



# Strategies of Effective Digitization of Commentaries and Sub-commentaries Towards the Construction of Textual History

Diptesh Kanojia, Malhar Kulkarni, Sayali Ghodekar, Eivind Kahrs,  
and Pushpak Bhattacharyya  
IITB-Monash Research Academy  
IIT Bombay  
Monash University  
Cambridge University  
diptesh@cse.iitb.ac.in

# Contribution

Our contribution is the addition of two major features to a tool:

- Enable the addition of “n” number of commentaries data to the tool.
- Enable the addition of “n” number of sub-commentaries data to the tool.

The tool already provides the following features:

- Enable philologists to enter data for any text (including vulgate data) and various manuscripts versions.
- Compare the different versions in a separate mode.
- Edit the data while viewing the manuscript labels.
- Constructs phylogenetic trees based on distance matrices which can be constructed based on different approaches.

# Roadmap

- Introduction
- Tool Development - Additional Features
- Methodologies for Tree Construction
- Discussion and Conclusion

# Introduction

# Text as a historical document

Texts are primary sources of History-Physical + Intellectual- of any land.

Texts themselves have a history and evolve in the course of time.

Intellectual traditions get built around texts, ex: Text of Panini's grammar and the Paninian grammatical tradition that continues till date

Texts in the Indian tradition show stages of evolution, important in the reconstruction of history of that tradition

***Can digital technology help study/record the evolution of texts in Indian tradition?***

# Textual History and Criticism

Written transmission is carried out through copies of the text, also known as manuscripts. Historically, manuscripts were written or copied by one or more scribes.

Transmission of the text from one source to another generates variants which differ significantly when compared to each other.

Commentaries elaborately explain the wordings of terse sutras.

They also codify the various methodologies of interpreting these texts and they also act as a mirror as far as the process of intellectual development is concerned.

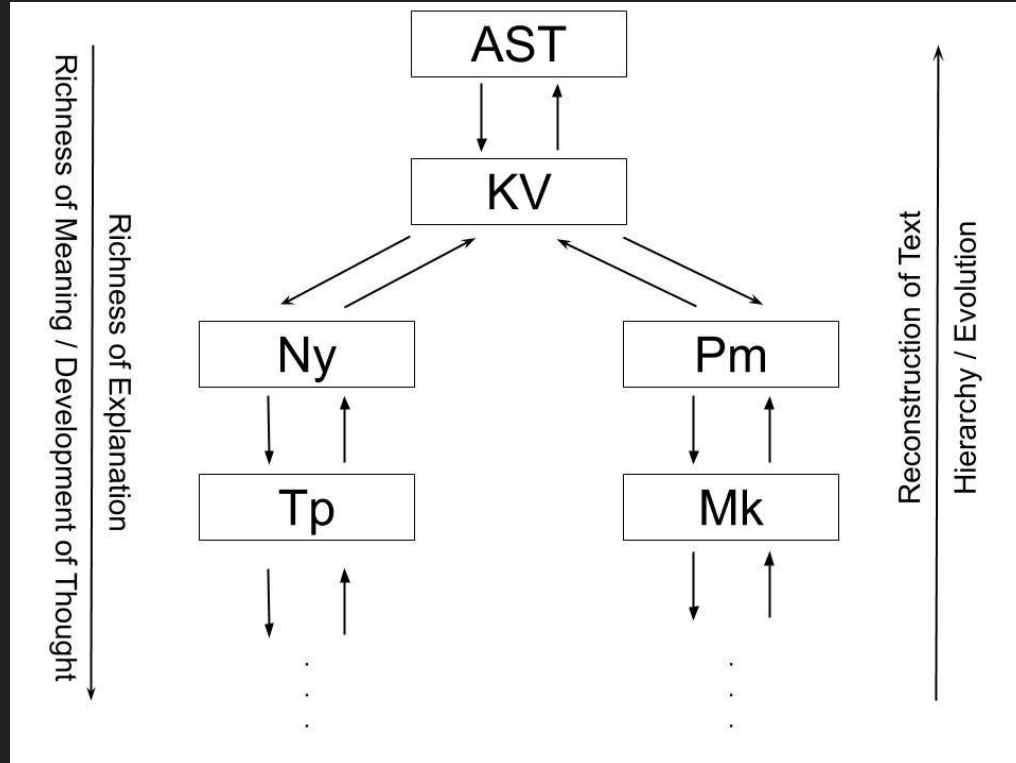
# Motivation

When we study the texts in the Indian grammatical tradition, that too, the paninian one, traditional commentators like Madhava and Bhattoji Dikshita etc., and modern scholars like Kielhorn (1887) and Kulkarni (2012a) observe that the text of the Aṣṭādhyāyī (AST) has evolved in the course of time.

The text of the sutras that Patanjali had in front of him is not the same as we have it today. It becomes important for scholars interested in the development of an intellectual tradition of linguistic thought in India to study the evolution of Kāśikāvṛtti (KV) through various sources like commentaries and manuscripts.

Commentaries represent evolution and development of linguistic thought in India over a period of more than one thousand years. It is therefore important to have with us a critical text of the commentary, for example, the *Kāśikāvṛtti* (KV).

# Evolution of the commentaries on AST





# Functional Units

The text of KV, as mentioned above, can be, generally, divided into its functional parts.

There are two basic divisions in the text of KV, one that of the sūtra and other of the KV. Within the KV, the text can further be divided according to its functional properties based on the type of sūtra it is commenting upon.

We present below the functional divisions in the KV on the saṁjñā sūtra.

saṁjñā: this type of sūtra introduces a technical term, and hence the KV on this sūtra is observed to contain the following functional parts:

1. Introduction of the words in the sūtra and meaning of the sūtra.
2. Examples.
3. Mention of other sūtras in which this technical term appears.

# Example

1.1.1.	Sutra	वृद्धिरादैच् [१॥१॥१]
1.1.1.1	Introduction & Meaning	वृद्धिशब्दः संज्ञात्वेन विधीयते प्रत्येकमादैचां वर्णानां सामान्येन तद्भावितानामतद्भावितानां च। तपरकरणमैजर्थं तादपि परस्तपर इति खट्वैरकादिषु त्रिमात्रचतुर्मात्रप्रसङ्गनिवृत्तये।
1.1.1.2	Examples	आश्वलायनः। ऐतिकायनः। औपगतः। औपमन्यवः। शालीयः। मालीयः।
1.1.1.3	Other Occurrences of the term	वृद्धिप्रदेशाः। सिचि वृद्धिः परस्मैपदेषु इत्येवमादयः॥

# Tool Development

# Technical Development

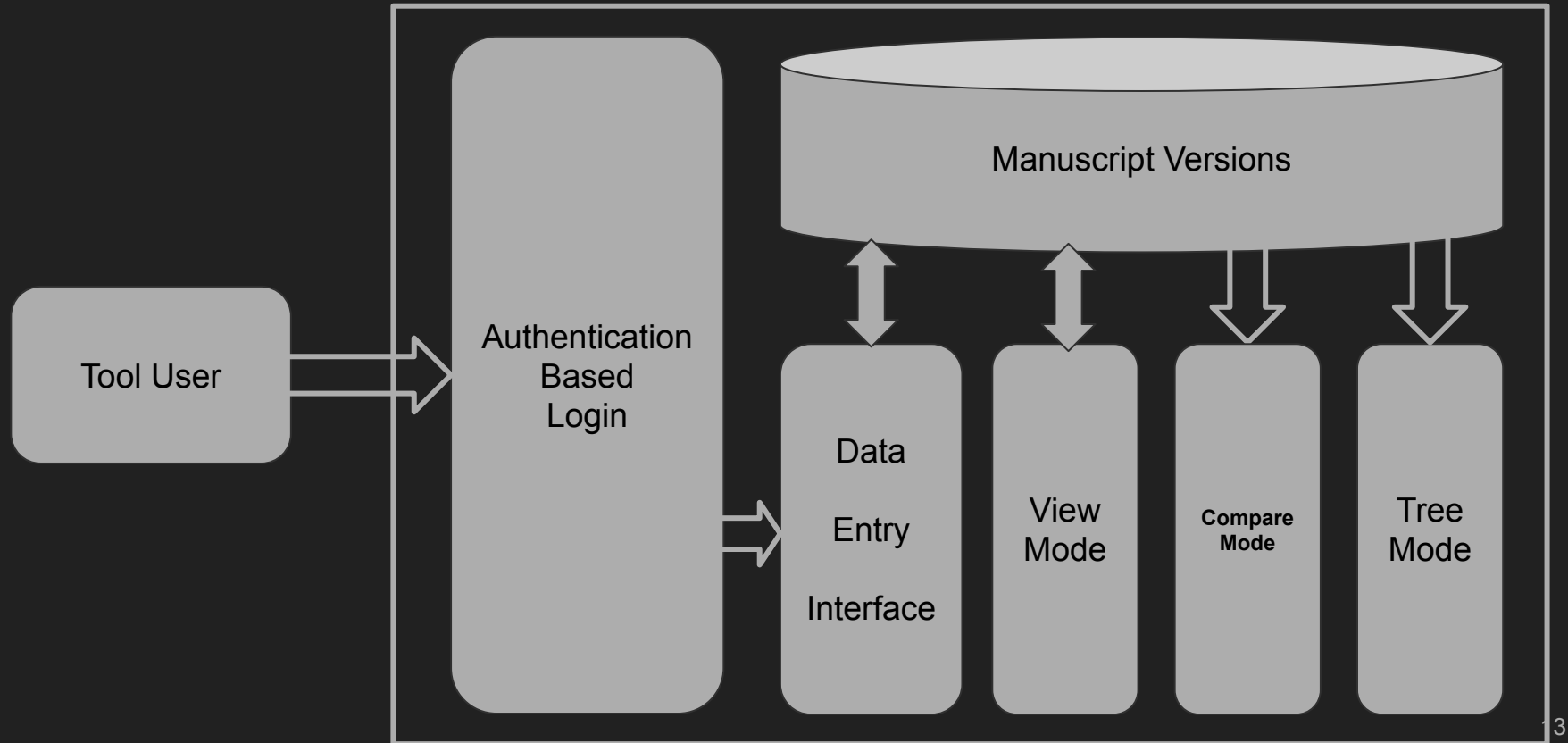
We develop the tool by using a simple server-side scripting language i.e., PHP and use MySQL for database storage on the backend. We use the Apache web server to host our tool.

Our tool allows a user to register themselves for using the tool via a simple registration form. The registration needs to be validated by the tool administrator.

The user can then logon to the tool and use the functionalities described further in our presentation and the paper.

The tool also uses Javascript, AJAX, CSS and HTML wherever necessary.

# Tool Architecture



# Data Entry Mode (Additional Feature Description)

The tool allows one to add the text in the data entry mode. It displays the vulgate text by default given the philologist has entered the vulgate text data earlier.

If not, the tool allows one to enter the data for a vulgate. In a rare case when the vulgate data is absent, the tool allows one to prepare the various versions in this mode.

Our current work allows philologists to add the text from any further commentaries on the text in question.

We provide text boxes divided based on functional units which allow one to enter the commentary data divided in the form of these units thus easing data entry.

# Commentaries

Our tool allows one to enter the commentaries on the text based on the philologists' expertise.

- The text of the commentary is entered in correspondence with the functional unit of the main text. As many functional units, so many boxes.

Apart from the functional unit module, the tool shows extra entry points for any commentary instances which may exist for the text.

We allow one to enter different commentaries based on the text distribution (sutras, proses, or verses).

The commentaries can be taken into account later when building phylogenetic trees using direct and indirect evidences from them.

# Direct Evidence from the Commentaries

Kulkarni and Kahrs (2019a) show that the textual evidence available in these two commentaries - Nyasa (Ny) and Padamanjari (Pm), can be classified under two broad categories:

- Direct Evidence
- Indirect Evidence

Kulkarni (2002c) mentions the effort on the part of its author to collect information from the Ny and the Pm, which can act as an evidence to reconstruct the text of the KV. Kulkarni and Kahrs (2019b) enlist the variants of the text of the KV as found in the Pm through more than 300 quotations.



# Indirect Evidence from the Commentaries

Indirect commentaries are the commentaries on the direct commentaries.

Tantrapradipa (Tp) is a commentary on Ny. Therefore, it becomes an indirect commentary on the KV.

While Direct evidence is clearly visible in the text of the Ny and Pm, indirect evidence can be further classified under two categories:

- paroksha
- atiparoksha

From the given text, a portion can be highlighted based on whether it is direct or indirect. Further classification of indirect commentaries is provided in our paper.

# Commentaries Entry - Screenshot

**FUNCTIONAL UNITS**

दारूपाश्चत्वारो धातवो धारूपौ च द्वौ घुसंज्ञका भवन्ति दाब्दैपौ वर्जयित्वा।Add More

डुदाञ् परणिददाति। दाण् परणिदाता। दो परणिद्यति। देङ्  
\foliochange{७अ}परणिदयते। डुधाञ् परणिदधाति। धेदX

अदाबिति किम्? दाप् लवने। दातं बर्हिः। दैप् शोधने। अवदातं मुखम्।X

घुपरदेशाः। नेर्गदनदघुमास्थागापाजहातिसां हलि इत्येवमादयः॥X

**COMMENTARIES**

Add

दाधाः घु अदाप्

दारूपाः चत्वारः धातवः धारूपौ  
च द्वौ दाब्दैपौ वर्जयित्वा

डुदाञ् परणिददाति [दाण्]  
परणिदाता दो परणिद्यति [देङ्]

अदाप इति किम् दाप् लवने –  
[दातम् बर्हिः] दैप् शोधने

NaN NaN NaN NaN

ADD SUB-COMMENTARIES

# Adding Sub-commentaries - Screenshot

**FUNCTIONAL UNITS**

वृद्धिशब्दः संज्ञात्वेन विधीयते परत्येकमादैचां वर्णानां सामान्येन तद्भावितानामतद्भावितानां च। तपरकरणमैजर्थं

आश्वलायनः| \beforec ऐतिकायिनः\afterc ऐतिकायिनः| औपगवः| औपमन्यवः| शालीयः| मालीयः|

वृद्धिप्रदेशाः| सिचि वृद्धिः परस्मैपदेषु इत्येवमादयः||

**COMMENTARIES**

Ny

वृद्धिः आत् ऐच्

वृद्धिशब्दः सञ्ज्ञात्वेन [विधीयते] परत्येकम् आदैचाम् वर्णानाम्

आश्वलायनः ऐतिकायनः औपगवः औपमन्यवः शालीयः मालीयः

NaNNaNNaN

वृद्धिः आत् ऐच्	वृद्धिः आत् ऐच्
वृद्धिशब्दः सञ्ज्ञात्वेन [विधीयते] परत्येकम् आदैचाम् वर्णानाम्	वृद्धिशब्दः सञ्ज्ञात्वेन [विधीयते] परत्येकम् आदैचाम् वर्णानाम्
आश्वलायनः ऐतिकायनः औपगवः औपमन्यवः शालीयः मालीयः	आश्वलायनः ऐतिकायनः औपगवः औपमन्यवः शालीयः मालीयः

# View Mode - Screenshot

(ग्रन्थातहास=दशक=यन्त्रम्)

Data Entry Mode Compare Mode View Mode Phylogenetic Tree Mode Logout

Select from Manuscripts Select from Labels Select from Sutras

kashikavritti A6 1.1.1.

Manuscript\_Text

वृद्धिरदिच् | (१॥१॥१)

FUNCTIONAL UNITS

Functional Unit 1	Functional Unit 2	Functional Unit 3	Functional Unit 4
वृद्धिशब्दः संज्ञालेन विधीयते प्रत्येकमादेयां वर्णानां सामान्येन तद्भववितानामतद्भाववितानां च   तपरकरण \lacuna {9} रस्तपर इति वृष्टका वृक्षेडका खट्टाएडका खट्टेडका वृक्षेडका दियु \eyeskip {} त्रिमात्रचतुर्मात्रनिवृत्तये	आश्रुतायनः   ऐतिकायनः   औपगवः   \lacuna {4} मालीयः   \illegible {२} कुलं	वृद्धिप्रदेशाः   वृद्धिर्यस्याचामादिस्तद्वृद्धम्   सिचि वृद्धिः परस्मैपदेषु इत्येवमादयः	NULL
Functional Unit 5	Functional Unit 6	Functional Unit 7	Functional Unit 8
NULL	NULL	NULL	NULL



# Discussion and Conclusion

# Observations

We observed that there will be commentaries over commentaries of the text and we needed to further inculcate the option of addition of sub-commentaries within the tool.

We have successfully added this feature to the tool thus getting a step close to making to more comprehensive in terms of the features it has.

We also provide the functionality of adding commentaries and sub-commentaries in a recursive manner which allow one to add sub-sub-commentaries or to be precise - n-sub\*-commentaries.

# Conclusion

We present a comprehensive data entry mechanism which can help digitize historically written texts.

This tool can be used to add multiple variants of the same manuscripts along with the commentaries and sub\*-commentaries based on them.

More importantly, the phylogenetic tree construction can be done on the basis of commentary and sub-commentary data available in the tool. One can choose to use or ignore the data present for tree construction.

The tool can be used by a philologist to compare the various versions of a manuscript and construct phylogenetic trees based on two different methods.



# Future Work

We aim to add more methods for tree construction within the tool including the feature which can take into account the presence of a time frame for the variant.

We also aim to inculcate various factors like testimonia and earlier texts to build a more accurate phylogenetic tree for a given text.

We also aim to create a faster method for tree generation (current distance matrix calculation takes a little more time than we envision for a web based service).

# Tool Demonstration

<http://www.cfilt.iitb.ac.in/that/>

# Acknowledgements

Irawati Kulkarni and Nilesh Joshi, CFILT, IIT Bombay

Noemie Verdon, University of Lausanne, Switzerland.

University of Cambridge, United Kingdom.

IIT Bombay, India.

British Academy, United Kingdom.

Rashtriya Sanskrit Sansthan, New Delhi, India.

All the manuscript libraries.

# Thanks

Questions?