Lecture reviews — Week 06
with solutions

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Week(s 5 &) 6 keypoints

Week 5:

- what "lemmatization" is
- what "part-of-speech tagging" is
- two hypothesis to transform PoS tagging into "the second problem" of HMMs
- order of magnitude of performances

Week 6:

- what an HMM is
- the 3 problems and how it relates to PoS tagging
- Viterbi algorithm
- properties of Baum-Welch algorithm

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Week 6 practice example

the cat you saw running

④ What is the most probable tagging (using data provided below)?

cat: N (1e-4), V (2e-6)
run: N (3e-6), V (4e-4)
running: N (5e-6), V (6e-4)
saw: N (7e-4), V (8e-5)
the: D
you: P

Pi(D) = 0.35 Pi(N) = 0.25 Pi(V) = 0.15 Pi(P) = 0.1

P(D|D) = 0	P(N|D) = 0.8	P(V|D) = 0	P(P|D) = 0
P(D|N) = 0.1	P(N|N) = 0.2	P(V|N) = 0.4	P(P|N) = 0.3
P(D|V) = 0.15	P(N|V) = 0.35	P(V|V) = 0.2	P(P|V) = 0.25
P(D|P) = 0.1	P(N|P) = 0.3	P(V|P) = 0.5	P(P|P) = 0

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Week 6 practice example

④ What is the most probable tagging (using data provided below)?

Generaly speaking, the way to answer such a question is to draw the lattice and do the Viterbi algorithm.

In this very case, since several transition probabilities are null, we are only left with the 4 following possibilities (among the 8 former ones):

- D N P N N:
  $\ldots \cdot P(\mathrm{N}|\mathrm{P}) \cdot P(\text{saw}|\mathrm{N}) \cdot P(\mathrm{N}|\mathrm{N}) \cdot P(\text{running}|\mathrm{N}) = 3 \times 7 \times 2 \times 5 \cdot 10^{-12}$
- D N P N V:
  $\ldots \cdot P(\mathrm{N}|\mathrm{P}) \cdot P(\text{saw}|\mathrm{N}) \cdot P(\mathrm{V}|\mathrm{N}) \cdot P(\text{running}|\mathrm{V}) = 3 \times 7 \times 4 \times 6 \cdot 10^{-10}$
- D N P V N:
  $\ldots \cdot P(\mathrm{V}|\mathrm{P}) \cdot P(\text{saw}|\mathrm{V}) \cdot P(\mathrm{N}|\mathrm{V}) \cdot P(\text{running}|\mathrm{N}) = 5 \times 8 \times 3.5 \times 5 \cdot 10^{-13}$
- D N P V V:
  $\ldots \cdot P(\mathrm{V}|\mathrm{P}) \cdot P(\text{saw}|\mathrm{V}) \cdot P(\mathrm{V}|\mathrm{V}) \cdot P(\text{running}|\mathrm{V}) = 5 \times 8 \times 2 \times 6 \cdot 10^{-11}$

among which the second is the biggest;
thus the tagging is D N P N V.