Induction of probabilistic context-free grammars from tree corpora

Praktikum Parsing von natürlichen Sprachen

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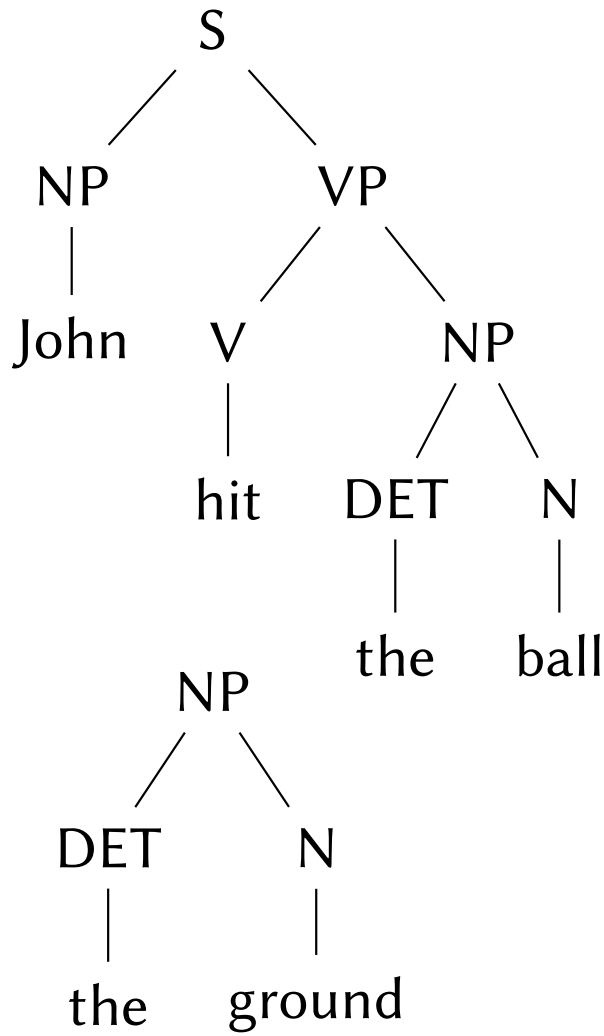
2019-04-09

Overview

1. Idea (recap)
2. Overall pipeline (suggestion)
3. Trees and s-expressions
4. Data structures (suggestion)
5. General advice

Idea (recap)

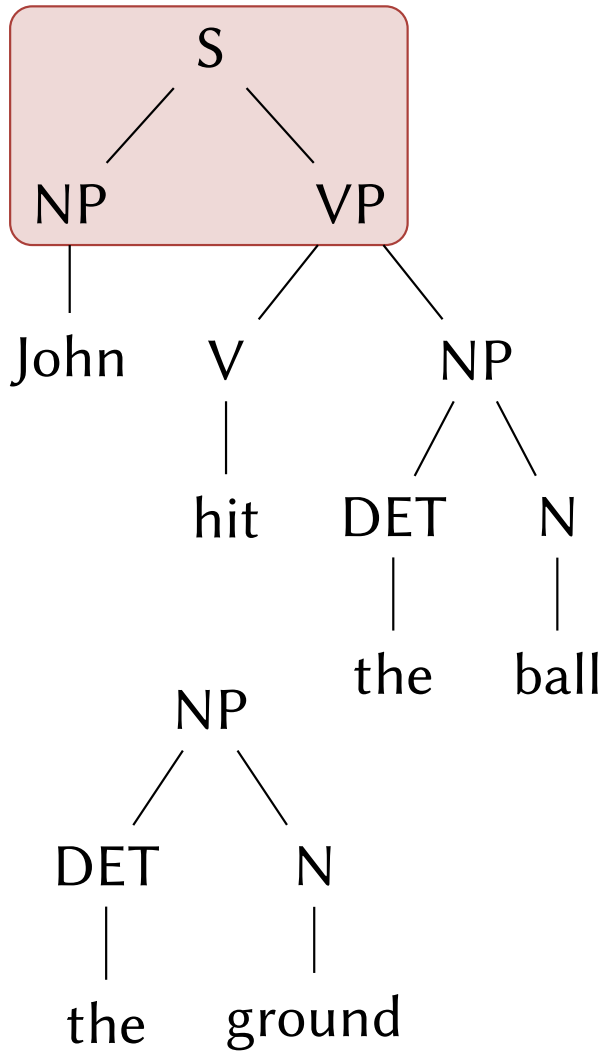
rules:



Idea (recap)

rules:

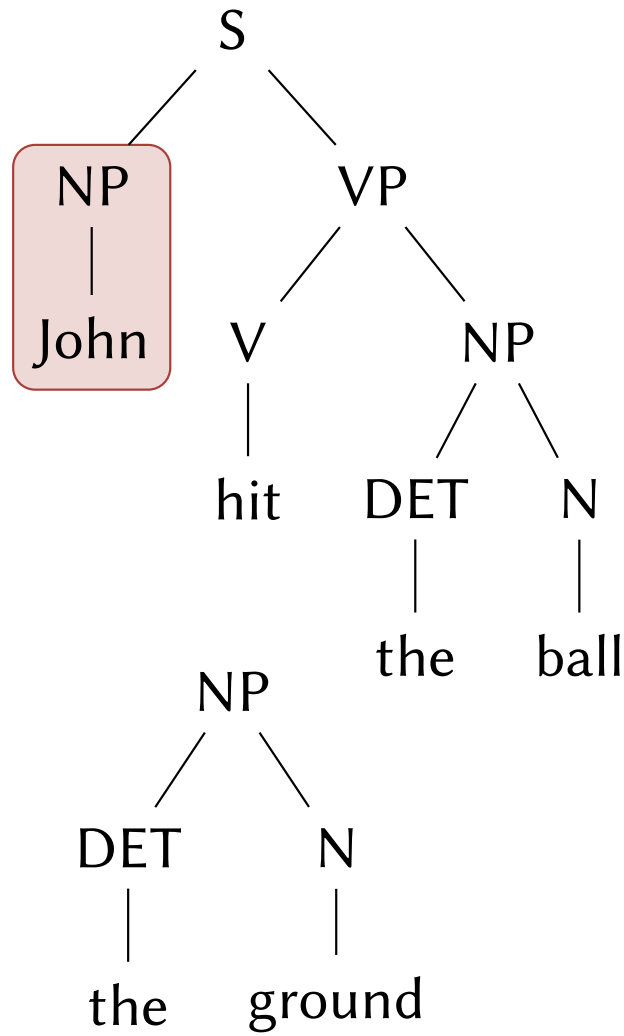
- $S \rightarrow NP\ VP$



Idea (recap)

rules:

- $S \rightarrow NP\ VP$
- $NP \rightarrow John$



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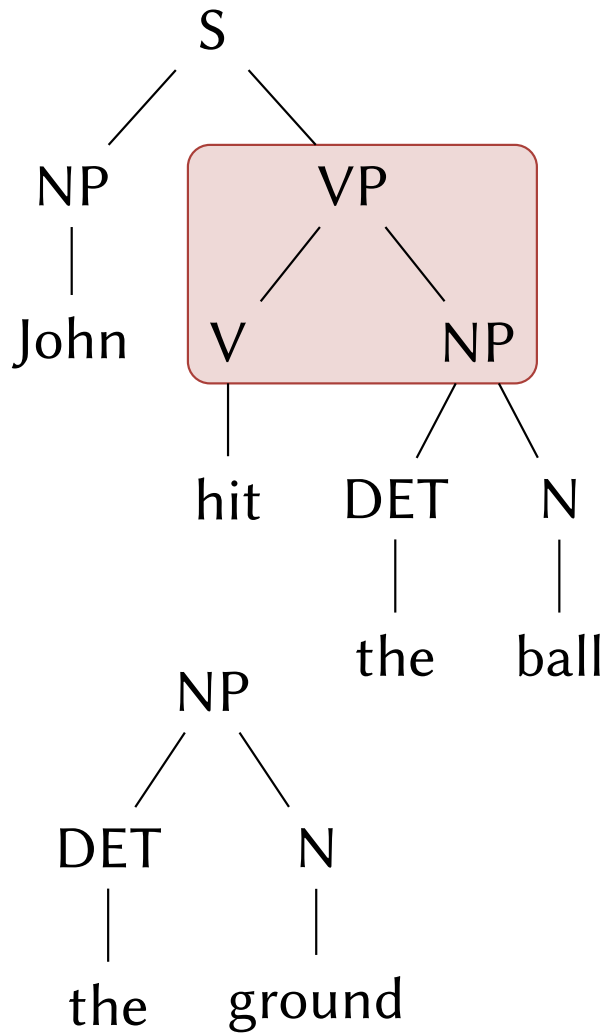
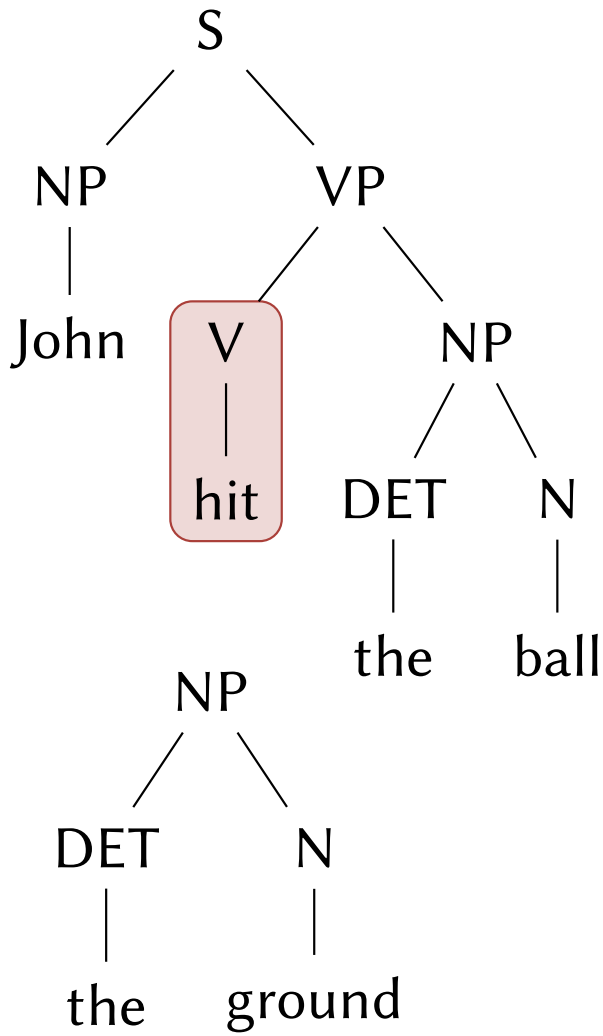


Idea (recap)

rules:

- S → NP VP
- NP → John
- VP → V NP
- V → hit



Idea (recap)

rules:

- S → NP VP
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- VP → V NP
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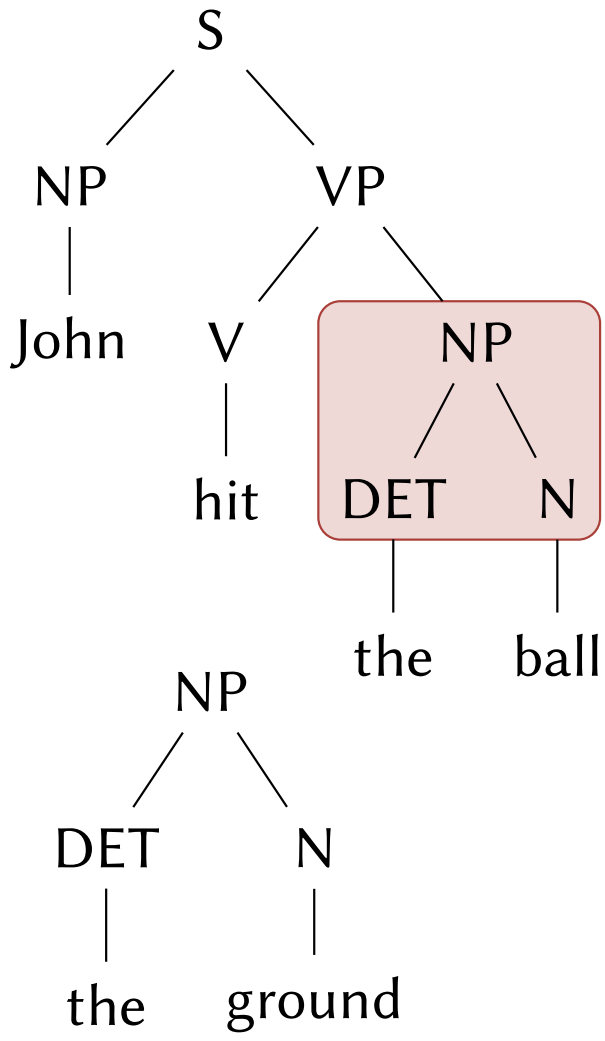
- NP → DET N



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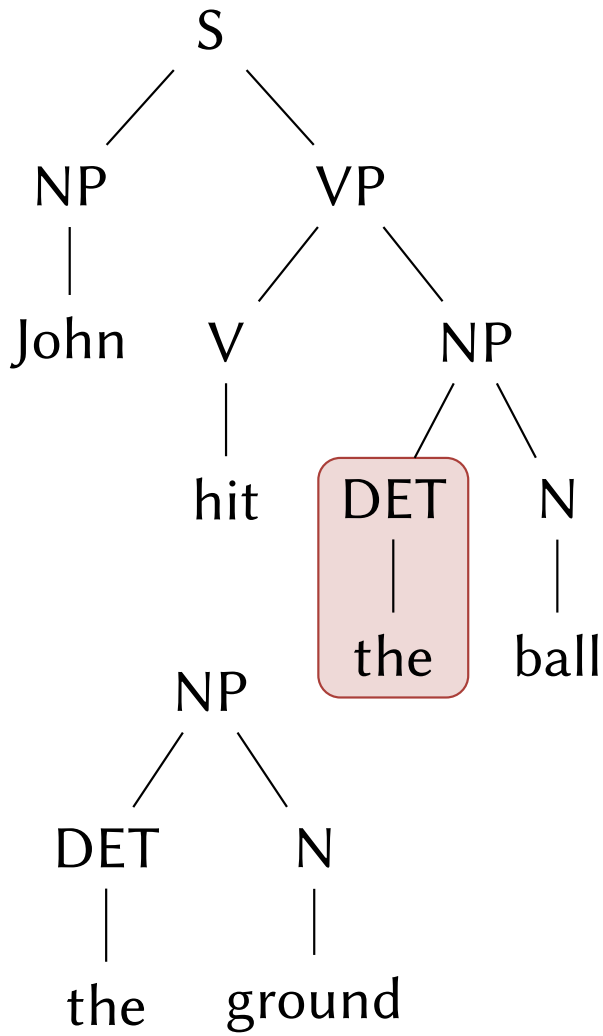

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rules:

- S → NP VP
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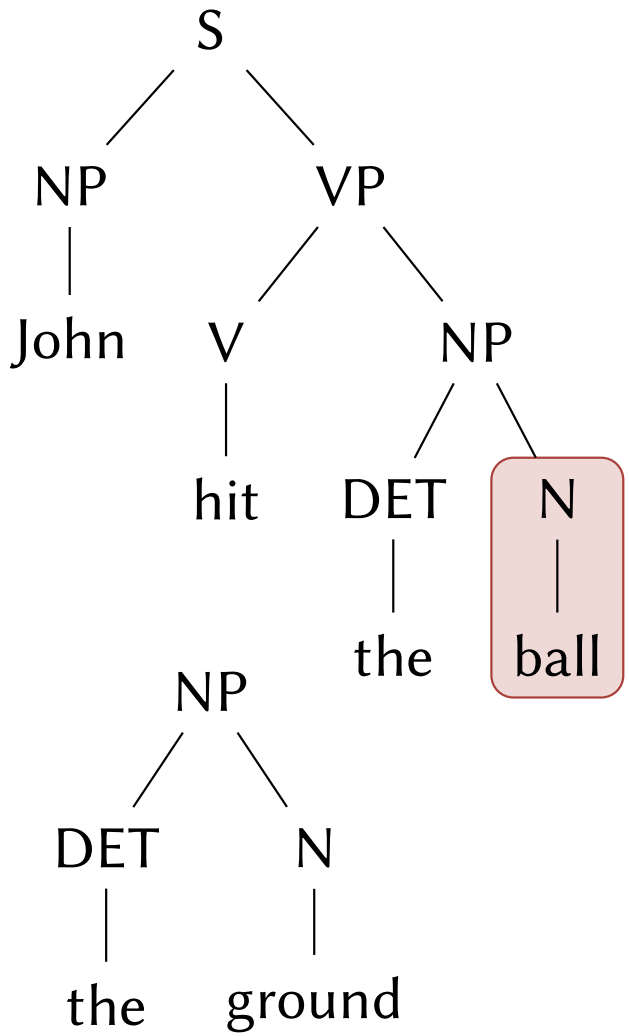
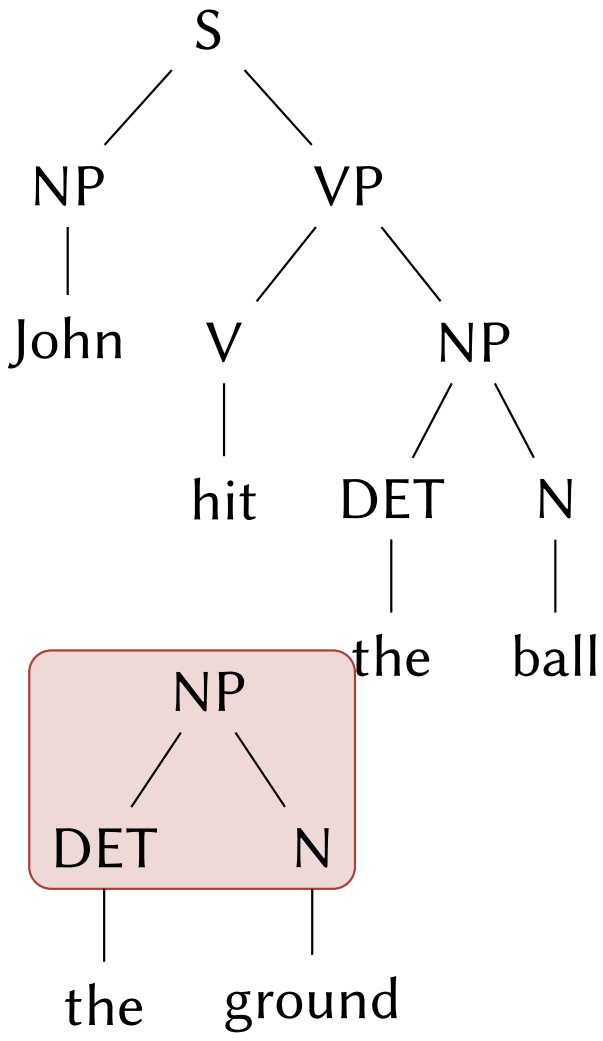
- DET → the
- N → ball



Idea (recap)

rules:

- S → NP VP # 1
- NP → John # 1
- VP → V NP # 1
- V → hit # 1
- NP → DET N # 2
- DET → the # 1
- N → ball # 1



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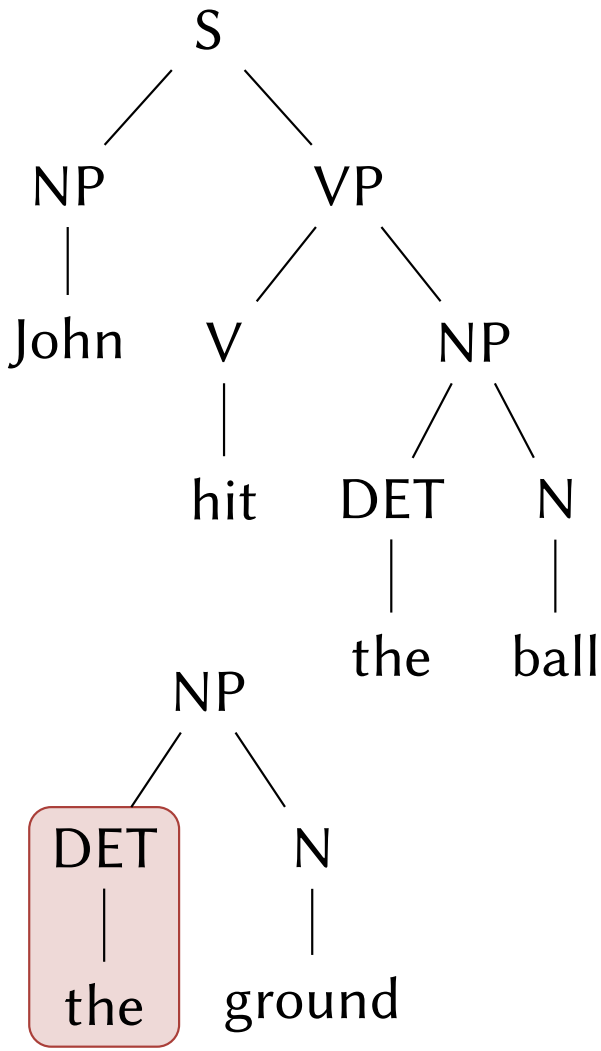

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- $NP \rightarrow DET\ N$ # 2
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- $N \rightarrow ball$ # 1
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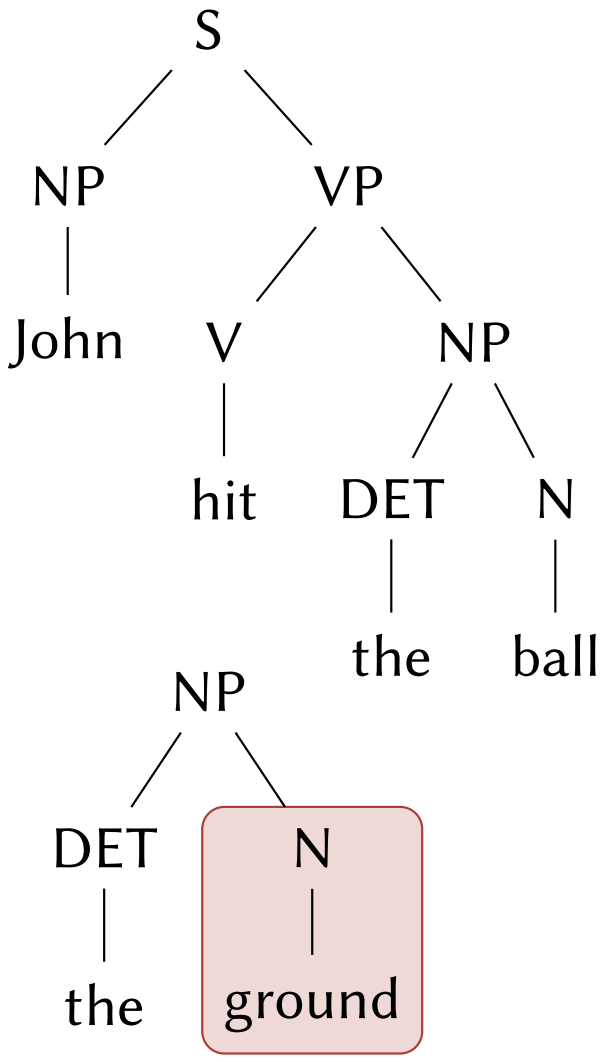

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normalised rules:

- $S \rightarrow NP\ VP$ # 1
- $NP \rightarrow John$ $\# \frac{1}{1+2} = 1/3$
- $VP \rightarrow V\ NP$ # 1
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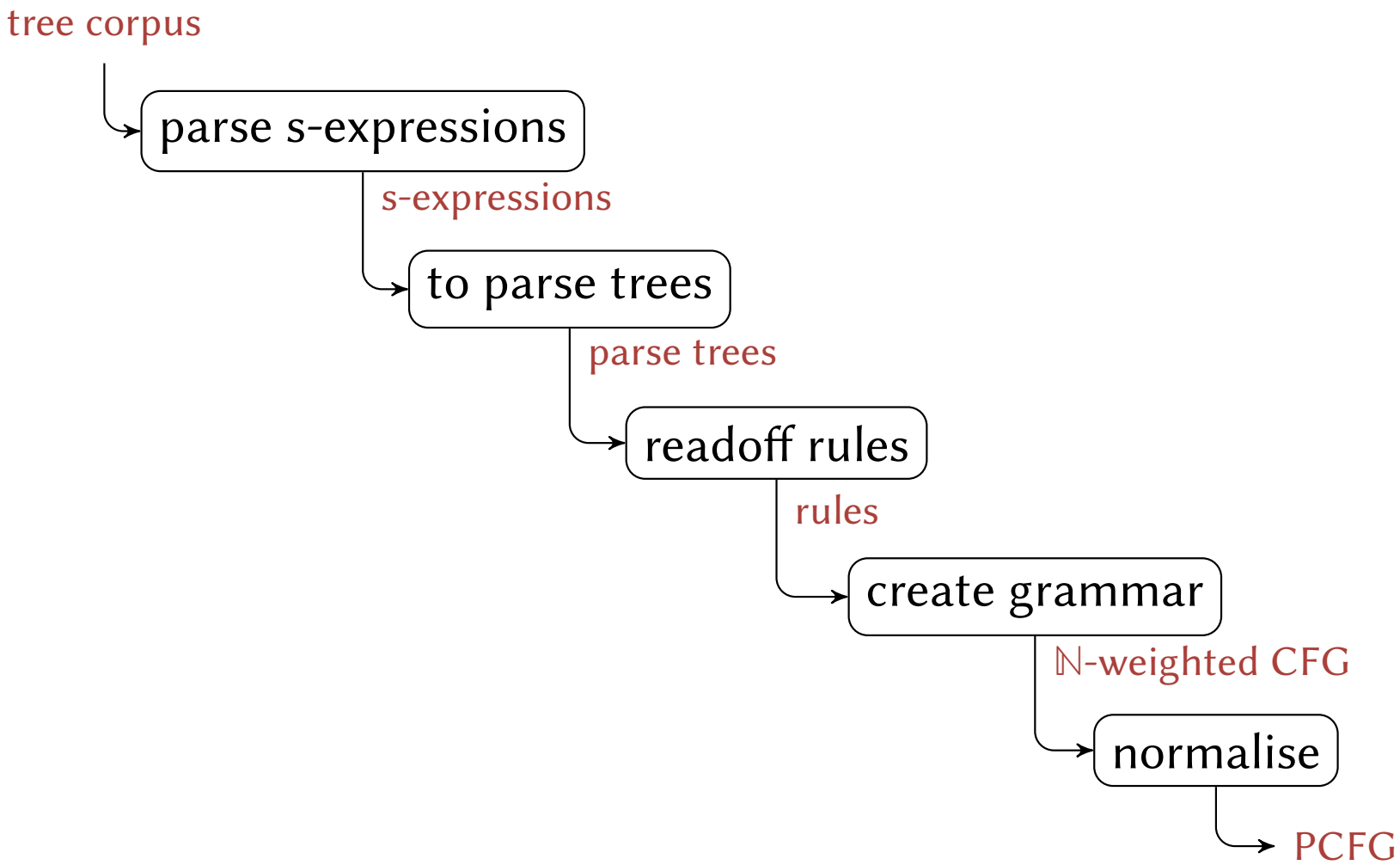
Overall pipeline (suggestion)



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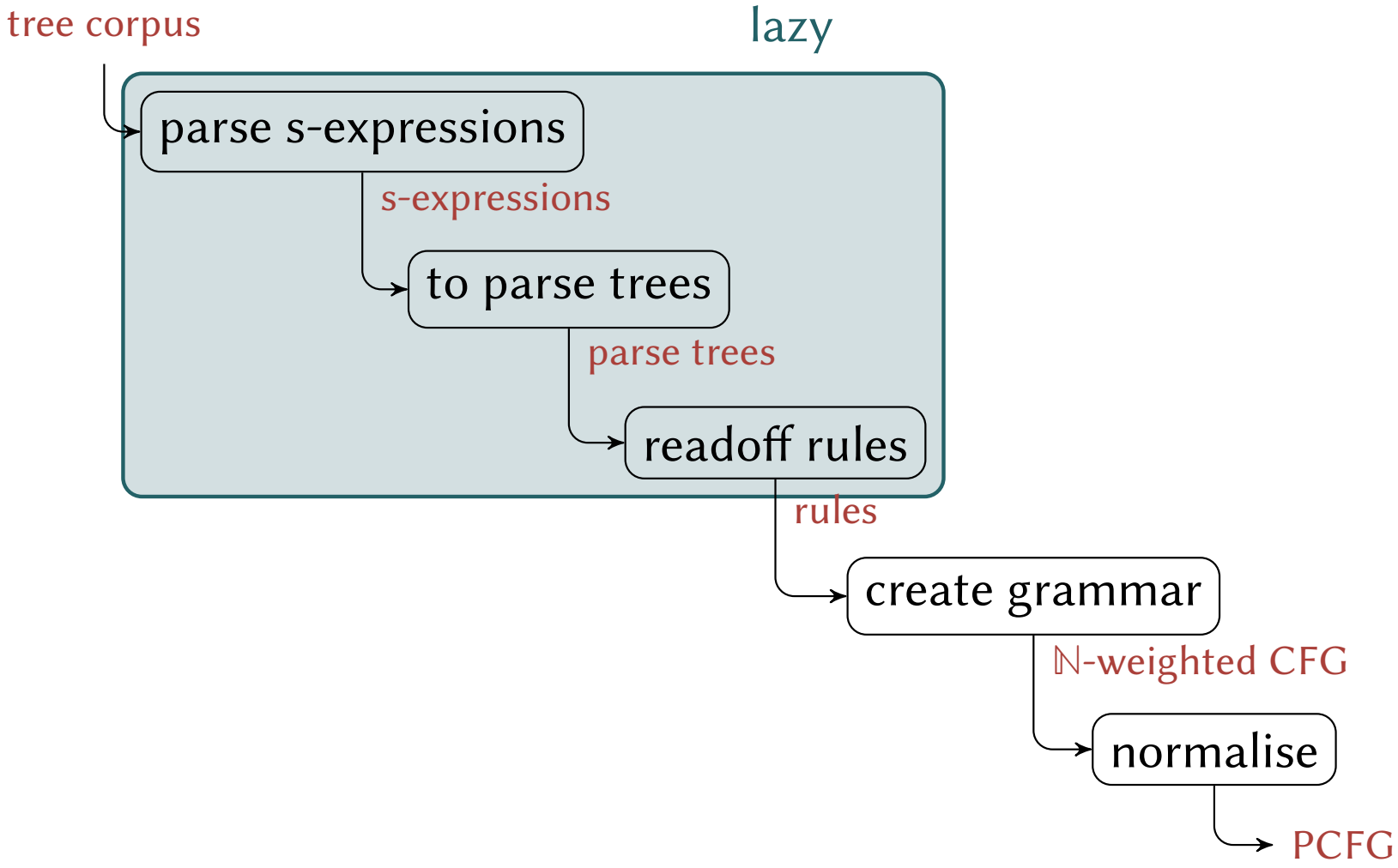

Trees and s-expressions

- *s-expression over a set A:* symbolic **expressions**

  atoms: elements of A

  lists: strings $(s_1 \sqcup s_2 \sqcup \ldots \sqcup s_k)$ where the s_i's are s-expressions

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- trees as s-expressions:
  - no empty lists
  - s_1 is always in A

Data structures (suggestion)

- tree

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  pub root: A,
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  Lexical    { lhs: N, rhs: T,      },
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}
```

- grammar

```rust
pub struct Grammar<N, T, W> where N: Eq + Hash, T: Eq + Hash {
  initial: N,
  rules: HashMap<Rule<N, T>, W>,
}
```

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- use *iterators* to act lazily on large data (e.g. corpora)