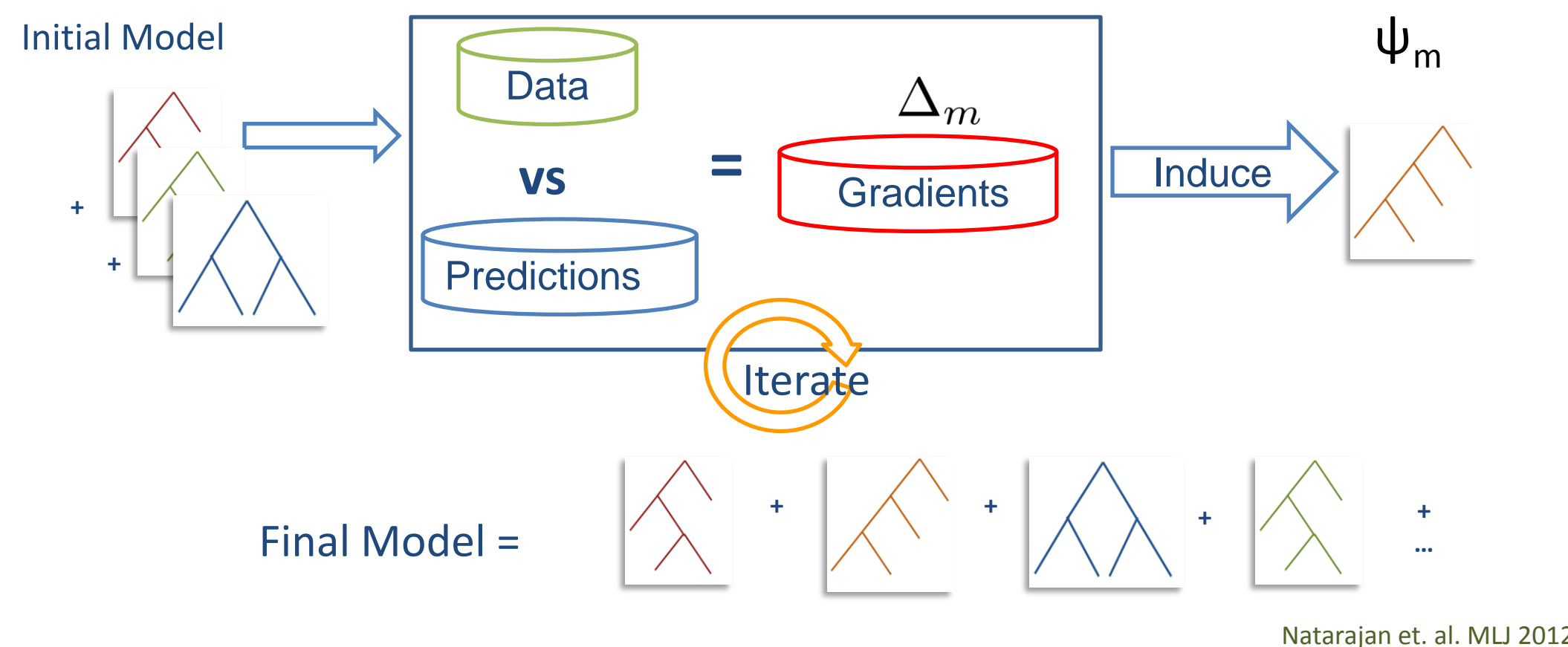


Motivation

- The TempEval task addresses the problem of extracting temporal relations from text. E.g.,
 - 'bought' event happened BEFORE '2002' in "He bought the house before 2002."
 - 'married' event OVERLAPS with 'September' in "She got married in September."
- Most of the approaches applied to the TempEval task independently learn relations for each task
 - Can lead to inconsistencies in the final prediction
 - e.g., $A < T$ and $T < B$ is inconsistent with $A > B$
- New approaches find consistent set of joint predictions
 - By selecting from the individual predictions during inference
 - By learning a joint model across tasks
- These approaches require the constraints to be provided by the expert
- We present an approach that uses structure learning in SRL models to learn these constraints while using expert advice when available

Relational Gradient Boosting



TempEval2 Tasks

- Determine the extent and features of the time expressions
- Determine the extent and features of the events in a text
- Determine the temporal relation between an event and a time expression in the same sentence**
- Determine the temporal relation between an event and the document creation time
- Determine the temporal relation between two main events in consecutive sentences.
- Determine the temporal relation between two events where one event syntactically dominates the other event.

In [September]^{t239}, it [announced]^{e133} [plans]^{e134} to [acquire]^{e135} the tropical-fruit business of RJR Nabisco Inc. 's Del Monte foods unit for #557 million (\$878 million).

Task C: e134 OVERLAP t239

Task E: e133 BEFORE e136

Task C: e133 OVERLAP t239

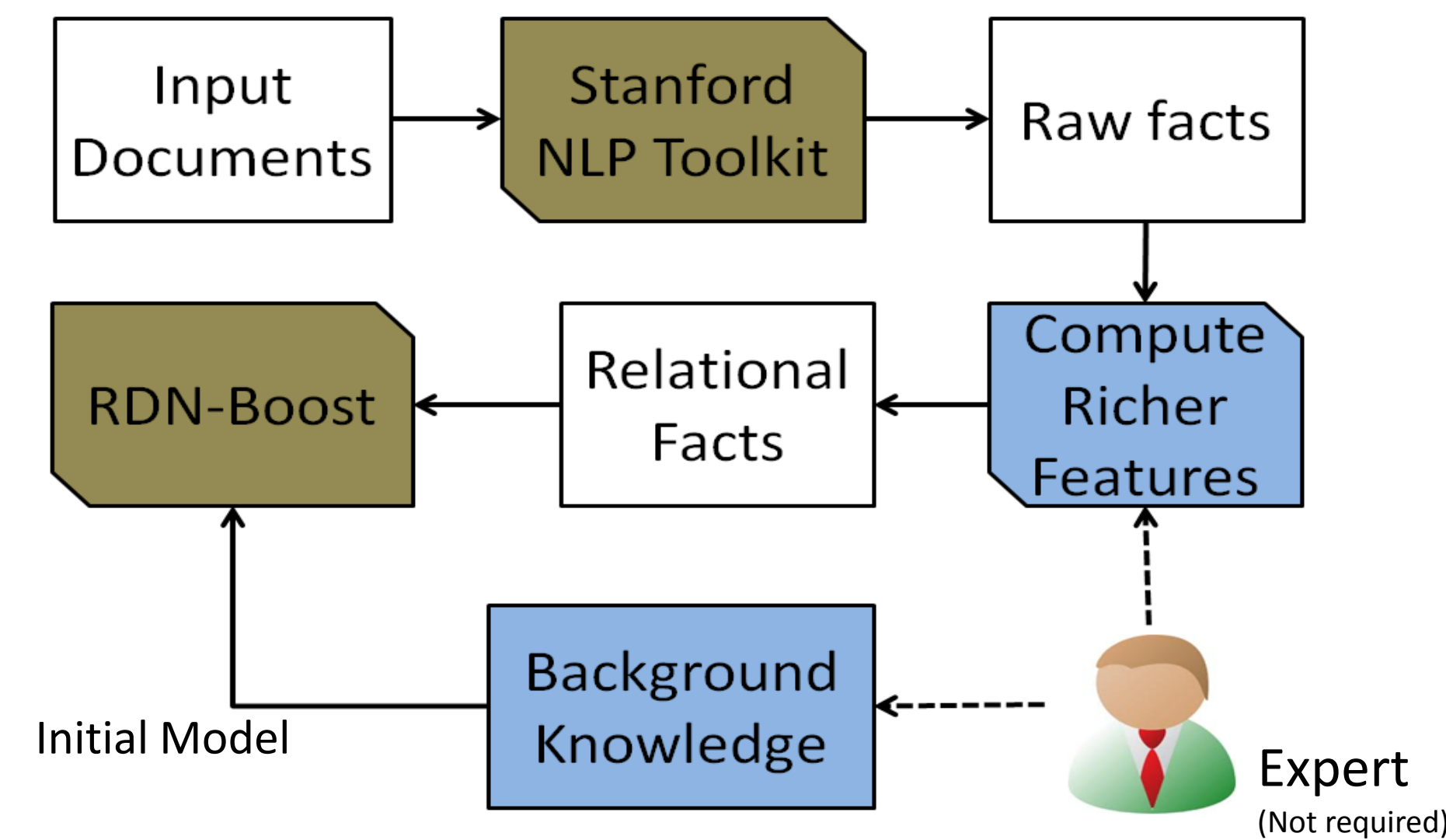
Task F: e134 BEFORE e135

Task C: e135 OVERLAP-OR-AFTER t239

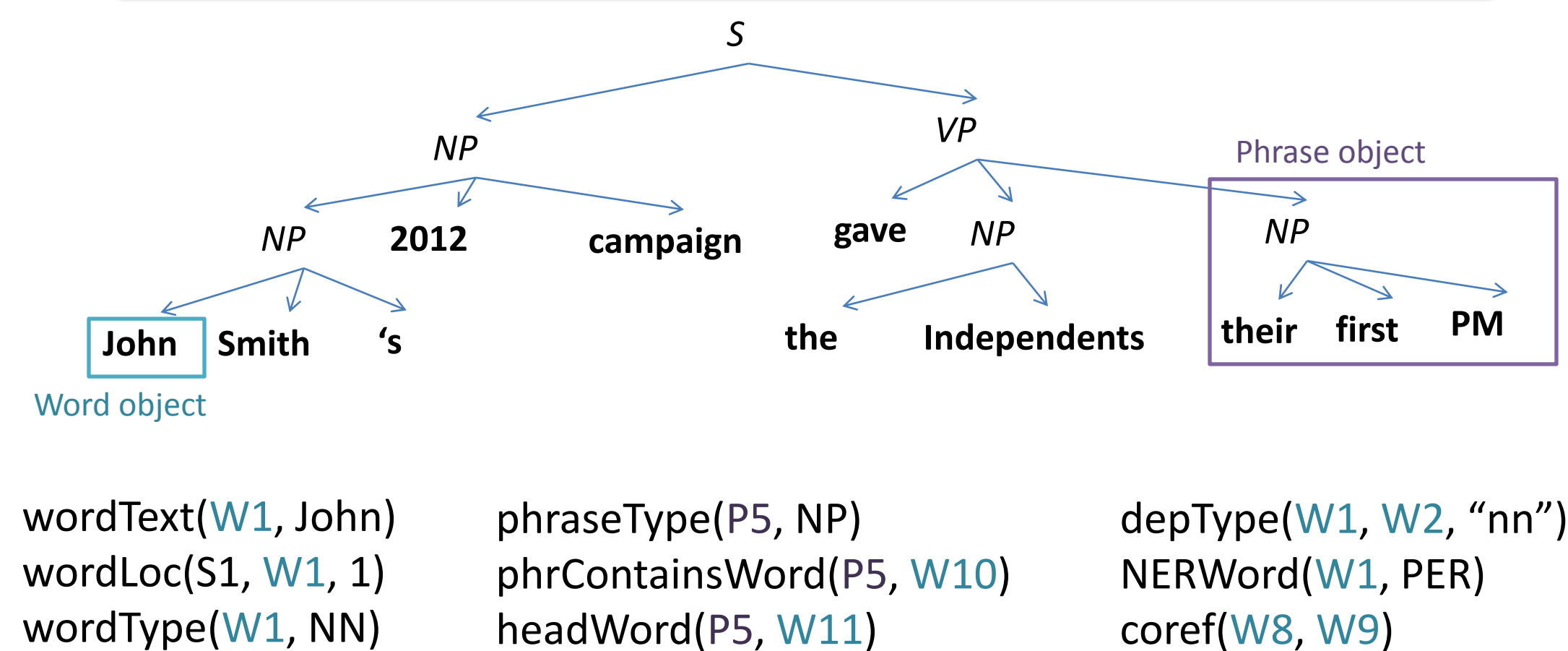
Task F: e133 OVERLAP e134

Verhagen et. al. Semeval 2010

Our Approach



Raw Facts



Richer Features

If DP goes up the tree and then goes down then it is a strong signal that the event and timex are not related

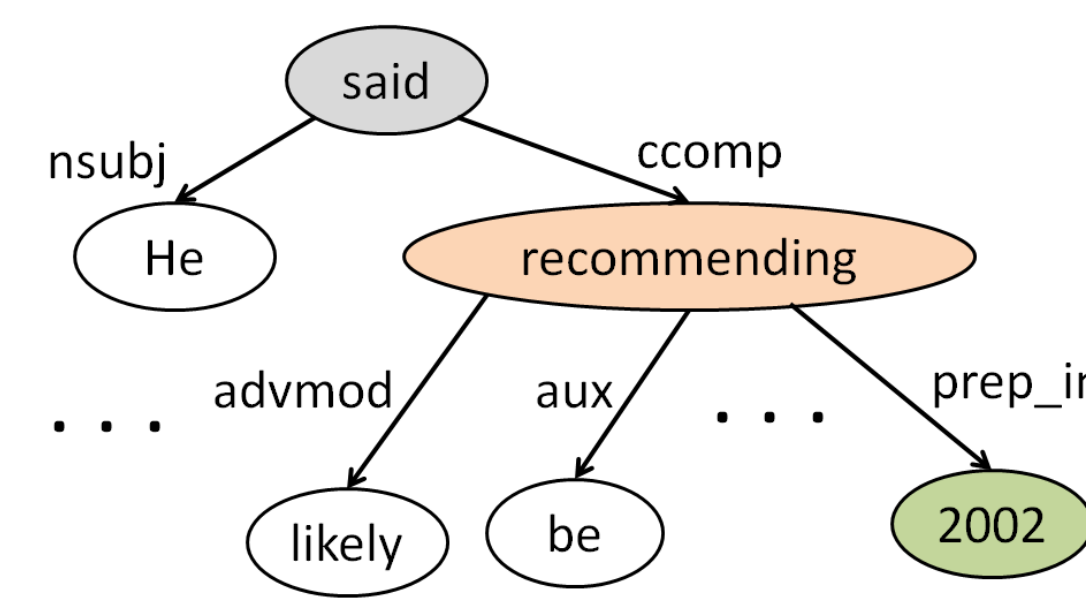
`veelnDepPath("be", "2002")`

Timex not related to the event, if a verb appears in the DP

`verbBetween("said", "2002")`

Verbs in the DP to the event can be ignored, if preceded by special dependency tags

`verbAlongDepPath("said", "2002", "recommending", "ccomp")`



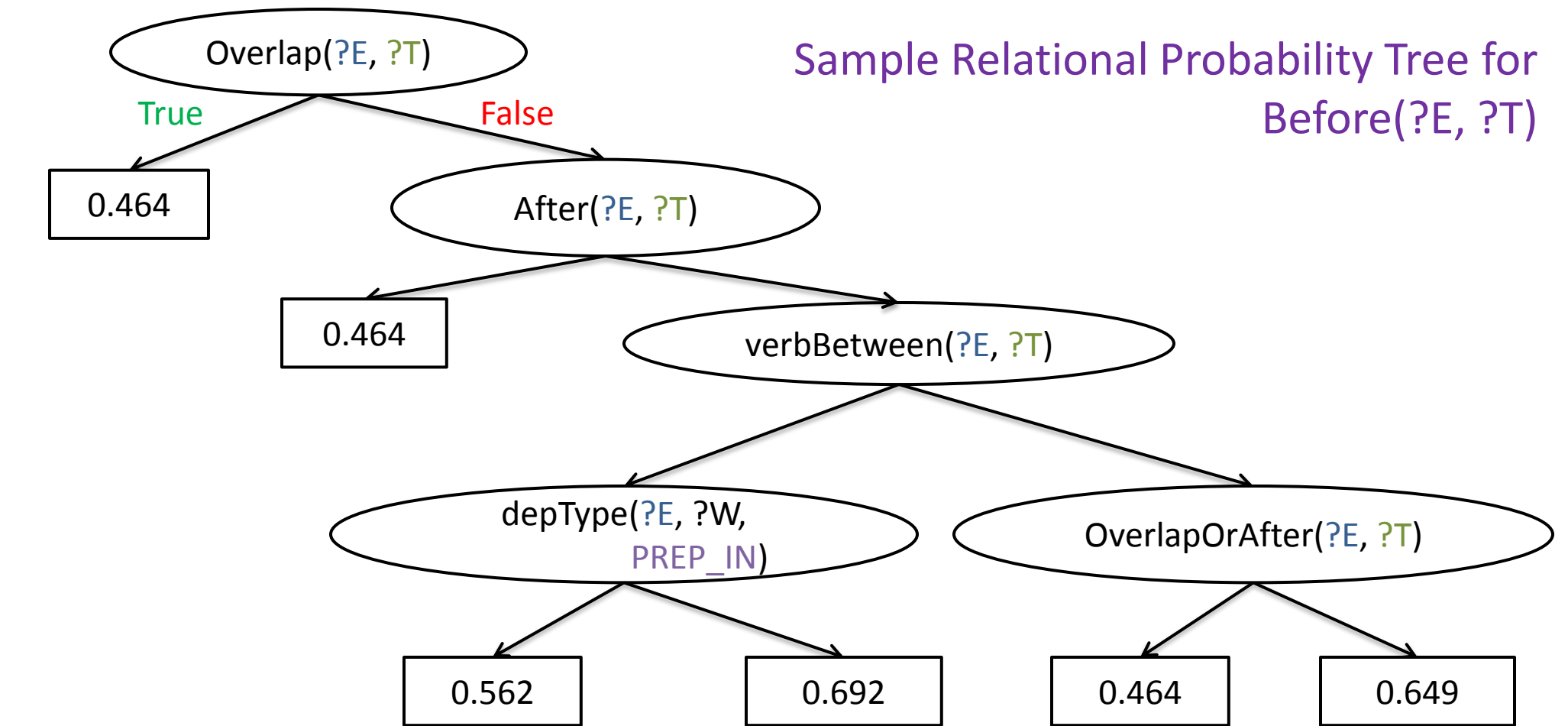
DP : Dependency Path
DG: Dependency Graph

Background Knowledge

- Previous SRL approaches designed rules for TempEval task
- We can use these rules as the initial model for RDN-Boost.
- E.g., a sample rule used by previous approaches was `relE2T(e1, t, "BEFORE") ^ relE2T(e2, t, "AFTER") -> relE2E(e1, e2, "BEFORE")`.
 - i.e., if $e1 < t$ and $e2 > t$ then $e1 < e2$
 - relE2T represents relations between events and timexes
 - relE2E represents relations between events.

Yoshikawa et al., ACL 2009

Results



Initial Results (Testset accuracy)

- Without expert advice: 0.56
- With expert advice: 0.60
- State-of-the-art: 0.65

UzZaman and Allen, Semeval 2010

Future Work

- Use the other TempEval tasks such as relation between events and document creation time to perform joint inference across tasks
- Use the cross-task MLN rules as the initial model
- Incorporate more features based on previous work on relation extraction such as the words between the event and timex
- Use the annotations from other tasks to increase the training data for relation extraction tasks
 - e.g., if the annotations have marked event $A < T$ and event $B > T$, we can add annotations to mark event $A < event B$

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