Prob parsing assignment calculations

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Finding the **Viterbi parse** is finding the most probable parse of the sentence. We call probability of the Viterbi parse the **Viterbi probability**. The Viterbi parse of the sentence will use the most Viterbi parses of its parts. That means if a sentence edge in the chart is made out of an np edge and a vp edge, the most probable parse of the sentence will be built up out of the most probable parse of the np and the most probable parse of the vp.

Let's talk more concretely abou finding the most Viterbi parse of an edge. We will assume that every edge E has a category (E.cat) and an associated list of daughter pairs (E.dtrs). An np edge that can be built 4 ways has 4 dtrs pairs in E.dtrs. Each daughter pair in E.dtrs defines a parse path for building the np, and the Viterbi probability of that np is the maximum of the probabilities of the 4 parse paths.
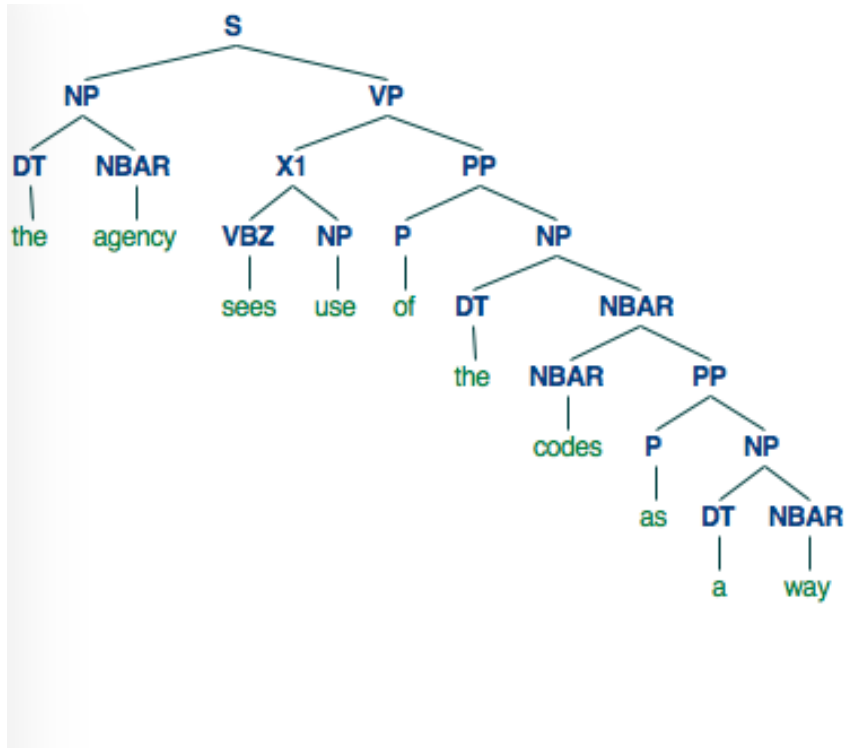
This is the recursion relation defining the Viterbi probability of an edge (Vit(E)):

$$\text{Vit}(E) = \text{Max}_{\langle D_1, D_2 \rangle \in \text{E.dtrs}} \text{PProb(E, } D_1, D_2)$$
$$\text{PProb(E, } D_1, D_2) = \text{Vit}(D_1) * \text{Vit}(D_2) * P(\text{E.cat} \rightarrow D_1.\text{cat} \quad D_2.\text{cat})$$

In the calculations below, in ambiguous edges, a '*' occurs next to the daughter record that provides the maximum "PProb". This is the daughter record that will be used in constructing the single Viterbi parse.

Below we give the Viterbi parse as well as the computations for computing the Viterbi parse of the homework sentence. Note that only '*'-ed daughter records are used in the parse tree.

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S
NP VP
DT NBAR X1 PP
the agency VBZ NP P NP
sees use of DT NBAR
the NBAR PP
codes P NP
as DT NBAR
a way

E	D_1	D_2	$Vit(D_1)$	$Vit(D_2)$	Rule	$Vit(E)$
s(0,10)	np(0,2)	vp(2,10)	.0025	2.3438e-09	1.0	5.8594e-12
np(0,2)	dt(0,1)	nbar(1,2)	.5	.01	.5	.0025
dt(0,1)	Lexical					.5
nbar(1,2)	Lexical					.01
vp(2,10)	vbz(2,3)	np(3,10)	1.0	9.3750-9	.4	3.7500e-10
	* X1(2,4)	pp(4,10)	.01	4.6875e-07	.5	2.3438e-09
	X2(2,7)	pp(7,10)	1.2500e-05	.00125	.1	1.5625e-09
	X1(2,7)	pp(7,10)	2.5e-06	.00125	.5	1.5625e-09
				max		2.3438e-09
X2(2,7)	X1(2,4)	pp(4,7)	.01	.00125	1.0	1.25e-05
X1(2,7)	vbz(2,3)	np(3,7)	1.0	2.5e-06	1.0	2.5e-06
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E	D_1	D_2	Vit(D_1)	Vit(D_2)	Rule	Vit(E)
X1(2,4)	vbz(2,3)	np(3,4)	1.0	.01	1.0	.01
vbz(2,3)	Lexical					1.0
np(3,10)	* nbar(3,4)	pp(4,10)	.01	4.6875e-07	.2	9.3750e-10
	nbar (3,7)	pp(7,10)	3.7500e-06	.00125	.2	9.3750e-10
				max		9.3750e-10
np(3,7)	nbar(3,4)	pp(4,7)	.01	.00125	.2	2.5e-06
nbar(3,7)	nbar(3,4)	pp(4,7)	.01	.00125	.3	3.7500e-06
np(3,4)	Lexical					.01
nbar(3,4)	Lexical					.01
pp(4,10)	p(4,5)	np(5,10)	.5	9.375e-07	1.0	4.6875e-07
pp(4,7)	p(4,5)	np(5,7)	.5	.0025	1.0	.00125
p(4,5)	Lexical					.5
np(5,10)	dt(5,6)	nbar(6,10)	.5	3.7500e-06	.5	9.375e-07
np(5,7)	dt(5,6)	nbar(6,7)	.5	.01	.5	.0025
dt(5,6)	Lexical					.5
nbar(6,10)	nbar(6,7)	pp(7,10)	.01	.00125	.3	3.75e-06
nbar(6,7)	Lexical					.01
pp(7,10)	p(7,8)	np(8,10)	.5	.0025	1.0	.00125
p(7, 8)	Lexical					.5
np(8,10)	dt(8,9)	nbar(9,10)	.5	.01	.5	.0025
dt(8, 9)	Lexical					.5
nbar(9, 10)	Lexical					.01