

TOWARDS AI-DRIVEN TRANSFORMATION OF VOLUNTEERING

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Voluntary engagement is an indispensable cornerstone of Critical Infrastructures (CI) such as civil protection, disaster, crisis and rescue management as well as health and social services. Sustainability of the voluntary sector, however, is massively endangered by profound changes in demography, social structure, and volunteer motives in the sense of individualization and pluralization of society. To address these challenges, this paper contributes a research roadmap for leveraging recent advances in Artificial Intelligence (AI) specifically for the volunteer sector, discussing the proposed research design and methods together with research objectives and promising technological solutions. A brief discussion of a first prototypical realization of LLM-based skill extraction from volunteering opportunities and an outlook on future research complements this contribution.

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1 Introduction

Voluntary engagement is an indispensable cornerstone of Critical Infrastructures (CI) such as civil protection, disaster, crisis and rescue management as well as health and social services, thus being of fundamental importance for the whole society. More than 34% of the world's population already volunteer, topped by even more than 48% in Austria, with a weekly workload of 14.7 million hours, of which more than 5.8 million are dedicated to CI (BMASGPK, 2025; UN, 2026). Sustainability of the voluntary sector to support CI is, however threatened by *demographic change* resulting in increasing demands for volunteering, but also by wide-reaching *motivational and social change* (Simsa, et al., 2019, UN, 2026).

Although initial efforts have been made in the past to address these challenges in the volunteer sector through *incremental digital transformation* (Pröll et al., 2017, 2018, 2020ab, 2023, 2024abc), the latest technological advances in *Artificial Intelligence (AI)* are opening up entirely new, revolutionary possibilities for a *disruptive transformation* of the whole volunteer sector and its IT-support (Li et al., 2025, Sun et al., 2025, Wang et al., 2024, Zha et al., 2025). The increasing use of AI in almost all areas of society holds *untapped potential* that can also be a crucial turning point for volunteer-driven CIs to effectively tackle existing challenges (Khan et al., 2024, Pröll et al., 2025, Shihaan et al., 2025).

This paper therefore contributes a *research roadmap* for leveraging recent advances in AI specifically for the volunteer sector in order to strengthen the resilience of volunteer-driven CIs. Section 2 examines the *state of the art* by, first, analyzing *digital transformation challenges* for volunteering from both the NPO and volunteer perspectives, and, second, *surveying current IT support*. Based on that, Section 3 gives an overview of the intended *research design and methods* to be used as a sustainable core for the AI-driven transformation of volunteering. Section 4 then translates this design into concrete *research objectives* and promising *technological solutions* along the voluntary engagement life cycle, focusing on the *pre-engagement* and the *post-engagement phase*, in order to specifically promote voluntary engagement. Finally, Section 5 concludes the paper with a brief discussion of *preliminary results* that already implement a small but nevertheless substantive part of the research roadmap, in terms of *skill extraction*, followed by an *outlook* to future work.

2 State-of-the-Art

This section delineates the state-of-the-art, first by identifying *challenges* in the *digital transformation of volunteering* and second, by assessing *current IT solutions* thereby identifying gaps and opportunities for AI-enabled advancement.

2.1 Challenges for Digital Transformation of Volunteering

Volunteer-driven CIs are fundamentally important worldwide and characterized by massive interdependencies (Pröll et al., 2023, Whittaker et al., 2015). Insufficient *sustainability* of the volunteer sector due to (i) *decline* in volunteer engagement, (ii) *overload* caused by excessive demand, or (iii) *failure* in times of crisis when volunteers themselves become in need of assistance, would lead to lasting supply bottlenecks and significant impairments to public safety and governmental stability (see Figure 1). This would endanger not only *service quality* in non-crisis periods but, above all, in crisis situations, the *mobilization* and *coordination* of the “best forces” would no longer be guaranteed (Pröll et al., 2023).

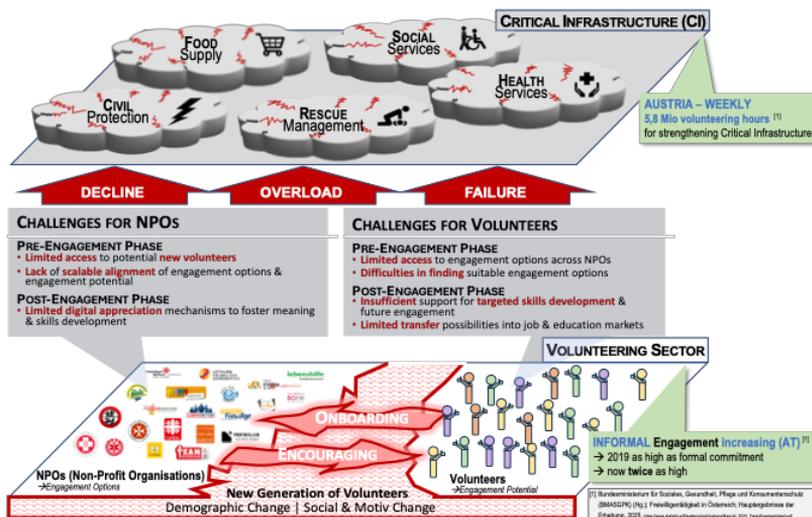


Figure 1: Challenges for the Digital Transformation of Volunteering

Source: Own

Demographic, structural, and motivational change as risk factors. The long-term sustainability of the volunteer sector to adequately support CIs is significantly at risk for two central reasons (Pröll et al., 2023). On the one hand, *demographic change* increases the need for volunteers, especially in health and care. On the other hand, profound *societal structural* and *motivational change* is giving rise to a *new generation of volunteers* with different expectations and needs, fundamentally changing the conditions for volunteering (Simsa, et al., 2019), (see Figure 1).

Resulting challenges for NPOs and volunteers. These challenges particularly affect the pre-engagement and post-engagement phases of volunteer activities (see Figure 1) (Pröll et al., 2025). In the *pre-engagement phase*, the need lies—in the sense of “*onboarding*”—in creating low-threshold, cross-organizational access to potentially new volunteers and suitable engagement options in order to ensure effective alignment of engagement options and potentials that can scale, especially in crises (Pröll et al., 2018, 2023, 2024abc, 2025). In the *post-engagement phase*—“*encouraging*”—digital appreciation of volunteer performance gains importance, in order to foster meaning, skill acquisition, and its usability for labor and education markets as well as for future engagement (Pröll et al., 2016, 2017, 2020ab).

2.2 Deficiencies of Volunteering IT-Support

Against this backdrop of challenges in the digital transformation of volunteering, we survey *Volunteer Management Systems (VMS)* and *Volunteer Web-Portals (VWP)*, (see Table 1) focusing on how they currently support—and where they fall short in—pre-engagement “onboarding” and post-engagement “encouraging”, as shown in our evaluation of 18 systems using over 100 evaluation criteria (Pröll et al., 2016).

VMS—State-of-the-art. Contemporary VMS—across commercial platforms, nonprofit CRMs, and bespoke deployments—support “*onboarding*” through *opportunity publishing*, *registration*, *scheduling*, and *messaging* that provide basic, low-threshold access within single organizations. However, *cross-organizational* access remains *limited*, and *alignment* of engagement options and potentials is predominantly *keyword- and role-driven* rather than skill-based, with sparse integration of standardized skill taxonomies, e.g., ESCO (Smedt et al., 2024) and policy-aware matching. This constrains scalable coordination, especially in crises. On the “*encouraging*” side, most systems *track hours* and *participation* and offer simple acknowledgments or certificates;

yet they rarely provide traceable, *ESCO-aligned skill acquisition*, portable credentials, e.g., W3C Verifiable Credentials via *EUDI Wallet* (EU 2023, W3C 2022), or analytics that make volunteer performance usable for labor and education markets and for future engagement planning.

Table 1: IT-Support for Volunteering - State-of-the-Art

Source: own

CHALLENGE	VOLUNTEER MANAGEMENT SYSTEMS (VMS)	VOLUNTEER WEB PORTALS (VWP)
Scope & Access	<ul style="list-style-type: none"> • NPO-centric onboarding • limited cross-NPO interoperability 	<ul style="list-style-type: none"> • manually entered engagement options • weak coordination
Matching Logic	<ul style="list-style-type: none"> • keyword/role-based • minimal skill or policy awareness 	<ul style="list-style-type: none"> • keyword-based • little skill alignment
Skills & Recognition	<ul style="list-style-type: none"> • limited ESCO use • no traceable skill acquisition or portable credentials 	<ul style="list-style-type: none"> • no standardized skill profiling • seldom verifiable recognition
Tracking & Analytics	<ul style="list-style-type: none"> • most often simple hours tracking for documentation • limited analytics for labor, education, or future planning 	<ul style="list-style-type: none"> • basic confirmations • minimal analytics
Explainability & Interoperability	<ul style="list-style-type: none"> • weak explainability • mainly engagement data silos 	<ul style="list-style-type: none"> • no explainability • accessibility not mature

VWP—State-of-the-Art. Aggregating VWP (e.g., VolunteerMatch¹, Idealist², Do it/UK³, regional/national hubs) advance “onboarding” by offering discovery of volunteering opportunities across NPOs—typically with listings entered manually—sometimes with search and filters for cause, location, and time. Yet cross-organizational alignment of engagement options and volunteer potentials is typically *keyword-centric*; skill-based matching and standardized profiling, e.g., ESCO (Smedt et al., 2024) are uneven, hindering scalable surge coordination in crises. Regarding “*encouraging*”, portals rarely go beyond *listings and basic confirmations*; they generally lack mechanisms for digital appreciation that derive and validate skill acquisition, produce portable, verifiable credentials (EU 2023, W3C 2022), or feedback insights into personalized upskilling and future engagement pathways.

¹ <https://www.volunteermatch.org/>

² <https://www.idealists.org/>

³ <https://doit.life/volunteer>

While some portals experiment with recommendation engines and chatbots, explainability, multilingual accessibility according to WCAG (W3C 2024), and privacy-preserving data sharing are not yet state-of-practice—leaving a gap precisely where cross-organizational, skill-aware onboarding and interoperable recognition would create the most value.

3 Research Design for AI-Driven Transformation of Volunteering

Building on our review of digital transformation challenges and IT-support deficiencies, the increasing use of AI across society offers *revolutionary possibilities* (Li et al., 2025, Sun et al., 2025, Wang et al., 2024, Zha et al., 2025). The relevance of AI for volunteering support is underlined by international developments, for example China's 2024 prioritization of comprehensive AI integration in the volunteering sector, with over 200 million registered volunteers (Shihan et al., 2025).

Pre- and Post-Engagement as High-Leverage Phases for AI-support. Based on this overall rationale it is therefore of utmost importance to systematically and comprehensively explore the *potential of AI* for the *volunteering engagement lifecycle* (Khan et al., 2024). Accordingly, we specifically address the *pre- and post-engagement phases* of volunteer activities, as they represent high-leverage points for AI support (Piccolo et al., 2025). These phases exhibit high *standardizability*, *predictability*, and *data availability* (Pröll et al., 2025; Shihan et al., 2025), which makes them particularly amenable to analytical and optimization-oriented AI-support. By contrast, the *actual engagement phase* is strongly shaped by empathy, interpersonal interaction, social presence and is, due to its domain specificity and variability (Pröll et al., 2025, Shihan et al., 2025), difficult to support with generic AI-services.

Research design and methods. The research design underlying this overall research focus addresses the high innovation dynamics in AI research and aims for sustainable results in order to *cope with AI breakneck evolution* as best as it gets (Haigh, 2025). Thus, methodologically, the design rests on four complementary pillars:

1. **Human-Centered AI** (Capel et al., 2023, Schmager et al., 2025) for technology-agnostic, participatory, and fair conception of data, function, and process pre- and post-engagement models leading to several benefits like *auditability*, *observability* and *accountability* as depicted in Figure 2;

2. **Hybrid LLM-based AI** (Kedi et al., 2025, Lex et al., 2025), combining, as illustrated in Figure 2, the verifiability, explainability, and reliability of deductive, rule- and knowledge-based “symbolic” methods (“*Human Intelligence*”) with the exploratory, generalizing and scalable capabilities of inductive, learning and probability-based “statistical” LLMs (“*Data Intelligence*”);

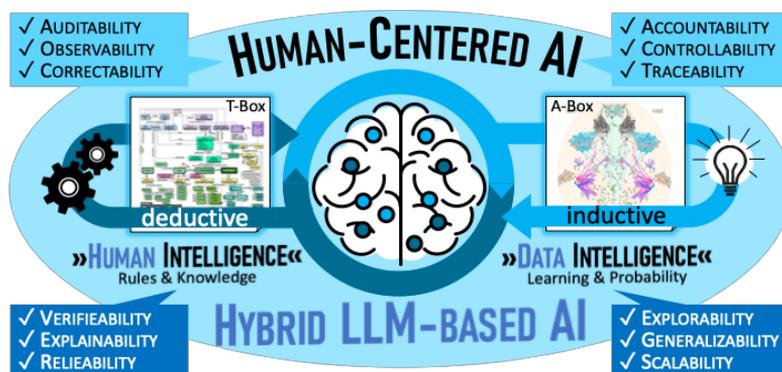


Figure 2: Human-Centered, Hybrid LLM-based AI-support for Volunteering

Source: Own

3. **Design-for-Change** (Bayram et al., 2025, Raatikainen, et al., 2025) for developing modular, *MLOps*-based, *evolvable AI services* with clear interfaces, configurable policies, and automated update, test, and rollback processes;
4. **Open-source technologies** and **emerging standards** (Kukreja et al., 2024) as a strategic foundation for rapid and sustainable integration of potentially *upcoming new AI paradigms*.

4 Skill-Aware Onboarding & Encouraging: Research Goals & AI Approaches

Grounded in our research design, the following research objectives and AI solution approaches translate our overarching vision into an operational *research roadmap*. Their rationale and ambition are underpinned by our prior work in the digital transformation of volunteering (Pröll et al., 2016, 2017, 2018, 2020ab, 2023, 2024abc, 2025), providing validated domain models, stakeholder access, and empirical baselines. Together, these objectives chart a pathway from AI-supported *engagement data collection* and *representation* to AI-enabled *matching*, *recognition*, and *planning*—

deliberately focusing on the high-leverage pre- and post-engagement phases (see Figure 1).

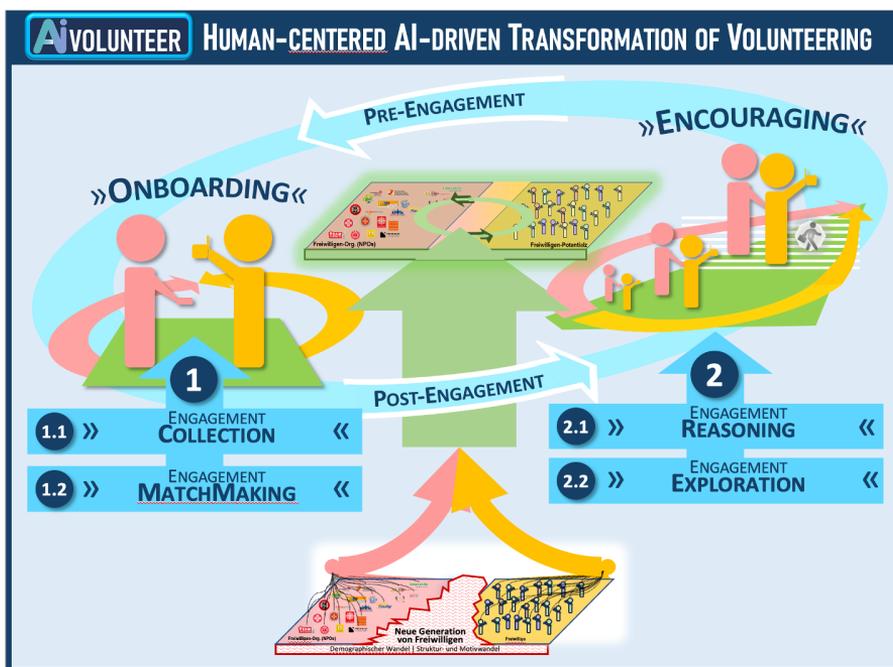


Figure 3: Human-Centered, Hybrid LLM-based AI-support for Volunteering

Source: Own

Research Objective 1: The first research objective is to enable *pre-engagement onboarding* by creating low-threshold, cross-organizational access to suitable *engagement options* and *volunteer potentials* through comprehensive AI-based *engagement data collection* and scalable, *skill-aware matchmaking*.

4.1 Engagement Collection

First of all, a continuous, dual-track pipeline for capturing both the demand and the supply sides of volunteering should be established. On the demand side, engagement options published by NPOs could be systematically harvested, for example via *AI-based web scraping* (Navroz et al., 2025) with the aim of extracting *required skills* alongside salient descriptors such as engagement form, duration, and intensity. In

parallel, the supply side should be addressed by eliciting volunteers' potential—including *existing skills*, preferences, and availability—through interactive mechanisms such as *AI-supported chatbots* (Naveen et al., 2025). At the same time, NPOs could be supported through structured *AI-driven authoring tools* (Liapis et al., 2023) for opportunity descriptions, in order to improve semantic consistency, data quality, and cross-organizational comparability.

Both pipelines should then be normalized using context-sensitive extraction of standardized skill representations, in particular *ESCO-aligned skill profiles* (Smedt et al., 2024), leveraging *NLP-based profiling approaches* (Luo et al., 2025). These techniques can be applied both to opportunity descriptions and to volunteer-provided inputs, with a deliberate focus on *ESCO transversal skills* that are especially relevant across the volunteer sector (Vásquez-Rodríguez, et al., 2024).

The extracted and harmonized knowledge should ultimately be consolidated within a demand-driven, *ontology-based data space* (Gieß et al., 2025), envisioned as a semantic engagement knowledge backbone (T-Box) following a “*pay-as-you-go*” *integration paradigm* (Franklin et al., 2005). Its instance layer (A-Box) would be continuously enriched through recurring data acquisition from scraping and conversational interfaces, and should be made programmatically accessible and interoperable, via emerging *AI application communication standards* such as the *Model Context Protocol (MCP)* (Xinyi et al., 2025).

4.2 Engagement MatchMaking

Building on this knowledge base, we propose *semantic engagement matchmaking* that deliberately *fuses symbolic and statistical AI*—an AI-enabled extension of our previous, largely rule- and metadata-based approach (Pröll et al., 2018). Symbolic models—ontologies, constraints, and deployment logics—should be used to provide validity, explainability, and policy compliance, while data-driven methods—embeddings and similarity metrics—could enhance robustness and recall in heterogeneous, real-world settings (Lin et al., 2025). We envision a matching engine that adapts continuously to *evolving engagement knowledge* (e.g., skill drift, newly emerging roles) via adaptive, feedback-driven, *LLM-supported reinforcement mechanisms* (Mehdi et al., 2023), with the goal of keeping recommendations context-sensitive, stable and fair, in line with governance criteria.

Research Objective 2: The second research objective is to strengthen *post-engagement encouraging* by delivering digital appreciation and practical reuse of volunteer work via *engagement reasoning*, while supporting future participation through analytics-driven *engagement exploration and planning*.

4.3 Engagement Reasoning

To make volunteer contributions visible and portable, we propose to derive traceable, *ESCO-based evidence of skill acquisition* (Smedt et al, 2024)—including proficiency levels aligned with engagement type, complexity, and autonomy (Ma et al., 2025). This “*hindsight*” layer would combine LLM-based justification generation (“*LLM-as-Justifier*”) (Zhao et al., 2024), consensus-oriented evaluation procedures (“*LLM-as-Judge*”) (Dawei et al., 2025), and *semantic clustering* of deployment reports, feedback texts, and chatbot dialogues (Naveen et al., 2025). Verified outcomes are envisioned to be anchored in a *digital volunteer passport* as already available, e.g., in Austria (BMASGPK, 2025) and the UK (DCMS, 2021), using cryptographically signed credentials compliant with the *W3C Verifiable Credential standards* (W3C, 2022), issuable and verifiable via the *EUDI Wallet* (EU, 2023) under interoperable governance—enabling recognition across organizations and sectors.

4.4 Engagement Exploration

Complementing recognition, we plan to equip volunteers and NPOs with *analytic and planning capabilities*. Retrospective impact analysis (“*insight*”) would leverage *LLM- and embedding-supported sentiment and causal analysis* (Cho et al., 2022) to surface self-efficacy, challenges, and skill gains (Song et al., 2025), augmented by dynamic, multi-perspective *AI-based visual analytics* (Wang et al., 2025) to facilitate reflection on individual engagement trajectories (Jung et al., 2025). Prospective planning (“*foresight*”) is proposed to employ *time-series and LLM-based forecasting models* (Morita et al., 2025), complemented by *conversational LLM-based chatbot agents* (Naveen et al., 2025), to outline personal skill pathways and explore IF-THEN scenarios. Together, these components are intended to strengthen retention, guide upskilling, and inform strategic workforce planning across the volunteer ecosystem.

5 Preliminary Results and Outlook

This paper presented a *research roadmap* for AI-enabled transformation of volunteering to strengthen volunteer-driven CIs. It highlights deficits in current IT and proposes a *human-centered, hybrid AI approach* focused on *pre- and post-engagement*: smarter onboarding, competence-aware matching, and recognition/planning to boost retention and impact.

To address a substantive, honestly still small part of this agenda, we developed a *first prototype for LLM-based skill extraction* from engagement option descriptions (Pröll et al., 2025). It bridges labor-market taxonomies and prose-like, soft-skill-heavy texts using lightweight, scalable *Cache- and Retrieval-Augmented Generation (CAG/RAG)* (Kedi et al., 2025) for ESCO-based soft-skill classification, avoiding costly fine-tuning. We evaluated six LLMs on an expert-labeled set of *66 engagement options* drawn from a ~2,000-item corpus, published on an existing VWP. Early results show higher consistency and precision than purely generative baselines, fewer hallucinations via ESCO-grounded retrieval, and efficiency gains through prompt/context-aware caching; *challenges remain* in fine-grained soft-skill granularity, free-text ambiguity, and robustness to stylistic variance.

Looking ahead, the *skill extraction layer* will serve as the bridge into the broader roadmap's open points: in *onboarding*, to surface transparent skill requirements and candidate strengths; in *matching*, to align engagement options with volunteer profiles and organizational needs; and in *recognition/planning*, to track acquired competencies and inform training and deployment.

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References

- Bayram, F. (2025). "Towards Trustworthy Machine Learning in Production: An Overview of the Robustness in MLOps Approach". *ACM Comput. Surv.* 57, 5, Article 121 (May 2025)
<https://doi.org/10.1145/3708497>

- Bundesministerium für Soziales, Gesundheit, Pflege & Konsumentenschutz (BMASGPK) (Hg.) (2025). *Freiwilligentätigkeit in Österreich*
https://www.statistik.at/fileadmin/publications/Bericht_2025_Freiwilligentaetigkeit.pdf
- Capel, T., et al., (2023). "What is Human-Centered about Human-Centered AI"? A Map of the Research Landscape. In *Proc. of the Conf on Human Factors in Computing Systems (CHI '23)*. ACM, NY, Article 359, 1–23
- Cho, J., (2022). "Reflection in Theory and Reflection in Practice: An Exploration of the Gaps in Reflection Support among Personal Informatics Apps". In *CHI Conference on Human Factors in Computing Systems (CHI '22)*, New Orleans, LA, USA. ACM,
<https://doi.org/10.1145/3491102.3501991>
- Zha, D., et al., (2025). "Data-centric Artificial Intelligence: A Survey". *ACM Comput. Surv.* 57, 5, Article 129 (May 2025). <https://doi.org/10.1145/3711118>
- Dawei, L., et al. (2025). "From generation to judgment: Opportunities and challenges of LLM-as-a-judge." *Proceedings of the Conference on Empirical Methods in Natural Language Processing*.
- Department for Digital, Culture, Media & Sport (DCMS), (2021). "Research report on Volunteer Passports," *UK Government Digital Service*.
<https://www.gov.uk/government/publications/research-report-on-volunteer-passports>
- European Commission (EU). (2023). *European Digital Identity Wallet Architecture & Reference Framework (EUDI Wallet ARF)*. <https://digital-strategy.ec.europa.eu/en/library/architecture-and-reference-framework-european-digital-identity-wallet>
- Franklin, M., (2005). "From databases to dataspace: a new abstraction for information management". *SIGMOD Rec.* 34, 4 (December 2005), 27–33.
<https://doi.org/10.1145/1107499.1107502>
- Gieß, A., et al., (2025). "Discovering data spaces: A classification of design options", *Computers in Industry*, Volume 164, 2025, 104212, ISSN 0166-3615,
- Haigh, Th., (2025). "Artificial Intelligence Then and Now". *Commun. ACM* 68, 2 (Feb. 2025), 24–29.
<https://doi.org/10.1145/3708554>
- Liapis, A., et al., (2023). "Designing for Playfulness in Human-AI Authoring Tools". In *Proceedings of the 18th International Conference on the Foundations of Digital Games (FDG '23)*. ACM, New York, NY, USA, Article 75, 1–4. <https://doi.org/10.1145/3582437.3587192>
- Jing Yi Wang, Nicholas Sukiennik, Tong Li, Weikang Su, Qianyue Hao, Jingbo Xu, Zihan Huang, Fengli Xu, Yong Li, A Survey on Human-Centric LLMs, 2024,
<https://doi.org/10.48550/arXiv.2411.14491>
- Jiankai Sun, et al. (2025). "A Survey of Reasoning with Foundation Models: Concepts, Methodologies, and Outlook". *ACM Comput. Surv.* 57, 11, Article 278 (November 2025).
<https://doi.org/10.1145/3729218>
- Jiawei Li, et al. (2025). "Fundamental Capabilities and Applications of Large Language Models: A Survey". *ACM Comput. Surv.* 58, 2, Article 38 (January 2026).
<https://doi.org/10.1145/3735632>
- Jung, Y., et al., (2025). "Thinking Outside the Data Box: Investigating the Potential of Data Manipulation for Self-Reflection on Personal Data". In *Proc. of the ACM Designing Interactive Systems Conference (DIS '25)*. ACM, New York, 2189–2207.
<https://doi.org/10.1145/3715336.3735840>
- Khan, N., Ranade, P., Verma, I.K. (2024). "Revitalising Volunteerism: The Transformative Influence of AI in Volunteer Management". In: *Computing and Machine Learning. CML. Lecture Notes in Networks and Systems*, vol 1108. Springer. https://doi.org/10.1007/978-981-97-6588-1_5
- Kedi, Ch., (2025). "A Survey of Inductive Reasoning for LLMs". 10.48550/arXiv.2510.10182.
- Kukreja, S., et al., (2024). "A Literature Survey on Open Source Large Language Models". In *Proc. of the 7th Int. Conference on Computers in Management and Business (ICCMB)*. ACM, NY, USA, 133–143.

- Lex, E., et al., (2025). "Hybrid AI for Human-Centric Personalization (HyPer)". In *Adjunct Proceedings of the 33rd ACM Conference on User Modeling, Adaptation and Personalization (UMAP Adjunct '25)*. ACM, New York, NY, USA, 336–338. <https://doi.org/10.1145/3708319.3727563>
- Lin, J., et al., (2025). "How Can Recommender Systems Benefit from Large Language Models: A Survey". *ACM Trans. Inf. Syst.* 43, 2, Article 28 (March 2025), <https://doi.org/10.1145/3678004>
- Ma, H., et al., (2025). "Joint Ability Assessment for Talent Recruitment: A Neural Cognitive Diagnosis Approach". *ACM Trans. Manage. Inf. Syst.* 16, 2, Article 18 (June 2025). <https://doi.org/10.1145/3714414>
- Mehdi Afsar, M., et al. (2023). "Reinforcement Learning based Recommender Systems: A Survey". *ACM Comput. Surv.* 55, 7, Article 145 (July 2023). <https://doi.org/10.1145/3543846>
- Morita, T., et al. (2025). "Reflection Before Action: Designing a Framework for Quantifying Thought Patterns for Increased Self-awareness in Personal Decision Making." *arXiv preprint arXiv:2510.04364* (2025).
- Luo Y. et al. (2025). "OneKE: A Dockerized Schema-Guided LLM Agent-based Knowledge Extraction System". In *Companion Proceedings of the ACM on Web Conference (WWW '25)*. ACM, New York, NY, USA, 2871–2874. <https://doi.org/10.1145/3701716.3715189>
- Naveen R., et al. (2025). "Steve: LLM Powered ChatBot for Career Progression." *arXiv preprint arXiv:2504.03789*.
- Navroz K., and Williamjeet S., (2025). "A Systematic Review of Web Scraping: Techniques, LLM-Enhanced Approaches, Performance Metrics, and Legal-Ethical Issues". <http://dx.doi.org/10.2139/ssrn.5429131>
- Piccolo, V., (2025). "AI Solutions For Volunteer Management", *Whitepaper*, <https://callin.io/ai-solutions-for-volunteer-management>
- Pröll, B. and Retschitzegger, W., et al. (2016). "A Survey on Volunteer Management Systems," in *Proc. of HICSS'16*.
- Pröll, B. and Retschitzegger, W., et al. (2017). "iVOLUNTEER: A Digital Ecosystem for Life-Long Volunteering" in *Proc. of iWAS'17*. ACM.
- Pröll, B. and Retschitzegger W., et al. (2018). "A Semantic MatchMaking Framework for Volunteering MarketPlaces". In: Trends and Advances in Information Systems and Technologies. *WorldCIST'18. Advances in Intelligent Systems and Computing*, vol 745. Springer, Cham.
- Pröll, B. and Retschitzegger, W., et al. (2020a). "(L)earning by Doing – Blockchainifying Life-Long Volunteer Engagement," in *Proc. of ICEIS'20*. SciTePress.
- Pröll, B. and Retschitzegger, W., et al. (2020b). "iVolunteer – A Platform for Digitization and Exploitation of Lifelong Volunteer Engagement," in *Enterprise Information Systems*, ser. LNBI, vol. 417. Springer.
- B Pröll, B. and Retschitzegger, W., et al., (2023). "Towards a Digital Platform for Goal-oriented and Competence-based Bundling of Volunteering," in: *Proc. of the 18th Iberian Conference on Information Systems and Technologies (CISTI)*, Aveiro, Portugal, 2023, pp. 1-4
- Pröll, B. and Retschitzegger, W., et al. (2024a). "Through the Lens of Goalification - A Survey on Personal Informatics and Persuasive Systems Research," in *Proc. of the Int. Conf. on Information Technology and Systems (ICITS'24)*. Cham, Chile.
- Pröll, B. and Retschitzegger, W., et al. (2024b). "Engagement by Goals - A Digital Platform for Goal-Oriented Volunteering," *Proc. of the Int. Conf. on Next Generation Computing Applications (NextComp)*, Mauritius.
- Pröll, B. and Retschitzegger, W., et al. (2024c). "Towards Goal-Oriented Volunteering - LLMs to the Rescue?," *Proc. of the Int. Conf. on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME'24)*, Maldives.
- Pröll, B. and Retschitzegger, W., et al. (2024). "Towards Goal-Oriented Recommender- and DataSpace-Driven Volunteering", *Proc. of the 44th International Conference on Organizational Science Development: Human Being, Artificial Intelligence and Organization*. S. 798 - 810
- Pröll, B. and Retschitzegger, W., et al. (2025). Silverbullet or Mystery Box – LLM-based Soft Skill Classification in Volunteering", *Proc. of the International Conference on Electrical,*

- Computer, Communications and Mechatronics Engineering (ICECCME), Zanzibar, Tanzania.
- Raatikainen, M., et al. (2025). "Machine Learning Lineage for Trustworthy Machine Learning Systems: Information Framework for MLOps Pipelines". *IEEE Software* 42, 1 (Jan.-Feb.), 51–58. <https://doi.org/10.1109/MS.2024.3414317>
- Schmager, S., et al. (2025). Understanding Human-Centred AI: a review of its defining elements & a research agenda. *Behaviour & Information Technology*, 44(15), 3771–3810.
- Shihan, Y., (2025). AI-Enabled Volunteer Services: Intrinsic Logic, Practical Dilemmas, & Adjustment Strategies. *Int. J. of Global Economics and Management*. 8. 199-208. 10.62051/ijgem.v8n2.22.
- Smedt, J. D., et al. (2024). "The ESCO Ontology", version 1.2. <https://ec.europa.eu/esco/lod/static/model.html>
- Song, L., et al., (2025). "ExploreSelf: Fostering User-driven Exploration and Reflection on Personal Challenges with Adaptive Guidance by LLMs". In *Proc. of the Conf. on Human Factors in Computing Systems (CHI)*. ACM, NY, USA, Article 306, 1–22. <https://doi.org/10.1145/3706598.3713883>
- Vásquez-Rodríguez, L., et al., (2024). "Soft Skills in the Wild: Challenges in Detection and Classification", in *Proc. of the 10th edition of the Swiss Text Analytics Conference*. SEM24.
- Wang, H.; et al., (2025). "A Visual Trajectory-Based Method for Personnel Behavior Recognition in Industrial Scenarios". *Sensors*, 25, 6331. <https://doi.org/10.3390/s25206331>
- Whittaker, J., et al., (2015). "A review of informal volunteerism in emergencies & disasters: Definition, opportunities & challenges". *Int. J. of Disaster Risk Reduction*. 13. 10.1016/j.ijdrr.2015.07.010.
- W3C. (2022). "Verifiable Credentials Data Model v1.1". *W3C Recommendation*. <https://www.w3.org/TR/vc-data-model/>
- W3C. (2024). "Web Content Accessibility Guidelines 2.1", *W3C Recommendation*, <https://www.w3.org/TR/WCAG22/>
- Xinyi, H., et al. (2025). "Model context protocol (mcp): Landscape, security threats, and future research directions." *arXiv preprint arXiv:2503.23278*
- Zhao, H., et al., (2024). "Explainability for Large Language Models: A Survey". *ACM Trans. Intell. Syst. Technol.* 15, 2, Article 20