

Artificial Intelligence in Business

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Artificial intelligence is sometimes construed as destructive and out of control. However, it can be ethically and effectively employed to bring immense business value to organisations and help lift the overall economic status of countries.

Artificial Intelligence (AI), as described by Stuart Russell and Peter Norvig in their book, *AI: A Modern Approach*, is a programme that can sense, reason, adapt and act. However, in films such as *Terminator* and *Star Trek*, Hollywood and science fiction writers have presented AI in the realm of destructive robots out to eliminate humans.

Today's reality is more mundane. AI is deployed in everyday applications, such as email spam filters, Netflix movie recommendations, creditworthiness scoring, voice-to-text commands (such as Apple's Siri and Google's Alexa) and

smartphone camera focus detection. AI is a very powerful pattern recogniser that can change the course of business development.

Singapore's experience in developing AI solutions and products for industries over the last five years through the 100 Experiments (100E) programme are instructive. Programmes created on-the-fly address many AI ethics and governance issues and highlight some of the pitfalls of AI development. The course of this journey can be framed in the international context of the OECD framework outlined in the box, "The OECD Principles on Artificial Intelligence".

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The OECD Principles on Artificial Intelligence

The OECD Principles on Artificial Intelligence promote AI that is innovative and trustworthy and that respects human rights and democratic values. They were adopted in May 2019 by OECD member countries when they approved the OECD Council Recommendation on Artificial Intelligence. The five core principles are:



1. Inclusive growth, sustainable development and well-being

Stakeholders should proactively engage in responsible stewardship of trustworthy AI in pursuit of beneficial outcomes for people and the planet, such as augmenting human capabilities and enhancing creativity, advancing the inclusion of underrepresented populations, reducing economic, social, gender and other inequalities, and protecting natural environments, thus invigorating inclusive growth, sustainable development and well-being.



2. Human-centred values and fairness

- a. AI actors should respect the rule of law, human rights and democratic values, throughout the AI system lifecycle. These include freedom, dignity and autonomy, privacy and data protection, non-discrimination and equality, diversity, fairness, social justice, and internationally recognised labour rights.
- b. To this end, AI actors should implement mechanisms and safeguards, such as the capacity for human determination, appropriate to the context and consistent with the state of art.



3. Transparency and explainability

AI actors should commit to transparency and responsible disclosure regarding AI systems. To this end, they should provide meaningful information, appropriate to the context, and consistent with the state of art:

- a. to foster a general understanding of AI systems,
- b. to make stakeholders aware of their interactions with AI systems, including in the workplace,
- c. to enable those affected by an AI system to understand the outcome, and,
- d. to enable those adversely affected by an AI system to challenge its outcome based on plain and easy-to-understand information on the factors, and the logic that served as the basis for the prediction, recommendation or decision.



4. Robustness, safety and security

- a. AI systems should be robust, secure and safe throughout their entire lifecycle so that, in conditions of normal use, foreseeable use or misuse, or other adverse conditions, they function appropriately and do not pose unreasonable safety risk.
- b. To this end, AI actors should ensure traceability, including in relation to datasets, processes and decisions made during the AI system lifecycle, to enable analysis of the AI system's outcomes and responses to inquiry, appropriate to the context and consistent with the state of art.
- c. AI actors should, based on their roles, context, and ability to act, apply a systematic risk management approach to each phase of the AI system lifecycle on a continuous basis to address risks related to AI systems, including privacy, digital security, safety and bias.



5. Accountability

AI actors should be accountable for the proper functioning of AI systems and respect the above principles, based on their roles, the context, and consistent with the state of art.

1. Inclusive growth, sustainable development and well-being

To ensure everyone in Singapore is on board the AI revolution, AI Singapore's Generational AI Capability Development programme targets working professionals and students in primary, secondary and tertiary institutions. These include:

- **AI Apprenticeship Programme.** The objective is to deepen the skills of passionate data and AI-aware professionals, who will be mentored by experienced AI engineers in data science, machine learning and AI, through the real-world deployment of AI projects under the 100E programme. Over the past three years, the programme has trained more than 200 AI engineers for AI Singapore and the national economy.
- **AI For Everyone.** The programme seeks to demystify AI and increase the awareness and adoption of AI. It targets working professionals and has since expanded to all students in Singapore. More than 70,000 Singaporeans have completed the programme, and more than 10,000 are expected to complete the programme by the end of 2023. The Civil Service College also uses the programme to train all public officers in Singapore on the basics of AI.
- **AI For Industry.** The programme provides a professionally curated AI learning journey for the more tech-savvy working professionals. They need to understand the various AI algorithms and terminology in their daily work and are keen to start learning Python programming and embark on an AI career.

We can produce AI systems, solutions and products, but we also need intelligent AI consumers. This holistic end-to-end approach to talent development addressing both the demand and supply side ensures the country's growth is inclusive and sustainable.

2. Human-centred values and fairness

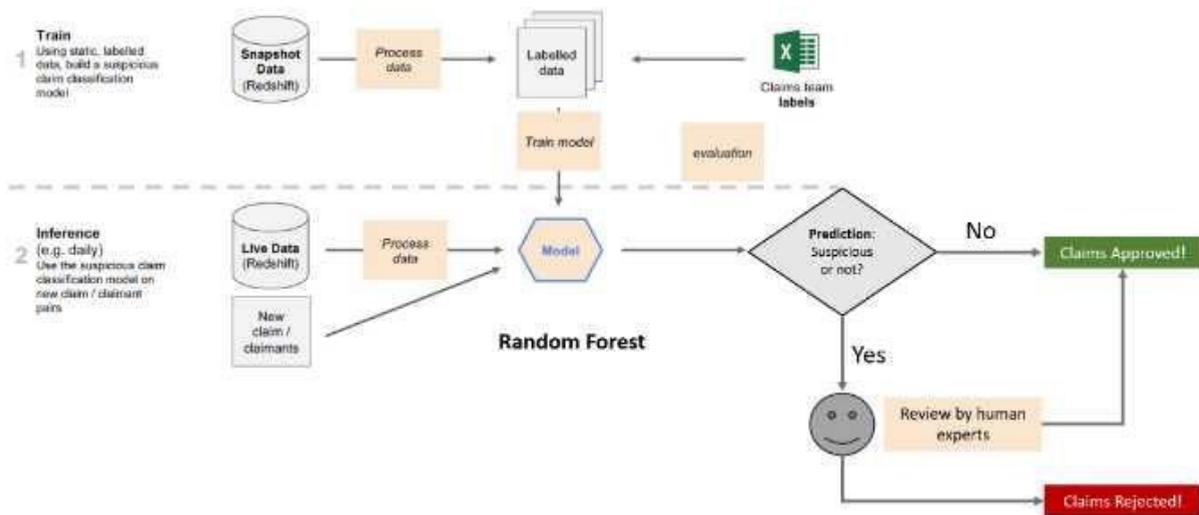
Modern AI systems leverage the power of the cloud and the ubiquity of the mobile phone to deliver many services, and they multiply the impact of poorly designed and implemented AI systems. "Man-in-the-loop" in an AI system is often a requirement when decisions made by the AI systems affect humans directly that involve financial, health and other personal matters. This has been the best practice for many years since the early days of developing AI expert systems in the 1980s-1990s.

For example, AI Singapore developed a fraud detection system for insurance claims using a machine learning pipeline and AI model integrated into a company's digital platform. (See box, "Man-in-the-Loop Insurance Example"). All claims deemed non-fraudulent (at an acceptable error rate) are approved for payment processing. For any claim that the model flags as a potential fraud, the case is routed to a human expert analyst for review. This human determination of such an important decision is necessary to ensure errors by the AI systems do not affect an individual's claim, which may have a significant financial impact on the individual as well as the company's credibility.

3. Transparency and explainability

Many modern deep-learning AI systems are considered black boxes, where outputs generated are often taken at face value (as it is

Man-in-the-Loop Insurance Example



nearly impossible to determine the rationale of the results hence lacking transparency). Much research is ongoing to decipher such systems, and today we can determine with some confidence inputs that may affect the outputs and decisions made by the AI systems.

However, not all AI systems built are necessarily black boxes, and many machine learning algorithms provide meaningful reasons for the decisions made. For example, why a certain loan application is rejected, or a specific patient is classified as a high health risk, and hence intervention is required.

A case example is an AI system that alerts nurses to potential health risks of their patients undergoing dialysis. Building the AI model was simple as data was sufficient, and we had access to doctors and nurses who were the domain

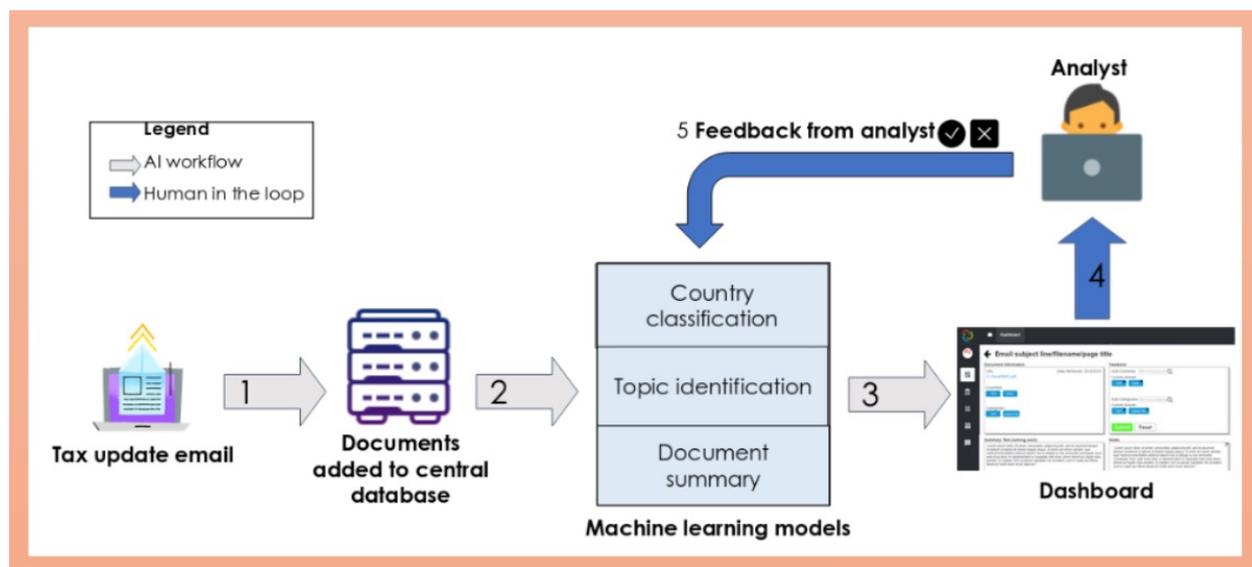
experts that guided our AI Engineering team. Instead, we had to overcome non-engineering-related challenges related to transparency and explainability.

4. Robustness, security and safety

The security and safety of AI systems is an important topic. AI Singapore has worked with the Singapore ecosystem to publish an AI Security Standards as a Singapore Standards Council Technical Reference (TR 99:2021).

AI systems should be robust, secure and safe throughout their entire lifecycle. The deployed AI system needs to be updated regularly, as underlying assumptions and data change in many domains. Understanding model drift and having the proper man-in-the-loop pipeline to update the model is often required in production.

Retraining Loop Illustration



The box, “Retraining Loop”, depicts a project where AI Singapore built a retraining loop so that the analyst can give a thumbs-up or thumbs-down to the output of the AI model. This ensures that the model continues to get feedback and can retrain itself when appropriate to maintain the correctness of the output for the duration of its lifecycle. This retraining loop is a standard part of 100E deliverables for most projects.

5. Accountability

Awareness of culture, race and gender bias can creep into AI projects if there are no ethical guidelines and processes to detect such bias. For example, human resource systems that classify candidates based on race and gender profiles can be skewed towards a particular bias if the data sets and algorithms selected are not well thought through. The Model AI Governance Framework developed by the Info-

comm Media Development Authority addresses some of these issues.

AI is not magic

AI is a tool that software developers, engineers, data analysts and managers can leverage to business advantage. It is just math and not magic.

It is also important to understand that AI is a mathematical construct and does not have feelings, and hence cannot itself be unethical. When deploying AI, the question to ask is not whether AI is ethical but rather: Is the business use case ethical? Or is the government policy or use case ethical? Whether AI is used or not is immaterial. One can easily build a biased system without the use of AI.

Ultimately, the ethics of the use case is the most crucial consideration. AI is just a means to the end. ■