when we

Image created by Aurora Grefsrud, HVL, using the text prompt, "A female scientist sitting inside the ATLAS detector watching particles collide in bursts of colour, painted in the style of Edvard Munch". The image was the winning entry of the Munch AI Competition organised at the Nordic AI Meet 2022.

work together and that collaboration in the field of AI adds value to all consortium partners. That is why eight Norwegian universities, three university colleges and five Norwegian research institutes have joined the NORA consortium to coordinate their efforts within artificial intelligence, machine learning and robotics. These sixteen consortium partners have taken a national role in coordinating research, education and innovation in Norway. In close collaboration with the government, public sector and industry, we aim to bring Norway to the forefront of the most important technology of our time.

NORA has been operational since 2019. With support from The Research Council of Norway, Innovation Norway and EU's Digital programme, NORA has already established several structures to make Norway a leading nation in AI. Over the next few years, NORA will work with its partners to utilise these structures to their fullest potential.

We have started a national research school in AI; an EU network for AI, supporting partner's EU applications; NORA.startup as a collaboration between academia and the startup sector; a European Digital Innovation Hub (EDIH) for supporting the public sector and small and medium-sized

businesses to apply AI; and together with partners we are building a Norwegian infrastructure for AI, the Norwegian AI Cloud. We have also created conferences and arenas for collaborations, and we have established strong connections between the Norwegian AI community and some of the best international AI communities.

Norway has a strong culture of collaboration. Through the NORA partnership, we aim to position Norway at the international forefront of developing artificial intelligence to benefit humanity and the world we live in.

About NORA

The Norwegian Artificial Intelligence Research Consortium (NORA/NORA.ai), was established as a consortium to strengthen Norwegian research, education, and innovation within artificial intelligence, machine learning, and robotics (hereafter referred to as AI), as well as other areas relevant to this field.

Since the inception of NORA, the consortium has expanded. We now count eight universities, three university colleges and five research institutes: Norwegian University of Life Sciences, OsloMet – Oslo Metropolitan University, UiT – The Arctic University of Norway, University of Agder, University of Bergen, University of Oslo, University of Stavanger, University of South-Eastern Norway, BI Norwegian Business School, Kristiania University College, Østfold University College, NORCE Norwegian Research Centre AS, Norwegian Computing Center, SINTEF, Simula Research Laboratory AS and Vestlandsforskning.

The highest decision-making body of NORA is the general assembly, where all of NORA's consortium partners are represented. The general assembly selects NORA's governing board. While NORA is structured as an organisation, it is not a legal entity. NORA is a collaboration between its partners, with the University of Oslo as the host institution. According to NORA's Articles of Association, the NORA collaboration is based on recognised national and international ethical standards and norms for AI, promoting sustainable, transparent and inclusive use of AI.

It is further stated that NORA shall function as a national network, competence centre and contact point within AI and as a resource for AI and AI-related issues for Norwegian authorities. NORA will work to strengthen Norway's research policy and national commitment to AI.

The Articles of Association suggest that NORA's tasks will include, but not be limited to, the following:

- Facilitating national and international research collaboration and the development of joint research projects among NORA's partners

- Strengthen AI education in Norway

- Strengthen collaboration and establish meeting venues between the NORA partners' research communities, academia, public actors and businesses

- Strengthen the innovative power of our partner institutions, support start-ups and the establishment of start-ups

- Position Norwegian AI research internationally, with a special focus on activities aimed at EU research programmes

Based on these tasks and principles, NORA's development since its inception, and the recent development of the field of AI, NORA's management and board have developed a strategic plan for 2023–2026.

NORA's ambition

International recognition of Norwegian AI research, education and innovation

☆☆☆
Add value through collaboration

Promote ethical AI, AI for sustainability and diversity

Strengthen Norway's research policy and national commitment to AI

Mission

Serve as a national access point for AI

Advance national and international cooperation in AI

NORA's vision

Excellence in AI research, education and innovation

Facilitate open science and innovation

Position Norwegian AI internationally

Promote ethical AI

Advance collaboration between academia and other sectors

Mission

Strengthen Norwegian AI innovation

Strengthen Norwegian AI research

Strengthen AI education and training

NORA's vision

Excellence in AI research, education and innovation

NORA's ambition

International recognition of Norwegian AI research, education and innovation

NORA's mission

- Advance national and international cooperation in AI
- Advance collaboration between academia and other sectors
- Promote ethical AI
- Serve as a national access point for AI

NORA's ambition, vision and mission

NORA's ambition is to establish the necessary conditions for Norway to be recognised as an excellent country for AI research, education and innovation. NORA will offer a collaborative platform for both fundamental and applied research that reflects the complexity, interdisciplinarity and diversity of the field of AI.

NORA, as an AI network, will be a research-based environment of partnerships between institutions focusing on AI with strong bases in ethical principles. NORA will promote sustainable, ethical, transparent and inclusive AI. Nationally, NORA will seek more and stronger collabora-

tions between academia, business and the public sector. We will connect closer to industry and the public sector by inviting strategic partners to join the NORA network. We will also continue the active collaboration with industry clusters and AI startups.

International cooperation will be fundamental for bringing Norwegian AI research and innovation to the forefront and for achieving international recognition for Norwegian AI research. NORA will continue playing key roles in European AI networks and engaging in national and international AI policy meetings. NORA will also continue

supporting the Norwegian government and funding bodies in achieving the country's research and education goals as outlined in the Long-Term Plan for Research and Higher Education 2023–2032 and the National Strategy for Artificial Intelligence, recognising the AI impact also on security policy and its potential to address crises.

NORA will continue to work closely with the Norwegian government, ministries, directorates and funding bodies in order to strengthen Norway's research policy and national commitment to AI. NORA is already recognised and established as a national access point for AI competence

Box 1:
Memorandum of Understanding with The Department of Energy *(USA)*

In 2022 a Memorandum of Understanding (MoU) was signed between The Department of Energy (DoE, USA) and The Royal Ministry of Education and Research (KD, Norway) on collaboration on artificial intelligence and its applications to science, climate, energy and health. NORA has been active in the processes leading up to this agreement and will follow up the agreement in collaboration with KD. The MoU and related workshops will connect US National Laboratories with Norwegian AI research groups.

Box 2:
AI Directory

The Norwegian AI Directory (aidirectory.no) was developed by NORA as a repository of information about the field of AI in Norway. The AI Directory currently offers an overview of AI-related research and innovation projects, AI labs, startups, conferences and educational courses in Norway. It also provides links to funding opportunities for AI.

and infrastructure. Internationally, we have been actively involved in establishing bilateral agreements of AI collaborations between national bodies (**Box 1**), aligned with the Norwegian government's agenda. We will continue participating in international AI delegations related to these agreements to support Norwegian research collaborations. We will also continue to serve as a national access point for embassies and larger AI networks in other countries, international EU actions, research and innovation projects, and national and international industry and the public sector.

Serving as a national access point comes with the responsibility of having the best possible overview of the field of AI in Norway. NORA will continue to collect, systematise and convey information about everything AI in Norway from labs and education to conferences, collaborations, and funding possibilities. This information is structured and made publicly available in the Norwegian AI Directory (**Box 2**).

From its inception, NORA and the NORA partners have been heavily involved in larger international AI and AI-related networks such as CLAIRE, ELLIS, euRobotics, BDVA, EurAI and ADRA. NORA will continue

engaging with these and other networks to provide NORA and partners good opportunities for collaboration and funding.

The structures developed within the NORA consortium in the first years will be used to propel Norwegian AI to the next level, to achieve our vision for Norway as a country of excellence in AI research, education and innovation. How we plan to do this will be described in the next section.

NORA's strategic goals

NORA has outlined eight strategic goals that will help us move closer to our vision, ambition and mission.

To strengthen Norway's research policy and national commitment to AI, NORA will:

- Offer guidance and scientific advice on AI-related matters to Norwegian government agencies

- Participate in relevant national and international committees and forums where it will further national interests

- Participate in governmental working groups where it will benefit national interests

- Organise relevant AI delegations

- Engage in international AI policy networks

NORA will contribute to strengthening Norway's national AI policy and governance. NORA will actively support and inform policy discussions in the Norwegian government, ministries, directorates, shared public forums for AI, regulatory AI sandboxes, public companies, municipalities and cities. This may include training or advising political leadership, operational leaders, or workers in the public sector when appropriate, to support the responsible use of AI in Norway.

NORA will work with its partners to increase the national commitment to AI. This includes the national commitment towards research, education and innovation, as well as supporting the adoption of AI by businesses, citizens and public administrations.

We will encourage researcher participation in relevant national and international committees and forums where it will further national interests. NORA is also a natural advisor for suggesting suitable candidates for committees, boards and forums.

NORA will encourage Norwegian participation in multilateral platforms for discussing AI for public services and AI policy. A crucial part of this will be a proactive approach to the upcoming regulations for AI and data in the EU.

To position Norwegian AI internationally, NORA will:

- Build strong relations with selected international organisations and networks within AI

- Organise international conferences and be visible at larger international conferences

- Seek to develop international AI networks in Norway's best interests

- Develop competence on EU policies, programmes and processes to the benefit for Norwegian institutions and the Norwegian government

- Facilitate international research collaborations

Building strong relationships with selected international partners is central to positioning Norwegian AI research and innovation for funding and participation in international research applications and consortia. NORA will continue to work to position Norway and its AI actors internationally. NORA will play a coordinating role in international AI networks to help its partners achieve international relevance and excellence in AI research, education and innovation. Specifically, NORA will continue strengthening collaborations with other Nordic countries, the UK, Germany and the US.

Within the Nordics, we will focus on our close collaboration with other Nordic AI networks such as the Danish Pioneer Centre for AI, Finnish Center for Artificial Intelligence (FCAI), Wallenberg AI Autonomous Systems and Software Program (WASP) and AI Sweden. NORA will support AI initiatives within the Nordic Council of Ministers,

and NORA will continue to develop the conference Nordic symposium for young researchers (**Box 3**), making it a truly Nordic conference alternating between the Nordic countries. As part of a Nordic focus, NORA will strengthen the journal Nordic Machine Intelligence (**Box 4**).

Outside the Nordic countries, we will continue our strong collaboration with the Alan Turing Institute (UK), the National Laboratories of Department of Energy (USA) and HIDA Helmholtz Information and Data Science Academy (Germany).

Strengthened collaboration with these partners may include joint organisation of international conferences, exchange of students and researchers, and facilitating joint research projects and workshops.

NORA and the NORA partners are greatly involved in larger international AI networks such as CLAIRE, euRobotics, BDVA, ELLIS,

EurAI and the ADRA. NORA hosts the Norwegian CLAIRE office and has been given CLAIRE responsibilities far outside the Norwegian community. NORA will work to utilise Norway's excellent standing within these networks as a strategic advantage for Norway, ensuring that Norwegian groups are well-positioned with regard to strong international AI collaborations and future researcwh funding.

NORA will work with its consortium partners to influence the development of international calls, help Norwegian partners position initiatives toward these calls and connect Norwegian partners with excellent international research communities.

NORA will also take measures for Norway to become more visible at larger international AI conferences such as NeurIPS, ICML, ICLR or AAAI Conference on Artificial Intelligence.

Box 3:
The Nordic AI Meet – Nordic symposium for young researchers

NORA established the Nordic AI Meet as a Nordic conference to provide a platform for early career AI researchers to present, discuss and promote their research. The Nordic AI Meet also strengthens Nordic collaborations and encourages young researchers to reflect about what a "Nordic approach" to AI means and how to build AI solutions for societal good. The conference is supported by RCN for five years, ending in 2025 (grant agreement 311833).

Box 4:
Nordic Machine Intelligence

Nordic Machine Intelligence is an open AI journal with no publication fee. The journal was established by NORA and is owned and controlled by the research community of Norway. The journal being open and without publication fee qualifies the journal to a *Diamond open-access journal*. The journal is a level 1 journal in the Norwegian publication system.

To strengthen Norwegian AI research, NORA will:

- Facilitate research applications, especially applications aimed at EU's programmes

- Facilitate joint projects with participation from NORA partners

- Encourage Norwegian participation in international research consortia

- Support Norwegian researchers to engage pre-call

- Create special interest groups for specific AI topics

- Organise workshops and conferences and create arenas for interaction and cooperation between NORA partners' research environments, academia, public actors and businesses

---

Norway can be at the forefront of both fundamental and applied AI research. Excellence in AI research does not translate to excellence in all AI topics, but rather that Norway should achieve excellence and be world-leading in a few select topics.

As a consortium, we should think long-term and utilise the potential the NORA consortium provides to form larger academic collaborations. The Long-Term Plan for Research and Higher Education 2023–2032 mentions artificial intelligence, quantum computing and neurotechnology as prioritised technologies in its Chapter 3.4 on enabling and industrial technologies. Hence, we expect increased funding in the field of AI for the next decade.

NORA will organise, preferably in cooperation with funding bodies, brokerage events with relevant stakeholders to help the consortium prepare project applications and joint projects involving NORA partners. We will facilitate research applications, especially applications aimed at Horizon

Europe, and for Norwegian research groups to participate in international projects. To position Norwegian research and researchers on the international stage, we will support Norwegian researchers to engage pre-call through international networks, such as CLAIRE, or through international special interest groups (SIGs).

NORA will establish Norwegian SIGs for specific AI research topics when such national groups are beneficial.

NORA will also continue to organise workshops and conferences, and continue creating other arenas for interaction and cooperation between NORA partners' research environments, academia, public actors and businesses.

The field of AI has been growing rapidly and we foresee some challenges:

1. Funding for research and innovation projects is too low compared to the extreme international growth of the field

2. Fragmentation between the research communities

3. Differences between commercial and scientific approaches to AI

Available funding
The use of AI and machine learning methods has increased dramatically during the last decade due to a dramatic increase in available data sets, computing power and new methods. For Norway to become a leading country in AI, greater efforts must be made to accelerate funding possibilities for new methods, tools and infrastructure. With increased research funding for AI, the field can strengthen both its current research communities and attract new researchers from other academic areas.

AI research is based on key areas of information and communications technology (ICT) and cannot be achieved without further investments in ICT research. Funding for fundamental and applied ICT research must therefore be strengthened to support

Box 5:
NORA.EU – EU network
for Horizon Europe

From July 2021, NORA.EU has been NORA's EU-network for Horizon Europe. The initiative will mobilise and support researchers in the fields of AI, machine learning and robotics to submit joint applications for Horizon Europe. NORA.EU is supported by The Norwegian Research Council, project #328602. The project period lasts up to July 2024.

Developing AI requires excellent research environments, both in fundamental and applied research.

a growing need for AI research. Research funding in other academic fields that include the use of AI, either theoretical or applied, must also be strengthened.

AI has huge business potential. To be at the forefront, Norway must invest in developing new technologies in AI, which requires excellent research environments, both in fundamental and applied research. Through coordination of research, information sharing, collaboration and guidance in the application processes, NORA can help Norwegian researchers receive increased funding. With NORA.EU (**Box 5**) we will focus in particular on supporting Norwegian researchers applying for funding under the Horizon Europe Programme.

**Fragmentation between
the research communities**
NORA is a Norwegian network for AI research, innovation and education. We will create arenas for interaction and cooperation between the NORA consortium partners and the society in general. These

arenas are important to avoid fragmentation and will include physical meetings such as conferences and workshops, but also digital meeting places, communication and collaboration platforms and video conferencing. We will include industry and the public sector as strategic partners of NORA. The research school will also serve to build a strong research-based AI community among the partners. In general, communication and distribution of information will be crucial in fostering a strong community, effective collaborations, and avoiding fragmentation between the communities that actively participate in AI research.

**Differences between the commercial
and scientific approach to AI**
The economic potential of AI-related technologies is massive. Effective cooperation between the business community and academia is crucial for Norway's increased investment in AI. NORA will strengthen collaboration between the consortium partners' research communities and the

business community by facilitating contact between academia and the business sector.

NORA will work closely with strategic partners in industry and the public sector within NORA's Innovation Council, with startup companies through NORA.startup (**Box 7**) and with small and medium-sized businesses through EDIHs (**Box 8**). However, conflicting interests between academic researchers and industry may arise as regards openness, transparency and publications. NORA will nurture a culture for open science and innovation, facilitating positive collaboration models between industry, public sector and academia with openness as a key value. Another challenge may be the focus of AI research in academia versus AI deployment in industry. NORA will encourage AI research in industry and the public sector, and through the EDIHs (**Box 8**) and the Norwegian AI Cloud (**Box 9**). NORA will also seek collaborations where research algorithms will be deployed by industry.

To strengthen AI education and training, NORA will:

- Work for increased number of AI-related study seats and study programs, and a correspondingly increased number of university positions

- Build a national research school in AI at a leading European level

- Conduct summer and winter schools, seminars, workshops, conferences and networking events

- Establish student exchange programmes with excellent international partners

- Organise seminars and workshops on the newest, cutting-edge methods of AI

- Facilitate the establishment of new courses

- Support our partners in establishing courses and workshops ensuring lifelong learning

---

The field of AI is quickly developing and there are many interdisciplinary AI applications. It isn't possible for each university to cover all aspects of AI or keep updated on all recent developments in the field. Norway has, however, many excellent research environments whose specialisations and strengths complement each other. When collaborating, these can provide necessary competences for PhD students in the field of AI. Through the NORA Norwegian AI Research School (**Box 6**) NORA will coordinate the education at the PhD level and increase the quality and breadth of the current offerings and help to identify and fill potential gaps. By interlinking parts of the PhD programmes, our universities will be able to provide significantly better education than they can individually, while at the same time contributing to the develop-

ment of a nationwide educational ecosystem among Norway's future AI experts. A coordinated effort increases the quality of the PhD study programmes and presently uncovered topics can be adequately covered. The research school will provide access to specialised education in AI, also for students from other fields applying AI within their own fields.

NORA Norwegian AI Research School makes it possible for all institutions, even the smaller ones, to have access to relevant courses, international collaborations for short visits and exchange programmes, internships, access to centralised computational resources, datasets and opportunities to work with industry and the public sector through conferences, events, industry days and workshops. NORA will

also organise winter and summer schools at the PhD level.

NORA will establish student exchange programmes with excellent international partners. NORA recently signed a MoU with the Alan Turing Institute (UK), and as the first country outside the UK starting in 2023, we will send PhD students to London following their Enrichment Scheme. There, students will be given the opportunity to enhance, refresh, and broaden their research with the Turing community. Similarly, NORA has started a student exchange with German institutions, through the HIDA Helmholtz Information and Data Science Academy.

The essence of the research school also lies in the real empowerment of the student community and in allowing students to contribute to the research school activi-

Box 6:
NORA Norwegian AI research school

NORA has established a national research school in AI. The research school has been supported by RCN for eight years (grant agreement 331723). The research school is a PhD level graduate school with the primary objective of raising the quality of PhD education in AI, machine learning and robotics to a leading European level, with a high degree of relevance for the labour market. The research school started in 2022 and will operate until 2030.

ties throughout the year, and for stakeholders from industry and the public sector to discuss their problems and engage talent. Bringing back cutting-edge topics in the research school activity and linkages with international environments will improve the overall visibility and attractiveness of Norwegian AI research for attracting talent globally.

In order to meet the demanding digital transformation and need for AI competence, steps must be taken to motivate and encourage young people to study ICT and AI. Industry and the public sector need employees with AI competence at all levels. To meet this need, Norway must increase the number of study places within the field of AI. The number of study programmes in AI should also increase. Especially at the bachelor level, our Nordic neighbours have far greater AI study programmes. In order to keep up and increase the educational quality and educate more students, more university positions in the field of AI are needed. Basic ICT education needs to be strengthened starting from primary school; not just coding, but how algorithms work, how software is developed and how machine learning methods work. At higher educational levels, it is important that the theoretical foundations for AI and the development of AI models become a central part of ICT education.

As AI will impact most parts of society, there is also a need to raise the general competence of the entire population, especially of workers who will be actively using AI technology. Previously, only specialists used advanced software. Now, AI is on its way into most software and tools, and the entire population will have to interact with advanced tools. It is important that people understand the choices such tools make, which judgments are used for decision-making, as well as error margins and interpretation options. NORA will, through its consortium partners, encourage lifelong learning.

As AI is a field that influences the daily life of ordinary people, researchers should be active disseminators and take part in the public debate. Researchers within the field should be encouraged to be visible in the public sphere, and they must be good intermediaries who speak a language that people understand.

To strengthen Norwegian AI Innovation, NORA will:

- Create a network for strategic partners from industry and the public sector

- Strengthen and grow NORA.startup as a leading innovation network connecting AI startups, researchers and students in Norway

- Establish services for the public sector and small and medium-sized enterprises within the European Digital Innovation Hub Nemonoor

- Collaborate with, and strengthen, relevant business clusters in Norway

- Make selected AI research algorithms available to the business community

- Connect strategic partners to international networks

NORA has developed several central innovation initiatives for supporting research-based innovation at consortium partners. Through NORA.startup, NORA has established an innovation network among the consortium partners. NORA.startup supports the establishment of startup companies and promotes academic collaboration with startup companies doing research-based innovation in AI. NORA has also created a network for selected strategic partners from industry and the public sector. NORA's network of strategic partners will strengthen industry collaborations between NORA's consortium partners, businesses, startups and public actors. In addition, NORA has created an Innovation Council. The NORA Innovation Council consists of strategic partners and is an advisory body to the NORA Consor-

tium Board and the NORA Norwegian AI Research School board. For collaboration with small and medium-sized businesses, NORA has, together with business clusters and other partners, created Nemonoor, an AI-focused European Digital Innovation Hub (EDIH, **Box 8**). NORA and NORA consortium partners are also part of the Oceanopolis, the other Norwegian EDIH, that has a broader focus on digitalization and AI.

The key to successful industry collaboration is connecting the whole NORA ecosystem. NORA will act as a facilitator, connecting our established structures for research and education to startup companies, small and medium sized businesses, large industry, and public actors. NORA will support both public actors and busi-

nesses to do research-based innovation, to explore the use of AI and advance the adoption of AI in Norway.

NORA Strategic Partners
The economic and societal potential of AI-related technologies is huge; however, the field of AI in Norway is still relatively small and fragmented. Strong collaboration between business and research communities is essential if Norway is to fully utilise the opportunities provided by AI.

The NORA Strategic Partners initiative is a network of and for research-based businesses. Through this network, NORA will actively seek to increase research collaboration among consortium partners, startups, public actors, and businesses. The Strategic Partner initiative will create

Box 7:
NORA.startup

NORA.startup was funded by Innovation Norway as a national innovation ecosystem within AI (grant UT-ØKOSYST 1089). The funding period ended in 2022, but NORA.startup continues to grow as NORA's primary innovation platform. By the end of 2022, NORA.startup had 40 startup members representing Norway's top startup companies within AI, and 50 researchers and students. NORA.startup has a steering committee consisting of representatives from some of Norway's top incubators (Startup Lab and Gründergarasjen), CEOs of top AI startup companies, and professors/researchers from NORA partner institutions. All companies in NORA.startup have a strong focus on research-based innovation. Students, researchers and innovators jointly benefit from NORA.startup as an ecosystem for innovation.

meeting venues for knowledge and technology exchange, education and training. It will also provide access to talent and student collaborations, and facilitate collaborations with the foremost leading AI, ML and robotic scientists, research labs and research institutions in Norway.

NORA.startup

NORA.startup will take an active part in supporting the establishment of startup companies in the field of AI. NORA.startup is a national networking arena for and by the research and startup community in Norway in the field of machine learning, artificial intelligence, and robotics. Members in the network enjoy access to a community characterised by a high degree of technical and academic competence and expertise. The NORA.startup network is primarily intended for Norwegian startups focusing on research-based innovation and students and researchers affiliated with Norwegian universities, university colleges and research institutions.

NORA.startup is a leading innovation network connecting AI startups, researchers and students in Norway. To strengthen this position, NORA.startup focuses on creating a community for knowledge exchange and the dissemination of research assured by professional expertise and competence. Furthermore, NORA.startup has as a core objective to facilitate and strengthen collaboration between startup companies, academic institutions and business through research projects, networking events, conferences, and workshops.

European Digital Innovation Hubs

NORA is part of Norway's two European Digital Innovation Hubs (EDIHs, **Box 8**) and is one of the core partners in Nemonoor.

The EDIHs will help public enterprises, and small and medium-sized businesses adopt AI and increase their digital maturity. As a work package leader on sustainable and trustworthy AI, we will address challenges related to sustainability and ethics that can arise when developing and adopting AI technologies. NORA will develop ethical guidelines, frameworks and tools for sustainable and trustworthy AI which will be made accessible to startups, SMBs and public organisations.

NORA will also contribute substantially to assisting with AI technology, education and dissemination within the EDIH. Specifically, we will make AI research algorithms available to the business community.

Box 8:
NEMONOOR and Oceanopolis,
Norwegian European digital innovation hubs (EDIHs)

NORA is one of eight core partners in the European Digital Innovation Hub (EDIH) Nemonoor, led by Digital Norway. NORA is also part of the EDIH Oceanopolis, led by NORCE. The EDIHs are one-stop shops supporting companies and the public sector to apply AI and become more competitive. The two EDIHs will have a close collaboration through NORA and the NORA partners. The EDIHs are seven-year projects, operational from the beginning of 2023, with funding from the Digital Europe programme.

To facilitate open science and innovation, NORA will:

- Strengthen the free-of-charge and open-access journal Nordic Machine Intelligence

- Facilitate and promote FAIR data for research and innovation projects

- Facilitate sharing of cutting-edge AI algorithms

- Organise open data competitions

- Promote the uptake of Norwegian AI Cloud resources and services in academia, the start-up community, public sector and industry

NORA will lead the way in making research and innovation as open as possible, and only as closed as necessary. We will support making research data FAIR (Findable, Accessible, Interoperable and Reusable) and we will promote open access publications and support RCN's goal of common international requirements for full and immediate open access to research publications (Plan S).

As part of the openness strategy, NORA established a new AI journal (**Box 4**), an open-access journal with no publication fee.

NORA has already hosted several open dataset-driven competitions on the initiative of its consortium partners. NORA will continue hosting data competitions, also using them as tools for education, industry collaboration and promotion of many of the excellent Norwegian datasets and algorithms.

NORA will provide access to cutting-edge AI methods, competence and infrastructure and will support development of digital resources and platforms for sharing and disseminating datasets, AI methods and algorithms. Such an initiative by NORA

was mentioned in Norway's "Long-term plan for research and higher education 2023–2032" (**Box 10**). When new breakthroughs occur in the field of AI, NORA will ensure that Norway is world-leading in adopting the algorithm by organising workshops and making the algorithm available on Norwegian infrastructure. As in the example of AlphaFold (**Box 10**), NORA will also establish competence groups (special interest groups) for such breakthrough algorithms and support strategic partners in applying these algorithms.

As AI rapidly progresses, so does the need for better computing infrastructure and greater competence. The academic High-Performance Computing (HPC) infrastructure is crucial for the AI research community, mainly because it enables researchers to run large and complex computations that would otherwise be impossible with simple personal computers, ultimately with the purpose of new scientific discoveries to benefit humanity. The Norwegian HPC infrastructure landscape is centred around local clusters at the university level, and the Sigma2 collaboration at the national level. Currently, Sigma2 manages all three of the largest

HPCs in Norway, namely Betzy, Fram, and Saga. Meanwhile, at the international level, Norwegian researchers have access to some of the fastest supercomputers in the world, LUMI and Aurora. NORA will connect AI research groups to Sigma2 and the national infrastructure.

NORA is a partner in the Norwegian AI Cloud infrastructure project (**Box 9**). The project aims to create a smart digital infrastructure enabling Norwegian universities, research institutions, and businesses to perform data-driven AI research and innovation. Through Norwegian AI Cloud, NORA will actively contribute to enabling access to and understanding of the infrastructure necessary to develop, train and deploy AI models. NORA also welcomes initiatives like Hugging Face, which promotes open-source access to AI models and enables the democratisation of AI to the masses and Responsible AI Licenses (RAIL). NORA will emulate similar initiatives at the National level through the Norwegian AI Cloud, making research algorithms available to the research community and to industry and the public sector.

Box 9:
The Norwegian AI Cloud – NAIC

The project was initiated in 2020 by numerous research and private institutions in Norway, including NORA, to create smart e-infrastructure enabling Norwegian universities, research institutions, and businesses to perform data-driven AI research and innovation. This infrastructure will allow the Norwegian AI research community to conduct their research more efficiently and effectively, eventually leading to more significant advances in AI technology. Finally, this project will help position Norway as one of the leading countries in the field of AI and allow Norwegian researchers to stay at the forefront of this rapidly evolving technology. The Norwegian AI Cloud is supported by RCN with a project period of three years from January 2023 (RCN grant agreement 322336).

Box 10:
Long term plan for research and higher education 2023–2032

The long term plan includes the following AI example (their box 3.11) titled a breakthrough since the previous long-term plan:

Proteins are essential for all life, and the shape of a protein determines its function. Finding the protein structure experimentally is a difficult and expensive endeavour. Finding one structure experimentally could typically take a year and cost NOK 1 million.

In 2020, something very special happened in this field however. The company DeepMind developed the AI algorithm AlphaFold, which quickly predicts the shape of completely new proteins based on data from the Protein Data Bank. After a short time, the algorithm had mapped all proteins in the human body, and species by species is now being mapped.

In 2021, AlphaFold was named "Method of the Year" by the journal Nature. DeepMind, which is a British company, opened the algorithm, and on the initiative of NORA (Norwegian Artificial Intelligence Research Consortium), USIT (University Center for Information Technology) at UiO and Sigma2, the algorithms were quickly installed on Norwegian infrastructure and made available to the Norwegian research community. The algorithm is available to the entire research community and can be used, among other things, in the development of drugs.

To promote ethical AI, AI for sustainability and diversity in AI NORA will:

- Develop guidelines that promote sustainable, ethical, transparent and inclusive AI

- Increase awareness of bias and discrimination in AI systems

- Promote diversity in AI in Norway

- Promote AI as an instrument for green transition and climate mitigation

- Strengthen NORA's recognition as a promoter of ethics and trustworthiness in AI

Increased use of AI raises several ethical and legal issues in both the public and private sectors. Many of the ethical issues are well known from previous work with data science, while other issues regarding responsibility or liability for decision-making for AI, ML and Robotics are emerging topics.

One prominent concern is that of algorithmic bias, both technical and social. The field of AI suffers from a lack of diversity, which has become a key topic as it further results in adverse biases in the solutions developed. The current lack of diversity in Norwegian universities, university colleges and research institutions teaching or con-

ducting studies in AI, and in the industry at large, will have severe repercussions on the development and deployment of AI in society.

NORA will work to ensure that sustainability is a central part of the development of AI in Norway through both awareness-building and operationalising the concept within research as well as industry. NORA leads the work package on sustainable and trustworthy AI in Nemonoor (**Box 8**). Part of this work will be creating guidelines, holding workshops, and listing certified products in the field of AI. Furthermore, NORA will encourage research and

innovation to address the green transition as well as climate adaptation and mitigation needs following the effects from the worsening climate crisis.

To design algorithms that are fair and trustworthy, one needs to scrutinise the input data used to train the AI algorithm. To fully exploit the opportunities offered by AI, researchers must have access to comprehensive data. With respect to data, Norway is in a privileged position. For example, our birth register is unique, and thanks to an open and transparent tax system, we have access to data on taxes, bank deposits, debts, etc. Although many

of the data sources may be accessible in principle, the process of obtaining access is often cumbersome. NORA will encourage and support systems to follow FAIR principles and make data more easily accessible.

NORA will contribute to exploring unintended consequences of AI across populations. To avoid producing unfair and biased AI, Norway needs a diverse AI workforce that will help mitigate bias, prevent discrimination, and negative consequences of AI in society.

NORA, in collaboration with consortium partners, will promote the use of fair algo-

rithms to mitigate bias and discrimination and encourage partners to recruit diverse talent. NORA will encourage and support transparent and testable algorithms and accessible training data.

Fairness cannot be fully automated over time, basing our decisions on past mistakes or ignoring the issues in the present may not make for a just society. It requires a broader engagement from the research community that goes beyond surface-level discussions of AI applications. Applications need careful consideration and NORA will work to ensure Norway has access to talented AI ethics researchers and practitioners.

NORA will contribute to raising awareness about AI and its effects on society. There are many assumptions and misunderstandings about AI, and its short-term and long-term impact on society. NORA welcomes discussions about AI and its impact, and NORA will contribute to ensuring that the discussions are well-informed and fact-based. NORA will host events and discussion groups focused on the importance of diversity in AI that addresses inequality and discuss initiatives to ensure inclusivity and diversity in AI for the future.

To add value through collaboration and development of NORA, NORA will:

- Develop NORA's organisation and financial basis

- Share knowledge and resources

- Expand the impact on policy by united efforts

- Expand the impact of research

- Facilitate larger, collaborative projects

- Foster a sense of community

NORA is all about adding value through collaboration, building excellence in AI research, education and innovation in Norway. Adding value through collaboration is a goal and a guiding principle through everything we do, and projects where collaboration gives added value will be prioritised.

NORA will add value through collaboration by sharing knowledge and resources across our consortium partners. In the interdisciplinary field of AI, a broader collaboration will potentially leverage more diverse perspectives, bringing new ideas and approaches to the table, leading to better and more innovative solutions. The impact of research will potentially also reach a broader audience.

Many AI research projects are large, interdisciplinary projects, suffering from being costly. As a national structure, NORA can facilitate and make larger projects also possible in Norway. Larger projects could benefit from the whole NORA ecosystem, including industry and the public sector. Model sharing is especially important for larger algorithms that are not easily handled and maintained by individual research groups.

By implementing the NORA strategy, NORA will be adding value for our partners. This will ensure further growth of the organisation and its financial basis, and it will give Norway an international position in driving advancements in the field of AI.

A broad collaboration between universities, university colleges and institutes also gives us a strong voice in policy when standing united. Not only will a united voice be strong nationally, a competent and united Norwegian AI community will also be able to influence AI policy at an international level.

To achieve all this, we need to foster a sense of community. This is what we have been building since NORA's inception in 2019, and this is what we will continue to do in the years to come.