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Decentralisation of Artificial Intelligence systems

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Motivation

More complex tasks, uncertain environments and the ensuing need to rapidly adapt to changing conditions have spurred a trend towards decentralised organisations in the 20th century. While decentralisation is primarily about the dispersion of the locus of decision-making, other aspects can also be considered, such as the division of labour, the processing of information or the monitoring of processes and results. Similar trends can be retraced for information systems: early software was centralised to a high degree, which manifested itself in monolithic applications architectures. Although these architectures are relatively simple, they have inherent limitations, for instance in terms of scalability or fault tolerance. This has led to the development of concepts such as microservice architectures and distributed computing. Artificial Intelligence (AI) systems can also be discerned by their degree of decentralisation, but their self-learning component makes them architecturally distinct from classic information systems.

However, research on the effects of these differences is still in its infancy. This thesis aims to compile an overview of the extant literature on decentralisation and develop a classification scheme for the decentralisation of information systems. Finally, the taxonomy will be applied to different types of AI systems.

Objectives

- Summarise the literature on organisational and technical Decentralisation with a structured literature review
- Develop a taxonomy for the Decentralisation of information systems
- Elaborate how Artificial Intelligence systems in general and Federated Learning systems in particular can be classified in your taxonomy and what implications can be derived from this

Literature

- Reineke, P., Katila, R., & Eisenhardt, K. M. (2025). Decentralization in Organizations: A Revolution or a Mirage? *Academy of Management Annals*, 19(1), 298–342. <https://doi.org/10.5465/annals.2022.0206>
- Vergne, J. (2020). Decentralized vs. Distributed Organization: Blockchain, Machine Learning and the Future of the Digital Platform. *Organization Theory*, 1(4), 2631787720977052. <https://doi.org/10.1177/2631787720977052>
- Li, T., Sahu, A. K., Talwalkar, A., & Smith, V. (2020). Federated Learning: Challenges, Methods, and Future Directions. *IEEE Signal Processing Magazine*, 37(3), 50–60. <https://doi.org/10.1109/MSP.2020.2975749>