CS-583: Deep Learning
Beam Search

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Beam Search

Lets say we have a machine translation model already trained
Translation output is one word at a time
We want to use it to output the best translation for any given input sentence

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Given the input sentence (french) and the previous output word (English), the model outputs the next word

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If we have V words in the vocabulary and maximum sentence length is L
Exhaustive search will be V^L
If $vocab = 1000$ and $max\_length = 10$, then 10^{30} possible choices to select from

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A simpler option is to select the best at each position

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Typically greedy selection for the word at each position

Position	1	2	3	4
A	0.5	0.1	0.2	0.1
B	0.2	**0.4**	0.2	0.2
C	0.2	0.3	0.4	0.1
<END>	0.1	0.2	0.1	0.6

Output probability $= 0.5 \times 0.4 \times 0.4 \times 0.6 = 0.048$

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It can happen that this is not the optimal
Selecting 2*nd* best at position 2 gives better total probability

Position	1	2	3	4
A	0.5	0.1	0.1	0.1
B	0.2	0.4	0.6	0.2
C	0.2	**0.3**	0.2	0.1
<END>	0.1	0.2	0.1	0.6

Output probability $= 0.5 \times 0.3 \times 0.6 \times 0.6 = 0.054$

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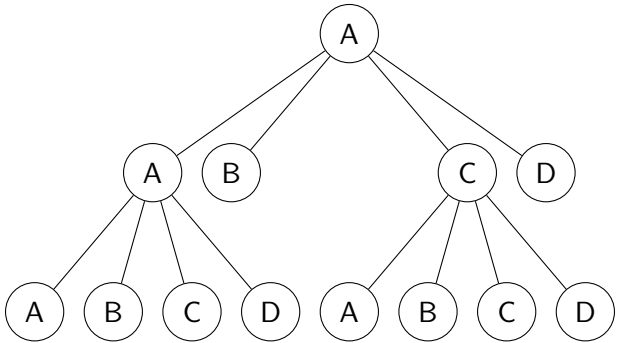
1*st* step:
Select the K maximum probability words

For each subsequent step:
Fix the previous selections and generate K possibilities and select the overall K maximum

Beam Search



Whiteboard