

TOWARD AN INDIC METADATA MODEL: A NAVYA-NYĀYA GROUNDED FRAMEWORK FOR STRUCTURED KNOWLEDGE REPRESENTATION

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Abstract:

The paper demonstrates the ability of an Indian school of logic and philosophical system, Navya-Nyāya, to comprehensively act as a conceptual framework for an Indic metadata model. It demonstrates how Navya-Nyāya's precision in organising relational logic, epistemological rigour, and linguistic formalism can inform the structure, semantics, and functionality of metadata systems. The study investigates fundamental notions such as 'sambandha' (relation), qualifier–qualification structures, 'avacchedaka' (limitors), and inferential methods, aligning them with modern metadata models like RDF triples and layered data frameworks. The paper suggests a philosophically sound, very detailed way to express information by using Navya-Nyāya's theory of relations, which includes direct, indirect, and occurrence-exacting relations, in the construction of metadata. The resulting model improves accuracy, semantic clarity, and compatibility, fixing problems with how metadata is used now. The research concludes that Navya-Nyāya serves as both a historical intellectual resource and a robust conceptual framework for contemporary information systems, especially in scenarios necessitating intricate relational mapping and interpretative precision.

Keywords: Navya-Nyāya; metadata; sambandha; avacchedaka; knowledge representation

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Introduction:

Metadata, commonly understood as structured data about data, affords the infrastructure of digital society. It primarily acts as the structural backbone of modern information systems, facilitating information seekers and managers with identification, retrieval, and management of digital information resources through structured descriptions (Haynes, 2018). By its very operational nature, metadata is descriptive as well as relational. It connects various entities with its contextual meanings guided by defined principles and properties. (Haynes, 2018). While the concept of metadata is a recent phenomenon for explicit use in the digital paradigm, structured descriptions of any information entity have always been utilised in galleries, libraries, archives, and museums in the form of finding aids or catalogues.

Navya-Nyāya, on the other hand, is a refined school of the Indian philosophical logic system that offers an intricate system of relational analysis and linguistic precision. Navya-Nyāya, or the new Nyāya, is a methodological improvement over classical Nyāya. It puts a lot of emphasis on being precise when defining

knowledge, relationships, and ways of drawing conclusions (Ingalls, 1951/1988). The Navya-Nyāya framework tends to create a condition where the main concern is how relevant entities are connected, qualified, and understood within cognition, particularly by emphasising the relationships between concepts and the clarity of their definitions in the process of knowledge acquisition.

The metadata standards in use worldwide have emerged from Western traditions of knowledge and episteme. This paper argues that the Navya-Nyāya system of knowledge traditions offers insights in knowledge organisation and knowledge representation in this digital age. It is advantageous to develop an Indic metadata model because it has a strong philosophical basis and embraces an Indian perspective. This contextual, concise, and culturally attuned system of knowledge representation can be realised by integrating Navya-Nyāya's relational ontology and epistemological instruments with contemporary metadata frameworks, like those employed in digital libraries and information systems, to improve the accessibility and usability of knowledge across various cultural contexts.

Metadata as Structured Relational Knowledge:

Metadata is structured, encoded data that describes information-bearing entities to make it easier to find, identify, and manage them (Haynes, 2018). The operational scope of metadata encompasses six primary objectives: resource identification, information retrieval, resource management, rights management, interoperability, and governance. Modern information models like RDF use structured triples—subject, predicate, and object—to store these kinds of relationships.

- Subject: the entity described
- Predicate: the property
- Object: the value or related entity (Haynes, 2018).

However, even though these models work well on a technical level, they often don't have a deeper semantic basis. They use syntax to define relationships, but they don't fully consider their nature.

This paper states the Navya-Nyāya discourse plugs this gap. The concepts, like Sambandha (relation) in Navya-Nyāya, treat relationships as real entities, not merely conceptual links (Vidya-mitra, 2015). This worldview provides fresh insights into the exciting discourse of metadata. This 'realism' offers certain philosophical depth to existing metadata systems by embedding meaning directly into relational structures.

Navya-Nyāya: A System of Precision and Relation:

Navya-Nyāya highlights a transition towards methodological rigour in logic and epistemology from the classical Nyāya school. It substitutes general linguistic expressions transformed into meticulously structured, linguistically technical language, enabling accurate knowledge representation (Ingalls, 1951/1988).

The key aspect of this logic system is that it sees cognition as structured knowledge (jñāna), where comprehension comes from how things are related to each other. Knowledge is not abstract; it is rooted in tangible connections, such as the relationships between concepts, experiences, and the context in which they are understood.

1. Qualified Cognition and Metadata Structure

Navya-Nyāya asserts that all cognition is “qualified cognition” (viśiṣṭa-jñāna), necessitating three components:

- Qualifier (viśeṣaṇa)
- Qualification (viśeṣya)
- Relationship (samsarga)

In the cognition "a man with a stick", the stick characterises the man through a relation of contact (Vidya-Mitra, 2015).

This three-part structure is very similar to metadata models. The qualifier is like metadata attributes, the qualification is like the resource, and the relation is like the linking predicate. Navya-Nyāya, on the other hand, makes the nature of the relation clear, which makes the meaning clear.

Sambandha as the Core of an Indic Metadata Model:

The proposed metadata model is based on Navya-Nyāya's theory of relation (sambandha). There are two main types of relations: direct and indirect. Each type has its own logical properties.

1. Direct Relationships:

Three main direct relationships have been found:

- **Contact (samyoga):** A short-term connection between substances
- **Inherence (samavāya):** an unbreakable link between things
- **Self-linking (svarūpa):** a relationship that is built into the entities themselves

These differences make it possible to model how things interact in a very precise way. Inherence, for instance, captures structural relationships like part-whole or property-substance. These features also held important ramifications for metadata that describes hierarchical or intrinsic attributes (Vidya-Mitra, 2015).

2. Indirect Relationships

By linking direct relations together, we obtain indirect relations (paramparā-sambandha). This makes it possible for entities that aren't directly linked to connect (Vidya-mitra, 2015).

This means that there are multi-step relationships between datasets in terms of metadata. For example, if a resource is linked to an author, who is linked to an institution, there is an indirect link between the resource and the institution.

Navya-Nyāya makes this linking or chaining process practically possible, making sure that it is logically consistent and can be traced.

Occurrence-Exacting Relations and Locus-Based Modeling:

A pivotal distinction in Navya-Nyāya is between occurrence-exacting (vṛttiniyamaka) and non-occurrence-exacting relations.

- Occurrence-exacting relations stipulate that an entity exists within a locus.
- Non-occurrence-exacting relations do not necessitate such containment.

Inherence is always occurrence-exacting, but contact may or may not be (Vidya-Mitra, 2015).

This distinction is crucial for metadata. This distinction allows us to differentiate between the following:

- attributes that are part of a resource itself (like file size)
- Relationships that are external or contextual (for example, being linked to another resource)

Adding this classification to a metadata model can help it better show what kinds of relationships exist.

Avacchedaka and Semantic Precision:

Navya-Nyāya offers the notion of avacchedaka (limiter) that delineates the extent of a property or relation. This notion, when applied, ceases things from being unclear and too general (Ingalls, 1951/1988).

Ambiguity is a big problem in metadata systems. This often happens when properties are utilized without clear constraints on the context. Avacchedaka offers a means to accurately delineate these contextual boundaries. A Navya-Nyāya-inspired model, for instance, would not just say "author". It would also specify the type of relationship being claimed for authorship, including its limits and context.

This method makes the meaning clearer and reduces down on mistakes in understanding.

Inference and Knowledge Retrieval:

Inference (anumāna) is essential to Navya-Nyāya and involves a methodical process:

1. Comprehension of pervasion (vyāpti)
2. Thought (parāmarśa)
3. Conclusion (anumiti)

This process is comparable to how metadata systems look for data. Finding the correct connections and deciding how useful a resource is are both crucial pieces of retrieval. Because Navya-Nyāya is all about explicit relational comprehension, inference is only correct when the right relation is found (Vidya-mitra, 2015).

In metadata, the term indicates that receiving the proper information depends on both the data and how well the **relationships are set up.**

Mapping Navya-Nyāya to Modern Metadata Models:

1. RDF and Sambandha

The RDF triple structure is compatible with the relational architecture of Navya-Nyāya: • Subject → Qualification

- Predicate = Relationship
- Object → Qualifier

RDF views predicates as abstract qualities, but Navya-Nyāya presents a comprehensive ontology of relations.

2. Layers of Interoperability

Metadata operates on various levels, encompassing protocol, data binding, schema, and semantics (Duval, 2001). Navya-Nyāya mostly helps at the semantic level by defining what relationships are and what their logical limitations are. This is important for making sure that data can be correctly understood and used across multiple systems.

3. Metadata that describes and structures things

There are three basic types of metadata: descriptive, administrative, and structural (Riley, 2017). Navya-Nyāya's relational system can connect these groupings by treating all metadata as structured relationships based on ontology.

Toward an Indic Metadata Model:

An Indic metadata model based on Navya-Nyāya would have these features:

- 1. Relational Ontology:** A precise and standardised approach to put relationships into groups (contact, inherence, self-linking).
- 2. Qualifier Structure:** It exhibits all metadata as qualified thoughts.
- 3. Relational Chains:** It underpins linking and logical chaining that lets users discover relationships that aren't direct.
- 4. Locus Specification:** It distinguishes between occurrence-exacting and non-occurrence-exacting connections.
- 5. Semantic Limitation:** It specifies the limits and context using avacchedaka.
- 6. Thinking-Based Retrieval:** It employs reasoning to help users locate things.

This kind of model would do more than just show how syntax works; it would also make a semantically rich representation of knowledge. This would make it easy to understand and think about many different areas, like information retrieval and natural language processing.

Discussion:

The primary contribution of Navya-Nyāya to the development of the Indic metadata model is its ability to formalise relationships in a precise manner while also maintaining the principles of hospitality in library classification. The system of Navya-Nyāya focuses on reality, which means that relationships are based on real-world systems instead of random notions.

Modern metadata systems are advanced, but the Western context from which present metadata standards emerged leads to challenges in accurately depicting data from diverse cultural settings, such as those found in non-Western societies, which often have different conceptual frameworks and classifications, resulting in potential misrepresentation of their unique knowledge systems. That is why, to bring inclusivity in metadata practice, the paper tries to apply Navya-Nyāya ideas in a metadata system.

It has also been noted that Navya-Nyāya works effectively with computational logic in areas like natural language processing and artificial intelligence (Bharatiya Darshan Vibhag KKSU, 2021). This development **makes current metadata design even more critical.**

Conclusion:

This paper opines that Navya-Nyāya is a solid philosophical basis for an Indic metadata model. Its theory of relations, emphasis on qualified cognition, and tools for semantic precision give us useful ideas for organising and understanding metadata. By combining these ideas with modern data models, you may make a system that is both technically strong and full of ideas. This model not only makes it easier to identify

and handle information, but it also brings metadata practices in line with a long-standing intellectual tradition. Navya-Nyāya serves as a conduit between classical philosophy and modern information science, facilitating a route to enhanced and accurate knowledge representation.

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