Decoding Strategies

What is Decoding?

Learning goals

- Get to know the concept of decoding in NLP
- Learn about different decoding strategies

REMINDER: ARLM

- In Autoregressive Language Modeling (ARLM) the model predicts the next token given the previous tokens
- Given the context a language model produces a probability distribution over all the tokens in the vocabulary
- The context is the prompt given to the model plus the already generated tokens
- The way we then choose the next token from that probability distribution to generate natural text is called a decoding strategy

DECODING EXAMPLE (1)

Prompt: Once upon a time

Time step 1:

Model input: Once upon a time

Next token: there

Time step 2:

Model input: Once upon a time there

Next token: was

Time step 3:

Model input: Once upon a time there was

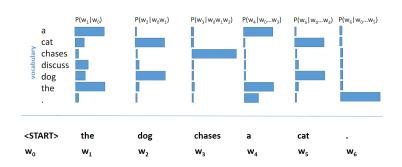
Next token: a

Time step 4:

Model input: Once upon a time there was a

Next token: cat

DECODING EXAMPLE (2)



- At teach timestep the model produces a probability distribution
- A decoding strategy determines how to choose the next token from that distribution, that token is then added to the context
- Generation stops based on stopping criteria (see: next slide)

STOPPING CRITERIA FOR TEXT GENERATIONS

- <EOS> Token: When this token is generated the model stops
- Maximum Length: A predefined maximum length can be set for the generated text. When the text reaches this length, generation stops to prevent excessively long outputs
- Maximum Time: A predefined maximum time for generation can be set. After this time has been reached, generation stops
- Other Criteria: There are more stopping criteria implemented in huggingface huggingface

DECODING STRATEGIES

Deterministic

- Greedy search
- Beam search
- Contrastive decoding Li et al., 2023
- Contrastive search ► Su et al., 2022

Stochastic

- Sampling (with temperature)
- Top-k sampling
- Nucleus top-p sampling
- Typical sampling

Remark: Other decoding strategies exist, and various combinations are possible, such as top-k sampling with temperature, or top-p sampling followed by top-k sampling (with temperature), etc.