Announcements
- A5 due Tues
- FP out Tues. Will discuss in-class

Recap seq-to-seq MT

I make a desk </s>

Je fais un bureau <s>

encoder ⟶ decoder
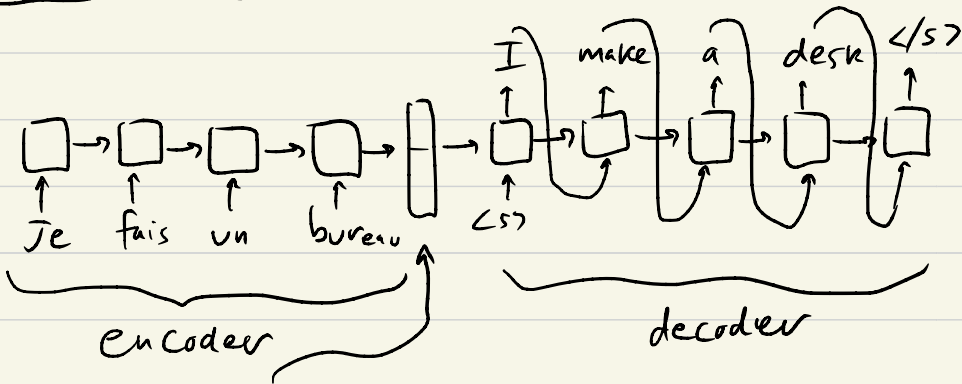
whole sentence crammed into a vector

attention

$\overline{C}^{(1)}$ W

ATTN

$\overline{h}_1^{(e)}$ $\overline{h}_2^{(e)}$ $\overline{h}_3^{(e)}$ $\overline{h}_4^{(e)}$ $\overline{h}_1^{(d)}$

Je fais un bureau <s>
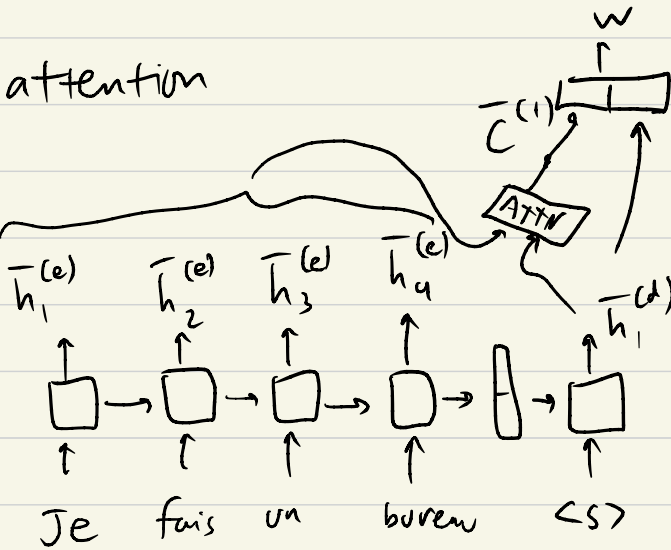
(not cell state)

ATTN:

$$\overline{\alpha}^{(1)} = \text{softm.} \begin{bmatrix} \overline{h}_1^{(e)} \cdot \overline{h}_1^{(d)} \\ \overline{h}_2^{(e)} \cdot \overline{h}_1^{(d)} \\ \vdots \end{bmatrix}$$

J f u b

$$\overline{C}^{(1)} = \sum_{i=1}^{n} \alpha_i^{(1)} \overline{h}_i^{(e)}$$

scalar

Intuition
- "Residual connection" to input
- Learned end-to-end : extra power given to the model on top of RNN
- Coverage, copy source words

Today
(see slides)
- NMT systems, details (rare words)
- QA intro
- (if time) CCG parsing } not on FP

Past 3 wks: generation (LM, MT)
Next up: applications

QA Very broad area

① When was Samuel L. Jackson born?
   Knowledge base QA / factoid QA
   ↳ KB, build query for the Q

② Who is Iron Man?
  ↳ open-ended, answer is a paragraph
  ↳ information retrieval + summarization
         (IR)

③ Who was the villain in Iron Man 1?
  ↳ middle ground: single phrase as answer,
     but probably not in our kB

  ↳ retrieve some text, answer from that
  ↳ IR + reading comprehension QA

      ans
  ⎡‾‾‾‾‾‾‾‾‾‾‾‾‾‾⎤
  "Obadiah Stane ... serves as the main
  antagonist in Iron Man."

Today: #1 KBQA
Tues/FP: #3 Reading comprehension

Knowledge base

KBQA Two steps:

① Convert Q to a formal semantic
representation

② Execute that representation against KB

KB: database

name	bday	starsIn
Samuel LJ	12/21/48	Pulp Fiction, Captain Marvel
Brie Larson	10/1/89	Captain Marvel, Scott Pilgrim...

When was SLJ born?   list of rows ↘

map ($\lambda v : v.bday$, filter ($\lambda r : r.name = SLJ$, DB))

⇒ List (12/21/48)

Semantic parsing: map {questions, statements}
into logical forms

Logical forms are expressions most
   typically in <u>lambda</u> <u>calculus</u>

When was SLJ born?
   ↳ lambda calculus: $\lambda d.\ bday(SLJ, d)$
         (similar to the Python lambdas
                           we wrote down)

Reduce KBQA to a semantic parsing problem
map language $\Rightarrow$ lambda calculus

What movies did Brie Larson star in?
                                      act in?
$\lambda m.\ movie(m) \wedge \underline{starsIn}(BL, m)$
                    predicate in our KB

How we do this: CCG parsing