

# Supporting Tertiary Students' Critical AI Literacy: A Practical Tool for Educators

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## Abstract

Ongoing developments in AI challenge educators to ensure that their course delivery integrates relevant aspects of AI literacy within their domains of study. This paper presents an online AI literacy course design evaluation tool, based on an AI literacy framework developed from an international Delphi Study. The framework has four capability levels, each addressing six categories of knowledge and skills. The tool addresses the initial level - "know and understand AI" - of the four-level framework, since this includes all the foundational components of AI literacy that are important to all learners. An illustrative example of the tool in use is presented, applied to a level 7 micro-credential that is designed to develop the digital skills of professionals in context. The results, which include recommendations generated by the tool, are discussed against the course learning outcomes to explore how they can be useful for enhancing course design to support AI literacy.

## Introduction - AI Literacy

The advent of generative artificial intelligence (GenAI) has led to a growing realisation of the importance of students being sufficiently digitally literate to engage with AI, in both their learning and future occupations. This engagement requires a new set of literacies that sit among other literacies (digital, data, media) necessary for learners to engage with a world that is increasingly driven by digital technologies. AI literacy is a term originally coined by Konishi (2016) as the ability to recognise tasks that can be performed by AI, and those that remain the domain of humans, and more developed ideas have followed (e.g., Long & Magerko, 2020; Laupichler et al., 2022). However, the recent rise of GenAI, with its general usability and applications, has lifted the profile and awareness of AI, and there has been a renewed focus on the importance of AI literacy and how we need to prepare for a world where AI is pervasive. Learners increasingly need support to understand how to interact with AI and how it influences us. This understanding is needed by all learners (and indeed all citizens), not just those specialising in computer science or AI systems.

In response to this need, this paper introduces a practical online tool, based on an AI literacy framework derived from a Delphi study by the authors, that can support tertiary educators in evaluating and enhancing their courses' AI literacy components. The tool is designed to guide educators through a two-step process: first, assessing the current level of AI literacy support in their courses, and second, identifying opportunities to further integrate AI literacy

concepts. The tool is designed to provide a structured process for educators to assess and enhance their course offerings. The tool and its supporting framework are grounded in research on the core competencies of AI literacy, which include understanding AI concepts, recognising AI applications, evaluating the societal impacts of AI, and developing ethical reasoning skills.

The tool offers a practical, evidence-based approach that educators can use to assess and enhance their course offerings. This has the potential to significantly improve AI literacy in tertiary education and contribute to empowering students to become more informed, critical, and responsible users of AI technologies.

The article gives an illustrative example of applying the framework through the online tool, demonstrating how it can be used to evaluate and then support the building of AI literacy.

### **Objective: Developing an AI literacy framework**

AI literacy in tertiary education has become a rising concern across academia. As AI technologies become increasingly ubiquitous, students must understand the fundamental principles of how these systems work, their potential biases and limitations, and the ethical considerations surrounding their use (Faruqe et al., 2021). Without this critical understanding, students may struggle to leverage AI effectively and responsibly in their studies and future careers. Developing students' AI literacy should, therefore, be a key priority for tertiary institutions.

As AI has evolved, there have been many definitions of AI literacy. A review by Ng et al. (2021), which explored the literature over the previous decade, identified four components to foster AI literacy: Know and understand AI, use and apply AI, evaluate and create AI, and AI ethics. While Ng et al.'s (2021) work helps to consolidate the different ways that we can understand AI literacy, structured frameworks are needed to develop robust AI literacy curricula and teaching practices. One such framework is proposed by Long and Magerko (2020), outlining four key competencies: Understanding AI concepts, recognising AI applications, evaluating the societal impacts of AI, and developing ethical reasoning skills, while the OECD (2018) offers a more general model that focuses on key skills and knowledge such as computational thinking, data literacy, and critical thinking about AI systems. Beyond this, there have been other frameworks, such as that drawn from the AI4future project (Chiu et al., 2022). This includes core concepts such as machine learning, big data, and cloud computing as core components of AI literacy that are related to understanding the ethics and societal impact of AI.

Against this background of different proposals, we have carried out a Delphi Study with seven experts in AI education to develop an AI literacy framework that we believe provides a sound basis for educators to integrate AI literacy into their work (MacCallum et al., 2023). This paper does not describe the framework itself, but instead shows how it can be applied in practice.

## Approach: The AI Literacy Analyser Tool

The AI Literacy Analyser (<https://davidparsons.ac.nz/AIanalyser.html>) is a web-based tool that provides an interactive feedback mechanism for assessing the coverage of AI literacy in course design. Based on statements from Level 1 of the AI Literacy Framework (Figure 1), it provides a series of statements about each of the six categories of the framework. The user can select the level of presence, based on a scale of 0-4, of each of these statements in a particular course design. The tool uses these responses to help evaluate the AI literacy content of the design and gives feedback as to how it might be improved. The tool can be used multiple times to help refine the design of a course.

# AI LITERACY FRAMEWORK CATEGORIES







<p><b>AI Concepts</b></p> <p>Understanding the nature of AI and how it impacts on people in their everyday lives</p>	<p><b>Application of AI &amp; Technical Skills</b></p> <p>Knowing how AI tools can be applied to useful tasks</p>	<p><b>Issues, Challenges &amp; Opportunities</b></p> <p>Being aware of the issues, risks and opportunities associated with AI</p>
<p> <b>The Impacts of AI</b></p>	<p> <b>Cognitive Skills</b></p>	<p> <b>Social &amp; Ethical Issues</b></p>
<p>Exploring AI's societal impacts by identifying human-AI interactions, understanding ethical use, assessing AI adoption and potential harms, and demonstrating data literacy and interdisciplinary applications.</p>	<p>Developing cognitive skills by assessing AI's implications, evaluating tool suitability, understanding its impact on work and creativity, and demonstrating computational thinking and AI model-building expertise.</p>	<p>Exploring social and ethical issues of AI by assessing societal benefits, identifying ethical implications, discussing cultural impacts, and applying principles-based approaches to equity, inclusivity, and policy development.</p>
<p> <b>What AI Is &amp; How It Works</b></p>	<p> <b>Applied Skills</b></p>	<p> <b>Challenges &amp; Opportunities</b></p>
<p>Mastering AI fundamentals by defining key terms, comparing technologies, understanding data use, explaining human language interaction, and exploring advanced concepts like deep learning and quantum computing.</p>	<p>Enhancing applied skills by selecting and using appropriate AI tools to collaborate, communicate, solve problems, and perform tasks in specific contexts such as learning and research.</p>	<p>Addressing AI challenges and opportunities by identifying and mitigating risks, promoting responsible use, ensuring inclusivity, and applying moral frameworks to assess AI's societal value and future directions.</p>

Figure 1: The AI Literacy Framework, level 1

The design of the analyser tool is relatively simple. Likert scale questions have been developed for each of the 24 literacy components in level 1 of the framework. Each input view of the tool presents the questions related to one of the 6 framework categories, with a

5-point slider for each response. At the end of the input process, the data is analysed and the results are presented in the following ways:

- A radar chart showing the extent of AI literacy in the course design
- The least-covered categories are identified
- Suggestions are given as to how the design can be improved
- Text and spreadsheet summary data can be downloaded.

## Case Study


The following worked example applies the analyser to a graduate-level micro-credential designed to develop the digital skills of professionals. This course was chosen as it was not primarily focused on AI but did have explicit coverage of some aspects. The learning outcomes of the course are:

1. Critically analyse digital tools used and emerging in the workplace in the context of work and community challenges.
2. Identify personal, professional and collective skills gaps in the context of the digitally-enabled workplace.
3. Develop advanced digital skills and knowledge across a range of digital solutions for use in contemporary work environments.

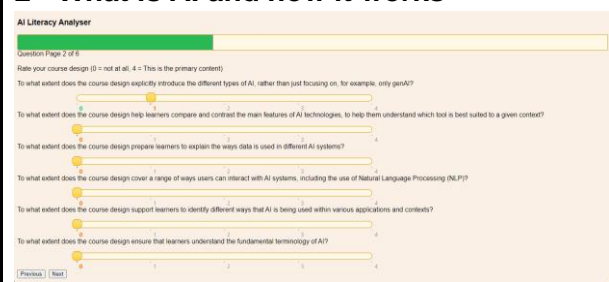
The focus here is clearly on having an informed and critical perspective on the application of digital tools in professional contexts, a context where AI literacy is important.

## Outcomes

This section shows the process of entering the data for each category and displaying the results. The educator is shown a series of questions related to the six categories and then asked to evaluate the level of coverage using a slider ranging from 0 (not at all) to 4 (this is the primary content).

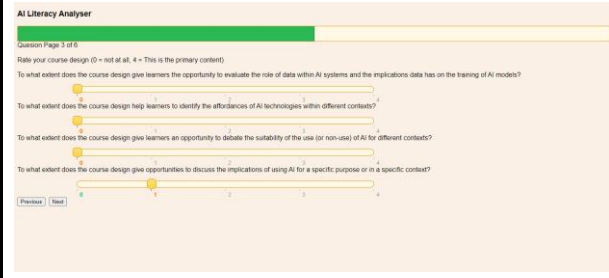
The response	The analysis
<p><b>1 - The Impact of AI</b></p>  <p>AI Literacy Analyser</p> <p>Question Page 1 of 6</p> <p>Rate your course design (0=not at all, 4=This is the primary content)</p> <p>To what extent does the course design enable students to recognise instances where AI is being used (i.e., where they or others interact with AI systems in their learning, work context or personal time)?</p> <p>To what extent does the course design explore how AI is impacting society (related to the activity/course context)?</p> <p>To what extent does the course design give learners an opportunity to discuss AI in the broader context of technological change?</p> <p>To what extent does the course design give learners an opportunity to evaluate case studies of how AI has impacted different sectors?</p> <p>Previous Next</p>	<p>The first four statements pertain to the impacts of AI. The design partially covers how AI affects society and provides opportunities for learners to discuss AI within the broader context of technological change. However, it lacks content on recognising AI applications and evaluating AI's impact through case studies. Overall, the course addresses general questions about AI's impacts but may not delve into detailed examples.</p>

## 2 - What is AI and how it works



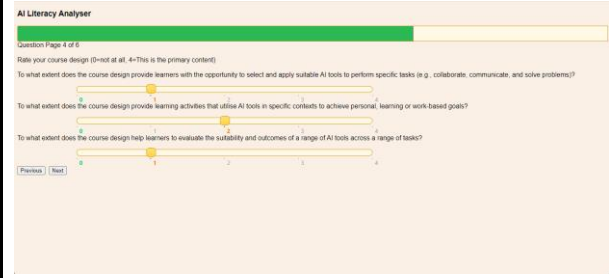
The next six statements uncovered that the course only covers different types of AI. While the broad nature of the course may not require detailed technical content, including core terminology, data usage, and AI features in various contexts could add value.

## 3 - Cognitive Skills



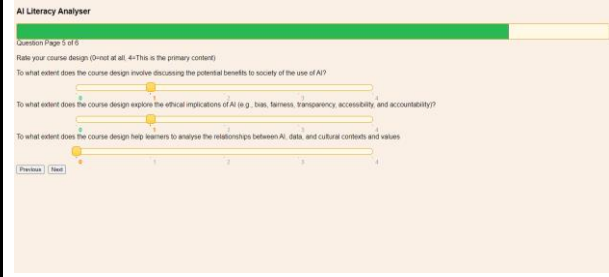
The course offers limited coverage of developing learners' cognitive skills related to AI. It primarily discusses the implications of AI use in specific contexts. However, there could be more emphasis on higher-level skills, which might not be the course's focus but could be beneficial.

## 4 - Applied Skills



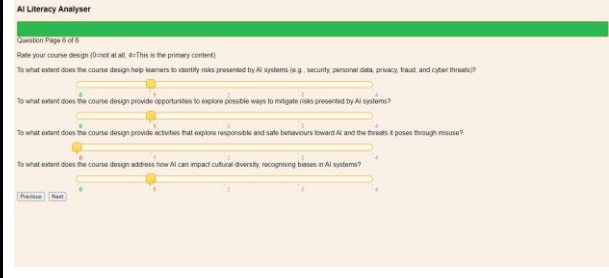
The course covers all aspects to some extent. It enables learners to select and apply AI tools for tasks, use these tools in specific contexts, and evaluate their suitability and outcomes across various tasks. This approach aligns with a course focused on digital skills in professional contexts, covering the broad skill of choosing tools, the focused skill of using them effectively, and the critical skill of evaluating the results.

## 5 - Social and ethical issues



The course design covers some aspects of social and ethical issues, including discussions on the social benefits and ethical implications of AI. However, it currently lacks content on linking AI with cultural contexts and values - an important area to address.

## 6 - Challenges and opportunities of AI



The final step shows that the course covers risks, limitations, and the impact of bias on cultural diversity. However, it does not address responsible and safe behaviours towards AI. Including this aspect, especially for workplace contexts, would add value.

## The Summary

Once all questions are completed, a radar chart (Figure 2) is generated, showing the overall coverage of each of the six categories of AI literacy in the course design. The graph gives a visual overview of the course and highlights the possible need to rethink the design to consider what aspects could be developed. The chart shows that the application of AI has good coverage, but other aspects of AI literacy less so.

To provide more detailed insights, the analysis tool also generates some feedback based on the data entered. It shows the mean coverage scores for each of the six categories in descending order, then states which category had the most extensive coverage in the course, which may be useful to check that it aligns with the focus of the course being analysed. For example, if the course is about the applied use of digital tools, having high coverage in the applied AI skills category would be appropriate. However, if the course targeted critical thinking about technology, a current focus on tools might indicate a need to develop other aspects further. The analysis tool then details the two categories with the least coverage, to indicate where further development could be considered.

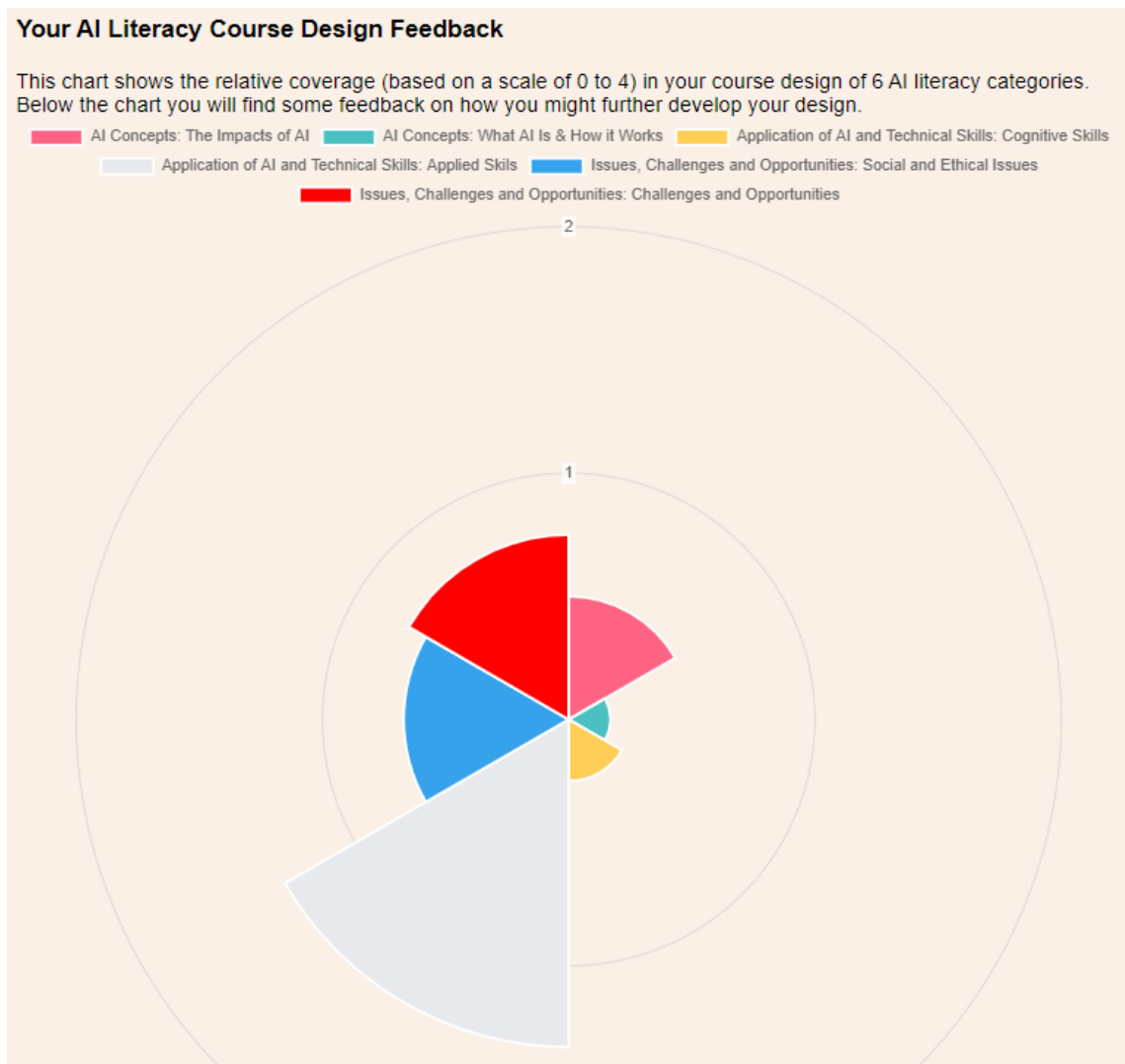


Figure 2: Radar chart showing the prevalence of AI Literacy categories in the course design

The analysis provided by the tool for this example course design is shown in Figure 3. In this case, the category *Applications of AI and Technical Skills: Applied Skills* has the greatest coverage, with *AI Concepts: What AI Is and How it Works* and *Applications of AI and Technical Skills: Cognitive Skills* being the least covered categories.

**The scores for each AI literacy category are as follows:**

1. Application of AI and Technical Skills: Applied Skills with a score of 1.33
2. Issues, Challenges and Opportunities: Challenges and Opportunities with a score of 0.75
3. Issues, Challenges and Opportunities: Social and Ethical Issues with a score of 0.67
4. AI Concepts: The Impacts of AI with a score of 0.50
5. Application of AI and Technical Skills: Cognitive Skills with a score of 0.25
6. AI Concepts: What AI Is & How it Works with a score of 0.17

**Please keep a record of these values so you can refer to them later**

The AI Literacy component most evident in your course design is Application of AI and Technical Skills: Applied Skills with a score of 1.33

The AI Literacy components least evident in your course design are AI Concepts: What AI Is & How it Works with a score of 0.17, and Application of AI and Technical Skills: Cognitive Skills with a score of 0.25

You might consider including further aspects of **AI Concepts: What AI Is & How it Works** in your course design by:

- Helping learners to define different types of AI
- Enabling learners to compare and contrast the main features of AI technologies
- Exploring the ways data is used in different AI systems
- Discussing how users can interact with AI systems, including using Natural Language Processing
- Exploring different ways that AI is being used within different applications and contexts
- Ensuring coverage of the fundamental terminology of AI

You might consider including further aspects of **Application of AI and Technical Skills: Cognitive Skills** in your course design by:

- Giving learners the opportunity to evaluate the role of data within AI systems and the implications data has on training of AI models
- Helping learners to identify the affordances of AI technologies for different contexts
- Debating the suitability for the use (or non-use) of AI for different contexts.
- Discussing the implications of using AI for a specific purpose or in a specific context.

If you want to save a text summary of your feedback, you can click on the button below.

[Download Summary as a Text File](#)

If you want to save a summary of your feedback as a CSV (spreadsheet) file, you can click on the button below.

[Download Summary as a CSV File](#)

Figure 3: The detailed output from the analyser showing the scores for each AI literacy category and some suggestions for extending the course coverage.

There are two download options for the user to record the data for later use. One of these is to download a text file summarising the feedback shown on the screen. The other is a CSV file of the values entered for each component and the mean values for each category (Figure 4).

category	label	score
AI Concepts: The Impacts of AI		0.5
	Helping learners to identify when people are using AI	0
	Helping learners to explore how AI is impacting society	1
	Facilitating discussions about the place of AI in the broader context of technological change	1
	Giving learners the opportunity to evaluate case studies of how AI has impacted different sectors	0
AI Concepts: What AI Is & How it Works		0.166667
	Helping learners to define different types of AI	1
	Enabling learners to compare and contrast the main features of AI technologies	0
	Exploring the ways data is used in different AI systems	0
	Discussing how users can interact with AI systems, including using Natural Language Processing	0
	Exploring different ways that AI is being used within different applications and contexts	0
Application of AI and Technical Skills: Cognitive Skills		0.25
	Giving learners the opportunity to evaluate the role of data within AI systems and the implications data has on training of AI models	0
	Helping learners to identify the affordances of AI technologies for different contexts	0
	Debating the suitability for the use (or non-use) of AI for different contexts	0
Application of AI and Technical Skills: Applied Skills		1.333333
	Helping learners to evaluate the suitability and outcomes of a range of AI tools across a range of tasks	1
	Providing learners with the opportunity to select and apply suitable AI tools to perform specific tasks (e.g., collaborate, communicate, and solve problems)	1
	Providing learning activities that utilise AI tools in specific contexts to achieve personal, learning or work-based goals	2
Issues, Challenges and Opportunities: Social and Ethical Issues		0.666667
	Helping learners to analyse the relationships between AI, data, and cultural contexts and values	0
	Discussing the potential benefits to society of the use of AI	1
Issues, Challenges and Opportunities: Challenges and Opportunities		0.75
	Exploring the ethical implications of AI (e.g., bias, fairness, transparency, accessibility, and accountability)	1
	Helping learners to identify risks presented by AI systems (e.g., security, personal data, privacy, fraud, and cyber threats)	1
	Providing opportunities to explore possible ways to mitigate risks presented by AI systems	1
		0
	Providing activities that explore responsible and safe behaviours toward AI and the threats it poses through misuse	0
	Discussing how AI can impact cultural diversity, recognising biases in AI systems	1

Figure 4: The CSV download format

### Discussion: Enhancing the AI literacy coverage of the course

As seen in Figure 3, the tool provides the user with some advice for improving the design by focusing on those areas of AI literacy with the least coverage. Considering this advice in isolation might bring a new and interesting dimension to the course design, but this alone may not be the best strategy. The nature of the course and its focus will also have an important role in deciding where AI literacy is most relevant to the learning outcomes. For example, for a course specifically intended to develop AI literacy, addressing the areas of least coverage would probably be the highest priority. However, in contrast, if a course was in the domain of social issues, then the priority might be to maximise coverage in the social and ethical issues category, even if its coverage was already its strongest area, while limited coverage of, for example, applied AI skills might be seen as less critical.

With those caveats in mind, a redesign of the course might take on board some of the advice in the context of the course's learning outcomes. Looking at the suggestions given, at a high level it would be helpful to incorporate a broader theoretical grounding in AI, to cover areas like key terminology, main technical features, the roles of data, and some more critical analysis of how AI is used across applications and contexts. Looking in more detail, the *Applications of AI and Technical Skills: Applied Skills* category has the greatest coverage. This would seem to map well to the learning outcome "Develop advanced digital skills and knowledge across a range of digital solutions for use in contemporary work environments."



However, one of the less well-covered areas of AI literacy is *AI Concepts: What AI Is and How it Works*. Taking into account the learning outcome “Develop advanced digital skills and knowledge across a range of digital solutions for use in contemporary work environments”, this could be an area where these digital skills are extended to include more coverage of AI. The other category having relatively low coverage is *Applications of AI and Technical skills: Cognitive Skills*. Given this category’s more reflective, critical aspects, further development here would perhaps help address the learning outcome, “Identify personal, professional and collective skills gaps in the context of the digitally-enabled workplace”.

Analysing the course at the category level may give some useful insights into focus areas for change, but it may also be useful to go into more detail at the component level. Looking more closely at the data (Figure 4), there are nine components not covered by the current course design. It could be instructive to consider each of these and identify any that could provide the most relevance and value if integrated more into the course design.

These are just a few suggestions about how the advice from the analyser tool might be used to develop and enhance course design, and of course, the tool could be used multiple times until the course designer is satisfied with their coverage.

## Conclusion

There are few comprehensive resources that can help educators integrate AI into their courses (Southgate, 2020). This tool bridges that gap by offering a practical and adaptable framework implementation that can be used across a wide range of tertiary programmes.

By using the tool, educators can first evaluate the extent to which their current curriculum covers these key competencies. The tool then provides guidance on how to effectively incorporate additional concepts tailored to the specific needs and context of the course.

Ultimately, this tool empowers tertiary educators to take a proactive approach to supporting their students' critical AI literacy. By equipping students with a solid understanding of AI and its implications, educators can help prepare the next generation of leaders, innovators, and decision-makers to navigate the complex and rapidly evolving AI landscape.

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