

# EDITOR'S COMMENTS

## Next-Generation Digital Platforms: Toward Human–AI Hybrids

By: **Arun Rai**  
**Editor-in-Chief, *MIS Quarterly***  
**Georgia State University**  
**arunrai@gsu.edu**

**Panos Constantinides**  
**Associate Editor, *MIS Quarterly***  
**Warwick Business School**  
**panos.constantinides@wbs.ac.uk**

**Saonee Sarker**  
**Senior Editor, *MIS Quarterly***  
**University of Virginia**  
**saonee@virginia.edu**

Organizations are increasingly using digital platform-based business models that mediate value-creating interactions between external producers and consumers. Unlike previous technologies, the layered modular architecture of digital platforms fuels generativity, defined as the platform's ability to foster unprompted innovation through continuous recombination of different modules. Leading digital platform companies have leveraged generativity, in combination with effective governance, to achieve positive network effects, value creation, and scalability (see Constantinides et al. 2018; Song et al. 2018).

We are seeing the emergence of next-generation digital platforms, arising from the application of artificial intelligence (AI) technologies. These technologies offer new possibilities for the relationship between humans and machines to perform tasks on digital platforms and for the effective design and governance of platforms, propagating important questions for IS researchers as we illustrate in this editorial.

AI is typically defined as the ability of a machine to perform cognitive functions that we associate with human minds, such as perceiving, reasoning, learning, interacting with the environment, problem solving, decision-making, and even demonstrating creativity. Major platforms are providing AI services such as:

- Open-source frameworks and libraries of machine learning models for developers and researchers (e.g., Google TensorFlow, Azure Machine Learning Packages, Facebook's PyTorch, Microsoft Computational Network Tool Kit)
- Application program interfaces (APIs) for services such as vision, speech, language, knowledge, and search (e.g., Google's Cloud Translation API, Cloud Natural Language API, and Cloud Speech-to-Text API)
- Drag-and-drop tools to build, test, and deploy customized AI models (e.g., Azure Machine Learning Studio)
- Pretrained AI models for users to deploy in their respective contexts

Platforms are also deploying AI for governance activities. For example, Google Play is using AI for app review and monitoring (e.g., detecting copycats, inappropriate content, harmful apps, and violations of intellectual property and security policies).<sup>1</sup>

The individual competencies of humans and AI, which continue to evolve, can now be dynamically (re)combined across the layered modules of a digital platform. Given that tasks are typically encapsulated within modules, we discuss human–AI hybrids in digital platforms at the level

---

<sup>1</sup>Source: <https://android-developers.googleblog.com/2018/01/how-we-fought-bad-apps-and-malicious.html>; accessed January 9, 2019.

of tasks.<sup>2</sup> While certain aspects of tasks on digital platforms are likely to align well with the capabilities of AI agents (e.g., speed, accuracy, reliability, scalability), others are likely to correspond better with competencies of human agents (e.g., creativity, empathy, judgment). This creates opportunities for *tasks* on platforms to be performed by novel human–AI hybrids that range from *task substitution* (AI substitutes humans) to *task augmentation* (AI and humans complement one another) to *task assemblage* (AI and humans are dynamically brought together to function as an integrated unit).

We illustrate the emergent spectrum of human–AI hybrids in digital platforms and discuss some implications for IS research by using one class of digital platforms: *digital labor platforms*. Recognizing the service orientation and the expanding role of AI in digital platforms, we define *digital labor platforms*<sup>3</sup> as online environments where digital services are sourced and delivered in exchange for compensation,<sup>4</sup> with constituent tasks for the services determined, executed, and coordinated by human and AI agents. Work done on these platforms is, by definition, digital and can thus be modularized into tasks which require a range of cognitive skills for execution and coordination, providing a rich context to illustrate human–AI hybrids and some key issues for next-generation digital platforms (see Table 1 for a summary).

<b>Table 1. Human-AI Hybrids in Next-Generation Digital Platforms</b>	
<b>Theme</b>	<b>Description</b>
Nexus of digitization transforming digital platforms	Modularization of tasks, automated tracing of granular task-related data, and AI learning modalities are establishing the foundations for the design and deployment of a variety of human-AI hybrids on digital platforms.
Types of human-AI hybrids	Hybrids can range in human-AI interdependence from substitution (AI replaces humans) to augmentation (humans and AI augment one and another) to assemblage (AI and humans are dynamically brought together to function as an integrated unit).  Types of hybrids to effectively execute tasks will depend on the roles of humans and AI systems in generating task inputs, performing the task, and communicating and implementing task outputs (e.g., decisions and solutions).
Designing unbiased Platforms	Biases in training data or in algorithms codified by designers need to be detected.  Dynamic learning processes involving humans and AI systems can be effective in mitigating biases.  Competencies required for new categories of tasks and the implications for human-AI hybrids that can avoid biases in decision processes for these tasks will need to be understood.
Data guardianship	New questions surrounding the accountability and ethics of decision-making in platforms deploying human-AI hybrids, as well as issues in data security and privacy, are likely to rise.  Peer-to-peer models and self-sovereign data guardianship, based on blockchain infrastructures, are emerging as alternative forms for data guardianship.
Platform dominance versus empowerment	The democratization of AI tools through open source platforms, combined with open boundary resources such as platform APIs, are empowering freelancers and new platform players to innovate and compete.  How novel capabilities of human-AI hybrids can be leveraged to trigger, catalyze, and scale movements to empower individuals and transform collaboration in heterogeneous collectives needs to be explored.

<sup>2</sup>Although viewpoints on AI impacts diverge based on the level of analysis adopted, we adopt a task-based perspective as it can provide a granular understanding on human–AI interdependence (e.g., Acemoglu and Restrepo 2018; Autor 2015; Von Krogh 2018).

<sup>3</sup>Previous definitions of digital labor platforms (typically referred to as “online labor platforms”) have focused primarily on two-sided interactions between employers and workers in exchange for money (Horton 2010).

<sup>4</sup>Compensation may be of different types; for example, in addition or in lieu of money, digital tokens may be used. Digital tokens can be both a form of value exchange between agents and a security mechanism that discourages unwanted behavior by both human and machine agents.

We set the scene by first highlighting the impact that digital labor platforms have had so far on digital, on-demand labor. We next discuss how digitization is establishing the foundation for the emergence of a variety of human–AI hybrids on these platforms. We then examine key themes that arise with the deployment of these hybrids and surface some issues for IS research.

### **Status of Digital Labor Platforms**

Digital labor platforms (e.g., Upwork and oDesk) are transforming how employers hire labor and how workers seek employment. These platforms provide the digital infrastructure for payment and recordkeeping, communications and search, feedback and ranking, and they mediate interactions between employers and workers. Platforms facilitate the search and fulfilment of a wide range of jobs from IT consulting to transcription services to even plumbing and babysitting. The Online Labour Index<sup>5</sup> (a measure of the utilization of these labor platforms across countries and occupations over time) has grown by 21% from May 2016 to mid-January 2018.

Studies have surfaced important issues related to market efficiency and governance, including hiring biases (e.g., based on gender and developing country) (Chan and Wang 2017); adverse selection (as workers find it challenging to build a representation and employers find it challenging to assess worker quality) (Horton et al. 2017); and challenges in building trust and monitoring work (arising from the lack of employer–worker co-location as well as the nature of formal/informal contracts between an employer and an individual worker) (Agrawal et al. 2015).

Other issues identified pertain to platform dominance and its consequences, including risk of monopsony where digital labor platforms use their market power to squeeze laborers into lower pay (Dube et al. 2018); and ambiguous net effects on income equality, productivity, and skill development (e.g., Agrawal et al. 2015).

The integration of AI into digital labor platforms, leading to the emergence of human–AI hybrids, is likely to create opportunities as well as exacerbate the challenges outlined above.

### **The Nexus of Digitization Transforming Labor Platforms**

We identify a nexus of three digitization characteristics that are transforming digital labor platforms:

1. **Task modularization:** The layered modular architectures of digital platforms enable the specification of inputs and outputs of digital tasks at granular levels, encapsulation of activities in modules to perform tasks, and definition of standardized interfaces between modules. The modularization of digital tasks enables experimentation and flexibility in task allocation and coordination.
2. **Automated generation of data:** The inputs, processes, and outcomes associated with digital tasks can be tracked and traced at granular levels along with contextual parameters. Cloud infrastructures and workflow technologies are generating data troves of task-related data to feed AI learning algorithms.
3. **AI learning modalities:** Innovations in the science and technology underlying AI methods (e.g., convolutional neural networks), coupled with sophisticated computational architectures and plummeting computing costs, are dramatically expanding AI learning modalities (e.g., supervised or autonomous with reinforcement, autodidactic (single machine), and machine-to-machine) that can be applied to tasks on digital labor platforms.

Collectively, the nexus of task modularization, generation of task-related data for AI learning, and expansion of AI learning modalities is establishing the foundation for leveraging a variety of human and AI agents in performing tasks on digital labor platforms.

### **Human–AI Hybrids in Digital Labor Platforms**

Based on the interdependence between the roles of AI and human agents in performing tasks, we suggest that digital labor platforms can leverage a spectrum of human–AI hybrids that range from substitution to augmentation to assemblage:

1. **Task substitution**, where digital labor platforms deploy AI systems to substitute for the role of human agents in performing a task. The opportunities for such substitution continue to expand, with rapid strides in AI across a wide range of application domains. For example,

<sup>5</sup>Source: <http://ilabour.oii.ox.ac.uk/online-labour-index/>; accessed January 10, 2019.

AI systems can write articles about sporting events, both in a fraction of the time and at a comparable quality level as experienced sports writers.<sup>6</sup> In a similar vein, multiple Swedish banks are using virtual assistants, referring to their “newest employees” as Aida or Nina, instead of their banking personnel for customer service tasks.<sup>7</sup>

2. **Task augmentation**, where digital labor platforms enable human and AI agents to augment one another in order to perform a task. For example, human designers and engineers in manufacturing, architecture, and engineering use AI tools to augment their exploration of solutions. They input design goals (along with parameters related to materials, manufacturing methods, and cost constraints) into AI-powered generative design software. The software quickly generates design alternatives by exploring a large number of solution permutations through an evolutionary learning process.<sup>8</sup>

Additionally, humans can also augment AI agents by (Daugherty and Wilson 2018):

- Training the AI agents to better identify language nuances and contextualized knowledge, correct errors, and reinforce successes
  - Explaining decisions made by black-box machine learning algorithms to individuals with no technical knowledge, improving the transparency of this decision-making process, and the accountability of their actions
  - Applying judgment and moral values to ensure that AI agents are performing well over time in areas such as ethical compliance
3. **Task assemblage**, where digital labor platforms dynamically bring together human and AI agents to perform an emergent task. In other words, AI and human agents are assembled contextually and temporally in practice (see Wise 2013). In contrast to task substitution and task augmentation where the roles of AI and humans are partitioned, in assemblage the human and AI agents work as an integrated unit to perform the task. As such, AI agents become embedded and embodied extensions of the cognitive capabilities of human agents to perform tasks digitally. Although task assemblages are not currently observed on digital labor platforms, they are being deployed for complex tasks in other contexts. For example, human surgeons and AI-powered robots can function as an integrated unit to perform minimally invasive surgeries.<sup>9</sup> Similarly, manufacturing firms such as Hyundai are using context-aware “cobots” (collaborative robots) with “exoskeletons”: wearable robotic devices attached to industrial workers that adapt quickly to the workers and their location, and function in an integrated manner with the workers to perform jobs “with superhuman endurance and strength.”<sup>10</sup> Such dynamic collaborative combinations of human and AI agents can generate collective intelligence that is context-sensitive.

Further research will need to examine the types of human–AI hybrids required for different types of tasks that are performed on a digital labor platform. This requires understanding when and how input data for a task should be automatically generated or requires human involvement, the roles of AI algorithms and human judgment to perform the task, and when and how task outputs (decisions, solutions) can be effectively communicated and applied by AI systems or humans.

## **Designing Unbiased Platforms**

As digital labor platforms evaluate how to incorporate human–AI hybrids, platform designers need to evaluate potential biases by such hybrids. However, the incorporation of AI systems into platforms will not necessarily eliminate biases from decision-making reported on digital labor platforms (e.g., gender hiring bias, developing-country hiring bias owing to lower wages) (Chan and Wang 2017). In a cautionary tale, Amazon cancelled a plan to deploy AI to mechanize the processing of applications to identify the best candidates for technology positions: the AI system was not providing a gender-neutral rating of candidates, as it was penalizing attributes in women’s applications (which were rare in a male-dominated industry) and downgrading them in its ranking of candidates.<sup>11</sup>

---

<sup>6</sup>Source: “Robo-Journalism: How a Computer Describes a Sports Match,” BBC News, September 12 2015 (<https://www.bbc.com/news/technology-34204052>, accessed January 15, 2019).

<sup>7</sup>Source: <https://www.computerweekly.com/news/252434043/Swedish-banks-embrace-rapidly-evolving-chatbots>; accessed January 15, 2019

<sup>8</sup>Source: <https://www.newequipment.com/research-and-development/what-generative-design-and-why-its-future-manufacturing>; accessed January 15, 2019.

<sup>9</sup>Source: <https://www.davincisurgery.com/>; accessed January 15, 2019.

<sup>10</sup>Source: <https://hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces>; accessed January 15, 2019.

<sup>11</sup>Source: “Amazon Scraps Secret AI Recruiting Tool That Showed Bias Against Women,” Reuters, October 9, 2018 (<https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G>; accessed January 15, 2019).

As platforms expand their utilization of AI, biases in training data and in algorithms codified by designers will need to be detected and prevented. Accenture, for example, is creating an “AI fairness tool” in order to detect, as well as correct, any unfairness exhibited by AI systems.<sup>12</sup> Moreover, AI can be used for recursive self-improvement to mitigate biases and noise in decisions previously made by humans alone (Kahneman 2018).

Dynamic learning by humans and AI systems working together to mitigate biases can increase the quality and efficiency of recruiting decisions and worker–employer recommendations, thereby benefitting both the job-seekers (by increasing their employability), and job-posters (by increasing their trust in potential workers).

Further research will need to examine the competencies required to perform new categories of tasks on digital platforms, and the implications for the design and deployment of human–AI hybrids that can effectively avoid biases in the decision processes for these tasks.

## Data Guardianship

The quality and efficiency of human–AI hybrids on digital labor platforms will depend on the data that can be used to design and deploy the hybrids. Recent scandals, like the use of Facebook user data by Cambridge Analytica without user consent, have placed the limitations of largely centralized models of data guardianship by the platform owner center-stage in public discourse and policy deliberations.

Peer-to-peer models for data guardianship are being explored as alternatives to the centralized platform model to effectively meet the fast-changing requirements of accountability, ethics, privacy, and security of data. Digital labor platforms can leverage blockchain infrastructures to establish peer-to-peer models, where the ownership and control of data are shared by humans and AI agents. These forms will enable self-sovereignty, meaning that an agent, “who has one or more identifiers or DIDs [decentralized ID], can present certain Claims or Credentials relating to those DIDs without having to go through an intermediary” (Wagner et al. 2018, p. 8).<sup>13</sup> Designing such a democratized environment, which incorporates both human and AI agents, will require an understanding of the tradeoffs between data control and quality on one hand and transaction costs on the other (Koutroumpis et al. 2017). It will also require the development of new data policies and enforcement mechanisms.

Future research should examine the different forms of data guardianship, as digital labor platforms involving human–AI hybrids are combined with blockchain infrastructures and evaluate how data ownership and control, user rights, and user consent can be effectively managed.

## Platform Dominance Versus Empowerment

As digital platform giants like Google, Facebook, Amazon, and Microsoft become increasingly competent in AI through both their advanced digital infrastructures and highly differentiated access to data, the dominance of these firms and market concentration can further increase. Moreover, the standardized, low-cost machine-learning-as-a-service offerings of these firms may tempt employers to drop out of digital labor platforms, which can leave large numbers of individual freelancers without a job.

However, AI tools are also being democratized through open source platforms (e.g., Google’s Tensorflow, Microsoft’s Cognitive Toolkit), making it easier and cheaper for workers to integrate AI to perform tasks listed on digital labor platforms. Such empowerment in the use of AI can enable freelancers both to combine their competence with AI tools to innovate how tasks are performed and to compete for tasks on digital labor platforms.

In addition, digital platforms are providing access to open boundary resources including APIs, which new platform players can exploit to emerge as “grassroots” competition to dominant digital platforms. Under current regulations of the fair use principle, APIs can be copied for interoperability purposes. This means that platforms can be forked: platform forking takes place by exploiting the open boundary resources of a platform (such as its APIs) to develop similar platforms (e.g., versions of the Android platform) (see Karhu et al. 2018). Platforms are likely to require novel mechanisms to govern the use of their boundary resources by the human–AI hybrids of other platforms.

<sup>12</sup>Source: <https://www.bloomberg.com/news/articles/2018-06-13/accenture-unveils-tool-to-help-companies-insure-their-ai-is-fair>; accessed January 15, 2019.

<sup>13</sup>Wagner et al. add: “With this model of SSI [self-sovereign identity], it is possible to express virtually any kind of Claim about an individual or entity, and given the adequate verification processes and legal acceptance, these Claims can represent anything about the individual or entity who is the subject of that Credential. This adds a level of flexibility and modularity that will encourage the development of new types of identity claims and will allow a Holder to selectively reveal only the relevant data necessary for a given transaction or interaction” (p. 2).

Further research needs to examine how the incorporation of human–AI hybrids in digital platforms will affect the tension between the dominance of platforms and the empowerment of smaller players. Understanding the novel capabilities of human–AI hybrids to trigger, catalyze, and scale movements to empower individuals and transform collaboration in heterogeneous collectives (e.g., open source software development communities) can be particularly interesting. The net effect of digital labor platforms using human–AI hybrids on income equality, productivity, and skill development across diverse segments of workers (e.g., geographical clusters, skillsets, income levels) also needs to be understood.<sup>14</sup>

## Concluding Remarks

The next-generation of digital platforms are being designed on a nexus of digitization forces: modularization of digital tasks, automated tracing of granular task-related data, and AI learning modalities. This nexus is fueling the design and deployment of a variety of human–AI hybrids that range in interdependence from substitution to augmentation to assemblage. These hybrids are likely to significantly transform digital labor platforms, as we have illustrated, as well as other types of digital platforms. The phenomenon of human–AI hybrids transforming digital platforms provides exciting opportunities for IS scholars. Drawing on diverse perspectives and methods, IS researchers can contribute to our understanding of, among other things, types of human–AI hybrids required for different types of tasks on digital platforms, novel mechanisms to mitigate biases in decision-making and to achieve data guardianship in platform ecosystems involving human and AI agents, and the changing dynamics between platform dominance and empowerment resulting from the deployment of human–AI hybrids.

## References

- Acemoglu, D., and Restrepo, P. 2018. "Artificial Intelligence, Automation and Work," NBER Working Paper No. 24196, National Bureau of Economic Research, Cambridge, MA.
- Agrawal, A., Horton, J., Lacetera, N., and Lyons, E. 2015. "Digitization and the Contract Labor Market: A Research Agenda," in *Economic Analysis of the Digital Economy*, A. Goldfarb, S. M. Greenstein, and C. E. Tucker (eds.), Chicago: University of Chicago Press, pp. 219-250.
- Autor, D. 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation," *Journal of Economic Perspectives* (29:3), pp. 3-30.
- Autor, D., Dorn, D., Katz, L. F., Patterson, C., and Van Reenen, J. 2017. "The Fall of the Labor Share and the Rise of Superstar Firms," NBER Working Paper No. 23396, National Bureau of Economic Research, Cambridge, MA.
- Chan, J., and Wang, J. 2018. "Hiring Preferences in Online Labor Markets: Evidence of a Female Hiring Bias," *Management Science* (64:7), pp. 2973-2995.
- Constantinides, P., Henfridsson, O., and Parker, G. 2018. "Introduction—Platforms and Infrastructures in the Digital Age," *Information Systems Research* (29:2), pp. 381-400.
- Daugherty, P., and Wilson, J. 2018. *Human + Machine: Reimagining Work in the Age of AI*, Boston: Harvard Business Review Press.
- Dube, A., Jacobs, J., Naidu, S., and Suri, S. 2018. "Monopsony in Online Labor Markets," NBER Working Paper No. 24416, National Bureau of Economic Research, Cambridge, MA.
- Horton, J. J. 2010. "Online Labor Markets," in *Proceedings of the International Workshop on Internet and Network Economics*, A. Saberi (ed.), Berlin: Springer, pp. 515-522.
- Horton, J., Kerr, W. R. and Stanton, C. 2017. "Digital Labor Markets and Global Talent Flows," NBER Working Paper No. 23398, National Bureau of Economic Research, Cambridge, MA.
- Kahneman, D. 2018. "Comment on 'Artificial Intelligence and Behavioral Economics,'" Chapter in forthcoming NBER book, *The Economics of Artificial Intelligence: An Agenda*, A. K. Agrawal, J. Gans, and A. Goldfarb (eds.), Chicago: University of Chicago Press (<https://www.nber.org/chapters/c14016>).
- Karhu, K, Gustafsson R, and Lyytinen, K. 2018. "Exploiting and Defending Open Digital Platforms with Boundary Resources: Android's Five Platform Forks," *Information Systems Research* (29: 2): pp. 479-497.
- Koutroumpis, P., Leiponen, A., Thomas, L. D. 2017. "The (Unfulfilled) Potential of Data Marketplaces," ETLA Working Paper No. 53, The Research Institute of the Finnish Economy, Helsinki (<https://www.etla.fi/wp-content/uploads/ETLA-Working-Papers-53.pdf>; accessed January 15, 2019).

---

<sup>14</sup>Past work presents an ambiguous picture on the impacts of digital labor platforms both at the country and individual levels. On the surface, high-income clients may benefit from low-income workers offering their skills for a lower cost (relative to the clients' home country), while at the same time the low-income workers may benefit from a job. However, studies reveal both the *superstar effect* (driven by vertical differentiation), the *long-tail effect* (driven by horizontal differentiation), and lower costs (due to fewer local offline opportunities) (Agrawal et al. 2015).

- Song, P., Xue, L., Rai, A., and Zhang, C. 2018. "The Ecosystem of Software Platform: A Study of Asymmetric Cross-Side Network Effects and Platform Governance," *MIS Quarterly* (42:1), pp. 121-142.
- Wagner, K., Némethi, B., Renieris, E., Lang, P., Brunet, E., and Holst, E. 2018. "Self-Sovereign Identity: A Position Paper on Blockchain Enabled Identity and The Road Ahead," Identity Working Group of the German Blockchain Association (<https://jolocom.io/wp-content/uploads/2018/10/Self-sovereign-Identity--Blockchain-Bundesverband-2018.pdf>; accessed January 15, 2019).
- Wise, J. M. 2013. "Assemblage," in *Gilles Deleuze: Key Concepts*, Stocksfield, UK: Acumen Publishing Limited, pp. 91-102.

## Announcements

### Retiring and Incoming Editors

I would like to thank the following individuals who completed their terms on the editorial board in December 2018 for their valuable service:

*Senior Editors:* Sue Brown (University of Arizona) and Omar El-Sawy (University of Southern California)

*Associate Editors:* Corey Angst (University of Notre Dame) and Xu Xin (Hong Kong Polytechnic University)

In addition, I am delighted to welcome the following individuals to the editorial board:

*Senior Editors:* Corey Angst (University of Notre Dame), Wai Fong Boh (Nanyang Technological University), Dennis Galletta (University of Pittsburgh), Shaila Miranda (University of Oklahoma), and Chee-Wee Tan (Copenhagen Business School)

*Associate Editors:* Ning Nan (University of British Columbia) and Ling Xue (Georgia State University)

I invite you to learn more about the outstanding qualifications and the range of expertise of our team of senior and associate editors by visiting the *MISQ* web site.

### Review Coordinator Transition

Jennifer Syverson, who served the journal for many years, has assumed another role at the University of Minnesota. I would like to thank Jennifer for her outstanding service to *MISQ* and the community of editors, reviewers, and authors. We will miss Jennifer and wish her the best in her new role. I would like to take the opportunity to thank Jan DeGross, Managing Editor for *MISQ*, for all her help in the transition period to a new review coordinator. Jan went well above the call of duty and played a key role during the transition. Finally, I would like to welcome Marsha Williams to her new role as *MISQ* Review Coordinator!

Arun Rai  
Editor-in-Chief, *MIS Quarterly*

