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# Sequence to sequence models

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## Error analysis on beam search

# Example

→ RNN

→ Beam Search

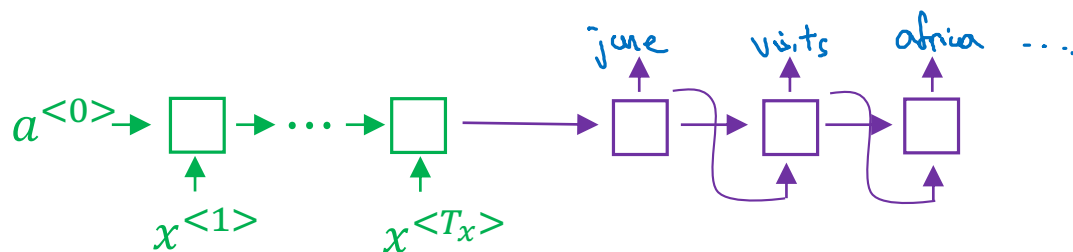
BT

Jane visite l'Afrique en septembre.

Human: Jane visits Africa in September. ( $y^*$ )

Algorithm: Jane visited Africa last September. ( $\hat{y}$ ) ←

RNN computes  $P(y^*|x) \geq P(\hat{y}|x)$



# Error analysis on beam search

Human: Jane visits Africa in September. ( $y^*$ )

$$P(y^*|x)$$

Algorithm: Jane visited Africa last September. ( $\hat{y}$ )

$$P(\hat{y}|x)$$

Case 1:  $P(y^*|x) > P(\hat{y}|x)$   $\leftarrow$

$$\arg \max_y P(y|x)$$

Beam search chose  $\hat{y}$ . But  $y^*$  attains higher  $P(y|x)$ .

Conclusion: Beam search is at fault.

Case 2:  $P(y^*|x) \leq P(\hat{y}|x)$   $\leftarrow$

$y^*$  is a better translation than  $\hat{y}$ . But RNN predicted  $P(y^*|x) < P(\hat{y}|x)$ .

Conclusion: RNN model is at fault.

# Error analysis process

Human	Algorithm	$P(y^* x)$	$P(\hat{y} x)$	At fault?
Jane visits Africa in September. ... ...	Jane visited Africa last September. ... ...	$\frac{2 \times 10^{-10}}{\text{---}}$ ---	$\frac{1 \times 10^{-10}}{\text{---}}$ ---	(B) (R) R R ...

Figures out what fraction of errors are “due to” beam search vs. RNN model