

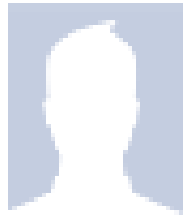


Stony Brook **University**

| The State University of New York

Syntactic Stylometry for Deception Detection

**Song Feng, Ritwik Banerjee,
Yejin Choi**



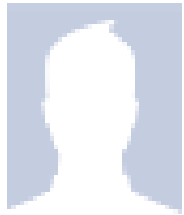
“I was visiting Chicago for a christening with my fiancé. I was impressed with this hotel from the moment I checked in. The lobby was exceptionally modern with color and furnishings. Front desk staff was pleasant and helpful, especially Susan, who quickly suggested and reserved a table for us at Keefer's Steakhouse for a late dinner. The room itself was fabulous. Extremely comfortable King sized bed, dual head shower, breathtakingly beautiful views, I couldn't ask for more. Next I was treated to a facial as my fiancé took a short run through the city. After a day full of shopping we retired to our room and ordered room service that was on time and delicious.”

Related Work - I

- Linguistic-based deception detection
 - Pennebaker et al., 2007
 - Hancock et al., 2007
 - Mihalcea and Strapparava, 2009
 - Ott et al., 2011

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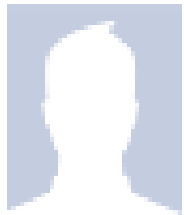
Deceptive

Personal Pn
Possessive Pn
“*Chicago*”
“*luxury*”
...

Truthful

Coord/Conj.
Preposition
Number
“...”, “\$”
...

(Ott et al., 2011)



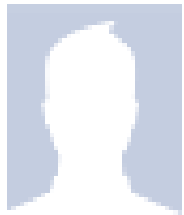
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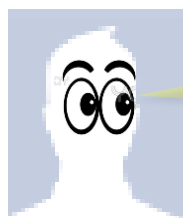
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Deceptive!

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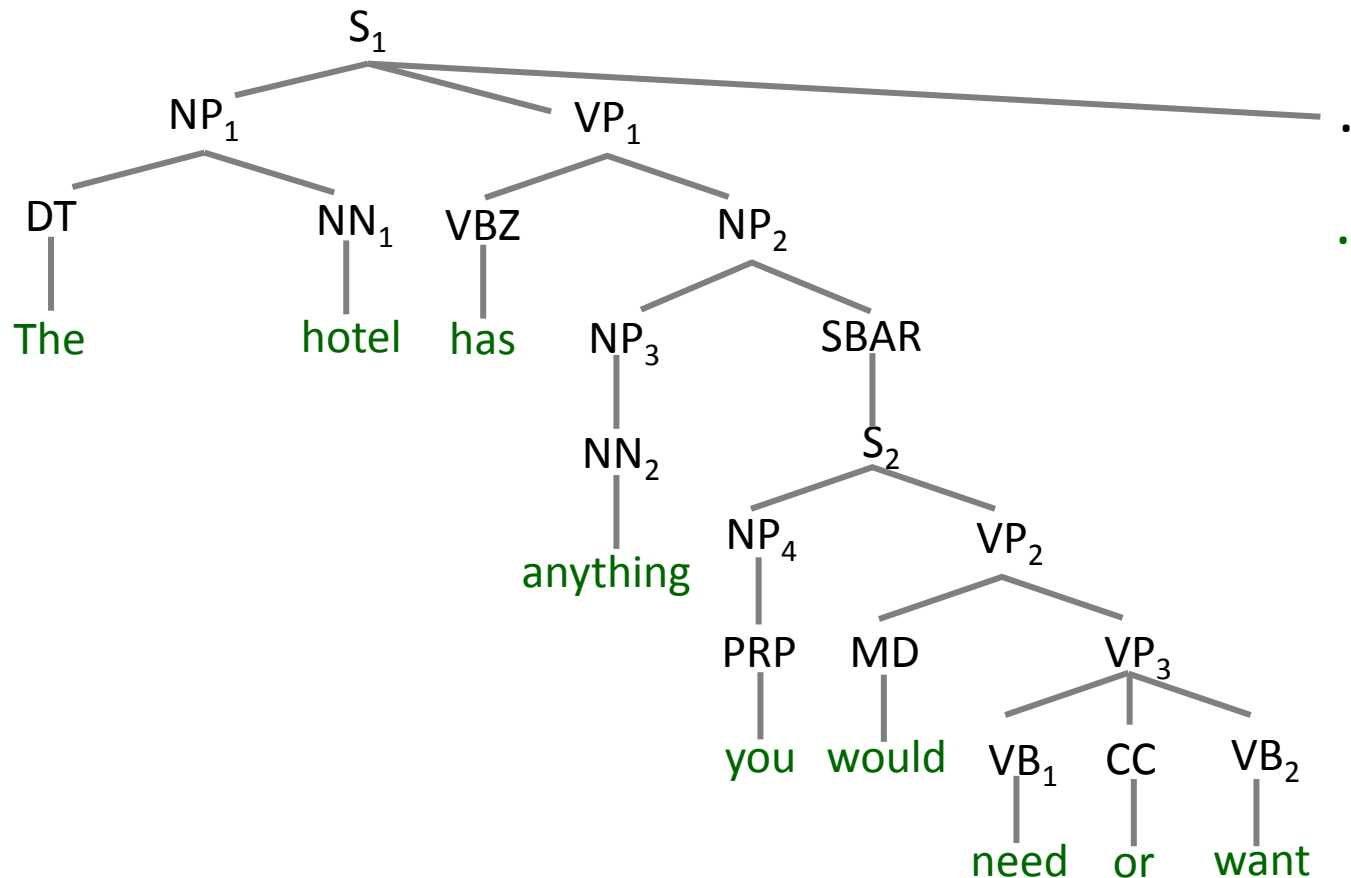
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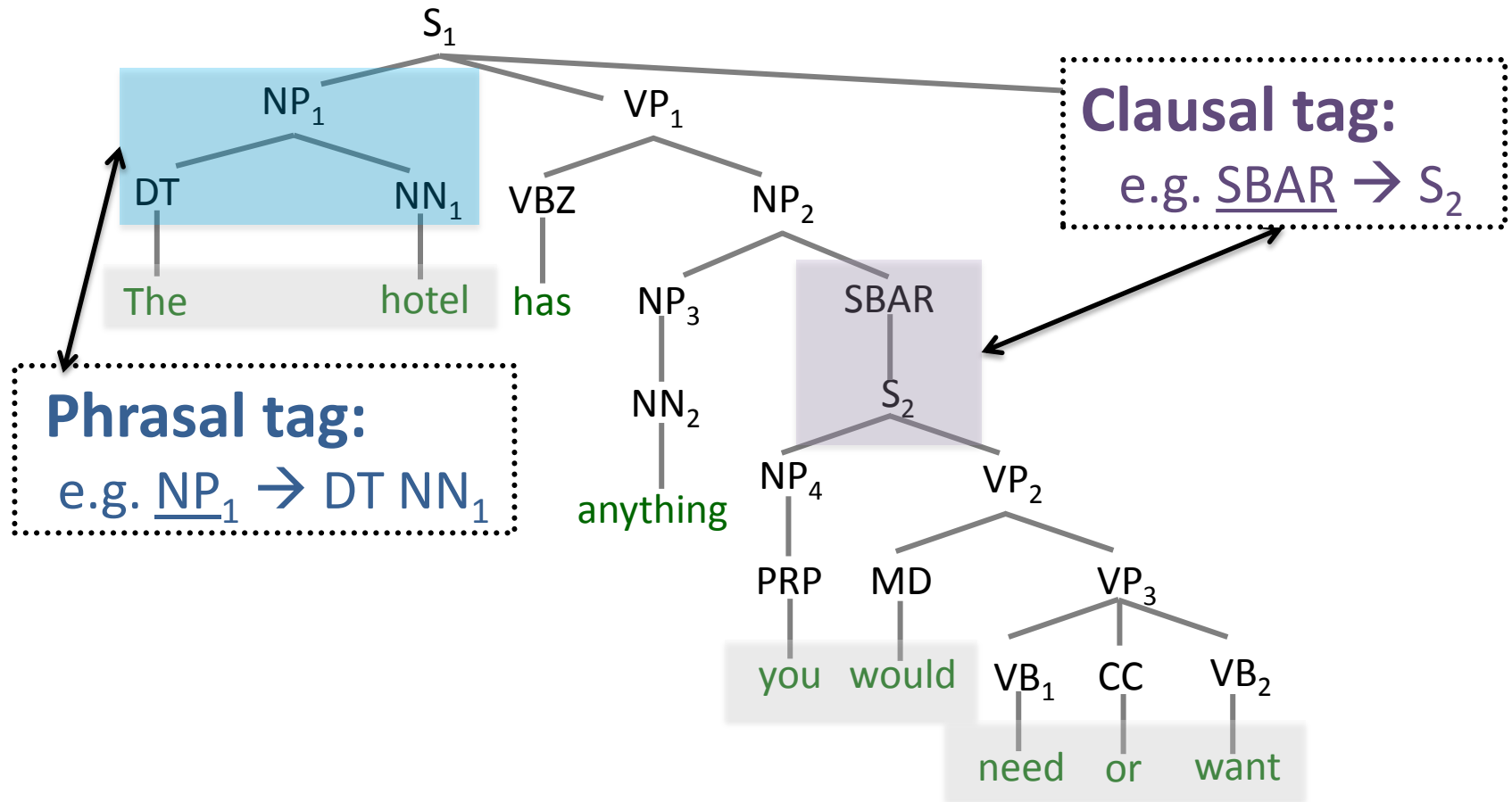
Parsing with Context-free Grammars

Input: “The hotel has anything you would need or want.”

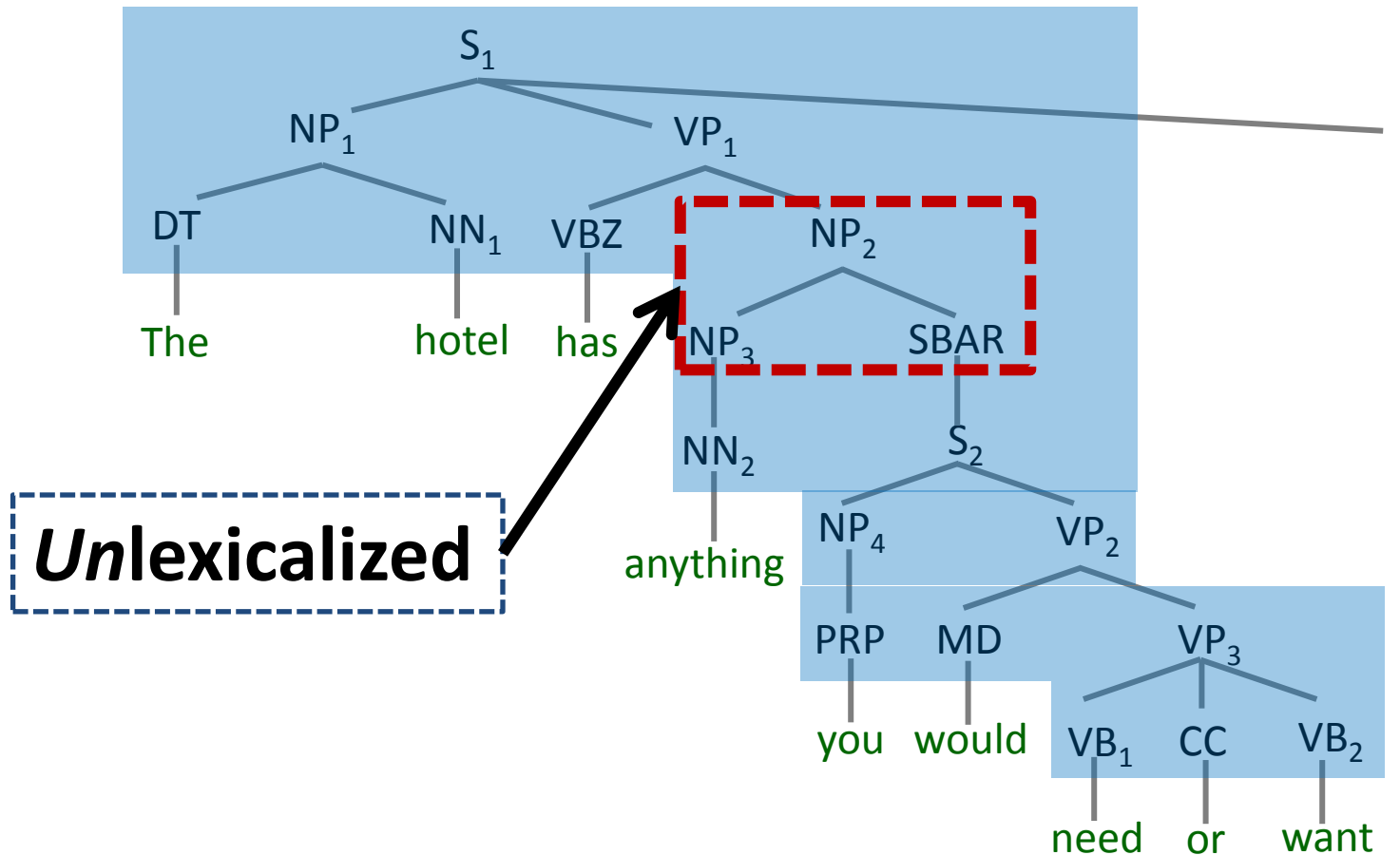
Output:



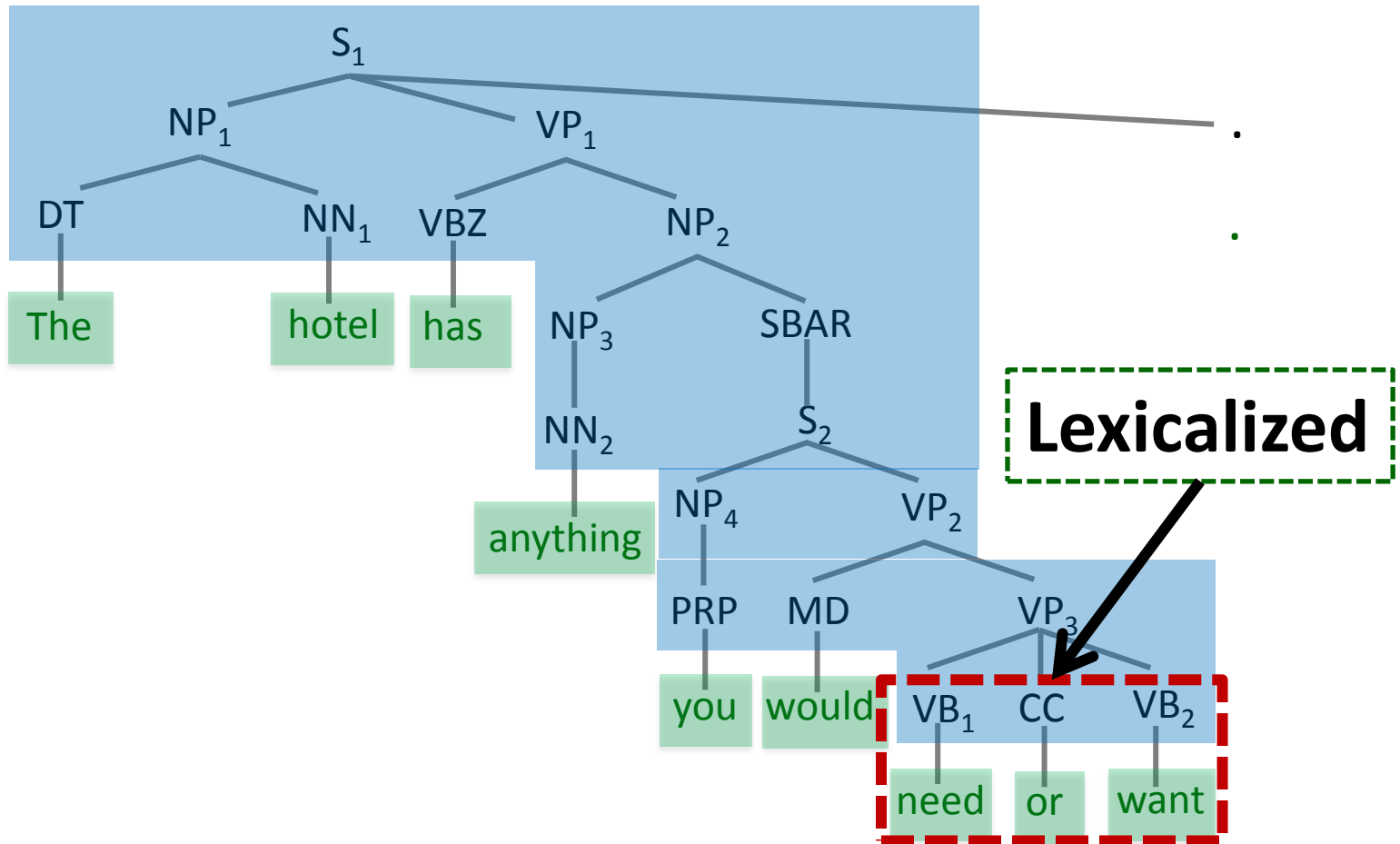
CFG Rewrite Rules

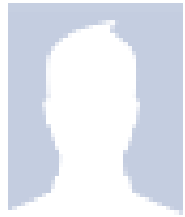


CFG Rewrite Rules

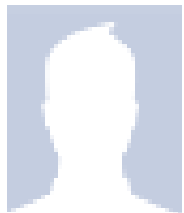


CFG Rewrite Rules

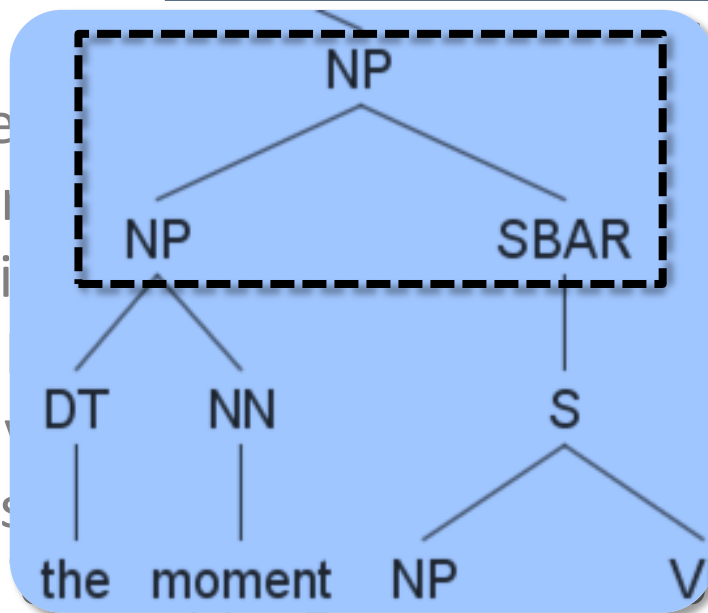


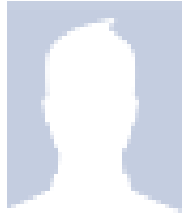


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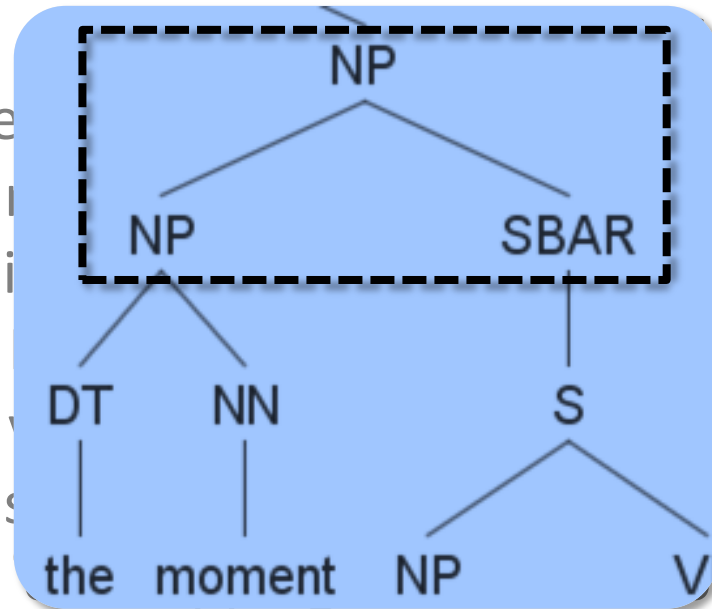
“I was visiting Chicago for a christening with my fiancé. I was impressed with this hotel from the moment I checked in. The lobby was exceptionally well-furnished. Front desk staff was pleasant. I met Susan, who quickly suggested a dinner at Keefer's Steakhouse for a late dinner. The food was fabulous. Extremely comfortable beds, a large walk-in shower, and a beautiful view of the city. Next I was treated to a facial as I walked through the city. After a day full of sightseeing, I ordered room service that was on time and delicious.”

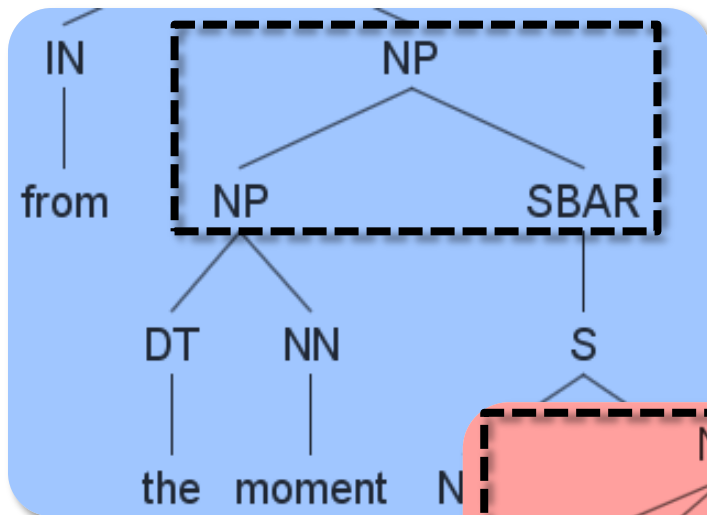




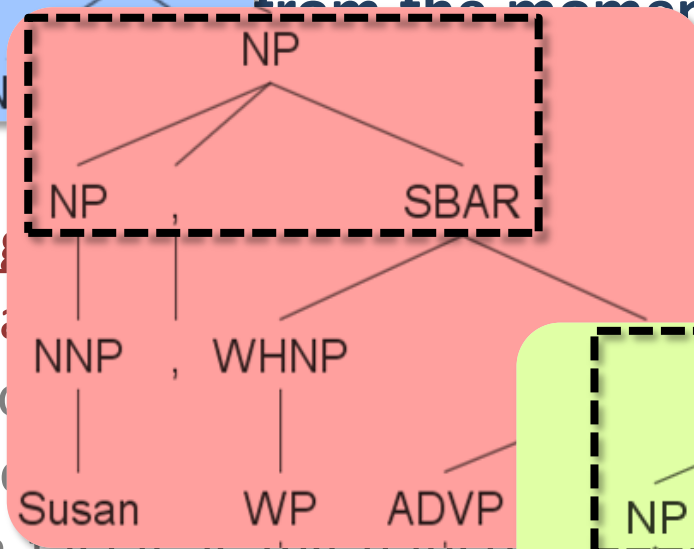
SBAR: Clause introduced by a (possibly empty) subordinating conjunction.

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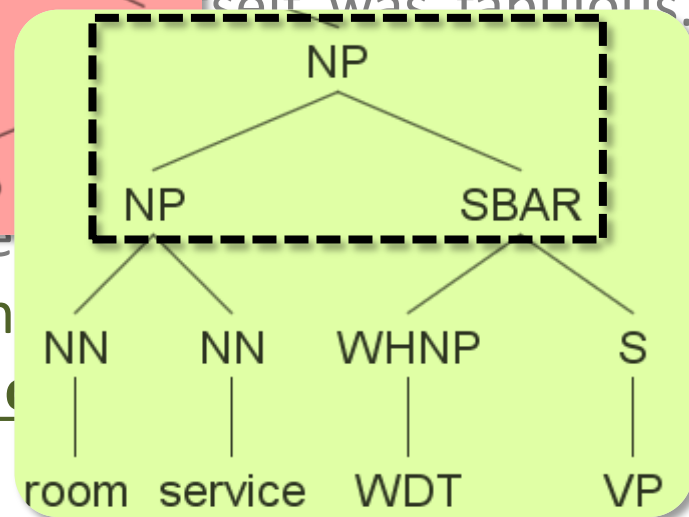
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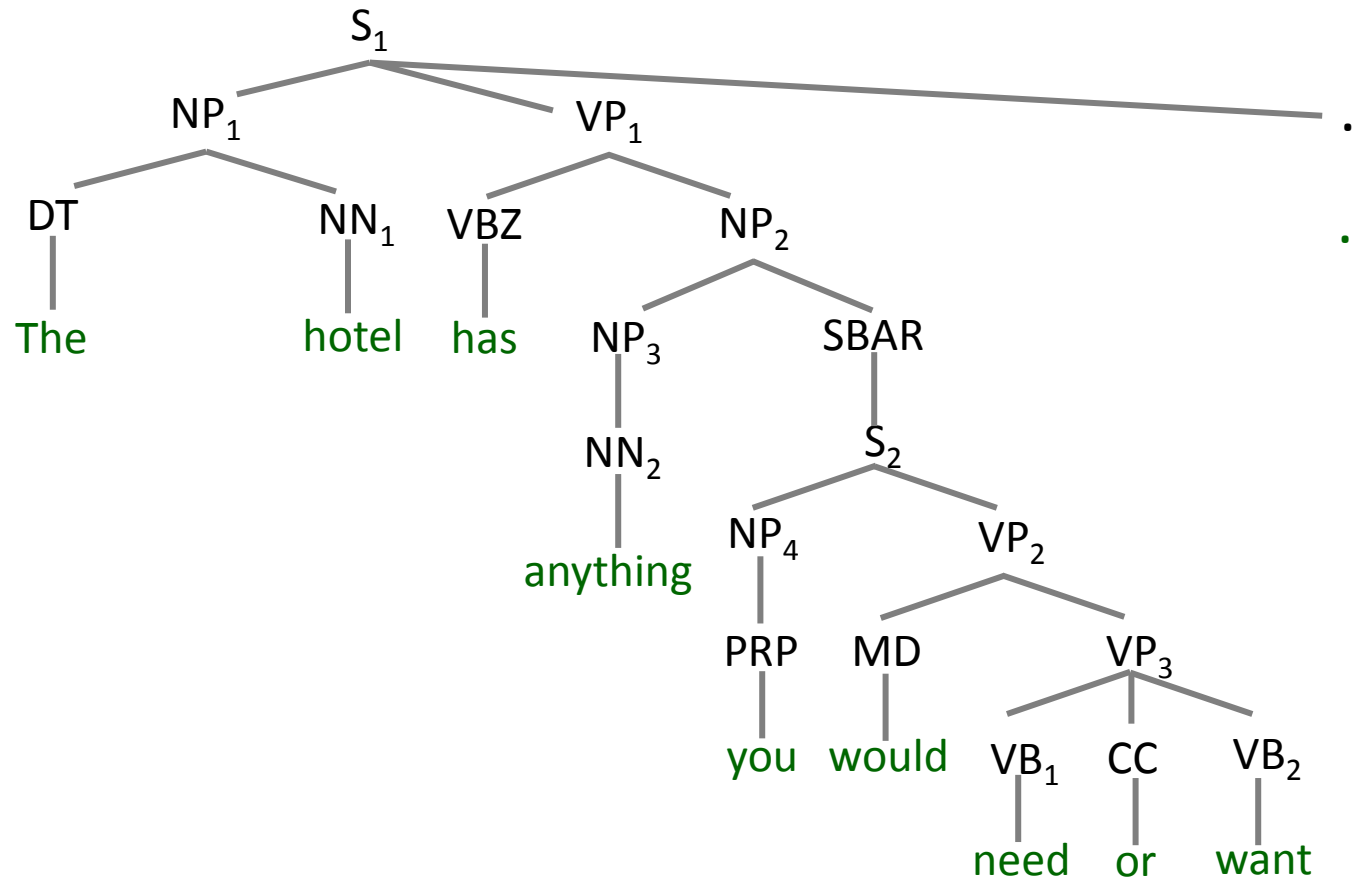
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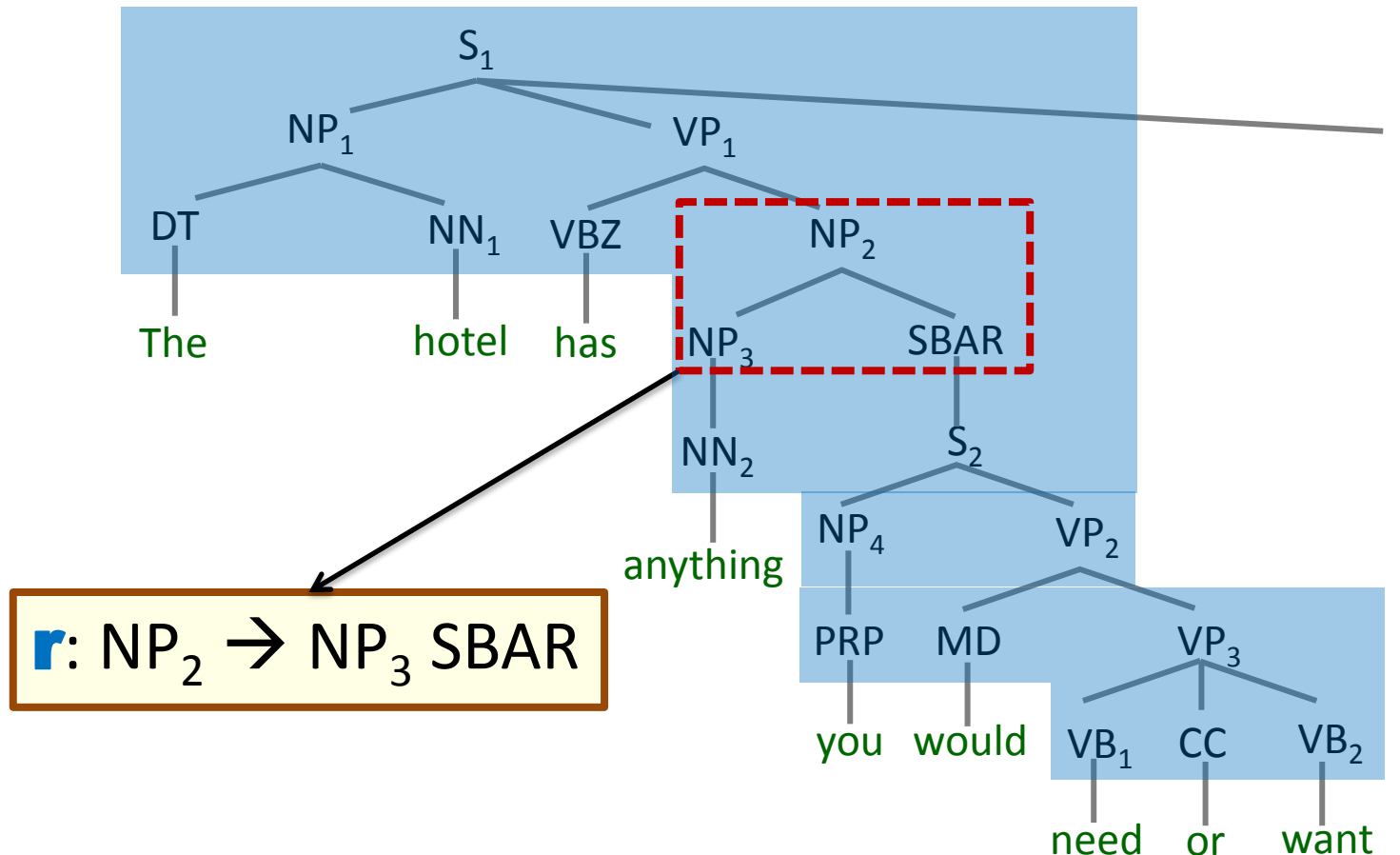
Related Work - II

- CFG analysis
 - Baayen, et al., 1996
 - Raghavan et al., 2010
 - Sarawgi et al., 2011
 - Wong and Dras, 2011

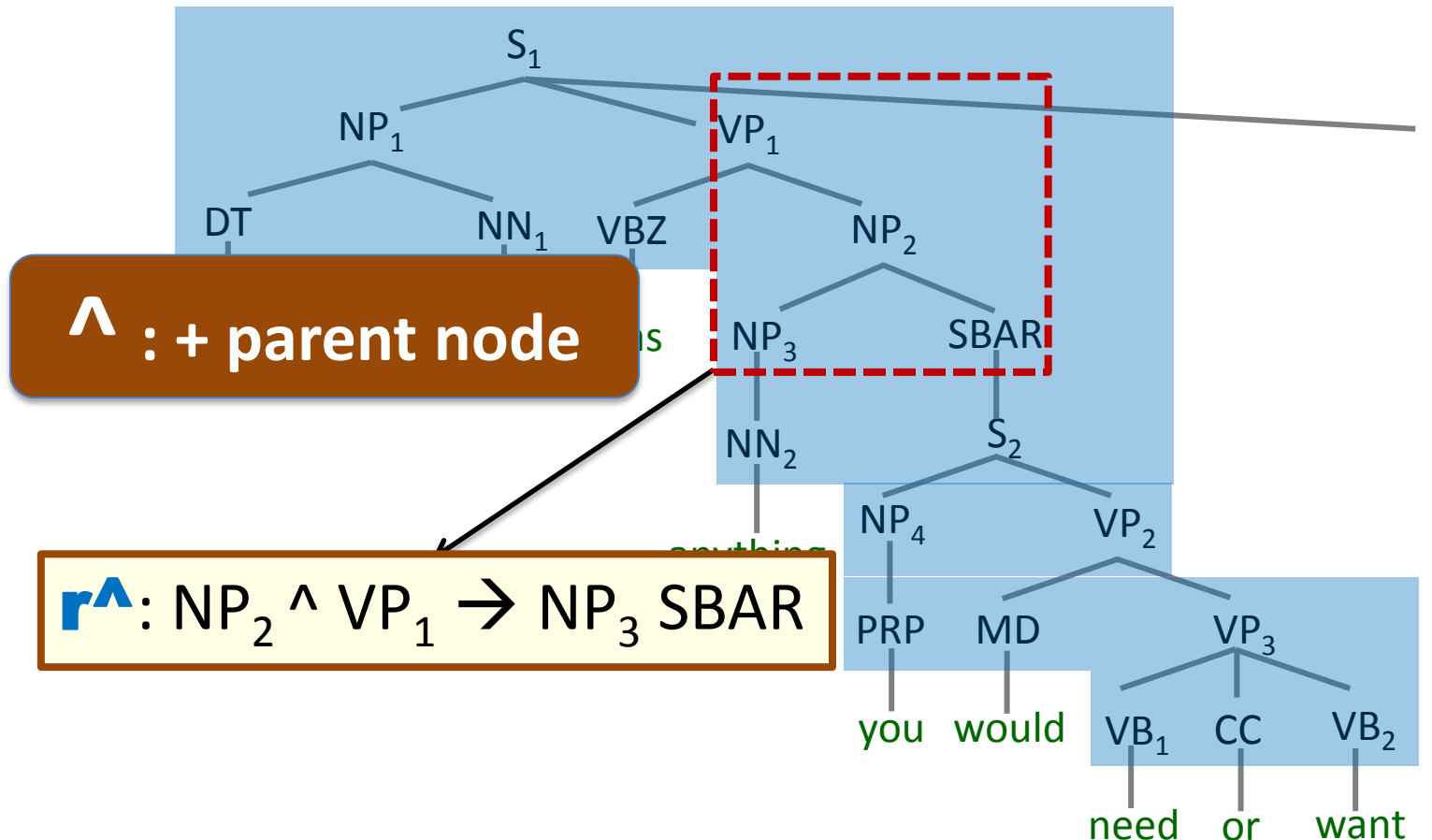
Syntactic Features (Rewrite Rules)



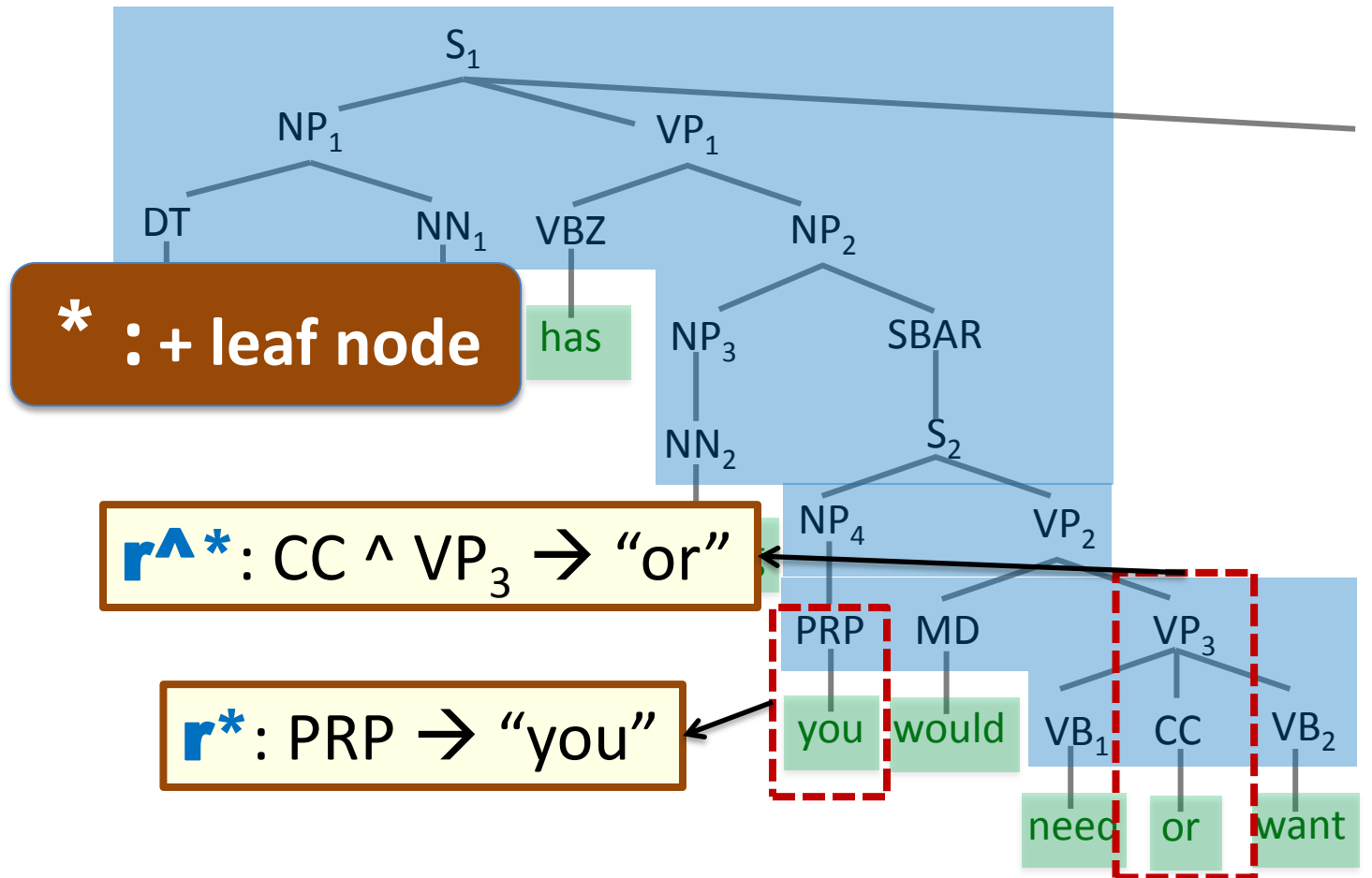
Syntactic Features (Rewrite Rules)






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Syntactic Features (Rewrite Rules)



Data

1. Hotel reviews (Ott et al. ACL 2011) 
 - *Gold* standard
 - 400 deceptive, 400 truthful
2. Hotel reviews (Feng et al., ICWSM 2012) 
 - *Pseudo gold* standard
 - 400 deceptive, 400 truthful
3. Essays (Mihalcea and Strapparava, ACL 2009)
 - 3 topics
 - 100 deceptive, 100 truthful per topic
4. Restaurant reviews 
 - 400 filtered vs. 400 displayed

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Experiment

- SVM classifier: LIBLINEAR
- 5-fold cross validation
- 80% training, 20% testing
- Tf-idf

Experiment

- Lexical features
 - Unigram/bigram
- Syntactic features
 - Shallow syntax: POS tags
 - Deep syntax: rewrite rules by CFG

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- Lexical features
 - Unigram/bigram
- Syntactic features
 - Shallow syntax: POS tags
 - Deep syntax: rewrite rules by CFG



Baselines

Experiment - I

	Features	TripAdvisor (Gold)	Essay (Friend)	Yelp
Words	unigram	88.4	77.0	59.9
Shallow Syntax + Words	POS(n=1) +unigram	87.4	80.0	62.0
Deep Syntax	r	78.5	67.5	56.9
	r [^]	74.8	65.5	56.5
	r*	89.4	77.5	64.0
	r [^] *	90.4	78.0	63.5
Deep Syntax + Words	r + unigram	89.0	82.0	62.3
	r [^] + unigram	88.5	81.5	62.5
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+2.8%

+8.0%

+4.4%

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Discriminative Syntax Features



Gold standard

Pseudo-gold standard

Gold standard		Pseudo-gold standard	
Deceptive	Truthful	Deceptive	Truthful
VP	PRN	VP	PRN
SBAR	QP	WHADV	NX
WHADV	S	SBAR	WHNP
ADV	PRT	WHADJP	ADJP
CONJP	UCP	INTJ	WHPP

Discriminative Syntax Features



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SBAR	QP	WHADVP	NX
WHADVP	S	SBAR	WHNP
ADVP	PRT	WHADJP	ADJP
CONJP	UCP	INTJ	WHPP

Syntax Tags:

VP: Verb phrase.

SBAR: Clause introduced by a subordinating conjunction.

WHADVP: *Wh*-adjective phrase.

Experiment - II

- **Essays** (Mihalcea and Strapparava, 2009)
 - 3 topics: abortion, best friend, death penalty
 - ~ 100 truthful/deceptive essays.

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<u>A</u> bortion + <u>B</u> est Friend	<u>D</u> eath Penalty	58.7	66.8
<u>A</u> bortion + <u>D</u> eath Penalty	<u>B</u> est Friend	58.7	70.9
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<u>B</u> est Friend + <u>D</u> eath Penalty	<u>A</u> bortion	62.9	+6% 69.0

Contributions

- Syntactic stylometry for deception.
- Verification in different domains.
- Improvement across topics in the given domain.