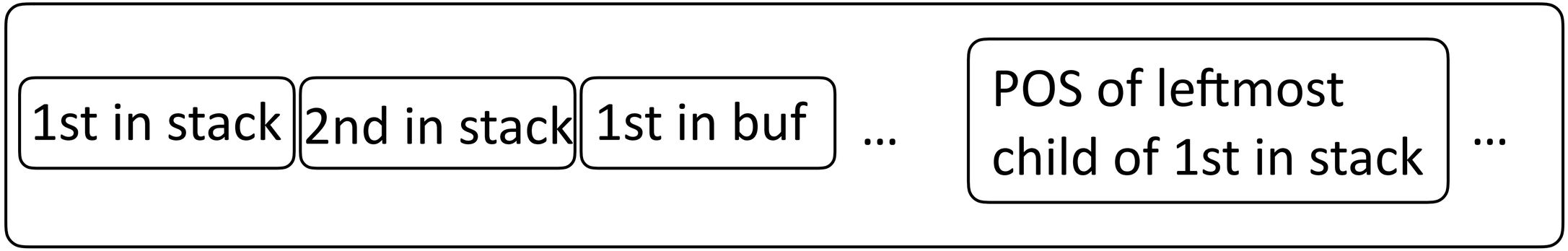
State-of-the-art Dependency Parsing

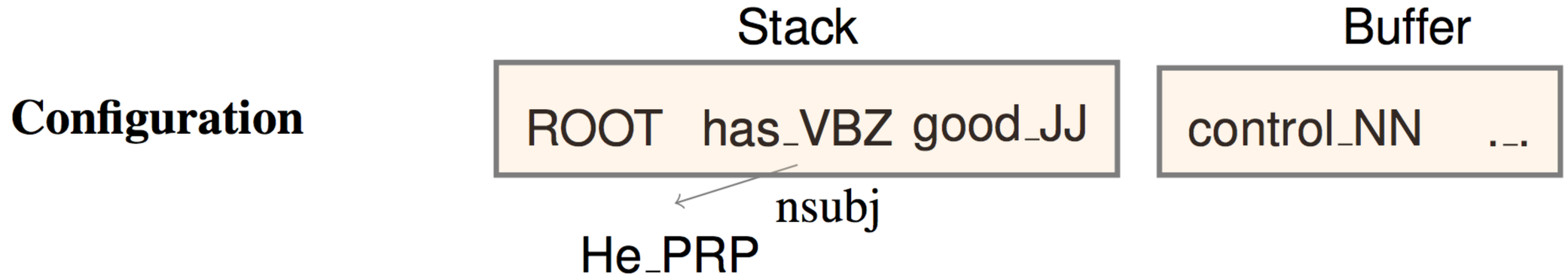
State-of-the-art Parsers

- Unlabeled attachment score: fraction of words with correct parent
- Labeled attachment score: have to label each edge correctly (but this isn't that hard — noun before verb -> `nsubj` in most contexts)
- 2005: Eisner algorithm graph-based parser was SOTA (~91 UAS)
- 2010: Better graph-based parsers using "parent annotation" (~93 UAS)
- 2012: Transition-based Maltparser achieved good results (~90 UAS)
- 2014: Stanford neural dependency parser (Chen and Manning) got 92 UAS with transition-based neural model
- 2016: Improvements to Chen and Manning

Stanford Dependency Parser

- Feedforward neural network on top of feature vector extracted from stack and buffer





Chen and Manning (2014)

Stanford Dependency Parser

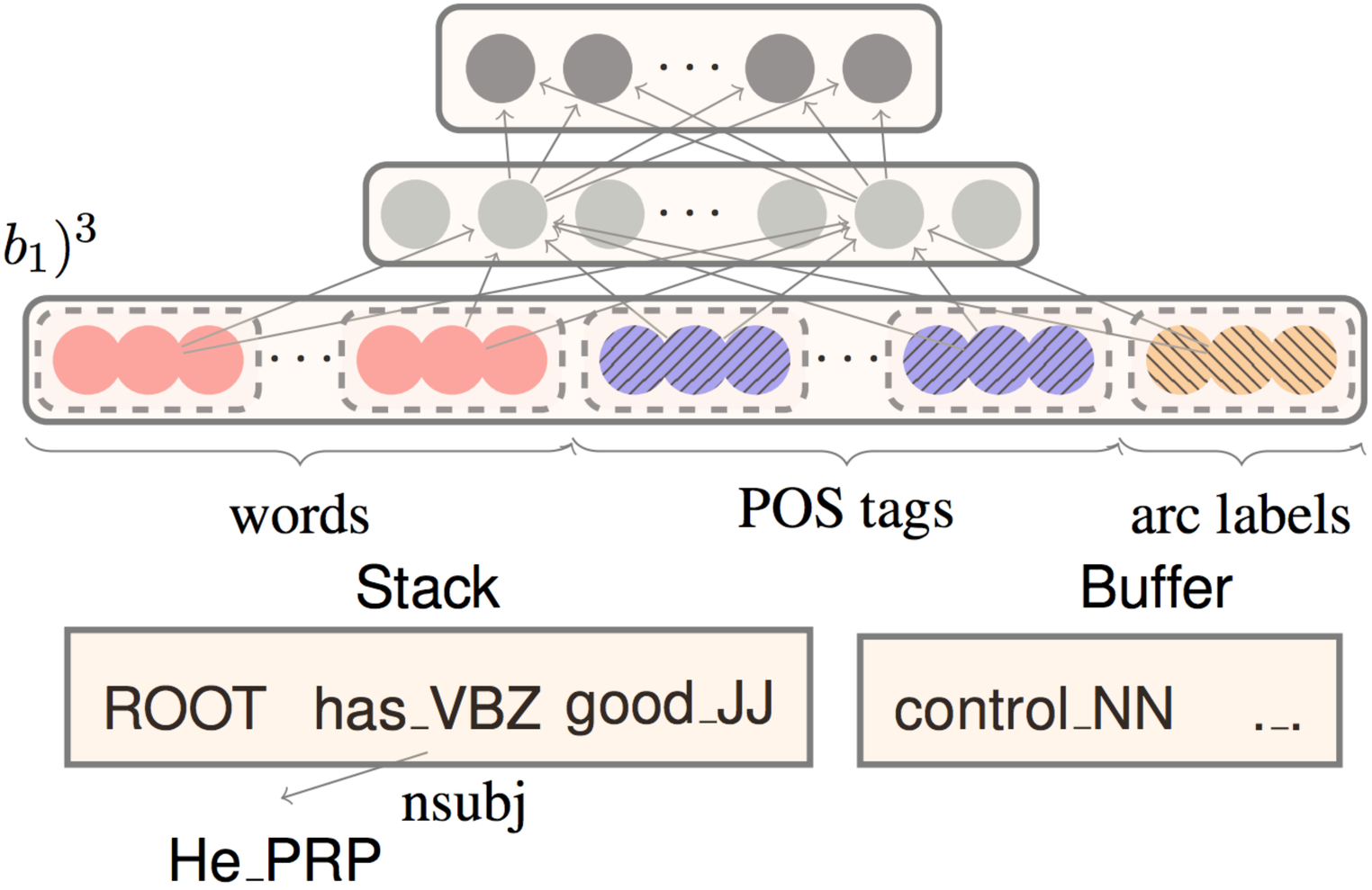
Softmax layer:

$$p = \texttt{softmax}(W_2 h)$$

Hidden layer:

$$h = (W_1^w x^w + W_1^t x^t + W_1^l x^l + b_1)^3$$

Input layer: $[x^w, x^t, x^l]$



Configuration

Chen and Manning (2014)

Stanford Dependency Parser

Parser	Dev		Test		Speed
	UAS	LAS	UAS	LAS	(sent/s)
standard	90.2	87.8	89.4	87.3	26
eager	89.8	87.4	89.6	87.4	34
Malt:sp	89.8	87.2	89.3	86.9	469
Malt:eager	89.6	86.9	89.4	86.8	448
MSTParser	91.4	88.1	90.7	87.6	10
Our parser	**92.0**	**89.7**	**91.8**	**89.6**	**654**

- MSTParser: “graph-based” parser (like CKY) from 2005 — so Chen+Manning’s parser isn’t much better but is much faster!

Chen and Manning (2014)

Parsey McParseFace (a.k.a. SyntaxNet)

- Close to state-of-the-art, released by Google publicly
- 94.61 UAS on the Penn Treebank using a transition-based system
  - Additional data harvested via “tri-training”, form of self-training
- Same feature set as Chen and Manning (2014), Google fine-tuned it

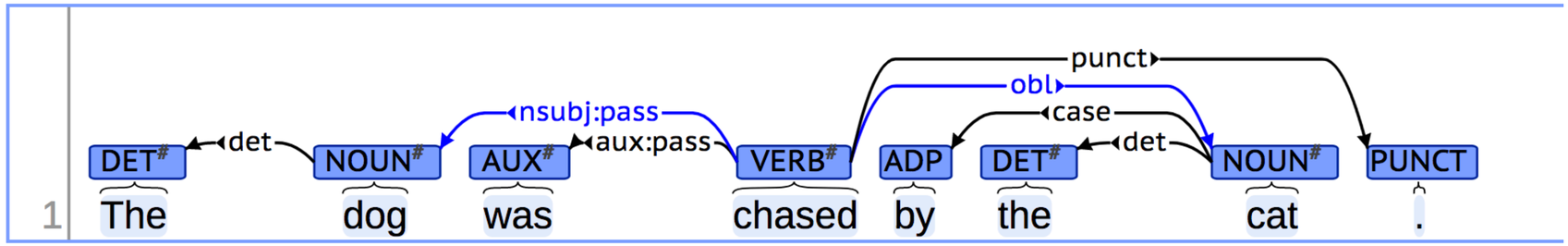
https://github.com/tensorflow/models/tree/master/research/syntaxnet

Andor et al. (2016)

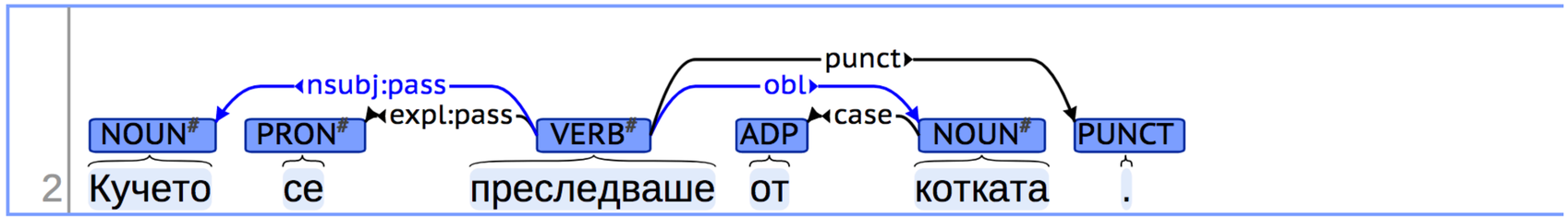
Other languages

- Annotate dependencies with the same representation in many languages

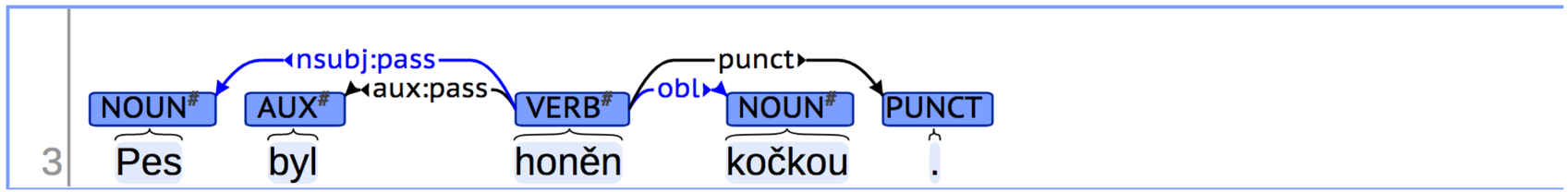
English



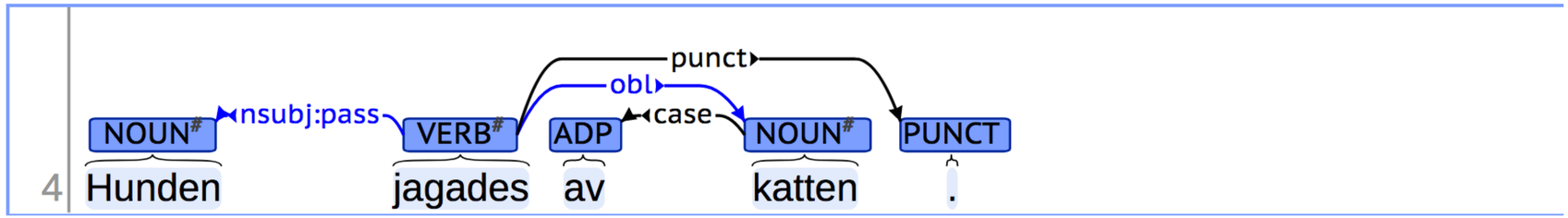
Bulgarian



Czech



Swiss



http://universaldependencies.org/