Unsupervised Tokenization Learning

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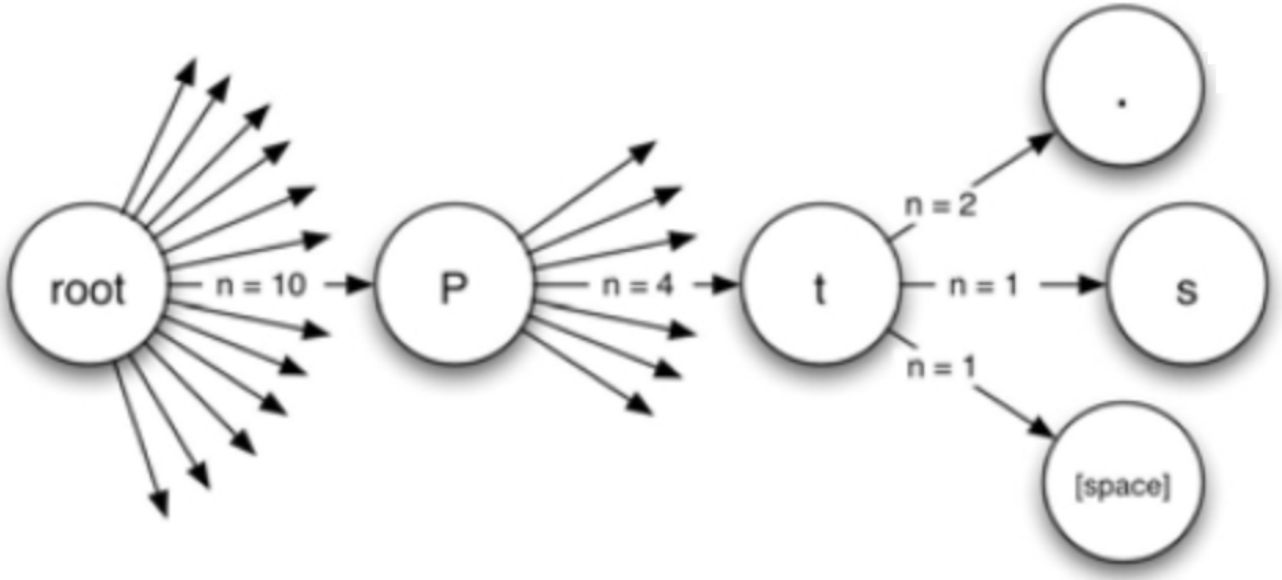
Background – Tokenization as Language Modeling



Metrics/Indicators:

Conditional Probability
“Transition Freedom”

Trie data structure. The probability of observing an ‘s’ given the preceding string “Pt” is ¼, or 25%. The freedom following “pt” is 3.

Unsupervised Text Segmentation (Tokenization)

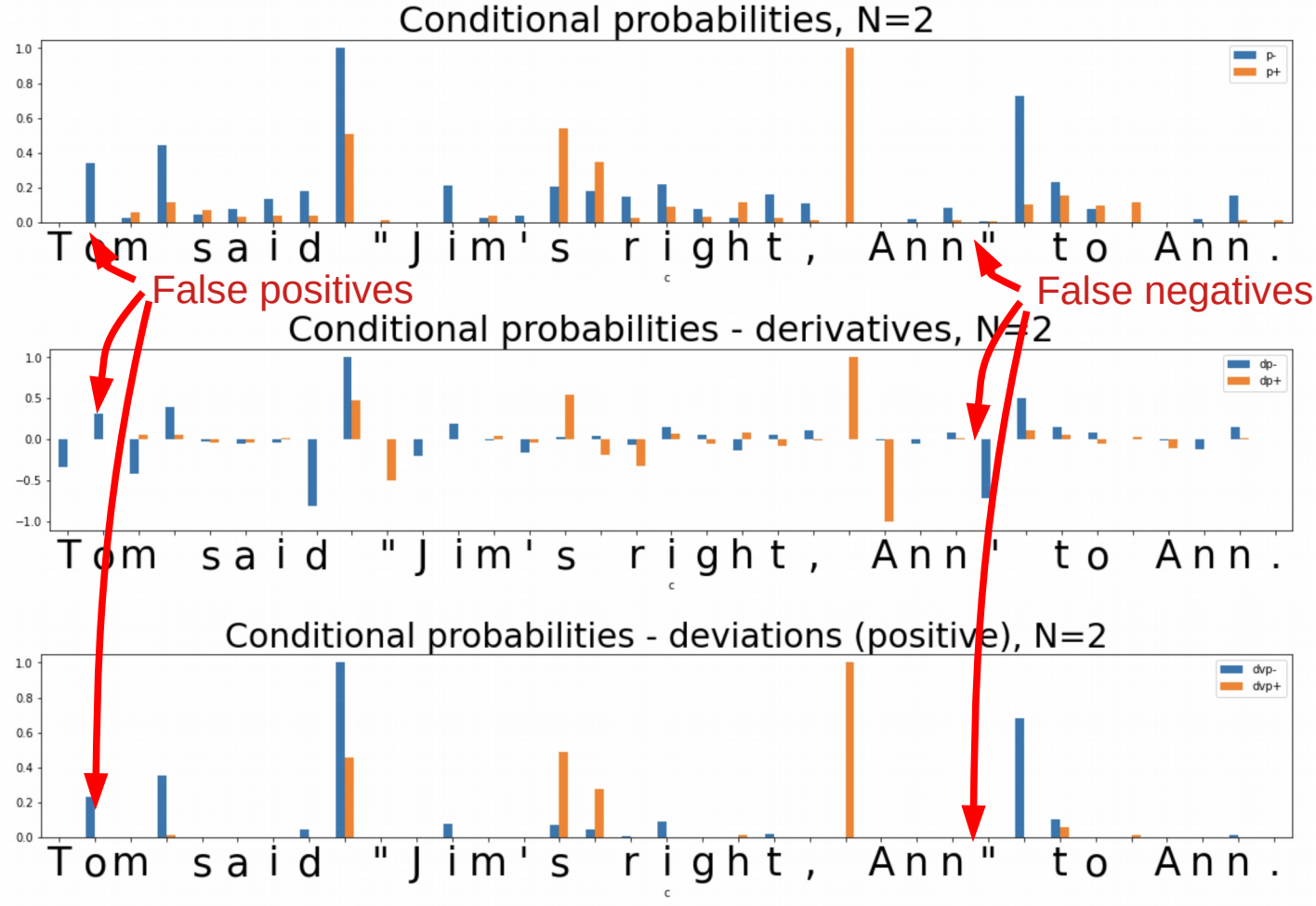
Metrics/Indicators:

Ngram (Character) Conditional Probability

(of Transition)

$P(Ngram_{n+1})/P(Ngram_n)$

P(“m ”)/P(“m”)

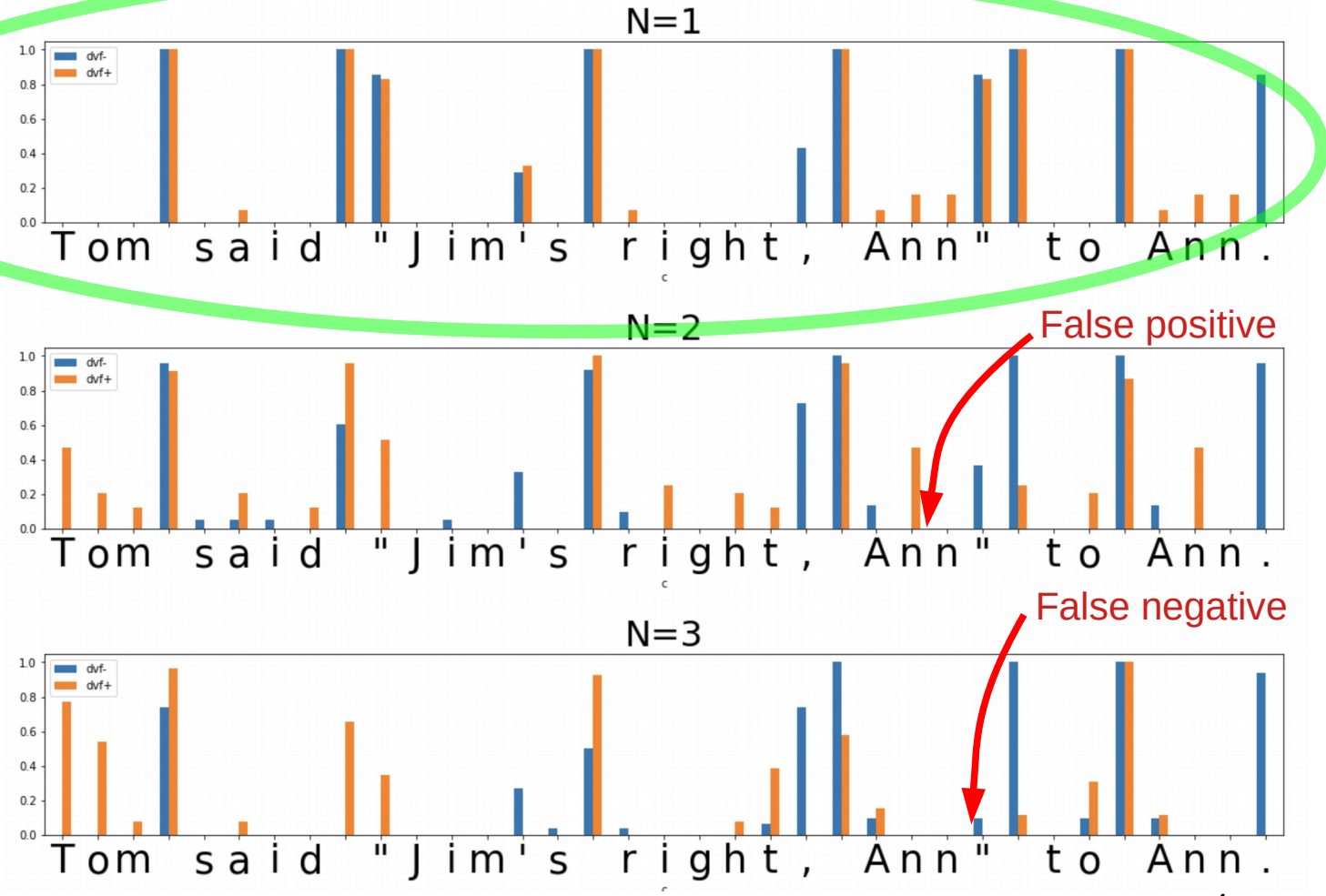


Unsupervised Text Segmentation (Tokenization)

Metrics/ Indicators:

Transition
Freedom
Deviation

(varying “N” of N-gram)



Unsupervised Text Segmentation (Tokenization)

English

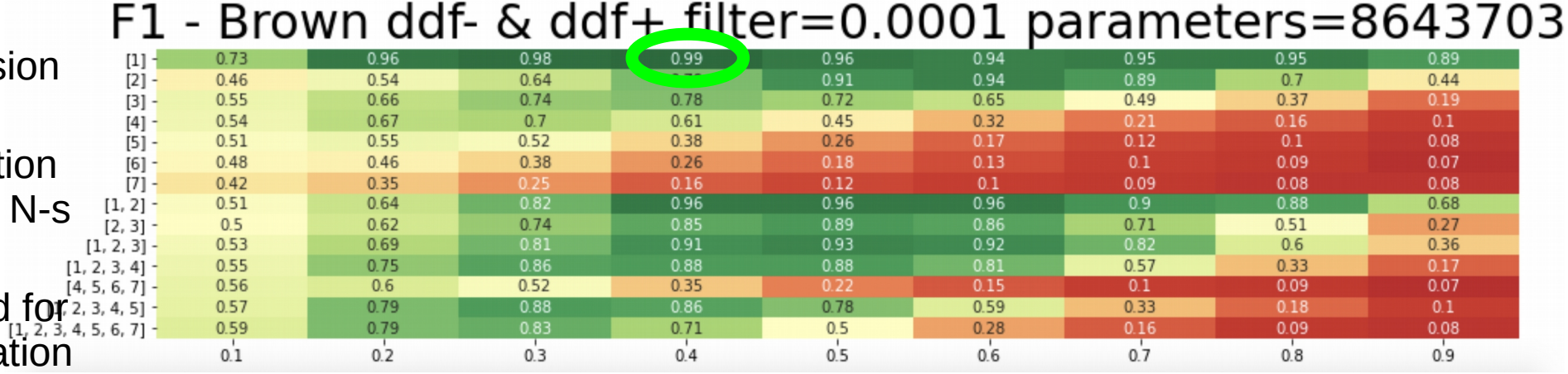
Hyper-Parameters:

Metric: Transition Freedom

Threshold for model compression

Combination of Ngram N-s

Threshold for segmentation



Results – Freedom-based Tokenization against Lexicon-based one (referring to Rule-based)

Language	Tokenizer	Tokenization F_1	Lexicon Discovery Precision
English	Freedom-based	**0.99**	**0.99** (vs. 1.0)
English	Lexicon-based*	0.99	-
Russian	Freedom-based	**1.0**	**1.0** (vs. 1.0)
Russian	Lexicon-based*	0.94	-
Chinese	Freedom-based	**0.71**	**0.92** (vs. 0.94)
Chinese	Lexicon-based*	0.83	-

**Lexicon-based Tokenization - greedy/beam search on word length (optimal) or frequency*

Preprint: https://arxiv.org/abs/2205.11443