NOVARTIS

<u>Our commitment to ethical and responsible use of AI " ></u>

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Taking a human-centred approach in using Artificial Intelligence to reimagine medicine.

AI is helping Novartis increase patient access, improve customer experience, drive automation, provide predictive analytics and detect potential misconduct. It also has the potential to be used to improve the speed and accuracy of diagnosis, treatment protocols, drug discovery, drug development, patient monitoring, and patient care, among other applications that will improve patients' lives and optimize the healthcare ecosystem.

These technological developments come with both opportunities and challenges, leading to important questions which, as a leading medicines company, we need to address thoughtfully and affirmatively. With AI playing such a critical role in enabling our digital strategy and transformation, we recognize the need to define clear ethical principles around AI. Hence, Novartis is committed to deploying AI systems in a transparent and responsible way. We will ensure that the use of AI systems has a clear purpose, that is respectful of human rights, and is accurate, truthful, not misleading and appropriate for the intended context.

Our principles for ethical use of AI

Novartis believes that any development, application or use of AI systems should be governed within the following ethical principles which are fully aligned to the Novartis Code of Ethics principles and commitments:

Empower Humanity

At Novartis, our values and culture are driven and defined by our purpose to reimagine medicines to improve and extend people's lives. Our everyday decision making is based on our ethical principles, as outlined in our Code of Ethics. These values and ethical principles form the basis from which we design, implement, and deploy AI. Novartis is committed to:

- Enforcing human-centric design in the deployment and use of AI systems;
- Building a mutually beneficial relationship between human knowledge, expertise and decision-making and the computational machinery which provides inferences and connections between data at scale;
- Respecting the rights and dignity of all people, and striving to prevent and mitigate identified adverse human rights impacts that may arise through our use of AI;
- Continuously assessing AI advances to ensure they proceed from within Novartis' context and are determined by Novartis, rather than influenced by external factors;
- Monitoring the impacts of AI to evolving human and societal values.

Hold Ourselves Accountable

As an accountable organization, Novartis is committed to establishing robust governance over the design and use of AI. Such rigorous governance includes appropriate leadership and oversight, risk and impact assessments, appropriate policies and procedures, transparency, training and awareness, monitoring and verification, response and enforcement. Therefore, Novartis is committed to:

- Maintaining human accountability in decision-making processes of designing, delivering and operating AI systems;
- Providing autonomy to associates in the controlling, creation, training, deployment and operation of AI systems;
- Performing business and regulatory impact assessments of AI systems within the Novartis value chain before integration and deployment;
- Applying Novartis Information Technology (IT) and Operation Technology (OT) controls and processes to plan, implement and continuously monitor AI systems, in alignment to the commitments in the Code of Ethics;
- Proactively monitoring and mitigating potential negative AI consequences;
- Enabling the auditability of the AI systems via validation and verification functionalities and keeping an audit trail in line with best practice.

Mitigate Bias

Data and algorithms used in AI systems need to meet Novartis' strong commitment to fairness and non-discrimination detailed, inter alia in our Code of Ethics; particularly where AI systems are used in sensitive areas that closely touch critical decisions regarding drug development, socio-economic benefits, hiring and matters that relate to human behavior. We are committed to mitigating the risk of bias throughout the process, from data gathering, model creation and application of the model. To that end, we will strive to:

- Design, develop, test, train and operate AI algorithms based on inclusive and representative data to eliminate possible biases and known discriminatory aspects such as race, gender, ethnicity, sexual orientation, political or religious beliefs;
- Use data samples that are representative of the studied and analyzed population to eliminate or prevent unconscious bias;
- Perform a risk impact assessment on the AI systems before their use in production to eliminate the risk of bias or discrimination;
- Develop and use AI systems in ways that reflect the social and cultural diversity of Novartis;
- In the short-term, assess, acquire or develop tools and establish techniques to assess statistical bias in data-sets from external sources – mitigating bias in all data sourced from outside of Novartis;
- Ensure the responsible use of AI when applied to the real world, as outlined in our 'Empower Humanity' Principle.

Respect Privacy

In some instances, AI systems are 'trained' on and use personal information. Outputs of AI systems may also impact the privacy of individuals. Novartis has established and implemented Global Data Privacy Principles that govern the use of personal information. These Principles apply without exception to the design and use of any AI system. The Principles are:

- Transparency: We are transparent about what personal information we process, how and why we collect it, use it, and who we share it with. We explain this in clear and simple language;
- Legitimate and Meaningful Collection: We connect all collection and use of personal information to specific business purposes related to how we operate, innovate or engage;
- Responsible and Sustainable Processing: We use personal information only in ways compatible with the purposes for which it was collected. We facilitate Individuals to exercise their rights with regards to their personal information;
- Security: We protect personal information by using reasonable safeguards to prevent its loss, unauthorized access, use, alteration or unauthorized disclosure;

- Integrity and Quality: We take appropriate steps to keep personal information accurate and up to date;
- Minimal Retention: We keep personal information only for as long we can legitimately use it.

Be Transparent and Explainable

Novartis strives to create transparency around the design and use of AI systems to explain how such systems work through:

- Short term: Openly disclosing / informing end-users when they are interacting with an AI system;
- Mid-term: Enabling the auditability and traceability of the decision pathways taken by AI systems using IT tools and infrastructure;
- Mid-term: Transparently communicating and explaining the limitations, purpose, decisions and capability of AI systems as new visualization models are developed;
- Ensuring the use of AI systems has a clear purpose that is accurate, truthful, not misleading, and appropriate for their intended context; aligning with the principles of Beneficial AI.

Assure Safety and Security by Design

AI systems need to be safe, performing as intended, secure and resistant to compromise via unauthorized parties. Hence, in the design, implementation and use of AI systems, Novartis commits to the following:

- Technically robust systems that translate in-depth human understanding to stable operations based on a review of impact assessments and the specific context of the use-case;
- If the AI systems are deployed in relation to products and manufacturing environments, we are committed to reporting adverse events within 24 hours of discovery to the Novartis Safety Department and quality complaints to Quality Assurance, and then transparently communicating the risks of our medicines and devices to regulatory authorities;
- In relation to confidentiality, Integrity and Availability of Novartis Information, we hold ourselves accountable for the information and technology that we handle, with an obligation to safeguard our patients' and partners' information.

Prioritize Environmental Sustainability

AI systems need to be designed sustainably, inter alia, assessing the resource usage and energy consumption to limit the risks to the environment. To address the environmental footprint of AI systems (e.g. assessing the resource usage and energy consumption), the Environmental Sustainability principle within the Code of Ethics would apply. This principle lays out that Novartis is committed to minimizing the environmental impact of our activities and products over their lifecycle. Novartis is aiming for carbon neutrality across the supply chain by 2030. In AI, this means addressing three broad areas:

- Short term: Partnering with like-minded sustainable technology platforms. Novartis will introduce sustainability as a key component in procurement of the computational infrastructure required for AI solutions and services;
- Mid-term: Ensuring optimal use of algorithms with internal implementation of AI, by training data scientists to be selective about the algorithms they want to train upfront, before committing them to the computational power required to deploy deep learning;
- Long-term: Reviewing internal operations, such as Novartis Technical Operations (NTO) to assess how AI can be used to reduce carbon footprint.

Review, Learn and Adapt

AI systems need to support and enable professional standards. As such, Novartis is committed to:

Ensuring and maintaining professionalism and accountability in the creation and deployment of AI systems; ensuring that associates have the necessary depth of understanding of the ethical implications;

Implementing and using AI systems that augment, complement and empower human capabilities and skills to improve speed, quality and maximize impact in a positive way;

Enhancing the offering of our Data Science Academy to educate data scientists as well the broader group of Novartis associates on the use of AI;

Empowering, educating and training associates in the short-term to have the right ethical professional awareness (knowledge, experience and required skills) as they use or operate AI systems, to ensure that ethical commitments (as laid out in the Code of Ethics) are not compromised; moving in the mid-term to a system of certification.

Download Novartis' commitment to the ethical and responsible use of Artificial Intelligence (AI) systems (PDF 1.6 MB)

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"AI is an accelerating force that drives our response to complex challenges, powering our capability to derive insights from data. We already are embedding AI into the workflow of our associates and have many instances across our value-chain in which we use AI in our day to day business. As a leading medicine company that is pioneering the use of AI we see as our responsibility to employ this technology in an ethical manner."
Shahram Ebadollahi, *Global Head of Data Science and AI, Novartis*

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"These principles provide our people with a clear framework for ethical use of AI – enabling them to challenge their own decisions and biases. By aligning them with our Code of Ethics, we are reinforcing their importance and creating a clear path which we must all follow."
Klaus Moosmayer, *Chief Ethics, Risk & Compliance Officer of Novartis*

How do we use AI to reimagine medicine?

We have applied AI broadly across Novartis in order to evolve or transform the way we:

- Innovate across R&D to develop novel therapies and drugs
- Optimize business processes, operations and commercial activities
- Engage with patients, healthcare professionals and partners

Generative Chemistry

We use generative chemistry to supplement chemistry teams with well-annotated, high-quality information in a seamless fashion for our end users. We use Machine Learning to scan billions of molecules in our compound library for virtual molecules with a desired target profile, as defined and identified by our drug discovery experts. It efficiently supplements the multi-parametric ideation process every medicinal chemist undertakes daily. The output is a manageable set of optimized compound suggestions that can be readily synthesized by discovery scientists. This informs them to come up with novel ideas.

AE Brain: Automating repetitive processes

AE Brain improves the quality of our safety information and also reduces the burden of manual repetitive work. We use AE Brain to process messages to identify potential adverse events and technical complaints in these messages. The system ingests textual data from multiple sources and applies Natural Language Processing (NLP) technology to understand the contents of those text documents to identify adverse events. This system is integrated into the workflow of human experts as a decision support system.

AI Nurse: Empowering patients

Novartis partnered with Tencent to develop a WeChat mini-app, called AI Nurse, for patients diagnosed with heart failure. The patient engagement platform is designed to empower patients and their healthcare providers to be more aware of their condition and to take appropriate actions to improve their health and wellbeing. The app uses multiple AI-driven algorithms to transform voice to text and text to voice. Algorithms are used to anticipate disease progression, recommend activities and provide targeted coaching and education. All of this data is continuously assimilated and interpreted to assess a patient's improvement or worsening condition. Accordingly, nurses and physicians can remotely track patients, with full consent and privacy protections as discussed in this commitment, and provide additional continuity of care recommendations.

Learn more about Data and Digital at Novartis and our Code of Ethics

- Data and Digital
- Artificial Intelligence
- Our Code of Ethics

Join us in harnessing the power of data for the benefit of patients.

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List of links present in page

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- https://www.novartis.com/stories/ai-nurse-evolving-health-failure-patients-china
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