6.864: Lecture 17 (November 10th, 2005)

Machine Translation Part III

Overview

- A Phrase-Based Model: (Koehn, Och and Marcu 2003)
- Syntax Based Model 1: (Wu 1995)
- Syntax Based Model 2: (Yamada and Knight 2001)

Methods that go beyond word-word alignments

A Phrase-Based Model

(Koehn, Och and Marcu 2003)

- Intuition: IBM models have word-word translation

- Intuition: in IBM models each French word is aligned with only one English word

- A new type of model:
  align phrases in English with phrases in French

- An example from Koehn and Knight tutorial:

Morgen fliege ich nach Kanada zur Konferenz

Tomorrow I will fly to the conference in Canada

Morgen	Tomorrow
fliege	will fly
ich	I
nach Kanada	in Canada
zur Konderenz	to the conference

Representation as Alignment "Matrix"

	Maria	no	daba	una	bof'	a	la	bruja	verde
Mary	●								
did		●							
not		●							
slap			●	●	●				
the						●	●		
green									●
witch								●	

(Note: "bof"' = "bofetada")

(Another example from the Koehn and Knight tutorial)

The Issues Involved

- Finding alignment matrices for all English/French pairs in training corpora
- Coming up with a model that incorporates phrases
- Training the model
- Decoding with the model

Finding Alignment Matrices

- Step 1: train IBM model 4 for $P(f \mid e)$, and come up with most likely alignment for each (e, f) pair

- Step 2: train IBM model 4 for $P(e \mid f)$**(!)** and come up with most likely alignment for each (e, f) pair

- We now have two alignments:

  take intersection of the two alignments as a starting point

Alignment from $P(f \mid e)$ model:

	Maria	no	daba	una	bof'	a	la	bruja	verde
Mary	●								
did						●			
not		●							
slap			●	●	●				
the							●		
green									●
witch								●	

Alignment from $P(e \mid f)$ model:

	Maria	no	daba	una	bof'	a	la	bruja	verde
Mary	●								
did		●							
not		●							
slap					●				
the							●		
green									●
witch								●	

Intersection of the two alignments:

	Maria	no	daba	una	bof’	a	la	bruja	verde
Mary	●								
did									
not		●							
slap					●				
the							●		
green									●
witch								●	

The intersection of the two alignments was found to be a very reliable starting point

Heuristics for Growing Alignments

- Only explore alignment in **union** of $P(f \mid e)$ and $P(e \mid f)$ alignments
- Add one alignment point at a time
- Only add alignment points which align a word that currently has no alignment
- At first, restrict ourselves to alignment points that are "neighbors" (adjacent or diagonal) of current alignment points
- Later, consider other alignment points

The Issues Involved

- Finding alignment matrices for all English/French pairs in training corpora
- Coming up with a model that incorporates phrases
- Training the model
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The Model

- The probability model again models $P(\mathbf{f} \mid \mathbf{e})$

- The steps:
  - Choose a segmentation of $\mathbf{e}$ (all segmentations are equally likely)
  - For each English phrase e, choose a French phrase f with probability

    $$\mathbf{T}(f \mid e)$$

    for example

    $$\mathbf{T}(\text{daba una bofetada} \mid \text{slap})$$

  - Choose positions for the French phrases: if start position of the i'th French phases is a_i, and end point of $(i-1)$'th French phrase is b_{i-1}, then this has probability

    $$\mathbf{R}(a_i - b_{i-1})$$

Training the Model

Simple once we have the alignment matrices!:

- Take maximum-likelihood estimates, e.g.,

$$\mathbf{T}(\text{daba una bofetada} \mid \text{slap}) = \frac{Count(\text{daba una bofetada}, \text{slap})}{Count(\text{slap})}$$

- Take similar estimates for the alignment probabilities

The Issues Involved

- Finding alignment matrices for all English/French pairs in training corpora

- Coming up with a model that incorporates phrases

- Training the model

- Decoding with the model

The Decoding Method

- Goal is to find a high probability English string $\mathbf{e}$ under

$$P(\mathbf{e})P(\mathbf{f}, \mathbf{a} \mid \mathbf{e})$$

where

$$P(\mathbf{f}, \mathbf{a} \mid \mathbf{e}) = \prod_{i=1}^{n} \mathbf{T}(f_i \mid e_i)\mathbf{R}(a_i - b_{i-1})$$

where f_i and e_i are the n *phrases* in the alignment,
a_i and b_i are start/end points of the i'th phrase

The Decoding Method

- A **partial hypothesis** is an English prefix, aligned with some of the French sentence

Maria   no   daba una bofetada a la bruja verde

Mary   did not

- S_m is a **stack** which stores n most likely partial analyses that account for m French words

- At each point, pick a partial hypothesis, and **advance** it by choosing a substring of the French string

Maria no daba una bofetada a la bruja verde

Mary did not

$$\Downarrow$$

Maria no daba una bofetada a la bruja verde

Mary did not slap

- In this case, we create a new member of the stack S_5

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Methods that go beyond word-word alignments

(Wu 1995)

- Standard probabilistic context-free grammars:
  probabilities over rewrite rules define probabilities over trees, strings, in one language

- **Transduction grammars**:
  Simultaneously generate strings in two languages

A Probabilistic Context-Free Grammar

S	$\Rightarrow$	NP	VP	1.0
VP	$\Rightarrow$	Vi		0.4
VP	$\Rightarrow$	Vt	NP	0.4
VP	$\Rightarrow$	VP	PP	0.2
NP	$\Rightarrow$	DT	NN	0.3
NP	$\Rightarrow$	NP	PP	0.7
PP	$\Rightarrow$	P	NP	1.0

Vi	$\Rightarrow$	sleeps	1.0
Vt	$\Rightarrow$	saw	1.0
NN	$\Rightarrow$	man	0.7
NN	$\Rightarrow$	woman	0.2
NN	$\Rightarrow$	telescope	0.1
DT	$\Rightarrow$	the	1.0
IN	$\Rightarrow$	with	0.5
IN	$\Rightarrow$	in	0.5

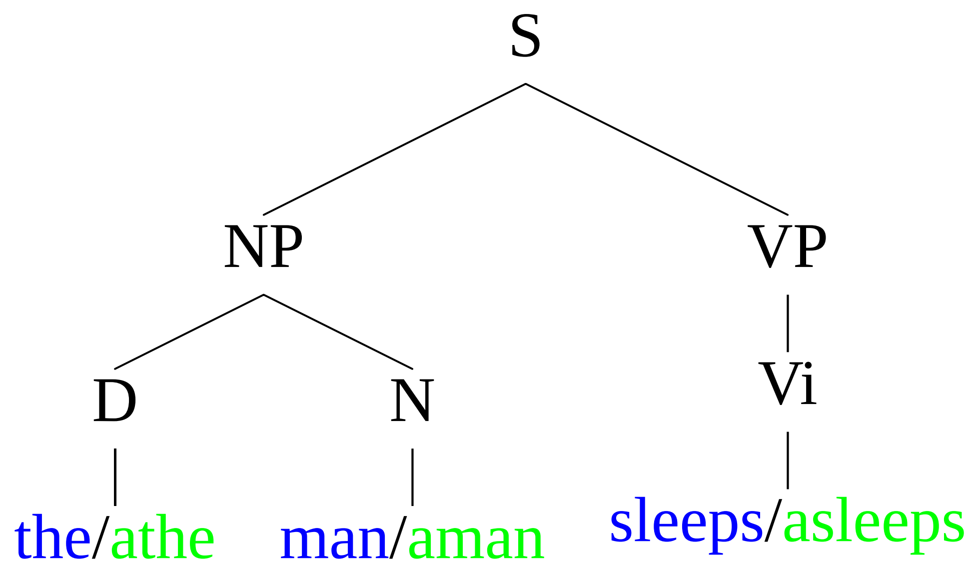
- Probability of a tree with rules $\alpha_i \rightarrow \beta_i$ is $\prod_i P(\alpha_i \rightarrow \beta_i | \alpha_i)$

Transduction PCFGs

- First change to the rules: **lexical** rules generate a pair of words

Vi	$\Rightarrow$	sleeps/asleeps	1.0
Vt	$\Rightarrow$	saw/asaw	1.0
NN	$\Rightarrow$	man/aman	0.7
NN	$\Rightarrow$	woman/awoman	0.2
NN	$\Rightarrow$	telescope/atelescope	0.1
DT	$\Rightarrow$	the/athe	1.0
IN	$\Rightarrow$	with/awith	0.5
IN	$\Rightarrow$	in/ain	0.5

Transduction PCFGs



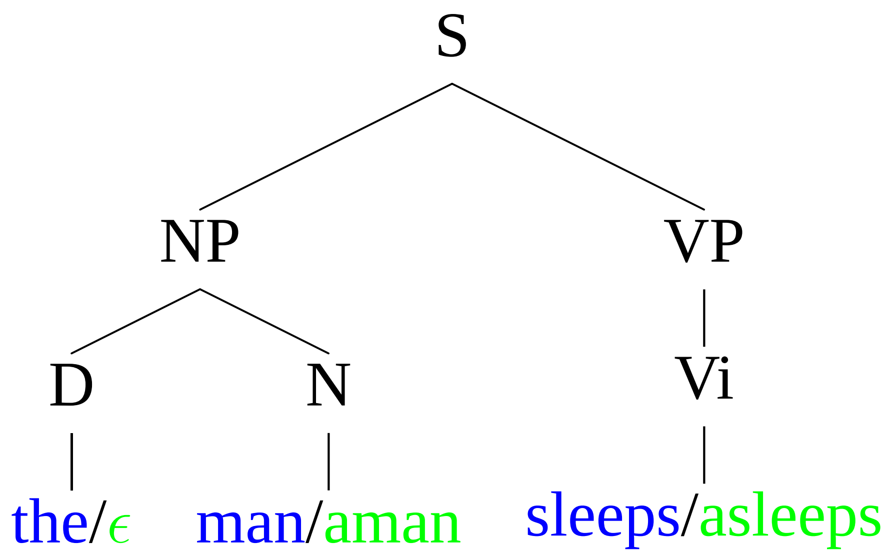
- The modified PCFG gives a distribution over $(\mathbf{f}, \mathbf{e}, T)$ triples, where $\mathbf{e}$ is an English string, $\mathbf{f}$ is a French string, and T is a tree

Transduction PCFGs

- Another change: allow empty string ϵ to be generated in either language, e.g.,

DT	$\Rightarrow$	the/ϵ	1.0
IN	$\Rightarrow$	ϵ/awith	0.5

Transduction PCFGs



- Allows strings in the two languages to have different lengths

  the man sleeps $\Rightarrow$ aman asleeps

Transduction PCFGs

- Final change: currently formalism does not allow different word orders in the two languages

- Modify the method to allow two types of rules, for example

$$
\begin{array}{llllll}
S & \Rightarrow & [NP & VP] & & 0.7 \\
S & \Rightarrow & \langle NP & VP\rangle & & 0.3
\end{array}
$$

- Define:
  - E_X is the English string under non-terminal X
    e.g., E_{NP} is the English string under the NP
  - F_X is the French string under non-terminal X

- Then for $\mathsf{S} \Rightarrow [\mathtt{NP}\ \ \mathtt{VP}]$ we define

$$\begin{aligned} E_S &= E_{NP}.E_{VP} \\ F_S &= F_{NP}.F_{VP} \end{aligned}$$

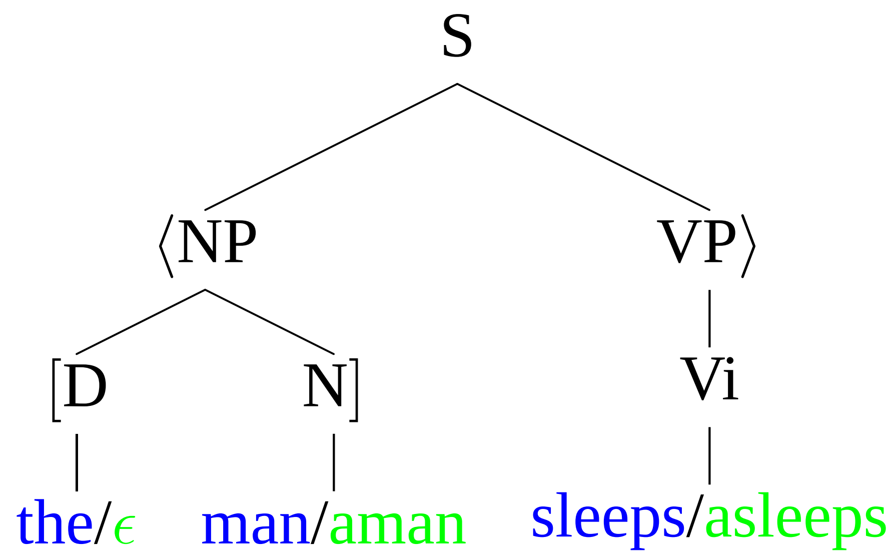
  where . is concatentation operation

- For $\mathsf{S} \Rightarrow \langle\mathtt{NP}\ \ \mathtt{VP}\rangle$ we define

$$\begin{aligned} E_S &= E_{NP}.E_{VP} \\ F_S &= F_{VP}.F_{NP} \end{aligned}$$

In the second case, the string order in French is reversed

Transduction PCFGs



- This tree represents the correspondance

  the man sleeps $\Rightarrow$ asleeps aman

A Transduction PCFG

S	$\Rightarrow$	$[$NP	VP$]$	0.7
S	$\Rightarrow$	$\langle$NP	VP$\rangle$	0.3
VP	$\Rightarrow$	Vi		0.4
VP	$\Rightarrow$	$[$Vt	NP$]$	0.01
VP	$\Rightarrow$	$\langle$Vt	NP$\rangle$	0.79
VP	$\Rightarrow$	$[$VP	PP$]$	0.2
NP	$\Rightarrow$	$[$DT	NN$]$	0.55
NP	$\Rightarrow$	$\langle$DT	NN$\rangle$	0.15
NP	$\Rightarrow$	$[$NP	PP$]$	0.7
PP	$\Rightarrow$	$\langle$P	NP$\rangle$	1.0

Vi	$\Rightarrow$	sleeps/ϵ	0.4
Vi	$\Rightarrow$	sleeps/asleeps	0.6
Vt	$\Rightarrow$	saw/asaw	1.0
NN	$\Rightarrow$	ϵ/aman	0.7
NN	$\Rightarrow$	woman/awoman	0.2
NN	$\Rightarrow$	telescope/atelescope	0.1
DT	$\Rightarrow$	the/athe	1.0
IN	$\Rightarrow$	with/awith	0.5
IN	$\Rightarrow$	in/ain	0.5

(Wu 1995)

- Dynamic programming algorithms exist for "parsing" a pair of English/French strings (finding most likely tree underlying an English/French pair). Runs in $O(|\mathbf{e}|^3|\mathbf{f}|^3)$ time.

- Training the model: given $(\mathbf{e}_k, \mathbf{f}_k)$ pairs in training data, the model gives

$$P(T, \mathbf{e}_k, \mathbf{f}_k \mid \Theta)$$

where T is a tree, Θ are the parameters. Also gives

$$P(\mathbf{e}_k, \mathbf{f}_k \mid \Theta) = \sum_T P(T, \mathbf{e}_k, \mathbf{f}_k \mid \Theta)$$

Likelihood function is then

$$L(\Theta) = \sum_k \log P(f_k, e_k \mid \Theta) = \sum_k \log \sum_T P(T, f_k, e_k \mid \Theta)$$

Wu gives a dynamic programming implementation for EM

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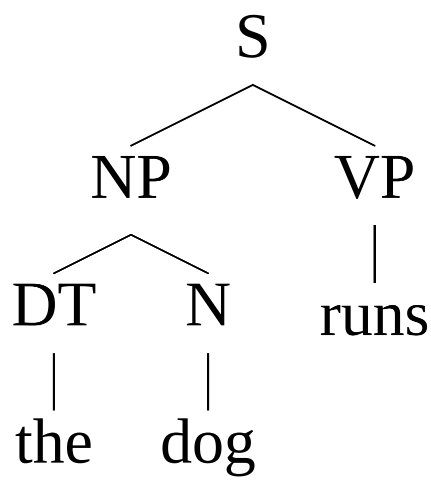
Methods that go beyond word-word alignments

(Yamada and Knight 2001)

- Task: English to Japanese translation
- IBM Models may be poor for languages with very different word orders?
- Task is Japanese $\longrightarrow$ English translation,
  and we have an English parser
- Notation: as before we'll use $\mathbf{f}$ as the source language (was French, now Japanese), and $\mathbf{e}$ as the target language
- Notation: we'll use $\mathcal{E}$ to refer to an English **tree**

An Example $(\mathcal{E}, \mathrm{f})$ Pair

$\mathcal{E}$:



f: arun athe adog anow

Preprocessing of the training set:
Parse all the English strings

Problems that Need to be Solved

- How to model $P(\mathbf{f} \mid \mathcal{E})$?
  i.e., how is a French **string** generated from an English **tree**?

- How do we train the parameters of the model?

- How do we decode with the model, i.e., find

$$\text{argmax}_{\mathbf{e}} P(\mathbf{f} \mid \mathcal{E}) P(\mathbf{e})$$

  where $\mathbf{e}, \mathcal{E}$ is a sentence/tree pair in English?

How to model $P(\mathbf{f} \mid \mathbf{e})$?: Three Operations that Modify Trees

- **Reordering** operations
- **Insertion** of French words
- **Translation** of English words

Reordering Operations

- For each rule with n children, there are $n!$ possible reorderings
- For example, $\texttt{S} \longrightarrow \texttt{ADVP NP VP}$ can be reordered in 6 possible ways

$$
\begin{array}{llllll}
\texttt{S} & \longrightarrow & \texttt{ADVP} & \texttt{NP} & \texttt{VP} \\
\texttt{S} & \longrightarrow & \texttt{ADVP} & \texttt{VP} & \texttt{NP} \\
\texttt{S} & \longrightarrow & \texttt{NP} & \texttt{ADVP} & \texttt{VP} \\
\texttt{S} & \longrightarrow & \texttt{NP} & \texttt{VP} & \texttt{ADVP} \\
\texttt{S} & \longrightarrow & \texttt{VP} & \texttt{NP} & \texttt{ADVP} \\
\texttt{S} & \longrightarrow & \texttt{VP} & \texttt{ADVP} & \texttt{NP}
\end{array}
$$

Reordering Operations

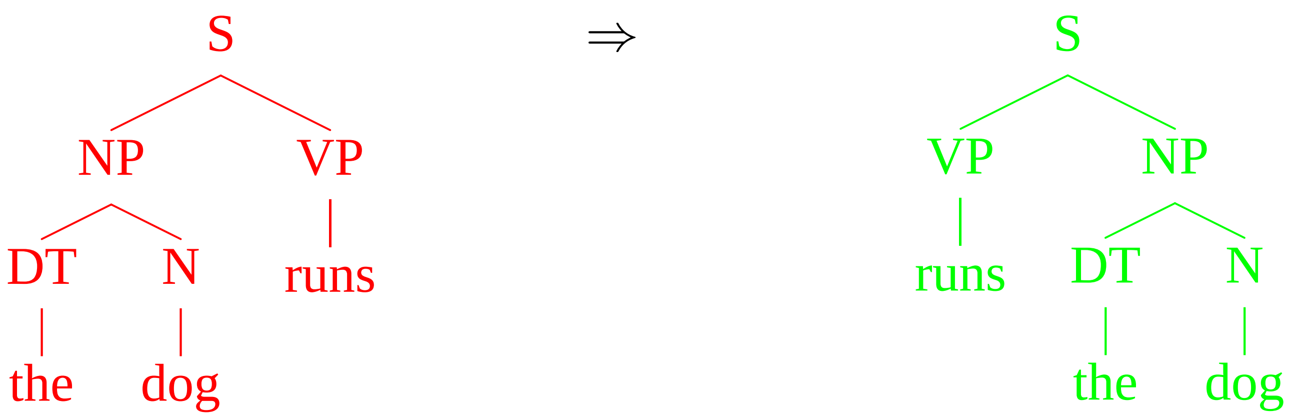
- Introduce $\rho(r' \mid r)$ as probability of r being reordered as r'
- For example,

$$\rho(\texttt{S} \rightarrow \texttt{VP ADVP NP} \mid \texttt{S} \rightarrow \texttt{ADVP NP VP})$$

- We now have a table of these probabilities for each rule:

r′					$\rho(r' \mid \texttt{S} \rightarrow \texttt{ADVP NP VP})$
S	→	ADVP	NP	VP	0.5
S	→	ADVP	VP	NP	0.1
S	→	NP	ADVP	VP	0.3
S	→	NP	VP	ADVP	0.03
S	→	VP	NP	ADVP	0.04
S	→	VP	ADVP	NP	0.03

An Example of Reordering Operations



Has probability:

$$\rho(\texttt{S} \rightarrow \texttt{VP NP} \mid \texttt{S} \rightarrow \texttt{NP VP}) \times$$
$$\rho(\texttt{NP} \rightarrow \texttt{DT N} \mid \texttt{NP} \rightarrow \texttt{DT N})$$
$$\rho(\texttt{DT} \rightarrow \texttt{the} \mid \texttt{DT} \rightarrow \texttt{the})$$
$$\rho(\texttt{N} \rightarrow \texttt{dog} \mid \texttt{N} \rightarrow \texttt{dog})$$
$$\rho(\texttt{VP} \rightarrow \texttt{runs} \mid \texttt{VP} \rightarrow \texttt{runs})$$

Note: Unary rules can only "reorder" in one way, with probability 1
e.g., $\rho(\texttt{VP} \rightarrow \texttt{runs} \mid \texttt{VP} \rightarrow \texttt{runs}) = 1$

Insertion Operations

- At any node in the tree, we can either:
  - Generate no "inserted" foreign words
    e.g., has probability

    $$\mathbf{I_1}(none \mid NP, S)$$

    here NP is the node in the tree, S is its parent
  - Generate an inserted foreign word to the left of the node
    e.g., has probability

    $$\mathbf{I_1}(left \mid NP, S)\mathbf{I_2}(anow)$$

    here NP is the node in the tree, S is its parent, and $anow$ is inserted to the left of the node

– Generate an inserted foreign word to the right of the node

$$\mathbf{I_1}(right \mid NP, S)\mathbf{I_2}(anow)$$

here NP is the node in the tree, S is its parent, and $anow$ is inserted to the right of the node

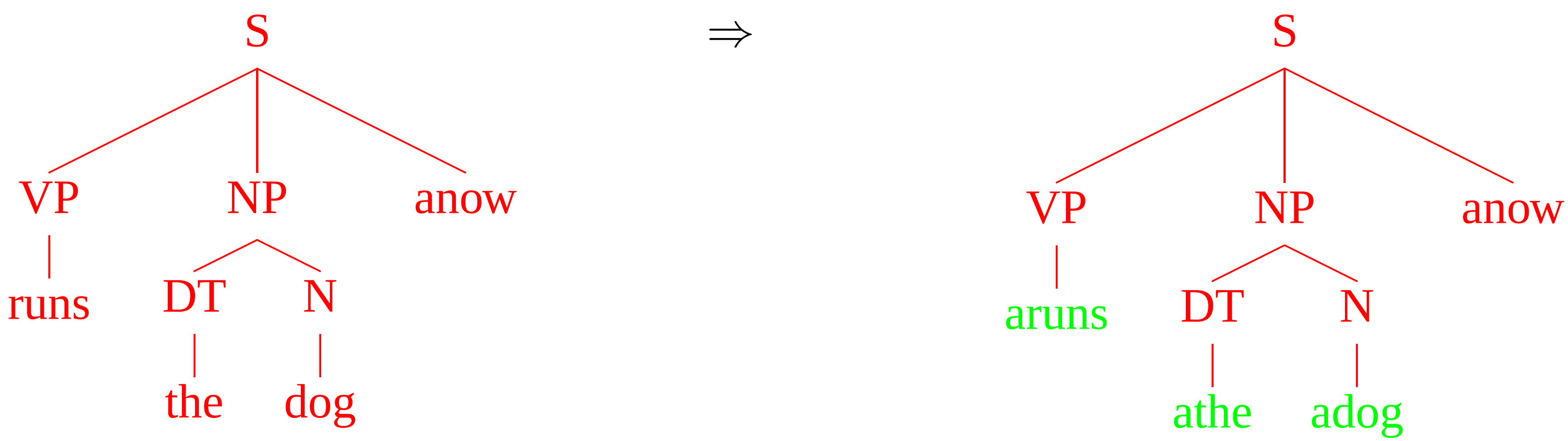
An Example of Insertion Operations

Has probability:

$$
\begin{aligned}
&\mathbf{I_1}(right \mid NP, S) \times \mathbf{I_2}(anow) \times \\
&\mathbf{I_1}(none \mid S, TOP) \times \\
&\mathbf{I_1}(none \mid VP, S) \times \\
&\mathbf{I_1}(none \mid runs, VP) \times \\
&\mathbf{I_1}(none \mid DT, NP) \times \\
&\mathbf{I_1}(none \mid N, NP) \times \\
&\mathbf{I_1}(none \mid the, DT) \times \\
&\mathbf{I_1}(none \mid dog, N)
\end{aligned}
$$

Translation Operations

For each English word, translate it to French word f with probability $\mathbf{T}(f \mid e)$ (note that f can be $NULL$)



Has probability:

$\mathbf{T}(aruns \mid runs) \times \mathbf{T}(athe \mid the) \times \mathbf{T}(adog \mid dog)$

Summary: Three Operations that Modify Trees

- The three operations:
  - **Reordering** operations with parameters ρ
  - **Insertion** of French words with parameters $\mathbf{I_1}$, $\mathbf{I_2}$
  - **Translation** of English words with parameters $\mathbf{T}$

- In this case, the **alignment** $\mathbf{a}$ is the sequence of reordering, insertion and translation operations used to build $\mathbf{f}$

- We have a model of $P(\mathbf{f}, \mathbf{a} \mid \mathcal{E})$

- Note that each $(\mathcal{E}, \mathbf{f})$ pair may have many possible alignments

- Two questions:

  1. How do we train the ρ, $\mathbf{I_1}$, $\mathbf{I_2}$, $\mathbf{T}$ parameters?
  2. How do we find

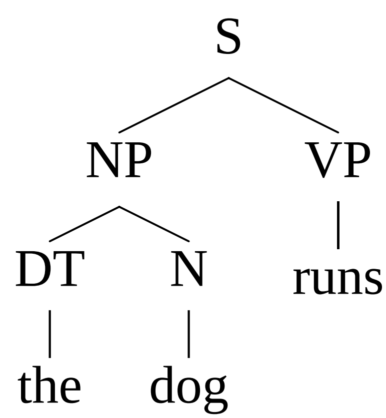
$$\mathrm{argmax}_{\mathcal{E},\mathbf{e},\mathbf{a}} P(\mathbf{f}, \mathbf{a} \mid \mathcal{E}) P(\mathbf{e})$$

  where $(\mathcal{E}, \mathbf{e}, \mathbf{a})$ is an English tree, sentence, alignment triple?

The translation problem:

Input: arun athe adog anow

Output:



A Slightly Simpler Translation Problem

- For now, instead of trying to find

  $$\text{argmax}_{\mathcal{E},\mathbf{e},\mathbf{a}} P(\mathbf{f}, \mathbf{a} \mid \mathcal{E}) P(\mathbf{e})$$

  we'll consider a method that finds

  $$\text{argmax}_{\mathcal{E},\mathbf{e},\mathbf{a}} P(\mathbf{f}, \mathbf{a} \mid \mathcal{E})$$

  (no language model)

- This can be done by transforming our model into a probabilistic context-free grammar, then parsing the French sentence using dynamic programming!!!

Constructing a PCFG

- For each English/French word pair (e, f), construct rules

  $\texttt{e} \rightarrow \texttt{f}$

  with probabilities $\mathbf{T}(f \mid e)$

- For example, $\texttt{dog} \rightarrow \texttt{adog}$ with probability $\mathbf{T}(adog \mid dog)$

- Also construct rules

  $\texttt{e} \rightarrow \epsilon$

  with probabilities $\mathbf{T}(NULL \mid e)$ (where ϵ is the empty string)

Constructing a PCFG

- For every pair of non-terminals construct rules such as

`NP-S` $\rightarrow$ `NP` with probability $\mathbf{I_1}(none \mid NP, S)$
`NP-S` $\rightarrow$ `INS NP` with probability $\mathbf{I_1}(left \mid NP, S)$
`NP-S` $\rightarrow$ `NP INS` with probability $\mathbf{I_1}(right \mid NP, S)$

- Also, for every French word f that can be inserted, construct rules such as

`INS` $\rightarrow$ `f` with probability $\mathbf{I_2}(f)$

e.g.,

`INS` $\rightarrow$ `anow` with probability $\mathbf{I_2}(anow)$

Constructing a PCFG

- For every rule in English r, for every reordering of r, construct following rules
(example with $r = \texttt{S} \rightarrow \texttt{ADVP NP VP}$,
$r' = \texttt{S} \rightarrow \texttt{VP ADVP NP}$)

$\texttt{S} \rightarrow \texttt{S(ADVP,NP,VP)}$ with probability 1

$\texttt{S(ADVP,NP,VP)} \rightarrow \texttt{VP-S ADVP-S NP-S}$

with probability $\rho(\texttt{S} \rightarrow \texttt{VP ADVP NP} \mid \texttt{S} \rightarrow \texttt{ADVP NP VP})$

Constructing a PCFG

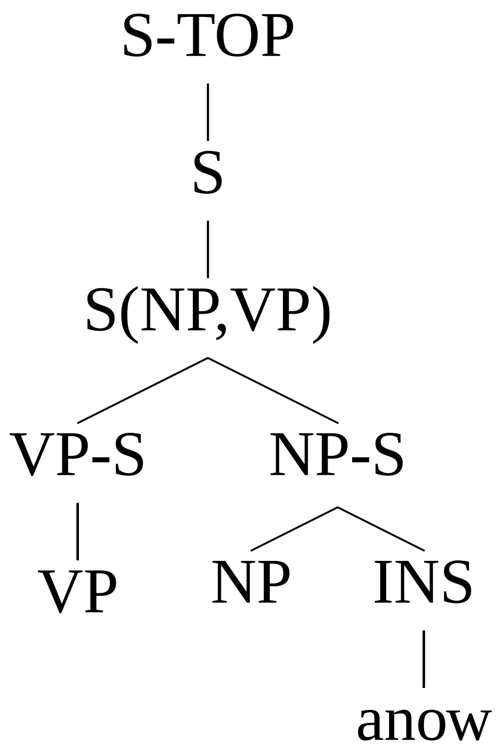
- Finally, for every non-terminal X, construct a start symbol

  `X-TOP`

  for example,

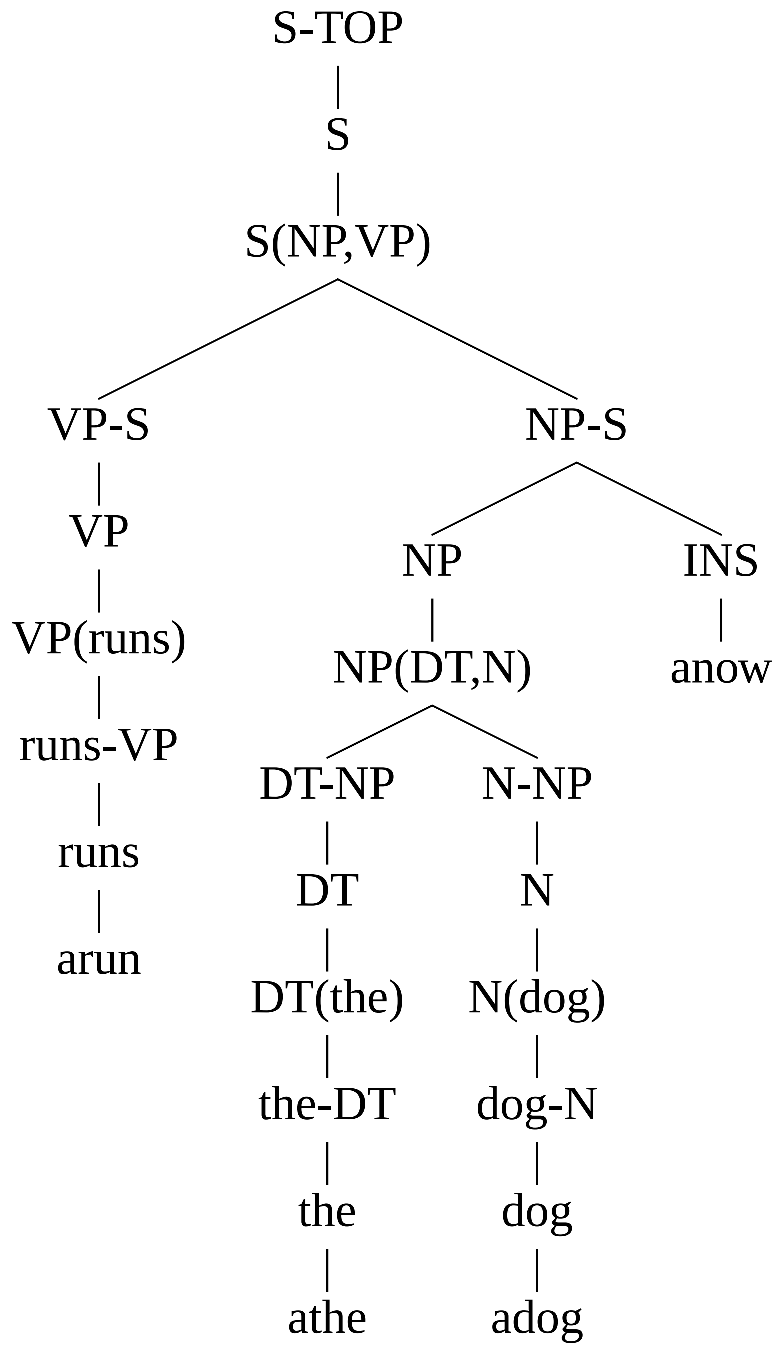
  `S-TOP`

An example:



This subtree has probability:

$\mathbf{I_1}(none \mid S, TOP) \times \rho(\texttt{S} \rightarrow \texttt{VP NP} \mid \texttt{S} \rightarrow \texttt{NP VP}) \times$
$\mathbf{I_1}(none \mid VP, S) \times \mathbf{I_1}(right \mid NP, S) \times \mathbf{I_2}(anow)$


S-TOP
S
S(NP,VP)
VP-S
NP-S
VP
NP
INS
VP(runs)
NP(DT,N)
anow
runs-VP
DT-NP
N-NP
runs
DT
N
arun
DT(the)
N(dog)
the-DT
dog-N
the
dog
athe
adog

Other Points

- Once we've constructed the PCFG, finding the most likely parse for a French string $\rightarrow$ finding the most likely English parse tree, English string, and alignment

- The model can be trained using EM:
  dynamic programming approach is possible

- Can parse a French sentence to produce a **forest**:
  a compact representation of all possible English translations

- A trigram language model can be used to pick the highest scoring string from the forest (although I'm not sure about the computational complexity of this...)

- (Yamada and Knight 2002) describe newer models

R:	the current difficulties should encourage us to redouble our efforts to promote cooperation in the euro-mediterranean framework.
C:	the current problems should spur us to intensify our efforts to promote cooperation within the framework of the europa-mittelmeerprozesses.
B:	the current problems should spur us, our efforts to promote cooperation within the framework of the europa-mittelmeerprozesses to be intensified.

R:	propaganda of any sort will not get us anywhere.
C:	with any propaganda to lead to nothing.
B:	with any of the propaganda is nothing to do here.

R:	yet we would point out again that it is absolutely vital to guarantee independent financial control.
C:	however, we would like once again refer to the absolute need for the independence of the financial control.
B:	however, we would like to once again to the absolute need for the independence of the financial control out.

R:	i cannot go along with the aims mr brok hopes to achieve via his report.
C:	i cannot agree with the intentions of mr brok in his report persecuted.
B:	i can intentions, mr brok in his report is not agree with.

R:	on method, i think the nice perspectives, from that point of view, are very interesting.
C:	what the method is concerned, i believe that the prospects of nice are on this point very interesting.
B:	what the method, i believe that the prospects of nice in this very interesting point.

R:	secondly, without these guarantees, the fall in consumption will impact negatively upon the entire industry.
C:	and, secondly, the collapse of consumption without these guarantees will have a negative impact on the whole sector.
B:	and secondly, the collapse of the consumption of these guarantees without a negative impact on the whole sector.

R:	awarding a diploma in this way does not contravene uk legislation and can thus be deemed legal.
C:	since the award of a diploms is not in this form contrary to the legislation of the united kingdom, it can be recognised as legitimate.
B:	since the award of a diploms in this form not contrary to the legislation of the united kingdom is, it can be recognised as legitimate.

R:	i should like to comment briefly on the directive concerning undesirable substances in products and animal nutrition.
C:	i would now like to comment briefly on the directive on undesirable substances and products of animal feed.
B:	i would now like to briefly to the directive on undesirable substances and products in the nutrition of them.

R:	it was then clearly shown that we can in fact tackle enlargement successfully within the eu 's budget.
C:	at that time was clear that we can cope with enlargement, in fact, within the framework drawn by the eu budget.
B:	at that time was clear that we actually enlargement within the framework able to cope with the eu budget, the drawn.

Figure 1: Examples where annotator 1 judged the reordered system to give an improved translation when compared to the baseline system. Recall that annotator 1 judged 40 out of 100 translations to fall into this category. These examples were chosen at random from these 40 examples, and are presented in random order. **R** is the human (reference) translation; **C** is the translation from the system with reordering; **B** is the output from the baseline system.

R:	on the other hand non-british hauliers pay nothing when travelling in britain.
C:	on the other hand, foreign kraftverkehrsunternehmen figures anything if their lorries travelling through the united kingdom.
B:	on the other hand, figures foreign kraftverkehrsunternehmen nothing if their lorries travel by the united kingdom.
R:	i think some of the observations made by the consumer organisations are included in the commission 's proposal.
C:	i think some of these considerations, the social organisations will be addressed in the commission proposal.
B:	i think some of these considerations, the social organisations will be taken up in the commission 's proposal.
R:	during the nineties the commission produced several recommendations on the issue but no practical solutions were found.
C:	in the nineties, there were a number of recommendations to the commission on this subject to achieve without, however, concrete results.
B:	in the 1990s, there were a number of recommendations to the commission on this subject without, however, to achieve concrete results.
R:	now, in a panic, you resign yourselves to action.
C:	in the current paniksituation they must react necessity.
B:	in the current paniksituation they must of necessity react.
R:	the human aspect of the whole issue is extremely important.
C:	the whole problem is also a not inconsiderable human side.
B:	the whole problem also has a not inconsiderable human side.

R:	in this area we can indeed talk of a european public prosecutor.
C:	and we are talking here, in fact, a european public prosecutor.
B:	and here we can, in fact speak of a european public prosecutor.
R:	we have to make decisions in nice to avoid endangering enlargement, which is our main priority.
C:	we must take decisions in nice, enlargement to jeopardise our main priority.
B:	we must take decisions in nice, about enlargement be our priority, not to jeopardise.
R:	we will therefore vote for the amendments facilitating its use.
C:	in this sense, we will vote in favour of the amendments which, in order to increase the use of.
B:	in this sense we vote in favour of the amendments which seek to increase the use of.
R:	the fvo mission report mentioned refers specifically to transporters whose journeys originated in ireland.
C:	the quoted report of the food and veterinary office is here in particular to hauliers, whose rushed into shipments of ireland.
B:	the quoted report of the food and veterinary office relates in particular, to hauliers, the transport of rushed from ireland.

Figure 2: Examples where annotator 1 judged the reordered system to give a worse translation than the baseline system. Recall that annotator 1 judged 20 out of 100 translations to fall into this category. These examples were chosen at random from these 20 examples, and are presented in random order. **R** is the human (reference) translation; **C** is the translation from the system with reordering; **B** is the output from the baseline system.