

6G and the Sustainability Aspect: Exploiting Surplus Renewable Energy for Distributed Learning Clusters in 6G Networks

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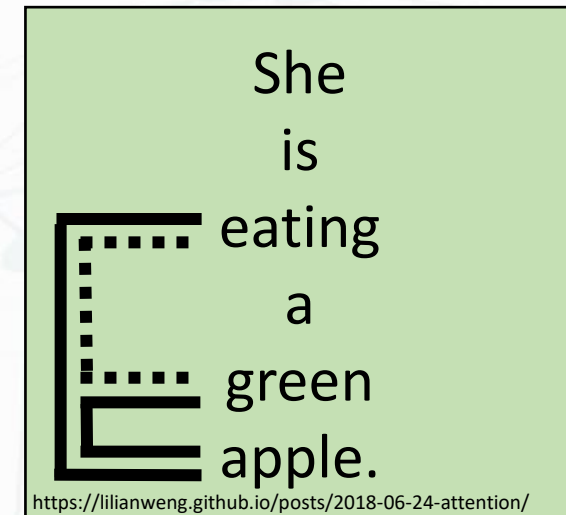
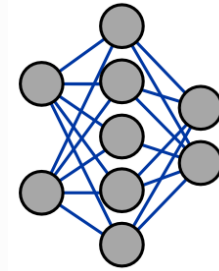


Towards large scale computing

- Large scale models are coming
- Recent breakthroughs in natural language processing
 - ChatGPT, BERT, ...
- Transformer: Attention-based, large models
- GPT-3: 175 billion parameter
 - -> 288 years computation on a NVIDIA V100¹
- OpenAI used 285 000 processors and 10 000 graphic cards²

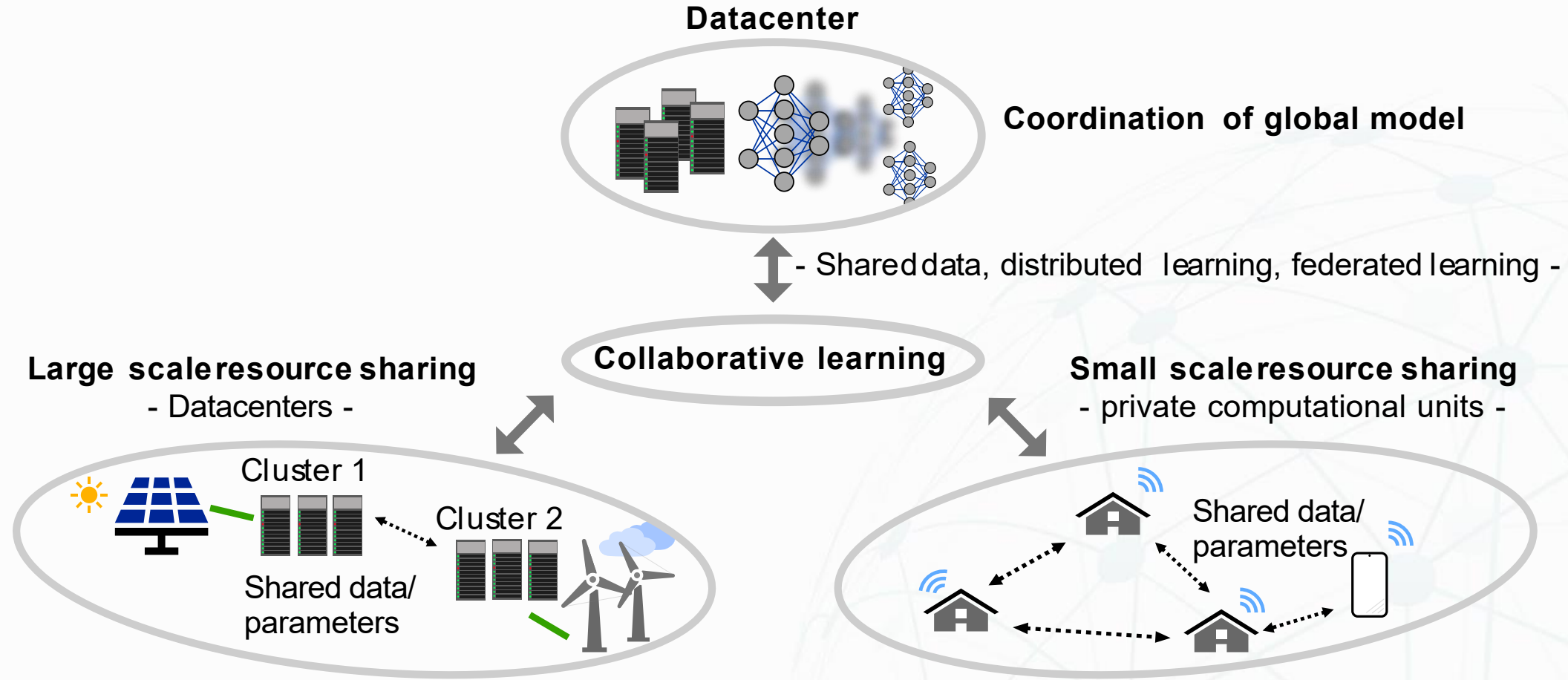
¹<https://techmonitor.ai/technology/ai-and-automation/chatgpt-ai-compute-power>

²<https://www.linkedin.com/pulse/mind-boggling-processing-power-cost-behind-chat-gpt-what-thakur/>



Attention in transformer models

Vision of sustainable collaborative work

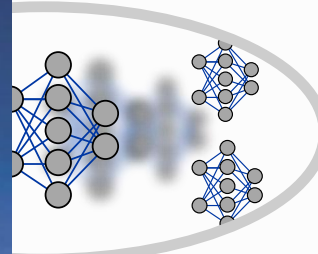


Vision of collaborative work



<https://www.motherearthnews.com/sustainable-living/renewable-energy/home-wind-power-zm0z13amzrob/>

Center

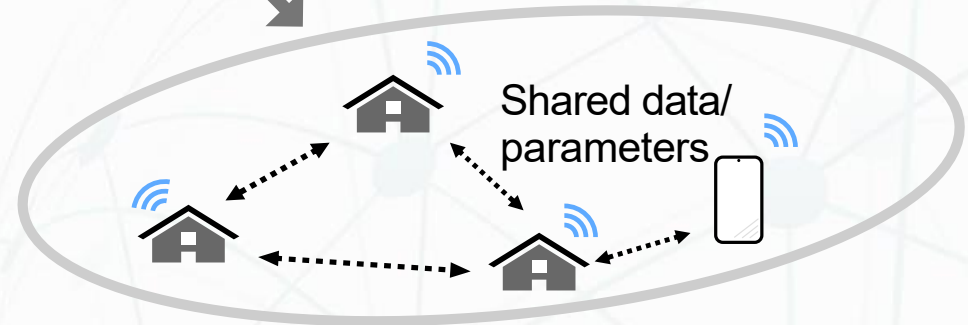


Coordination of global model

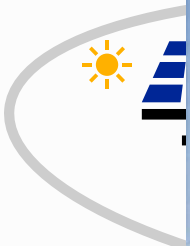
↕ - Shared data, distributed learning, federated learning -

Collaborative learning

Small scale resource sharing
- private computational units -



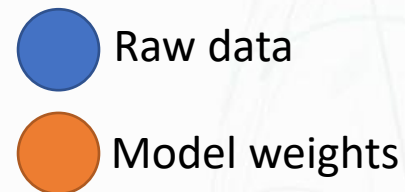
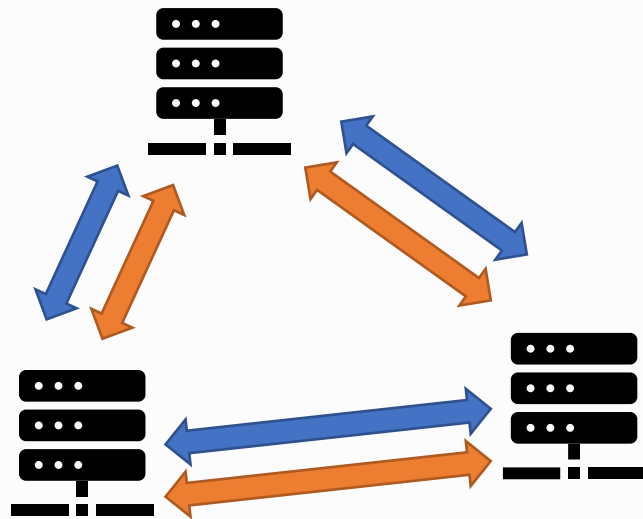
Large scale



Distributed Learning for AI

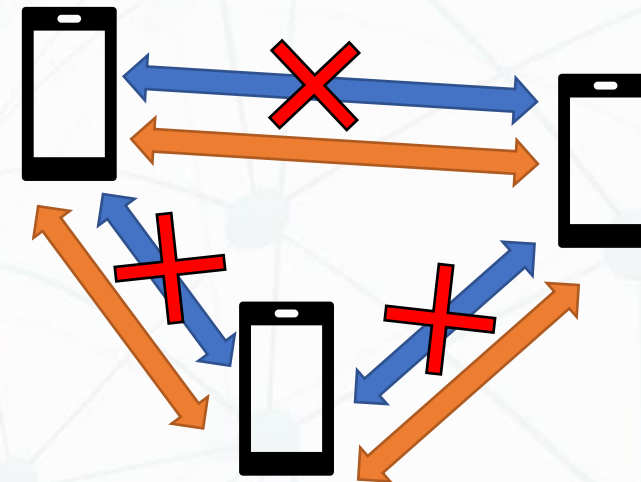
- Distributed learning:

- Data exchange between clients
- Focus on parallelism
- Pretraining of large scale model

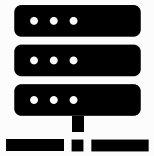


- Federated learning:

- No raw data exchange between clients
- Independent computations from different parties
- Continuous training

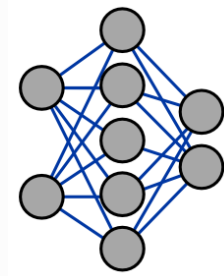


Federated learning architecture patterns



Client management

- Client clustering
- Client selection

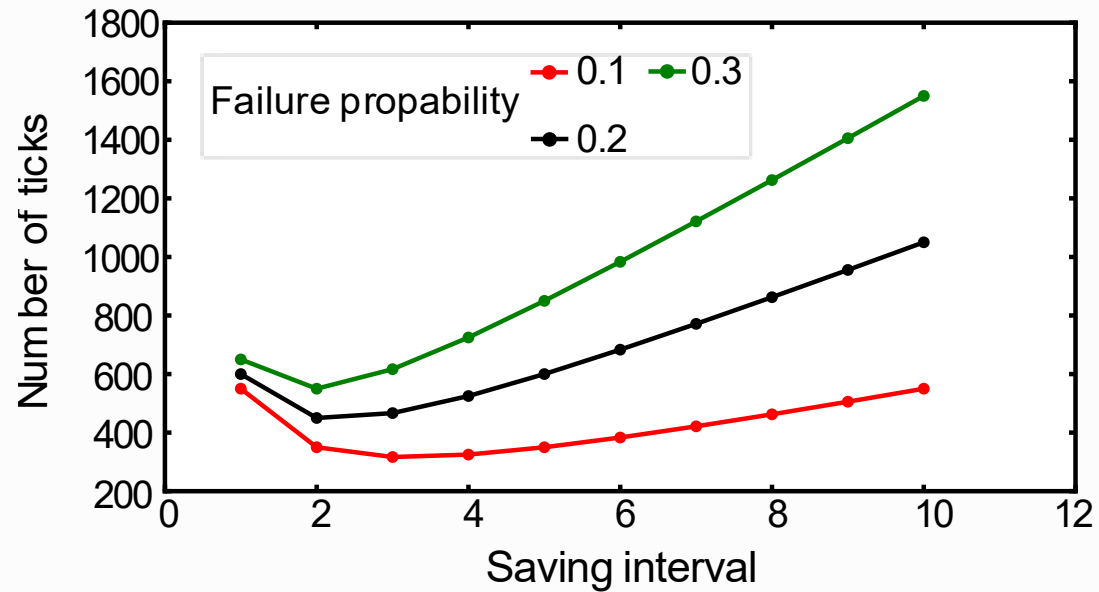


Model management

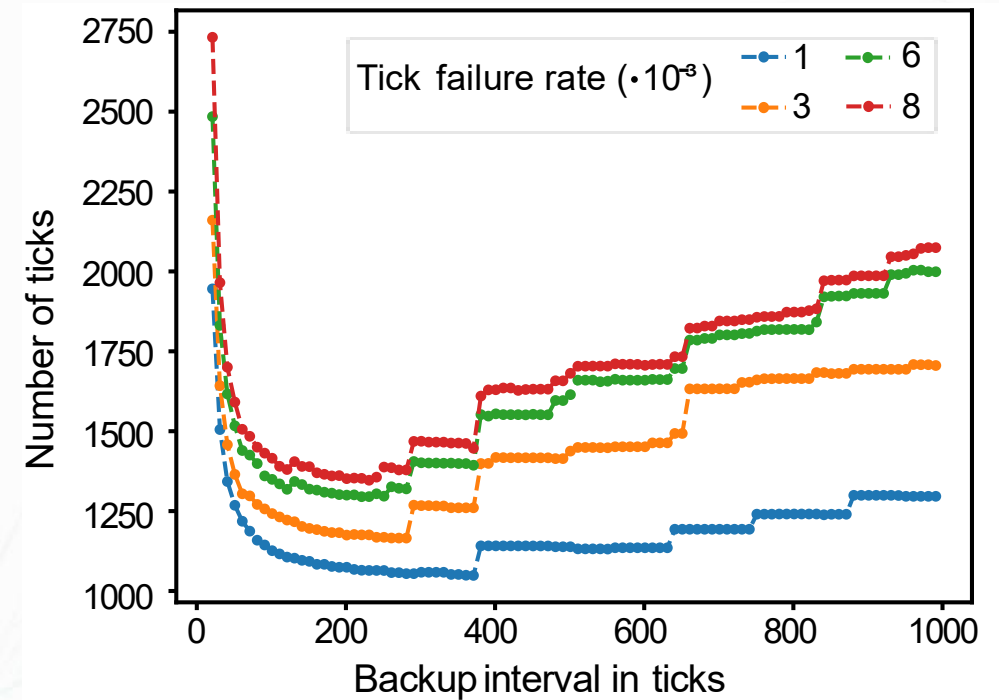
- Message compressing
- Model replacement trigger
 - Autonomy
 - Neural architecture search (NAS)

S. K. Lo, Q. Lu, L. Zhu, H.-Y. Paik, X. Xu, and C. Wang, "Architectural Patterns for the Design of Federated Learning Systems," J. Syst. Softw., vol. 191, no. C, Jul. 2022. DOI: 10.1016/j.jss.2022.111357.

Testbed for predictive AI




- Computation time $T = T_s + T_c$




Summary

 Upcoming large scale AI poses a large sustainability issue

 Vision for future collaborative work

 Federated learning architecture blocks

 Main problem of renewable energy: unreliability
-> Simulation testbed for predictive AI

THANK YOU

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