

AI-Augmented Knowledge Discovery: New Approaches to Interdisciplinary Scientific Research and Innovation

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Abstract

The rapid expansion of scientific literature, experimental datasets, digital repositories, simulation outputs, and computational resources has created both unprecedented opportunities and significant challenges for interdisciplinary research. Artificial intelligence (AI) is increasingly being used to augment knowledge discovery by identifying relationships across large and heterogeneous information sources, generating research hypotheses, synthesising evidence, predicting emerging trends, and supporting collaborative innovation. This paper examines the emerging role of AI-augmented knowledge discovery in interdisciplinary scientific research and innovation. A conceptual qualitative methodology is adopted to analyse AI-supported literature mining, knowledge graphs, natural language processing, multimodal learning, scientific foundation models, generative AI, automated hypothesis generation, and human–AI collaboration. The study proposes an integrated AI-augmented knowledge discovery framework that connects data acquisition, semantic representation, cross-domain knowledge integration, pattern identification, hypothesis generation, computational validation, expert assessment, and continuous learning. The analysis demonstrates that AI can help overcome disciplinary boundaries by connecting concepts, methods, datasets, and findings that may remain isolated within conventional research structures. However, important challenges include data quality, hallucination, algorithmic bias, explainability, reproducibility, intellectual property, research integrity, and overdependence on automated systems. The paper argues that AI should function as an augmentation layer rather than a replacement for scientific reasoning. The future of interdisciplinary research is likely to depend on effective integration between domain expertise, AI reasoning systems, scientific databases, computational modelling, and human-led experimental validation. Responsible implementation of these technologies can accelerate discovery while preserving scientific transparency, accountability, and intellectual rigour.

Keywords: Artificial Intelligence, Knowledge Discovery, Interdisciplinary Research, Scientific Innovation, Generative AI, Knowledge Graphs, Scientific Foundation Models, Natural Language Processing, Human–AI Collaboration, Research Intelligence.

