Character-level MT is good for **noise robustness** and not much else

Why don't people use character-level machine translation?

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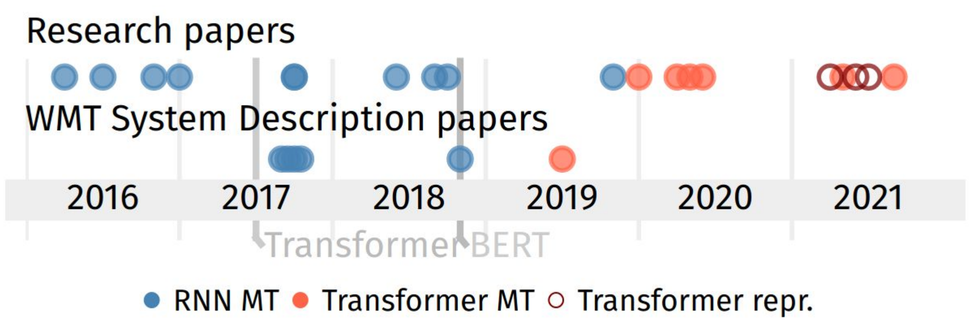
1. Extensive survey of research papers and WMT submissions.

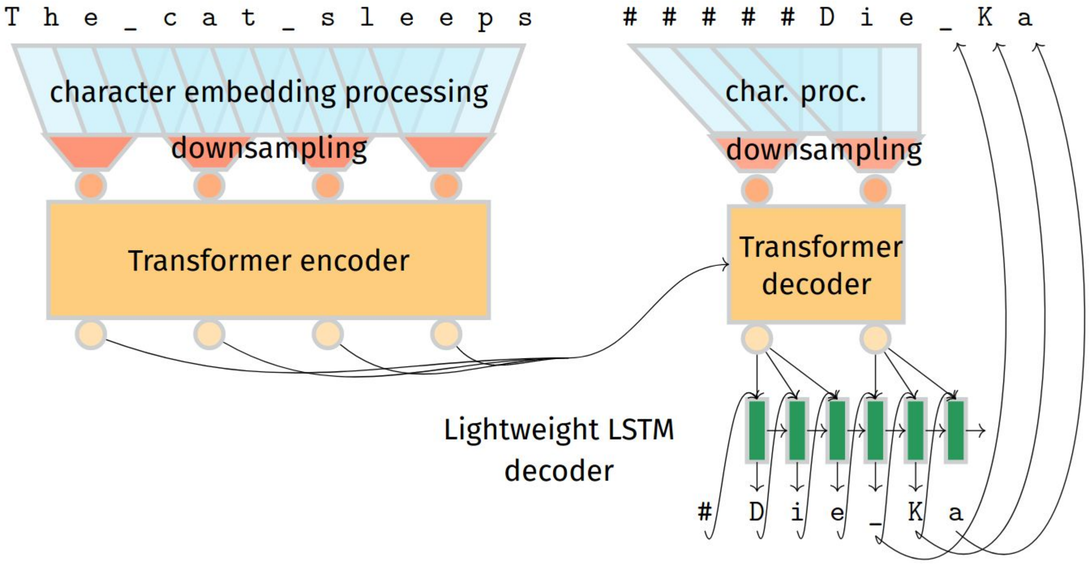


- Research papers claim parity or superiority of char-level models over subwords
- Character-level model hardly ever used in competitive WMT setups (>90% submission use subwords)
- Char-level model 5-6x slower than subwords
  → standard WMT methods unfeasible

2. Explore both existing and new character-level architectures.

- Architecture exploration on small IWSLT data
  en ↔ {de, fr, ar}
- Various architectures for char processing
  - 1D Convolution + Max-pool
  - CANINE = local self-attention + 1D convolution
  - Charfromer = based on *n*-gram averaging
- Standard and vs fast novel 2-step decoder

Winner: 1D convolution + Max pool + Vanilla decoder



3. Systematic evaluation with WMT-scale models.

- Use the best architecture from the small data experiments
- Use the same data as in used competitive WMT submissions (incl. back-translation)
- English → Czech
  - CzEng 2.0 dataset
  - 61M authentic sentences, 50M back-translated
- English → German
  - Data mix used in Edinburgh's WMT21 submission
  - 66M authentics sentences, 52M back-translated

Evaluation to assess often claimed advantages of character-level methods

- Quality in news, IT, medical domain
  worse overall, consistent over domains
- Gender evaluation dataset
  no clear advantage
- Morphology using Morpheval benchmark
  German seems slightly better, no difference for Czech
- Recall of novel forms and lemmas
  no difference between subwords and characters
- Robustness towards source-side noise
  character-level clearly better

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https://github.com/jlibovicky/char-nmt-two-step-decoder
https://github.com/jlibovicky/char-nmt-fairseq

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