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Morph-Dependency Model for *Upamā*

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Abstract

The development of a comprehensive dependency parser for Sanskrit remains a key research goal, requiring manually annotated corpora and treebanks for training. Since figures of speech are integral to Sanskrit poetry, this study analyses *upamā* through dependency structures. Our proposed *upamā* dependency model offers fresh insights into rhetorical analysis and contributes to existing Sanskrit treebanks. We present a sample treebank of *upamā* instances from the second canto of *Raghuvaṁśam*, featuring manually drawn dependency trees that highlight the structure and aesthetics of *upamā*. Additionally, each instance includes a morph-dependency tree, revealing its grammatical composition. This study illustrates the benefits of integrating dependency parsing with literary analysis and proposes a foundational framework for modelling *upamā* based on the selected text.

Keywords: Dependency, treebank, *upamā*, *raghuvaṁśam*

1. Introduction and Survey of Literature

Sanskrit poetry is more than grammatically correct sentences; it incorporates metres, sentiments, and figures of speech. Studies, such as Gajjam and Kulkarni (2019), highlight its higher cognitive demand compared to prose. The need for specialised processing is evident in the development of a Sanskrit dependency parser (Kulkarni et al., 2019), which relies on

annotated treebanks. This paper presents a dependency treebank dedicated to *upamā*[1]. Dependency structures effectively capture the beauty and essence of similes and contribute to computational purposes. Existing Sanskrit treebanks, such as Universal Dependencies (Dwivedi & Guha, 2017), the Sanskrit treebank (Kulkarni et. al., 2020) and those for Vedic Sanskrit (Hellwig et al., 2020) provide a foundation, but this study enhances them with additional details for analysing *upamā*.

As a key *alaṅkāra*, *upamā* belongs to the *arthālaṅkāra* category, emphasising meaning over wordplay. It has been a consistent element across Sanskrit rhetorical traditions, with its standard definition[2] elaborated in the *Udyota* commentary[3]. The four essential elements of *upamā* are summarised in Table 1.

upameya	object compared
upamāna	object compared to
sādhāraṇadharma	Similar property
sādharmyadyotakaśabda	term signifying similitude

Table 1. Components of *upamā*

This study examines instances of *upamā* from the second canto of *Raghuvamśam*, a masterpiece by *Kālidāsa*, renowned for his use of similes. Among the numerous similes found across its 19 cantos, selected examples from the *Nandinīvarapradāna*[4] episode are analysed and illustrated in this study. We follow the tagging guidelines of Ramakrishnamacharyulu (2009) and the *Samsadhani* dependency relations by Kulkarni et al. (2020). The *upamā* dependency tree is structured using the symbol and tag scheme outlined in Tables 2 and 3.

Numbers 1- 7	**Respective cases**
→	Compound relation
Pink box	*upameya*
Purple box	*upamāna*

[1] A figure of speech involving comparison based on common properties.
[2] *Mammaṭa*, author of *Kāvyaprakāśa*, defines *upamā* as "*sādharmyamupamā bhede*". Jha (1967: 401) translates it as, "when there is similarity of properties while there is difference between objects themselves, it is *upamā*."
[3] "*Upamānopameyayorbhede sati vākyārthopaskārakaṃ camatkārisādhāraṇadharmavattvam upamā*" (Abhyankar, 1929: 438). It means, *upamā* is a similar property, lying in two inherently different objects, that caters to the sentence meaning.
[4] In this episode, King *Dilīpa* and Queen *Sudakṣiṇā* serve the divine cow *Nandinī* to beget a child.

Blue box	*sādharmyadyotaka*
Green box	*samānadharma*
Yellow tags	Sentential relations
Boxes with red/ blue outline	*bimba-pratibimba bhāva* (Mirrored objects)
Colourful arrows	Sequence, correspondence

Table 2. Symbols and their meanings

kartā	Subject
karma	Object
karaṇam	Instrument
adhikaraṇam	Locus
ṣaṣṭhī-sambandhaḥ	Genitive
kriyāviśeṣaṇam	Adverb
viśeṣaṇam	Adjective/ modifier
anuyogī	*upameya* (the object compared)
pratiyogī	*upamāna* (the object compared to)

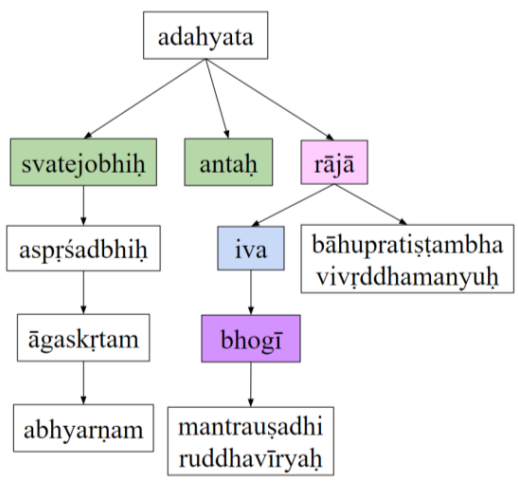
Table 3. Tags and their Meanings

2. Features of the Dependency treebank of *upamā*

2.1. Unfolding *upamā*

A dependency tree structures head-modifier relations using defined tags. To analyse *upamā*, we present three progressive dependency trees per instance, illustrating its depth step by step. Verse 32, depicted in Figures 1, 2, and 3, describes King *Dilīpa*'s fury upon failing to protect the divine cow from a lion. The *upamā* compares *upameya Dilīpa* to the *upamāna* serpent—both possessing immense power yet restrained by external forces.

- Figure 1 identifies the simile within dependency relations for basic comprehension.
- Figure 2 (morph-dependency tree) maps syntactic relations through labelled arrows, clarifying grammatical structure.
- Figure 3 delves deeper into word components, distinguishing root and termination levels, following the morpho-syntactic analysis guidelines of Kulkarni et al. (2010:113).



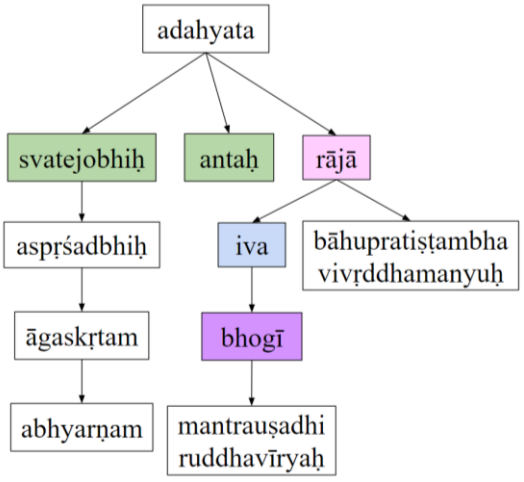


Figure 1. Dependency tree of verse 32, Figure 2. Morph-dependency tree of verse 32

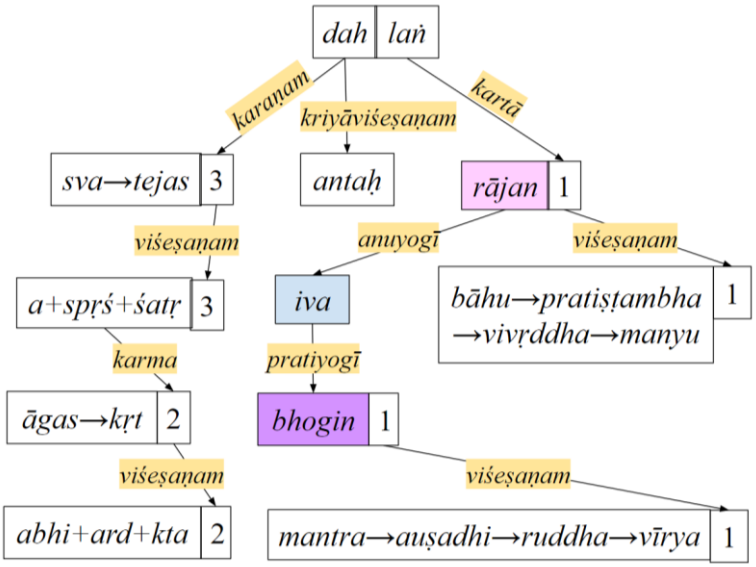


Figure 3. Internal morph-dependency tree of verse 32

2.2. Types of *upamā*

We aim to help readers identify types of *upamā* through this treebank, based on 25 categories outlined in *Kāvyaprakāśa*. By analysing the dependency tree, we provide an easy way to classify *upamā* using colour-coding and morph-dependency details for a basic three-fold classification (Table 4).

Based on the components present	*pūrṇā*	*luptā*	-
Based on *sādharmyadyotaka*	*śrautī*	*ārthī*	-
Based on the morphology of the compared ones	*vākyagā*	*samāsagā*	*taddhitagā*

Table 4. Classification of *upamā* according to *Kāvyaprakāśa*

2.2.1. *Pūrṇā* and *Luptā*

The colour shades and tags indicate whether a simile is *pūrṇā* (complete) or *luptā* (elliptical). For example, Figure 4 (Verse 7, Nandargikar, 1897: 39) lacks a green box, indicating it is a *sādhāraṇadharmaluptā upamā*, where the description of similitude is absent. Figure 5 (Verse 15, Nandargikar, 1897: 40) lacks a blue box linking the *upameya* and *upamāna*, as well as the *anuyogī* and *pratiyogī* tags, identifying it as a *dyotakaluptā* simile, where the word denoting similarity is missing.

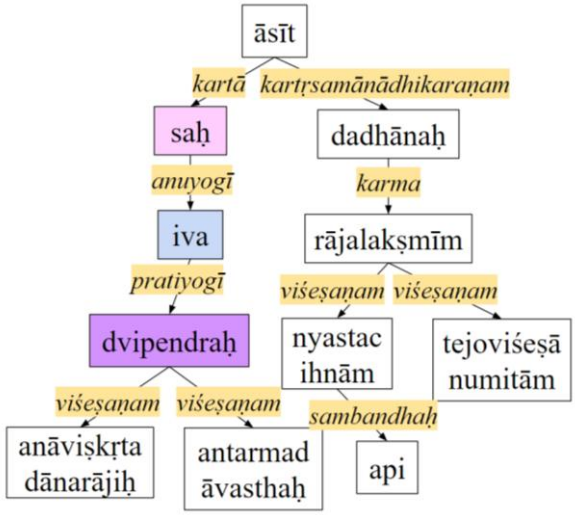


Figure 4. Morph-dependency tree of Verse 7 showing *sādhāraṇadharmaluptā* simile

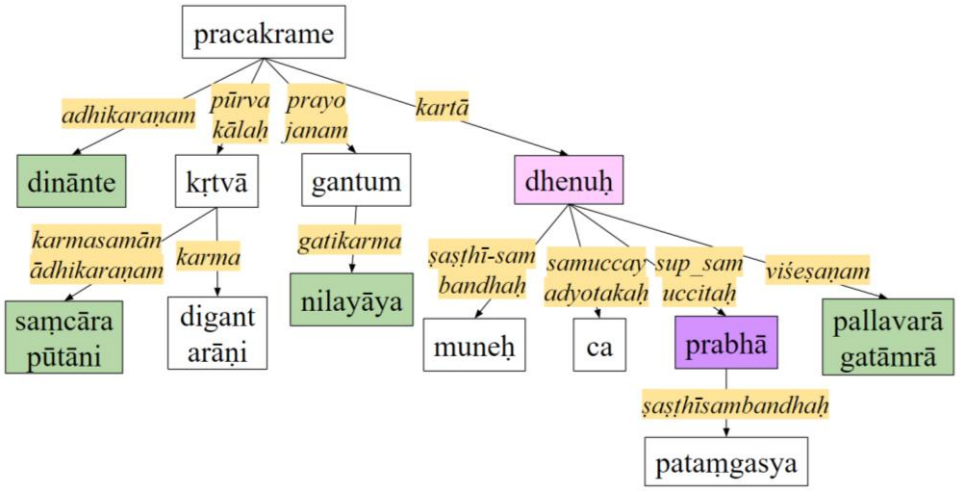


Figure 5. Morph-dependency tree of verse 15 showing *dyotakaluptā* simile

In this data, we observe that the *sādhāraṇadharma* is often elided in similes associated with *karma-kāraka*. For similes linked to a *kartā*, the verb typically expresses the occasion-specific *sādhāraṇadharma*[5]. Additionally, verses 15 and 73 feature multiple green boxes, indicating that more than one *sādhāraṇadharma* is shared between the *upameya* and *upamāna*. In such cases, wordplay allows the description of objects to apply to both elements, with the simile often involving a pun. For instance, in verse 73 (Nandargikar, 1897: 62), the word *navodaya* refers both to King *Dilīpa*'s return to his capital and the rise of the moon, with the attributes[6] fitting both *Dilīpa* and the moon perfectly.

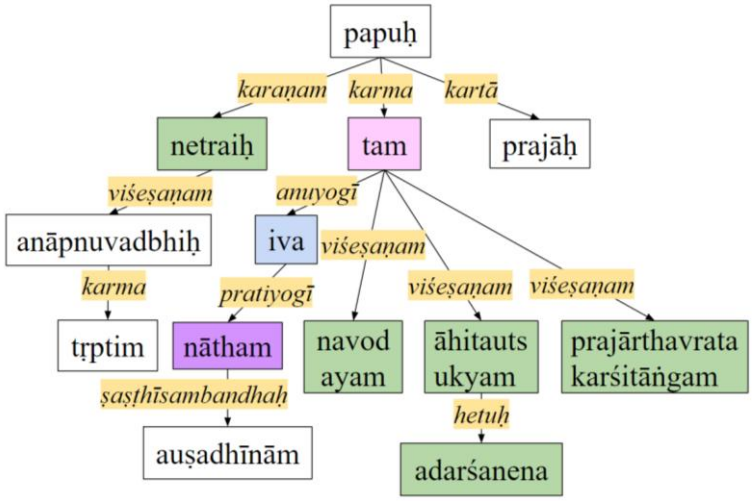


Figure 6. Morph-dependency tree of verse 7 showing a simile accompanied by a pun

2.2.2. *Śrautī* and *Ārthī*

The distinction between *śrautī* and *ārthī upamā* depends on how quickly one perceives the beauty in the similitude. *Śrautī* is grasped instantly with all its components, whereas *ārthī* involves *āsvādavilamba*[7]—a delay in realising the similarity and its elements. The *dyotaka* plays a key role in triggering this process[8]. In a dependency tree, this classification can be partially identified by the presence of markers like '*iva*, *yathā*,' etc.

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[5] See for instance: *anvagacchat* in verses 2 and 6, *pāsi* in verse 48, *ādhatta* in verse 75.

[6] 1) *adarśana* (non-appearance) - The king had stayed in the *tapovana* for a long time; the moon is not visible on no moon day 2) *autsukya*- eagerness on the part of people to get at least one glimpse 3) *prajārthavratakarśitāṅga* - Emaciated limbs of the king due to observance of a vow for *prajā* i.e. child. Reduced phases of the moon as he too observes a vow for *prajā* i.e., the people, the world. He allows the gods to drink him hence, fades away 4) *netraiḥ papuḥ*- (Kale, 1922: 447) *sādaramavalokanaṃ pānamucyate* (Nandargikar, 1897: 884)

[7] '*ārthyāmupamānopameyanirṇayavilambena-āsvādavilambaḥ; tadabhāvaḥ śrautyām*' from *Udyota* commentary (Abhyankar, 1929: 444)

[8] '*yathevādiśabdānāmupādāne śrautī; tulyādīnāṃ śabdānāṃ prayoge ārthī*' from *Pradīpa* commentary (ibid: 442)

2.2.3. *Vākyagā, Samāsagā* and *Taddhitagā*

An internal morph-dependency tree helps determine whether a simile appears in a sentence, a compound, or a word with a specific affix. In this data, 19 out of 20 instances fall under the *samāsagā* category, as *iva* is commonly present and always compounded[9]. Parameters[10] like *bhinnavibhaktikatva* (different cases) and *asamastatva* (non-compound) help identify *vākyagā upamā*, as case markings indicate grammatical roles. For example, Verse 9 (Nandargikar, 1897: 38, Figure 7) is the only *vākyagā upamā* in this dataset, where King *Dilīpa* is compared to *Varuṇa* based on their shared role in law enforcement. Additionally, the position of *iva*[11] (linked to the verb) suggests that this verse also exemplifies *utprekṣā* (another figure of speech).

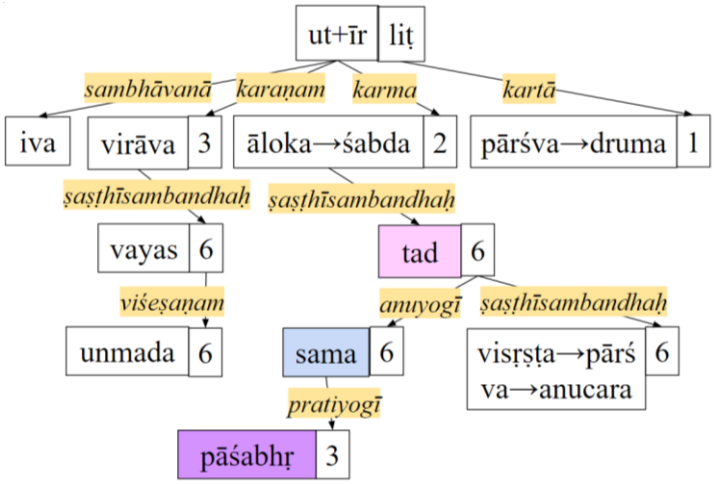

Figure7. Morph-dependency tree of verse 9 showing *vākyagā* simile

2.3. Denoting *bimba-pratibimba-bhāva*

Upamā compares two inherently different objects based on a strikingly similar property. However, sometimes, similarity extends beyond an object to its entire environment. *Bimba-pratibimba-bhāva*[12] refers to this similitude within the broader context of explicitly compared objects. It appears in various forms. At times, *upameya* and *upamāna* share comparable

[9] '*ivena nityasamāsaḥ*' from *Kāvyaprakaśa* (ibid: 443)
[10] '*upamānādipadāni catvāryapi yatrāsamastāni bhinnavibhaktikāni sā vākyagā*' from *Pradīpa* commentary (Ibid: 441)
[11] '*ivādīnāmupamānamātrānvitatā*' from *Pradīpa* commentary (Abhyankar, 1929: 450). In *upamā*, *sadharmyadyotaka* is connected to the *upamāna* only.
[12] This concept is central to *drṣṭānta* and *prativastūpamā* (Mishra, 2015: 67). *Udyota*, a commentary on *Kāvyaprakāśa* (Abhyankar, 1929: 445), also highlights *bimba-pratibimba-bhāva* in an *upamā* example. Following this approach, we identified this phenomenon in most *upamā* instances in our data and represented it with shaded boxes in our diagrams for clarity.

adjectives, especially when *sādhāraṇadharma* is elided[13]. Sometimes, a primary *upameya* (usually *kartā*) is supported by subordinate *upameya*-s like *karma* and *karaṇam*. Together, they form the *bimba*, reflected[14] in their corresponding *pratiyogī*-s—*upamāna-kartā, upamāna-karma*, etc.

To determine if these mirrored objects (called so by Desiraju, 2010) qualify as separate similes, we examine verses 2 and 75. Verse 2 (Nandargikar, 1897: 36) contains 2–3 *upameya-upamāna* pairs with a single *dyotaka*, *iva*. To meet *iva*'s expectancy, we create two separate trees, each with one *upameya-upamāna* pair (Figure 8). By merging them with *iva* as the principal simile and marking others as mirrored objects, we derive the full verse's dependency tree (Figure 9), demonstrating the necessity of *bimba-pratibimba-bhāva*.

In verse 75 (Nandargikar, 1897: 63), a cluster of *upamā* (Figure 10) features two distinct similes, each with its own *iva*. Both *kartā* and *karma* are compared to different objects, with the *dyotaka* appearing twice. Therefore, cases where a single *dyotaka* governs multiple *upameya-upamāna* pairs should be treated as instances of mirrored objects.

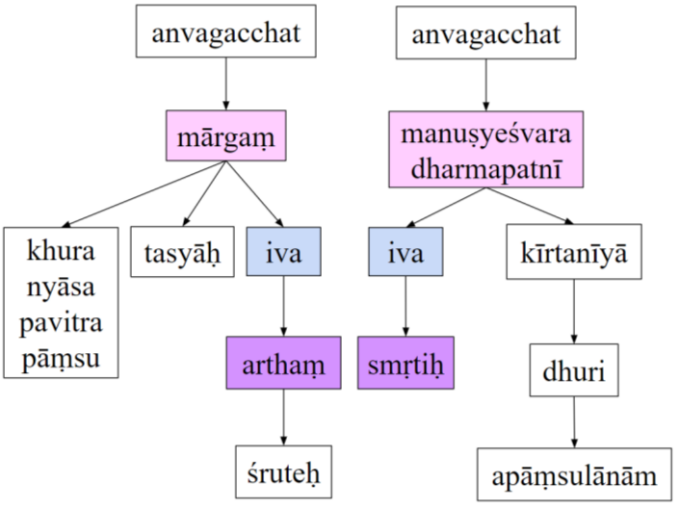

Figure 8. Separate the dependency trees of pairs of *upameya* and *upamāna* from Verse 2

[13] For instance: verses 7, 37, etc.
[14] See dependency trees of verses 2, 10, 15, 20, etc.

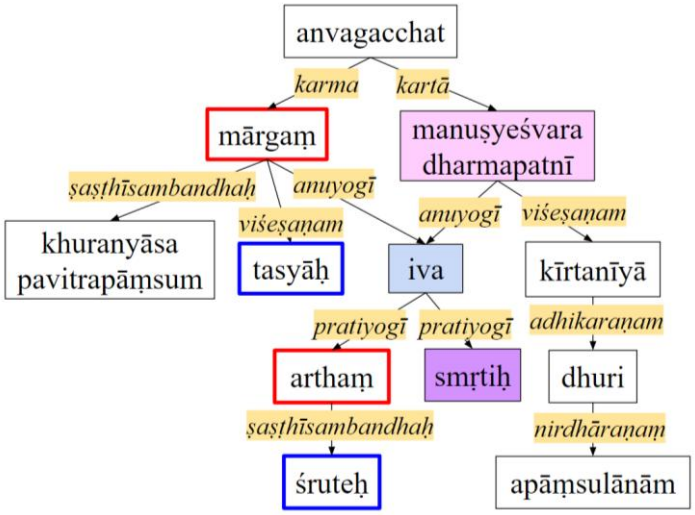

Figure 9. Morph-dependency tree of verse 2 showing a simile with mirrored objects

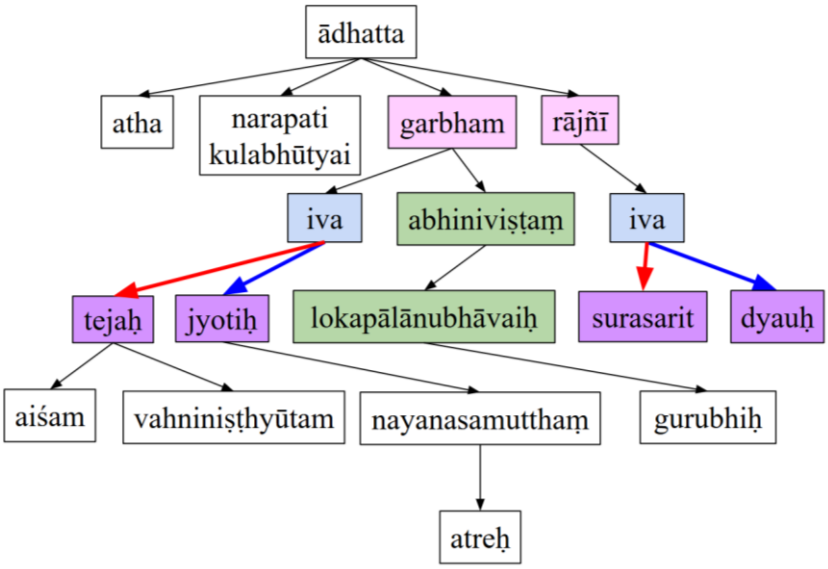

Figure 10. Dependency tree of verse 75

2.4. Additional benefits of the dependency model

A verse's *khaṇḍānvaya*[15] can be derived from its dependency tree, which visually represents a *khaṇḍānvita* sentence (Kulkarni & Das, 2012). This aids comprehension and captures sequential similarity within the structure. Matching arrows effectively denote correspondence, as seen in verses 6 and 75. In verse 6 (Figure 11), the simile highlights the king's devotion to serving the cow—wholeheartedly following her, forsaking his royal status

[15] It is a method of analysis of text with verb being the head and other relations being its modifiers.

and even himself. This dedication parallels how a shadow clings to a person, never leaving or separating from them.

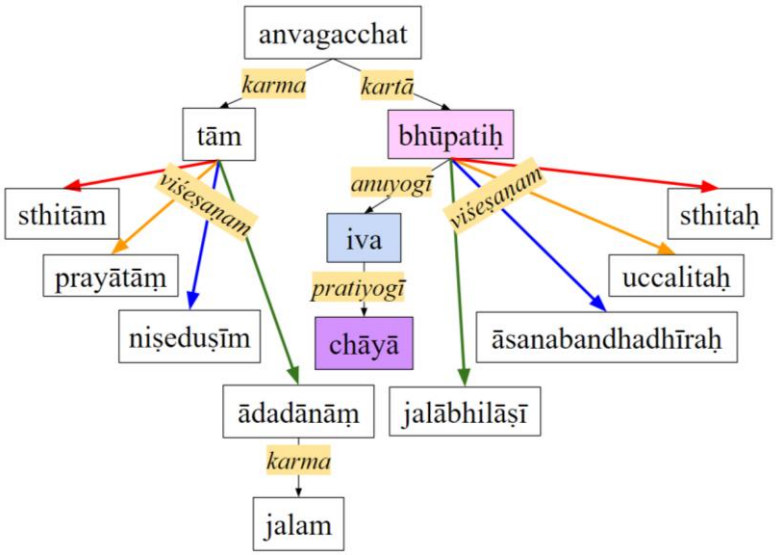

Figure 11. Morph-dependency tree of verse 6 showing a sequence through arrows

3. Concluding remarks

The previous sections explored how integrating dependency and *upamā* offers various advantages. *Kāraka* analysis within morph dependency has led to a potential template for simile dependency. Constructing dependency trees for multiple similes revealed a consistent *kāraka* assignment pattern, forming the basis for the prototype template of *upamā* dependency (Figure 12). By substituting values in this template, we can generate dependency trees for different *upamā* instances.

Since poetry is an artistic expression, rigid modelling is challenging. However, we propose a minimalistic framework based on the *kāraka* variations in the second canto of *Raghuvaṁśam*. This framework includes nodes for *vākya*-relations, various *kārakas* and the *upamā* relation at the second level, as similes primarily modify *kartā* or *karma*. The second canto contains 20 simile instances, summarised in Table 5.

Associated with *kartā*	11	Associated with *karma*	8
pūrṇā	6	*luptā*	14
śrautī	13	*ārthī*	7
vākyagā	1	*samāsagā*	19

Table 5. Classification of similes from *Raghuvaṁśam* Canto II according to their types

This study catalogues the similes in the second canto of *Raghuvaṁśam*, classifies them as per *Kāvyaprakaśa* and presents manually drawn dependency and tagged morph-dependency trees for each instance[16]. The next step is to train existing parsers to better process figures of speech. Beyond machine training, this treebank will aid research, information retrieval and education.

Currently, only the second canto has been analysed, but this approach can extend to all *Raghuvaṁśam* cantos and other rhetorical figures involving similarity and comparison. An indigenous treebank dedicated to figures of speech would encourage further study. The tag set can be refined to include *upamā*-specific elements like *sādhāraṇadharma* and *pratibimbita-upameya*. Elided *upamā* components can be marked with dotted lines in dependency trees for clarity. Additionally, we plan to modify the third dependency tree in several instances to better represent similes within compounds.

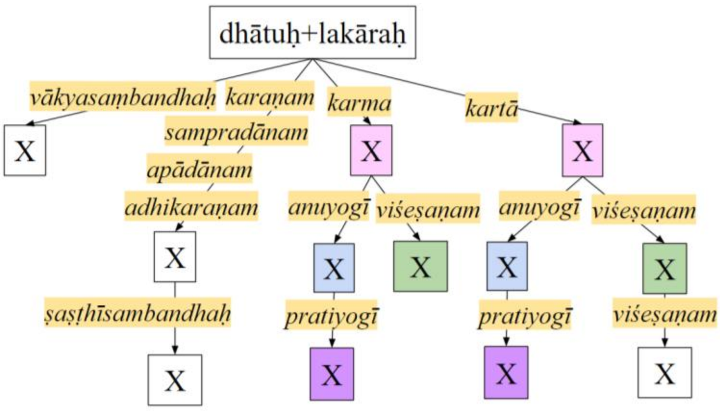

Figure 12. Template of dependency model for *upamā*

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