

# Treating utthita and utthāpya ākāṅkṣās independently for efficient parsing

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The dependency parser uses the expectancy (ākāṅkṣā) for parsing. Traditional Sanskrit texts discuss two types of ākāṅkṣās viz. utthita and utthāpya. The utthita ākāṅkṣā is mutual, while the utthāpya ākāṅkṣā is uni-directional. The stock example of utthita ākāṅkṣā is ‘pidhehi’ and ‘dvāram’. Both the words independently have an expectancy for each other. On the other hand while the word ‘sundaraḥ’ has an expectancy of another noun such as ‘rāmaḥ’, the word ‘rāmaḥ’ does not have an expectancy for an adjective such as ‘sundaraḥ’. From the structural point of view, the words representing utthita ākāṅkṣā represent the bare bone structure of a sentence, while the words with utthāpya ākāṅkṣā add flesh to it.

Taking into account the different strategies necessary to parse these two structures and given the fact that these two structures do not interfere with each other, we propose a parsing model which treats all the words with ‘viśeṣya-viśeṣaṇa-bhāva’ as a bag of words, and use only the utthita ākāṅkṣā to parse the sentence. Later the utthāpya ākāṅkṣā is used to establish the adjectival relations and then the results of these two parses are combined. Thus the overall complexity of such a parser is equal to sum of the complexity of each sub-task instead of their product.

The decision to parse these two types of relations independently, is further supported by the manually annotated dependency trees on the one hand, and the complexity involved in parsing the ‘viśeṣaṇas’ on the other. A manually parsed dependency trees of the anvaḃa of śrīmadbhagavadgītā has around 968 instances of the ‘kart.r’ relation, 868 instances of the ‘karman’ relation, whereas 1240 instances of ‘viśeṣaṇa’s, and 1095 instances of co-ordinations. The viśeṣaṇa relation is much more prominent than the kart.r or karman relation. Further the total number of possible span trees with ‘n’ viśeṣaṇas amount to  $n * n^{(n-2)}$ .