Unlocking human-level capabilities: GPT-4 empowers data mining for building energy management

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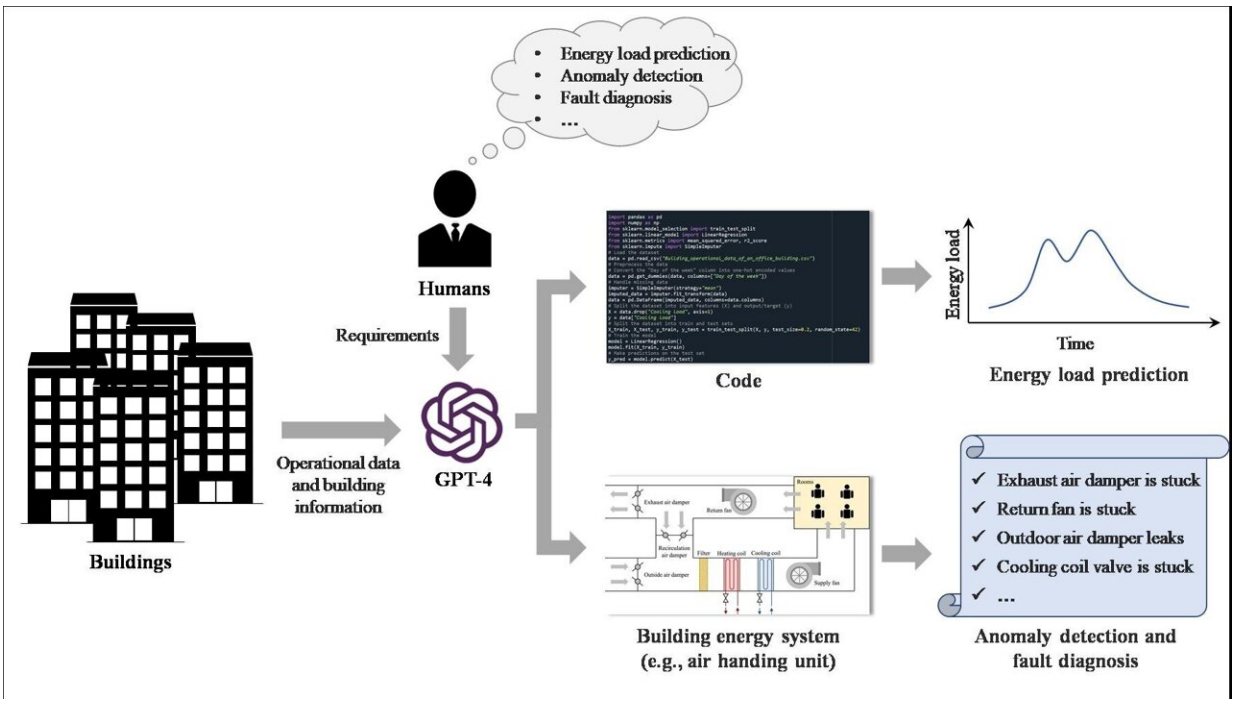

How the GPT-4 works on automated data mining for building energy management. Credit: Chaobo Zhang, Jie Lu, Yang Zhao

The building sector is a significant contributor to global energy consumption, accounting for approximately 33% of the world's final energy usage.

Recently, data mining technologies have showed powerful capacities for revealing energy waste and providing energy-saving tips to building owners. These technologies have the ability to save approximately 15%–30% of the energy consumed in buildings. However, the practical application of data mining technologies has been limited due to its labor-intensive nature, resulting in a scarcity of real-world use cases.

In a study published in the journal *Energy and Built Environment*, a collaborative team of researchers from China and the Netherlands has successfully developed a solution based on GPT-4. This innovative solution automates the analysis of building operational data, thereby providing comprehensive support for building energy management.

The study's first author, Chaobo Zhang, a postdoctoral researcher in smart buildings at the Department of the Built Environment, Eindhoven University of Technology, highlights the necessity for tailored data mining solutions in building energy management due to the highly diverse nature of building energy systems.

"While GPT-4 stands as one of the most advanced large language models currently available, demonstrating remarkable human-level performance in various real-world scenarios such as coding, writing, and image generation, its ability to analyze building operational data using data mining tools at a comparable human-level performance remains uncertain. Exploring the potential of leveraging GPT-4 to replace humans in data mining-based building energy management tasks holds significant value and warrants further investigation," Zhang explains.

The team successfully showcased GPT-4's capability to generate codes that forecast building energy loads, even when provided with limited user information. Furthermore, GPT-4 exhibits the ability to identify device faults and detect abnormal patterns in system operations by analyzing building operational data. When applied in real-world

buildings, the codes generated by GPT-4 demonstrate a high level of accuracy in energy load prediction.

"Additionally, GPT-4 offers reliable and precise explanations for fault diagnosis and anomaly detection outcomes. By automating coding and data analysis tasks, GPT-4 effectively liberates humans from tedious work, resulting in a more accessible and cost-effective approach to data-guided building energy management," adds Zhang.

This study represents a breakthrough in the domain of building energy management.

"Automated data mining solutions are still rare for building energy management until now. Our study indicates that GPT-4 is a promising solution to enabling computers to implement customized data mining solutions for building energy management with limited assistance from human," says Yang Zhao, a professor at Zhejiang University, and senior author of the study.

"We hope more scientists can explore the potential of GPT-4 in this domain, so that the building energy management will be smarter and more efficient in the future."

More information: Chaobo Zhang et al, Generative pre-trained transformers (GPT)-based automated data mining for building energy management: Advantages, limitations and the future, *Energy and Built Environment* (2023). DOI: 10.1016/j.enbenv.2023.06.005

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