

Evolution of Task Automation in the 21st Century

A Data-Driven Exploration of the Race between Man and Machine

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With the recent advance in artificial intelligence, machine learning, and other automation technologies, how humans race against, or with, machines has attracted a great deal of attention among policy makers and researchers (Frank et al. 2019). Indeed, recent technological advances in performing sophisticated and complex tasks differentiate the 21st century from previous ones. Despite the need for tracking the status of technological advances and automation over time, the lack of a quantitative measure for the degree of automation prevents researchers and policy makers from tracking the dynamics of technological advances over time with respect to the ability to automate distinct types of tasks. Especially noteworthy is that the “lack of high-quality data about the nature of work” is considered a major barrier to studying the future of work (Frank et al. 2019); further, there is a call for “tracking how technology is transforming work” to gauge, and prepare for, the unpredictable impacts of advancing technology (Mitchell and Brynjolfsson 2017).

This study aims to measure which tasks are vulnerable to automation and explore how the nature of tasks has evolved in the 21st century. Using a comprehensive dataset on occupational skill requirements and job characteristics in 2008 and 2018, we apply a data-driven methodology to reveal the latent task types in various occupations. Then, we gauge the degree of automation of each task and task complementarity with respect to the demand for occupations in which such a task is performed. Our findings demonstrate that all tasks are not equally affected by automation during 2008–2018. First, we identify four task types that are associated with the reduction in labor demand, while the degree of automation in these tasks has increased (*race against the machine*); the tasks are clerical, information processing, communication, and conflict resolution. Second, managerial tasks and dynamic physical tasks are in demand in the labor market, despite the increase in their degree of automation (*race with the machine*). Finally, human labor appears to *race ahead of the machine* in two tasks—strategic thinking and system analysis—as they are associated with an increase in labor demand and a decrease in their level of automation. Taken together, our data-driven exploration implies that the dynamics of automation, especially for cognitive tasks, has changed in the 21st century. Based on our analysis, we provide an online tool for researchers and policy makers to explore task-level susceptibility to automation: <http://jobautomation.pythonanywhere.com>.

References

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