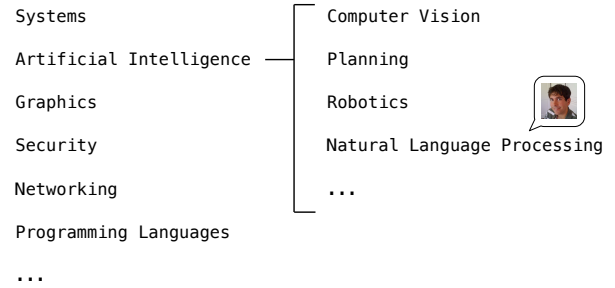


61A Lecture 37

Friday, December 2

What is Computer Science?



Machine Translation

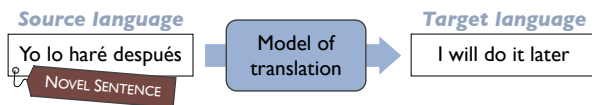
Target language corpus gives examples of well-formed sentences

I will get to it later See you later He will do it

Parallel corpus gives translation examples

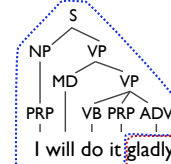
I will do it gladly You will see later
Yo lo haré de muy buen grado Después lo verás

Machine translation system:



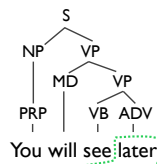
The Syntactic Structure of Natural Language

Parallel corpus gives translation examples



I will do it gladly

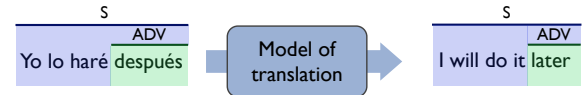
Yo lo haré de muy buen grado



You will see later

Después lo verás

Machine translation system:



A Translation System in 20 Minutes

Context-free grammars as a model of language generation

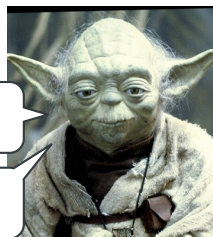
Large-scale linguistic annotations

Tree transformations

English → Yoda-speak

Help you, I can!
Yes! Mm!

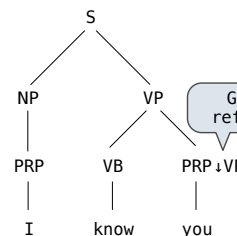
When 900 years old you reach,
look as good, you will not. Hm.



A Context-Free Grammar Describes Generation

"Grammar"

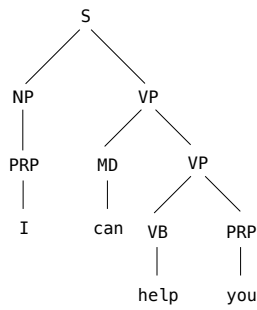
S → NP VP
NP → PRP NP
VP → VB
VP → VB PRP VP



"Lexicon"

PRP NP → I
PRP → you
VB → know
VB → help
PRP VP → me

A Context-Free Grammar Describes Generation



"Grammar"

$S \rightarrow NP VP$
 $NP \rightarrow PRP$
 $VP \rightarrow VB$
 $VP \rightarrow VB PRP$
 $VP \rightarrow MD VP$

"Lexicon"

$PRP \rightarrow I$
 $PRP \rightarrow you$
 $VB \rightarrow know$
 $VB \rightarrow help$
 $MD \rightarrow can$

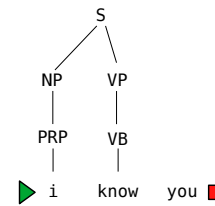
A grammar can be *learned* from data (demo)

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Left-Corner Parsing Builds Trees For Sentences

```

parse_next(S, 1)
complete(S, (PRP i), 1)
complete(S, (NP (PRP i)), 1)
parse_next(VP, 2)
complete(VP, (VB know), 2)
complete(VP, (VP (VB know)), 2)
complete(S, (S ...), 1)
  
```



"Grammar"

$S \rightarrow NP VP$
 $NP \rightarrow PRP$
 $VP \rightarrow VB$
 $VP \rightarrow VB PRP$

Left corners

"Lexicon"

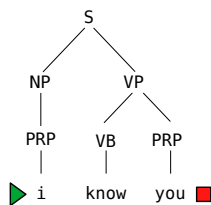
$PRP \rightarrow I$
 $PRP \rightarrow you$
 $VB \rightarrow know$
 $VB \rightarrow help$

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Left-Corner Parsing Builds Trees For Sentences

```

parse_next(S, 1)
complete(S, (PRP i), 1)
complete(S, (NP (PRP i)), 1)
parse_next(VP, 2)
complete(VP, (VB know), 2)
complete(VP, (VP (VB know) (PRP you)), 2)
complete(S, (S ...), 1)
  
```



"Grammar"

$S \rightarrow NP VP$
 $NP \rightarrow PRP$
 $VP \rightarrow VB$
 $VP \rightarrow VB PRP$

Left corners

"Lexicon"

$PRP \rightarrow I$
 $PRP \rightarrow you$
 $VB \rightarrow know$
 $VB \rightarrow help$

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