How artificial intelligence will affect energy system and climate change: an exploration research

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Overview

The huge progress of machine learning (especially in deep learning) since the early 2010s and recent rapid adoptions penetrations across a wide range of sectors draw great attention from academic, governments and investors. The open-source platform and freely accessible projects greatly reduced the entry barrier of development and implementation of AI systems. Recent research (Mckinsey, 2018) estimates AI could potentially boost global economy growth by about 1.2 percent a year if 70 percent of companies adopting AI technologies by 2030. However, even though its great potential, we observed that most AI startups are picking the "lower-hanging fruit" in the natural language processing, computer vision, and communication industry. The implementations of AI in the energy sector, electricity systems, and manufacturing sector are still rare. In the top AI conference International Conference on Machine Learning (ICML) and Conference on Neural Information Processing Systems (NeurIPS), AI scholars are calling the ML and AI communities to take actions on climate change mitigation and adaptation. A group of world-class AI experts also produced a report on the possible approaches that AI can contribute to tackling climate change (Rolnick et al., 2019). We expect that AI can greatly reduce the cost of mitigation by increasing the efficiency and reducing the waste and loss of production, consumption and the market of the electricity, energy and other sectors (Victor, 2019). Although with great uncertainty, the penetration of AI systems can also greatly affects human behaviours which is usually partially captured by the rebound effects, drives structural change in the energy systems, and might ultimately bridge the gaps to meet 1.5 °C target and sustainable development goals (Grubler, 2018).

Methodology

In this research, we also reviewed the literature surrounding the evaluation of the impacts that ICT technology penetration in different research diciplines. Then, the impacts of AI on tackling climate change is analyzed in a systematic approach. We started with examining the embodied energy, and operational energy consumption of typical AI systems. Secondly, we explored the energy impacts of the efficiency enhancement and possible substitution by implementing typical AI systems. Finally, we built several narrative scenarios to describe the possible human behaviours change and structural change of social-economic systems due to the penetration of AI systems by adjusting the low-demand scenarios (Grubler, 2018).

Conclusions

We find the net energy effects of AI systems can be difficult to understand and interpret. The uncertainty surrounding AI penetration, the results of efficiency enhancement and substitutive energy effect studies can be highly sensitive to scoping decisions and assumptions. Also, uncertainty increases as the impact scope broadens, especially when we include the human behaviour change in the analysis. However, it is likely that AI has large energy savings potential according to the previous research on the penetration of other ICT technologies, but that the realization of this potential is highly dependent on deployment details and user behaviours.

References

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