National Youth Conference on Indian Knowledge Systems (NYCIKS) – 2023 at IIT Roorkee



# **Āyurjñānam: Exploring Āyurveda using Knowledge Graphs**

#### **Hrishikesh Terdalkar** Vishakha Deulgaonkar **Arnab Bhattacharya**

Department of Computer Science and Engineering, Indian Institute of Technology Kanpur, India

hrishirt@cse.iitk.ac.in



#### Aim

Democratize the Knowledge from Ayurveda

#### Questions

- Do any meats (māṃsa) help in decreasing fat (meda)? <sup>a</sup>
- What is the effect of legumes (śimbīdhānya) on tridoṣa? <sup>b</sup>
- Which vegetable (śāka) is hard to digest (guru) but increases digestive fire (agni)? <sup>C</sup>

#### Corpus

Bhāvaprakāśanighaņțu of Ācārya Bhāvamiśra (16th Century CE)

## **KG-motivated Annotation**

- **Entity**: (Lemma, Node Label)
- **Relation**: (Entity, Relation Label, *Related*, Entity)
- **Curation**: Fixing errors









- Medicinal substances and their properties
- 23 Varga, ~2100 Śloka
- Dhānyavarga, Śākavarga, Māṃsavarga, ...

## Knowledge Graph

- Real world entities and relationships
- Efficiently capture, store and query semantic relations



Efficacy of knowledge graph in capturing information from text

Knowledge graph annotation and curation interfaces

# Querying

**Q2** 

- Multilingual templatized natural language querying
- Graphical and Tabular results



## Challenges: Sanskrit NLP

- Rich morphology
- No sentence boundaries
- Abundant sandhi and samāsa • Free word order
- Semantic Inference: Higher level than information retrieval
- Dependence on advanced and language-specific NLP tasks
- State-of-the-art of Sanskrit NLP not advanced enough

# Solution? – Human Annotation!

- Ayurveda experts
- Mark nodes and relationships  $\implies$  Knowledge Graph
- **Requirement**: Ontology (Skeleton of KG)
- **Requirement**: Annotation and Querying Framework  $\implies$  Sangrahaka [1]

# Architecture





# **Explore Graph**



#### Workflow of Āyurjñānam [2]

# Ontology

- Hierarchical structure
- 328 node labels, 373 relationship Labels

Node Label Hierarchy					Sanskrit	Description
SUBSTANCE					द्रव्यम्	Substance
SOLID_SUBSTA		NCE		अद्रव-द्रव्यम्	Solid Substance	
		DHAANYA			धान्यम्	Grain
			SHAALI_DHANY		शालिधान्यम्	Rice (Shali)
			VRIIHI_DHANYA	A	व्रीहिधान्यम्	Rice (Vriihi)
			SHUUKA_DHAN	YA	शूकधान्यम्	Awned Grain
			SHIMBII_DHAN	YA	शिम्बीधान्यम्	Dicotyledon / Legume / Pulse
			KSHUDRA_DHA	NYA	क्षुद्रधान्यम्	Shrivelled / Coarse Grain

**Example of hierarchical node ontology** 

# Āyurjñānam – Live!

# https://sanskrit.iitk.ac.in/ayurveda/

- **Username**: guest
- **Password** : nyciks23



#### References

[1] Hrishikesh Terdalkar and Arnab Bhattacharya. Sangrahaka: A tool for annotating and querying knowledge graphs. In ESEC/FSE 2021, page 1520–1524, Athens, Greece, 2021.

[2] Hrishikesh Terdalkar, Arnab Bhattacharya, Madhulika Dubey, S Ramamurthy, and Bhavna Naneria Singh. Semantic annotation and querying framework based on semi-structured Ayurvedic text. In CS & DH, WSC 2023, pages 155–173, Canberra, Australia, 2023.

<sup>D</sup> Primarily increase Vāta. Various effects. (Refer to Q2). <sup>a</sup> Yes. Sapādamatsya-Māṃsa (~Prawns). <sup>C</sup> Āluka (~Yam), Loņī (Purslane, Pigweed), Rājakośātakī (Ridge Gourd).

