# Connecting the Dots: Metadata and Cultural Heritage in Research Libraries



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# **Abstract**

Libraries stand as cornerstones of cultural heritage, serving as vital repositories and access points for a diverse range of materials that reflect the history, traditions, and intellectual achievements of societies. Beyond their traditional role as keepers of books, modern libraries, especially academic and research institutions, house extensive special collections encompassing rare books, manuscripts, archives, local history documents, and unique artifacts. These collections often hold immense cultural and historical significance, requiring specialized care and access protocols to ensure their preservation for future generations. The **Fung Ping Shan Library** at the University of Hong Kong, for instance, holds the **Dr Luo Zhenfu Collection** (羅禎符太醫特藏), a diverse collection including artwork, manuscripts, and medical and clinical records offering insights into early 20<sup>th</sup>—century evidence and practices in medical realm, as well as how metadata and expressions for next—generation.



Fig. 1 *Dialogues in Landscape* (excerpt) 山水人物畫 (局部) Shenqin 枕琴 (1791 - 1862)

Dr Luo Zhenfu Collection 羅禎符太醫特藏

Fung Ping Shan Library, HKU 香港大學 馮平山圖書館

## **Research Questions**

Traditional cataloging practices, often relying on standards like MARC, could be adequately extended to categorize and describe diverse and interdisciplinary knowledge systems. This rationale, researching a more semantically rich and interconnected metadata, has led to explorations of linked data concepts –

- 1. Metadata enrichment with Machine Learning (ML): How can ML technologies be effectively complemented with human expertise to enhance the existing metadata of the special collections?
- 2. How can the principles of Linked Data (LD), such as Resource Description Framework (RDF) and ontologies, be applied to represent the enriched metadata of the visual collection in a format that is both machine-readable and interconnected?
- 3. As a kind of metadata representation, Knowledge Graph (KG) is an accessibility enhancement for sustainable development of cultural knowledge. What are the advantages and challenges while adopting it along with the physical / digital collections in academic libraries?

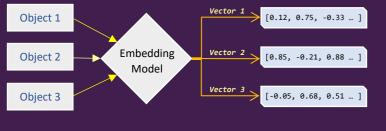
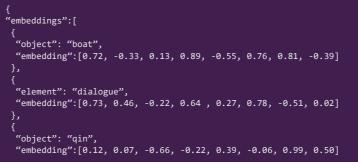


Fig. 2 Embedding objects and elements to vectors.



## Methodologies: Knowledge Graph (KG) with Ontologies

- Gathering unstructured source data.
- Defining inter-relatable RDF ontology with semantic qualities for Arts and Humanities.
- Generating the KG using Large Language Models (LLMs) guided by the ontology.
- Extending the *GraphRAG* library (e.g., neo4j) with text splitter for refined text chunks.
- Setting up RAG logic for querying the constructed Knowledge Graph.

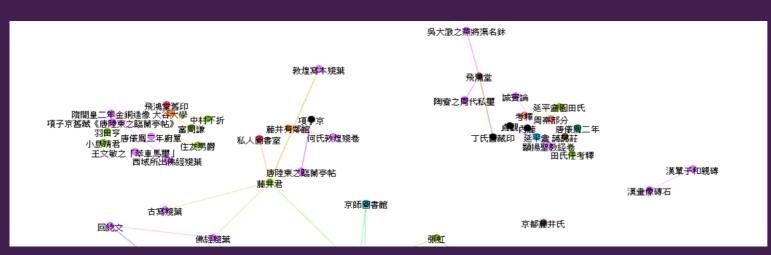


Fig. 4 Example of Transitive Relationship and its graphical expression (For the studies of Kyoto's collectors). (Ku, 2024)

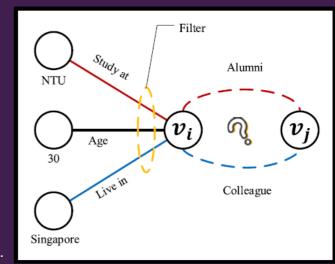


Fig. 3 Example for multi-aspect in Heterogeneous Information Networks (HINs), for one aspect instance whether  $v_i$  and  $v_j$  are alumni, we pay attention to where they graduated from, but for another aspect instance whether  $v_i$  and  $v_j$  are colleagues, we care more about where they are living. (Liu et al., 2022)

### References

Liu, Q., Long, C., Zhang, J., Xu, M., & Tao, D. (2022). Aspect-Aware Graph Attention Network for Heterogeneous Information Networks. *IEEE Transactions on Neural Networks and Learning Systems*, 35(5), 7259-7266.

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