Mask-Predict: Parallel Decoding of Conditional Masked Language Models

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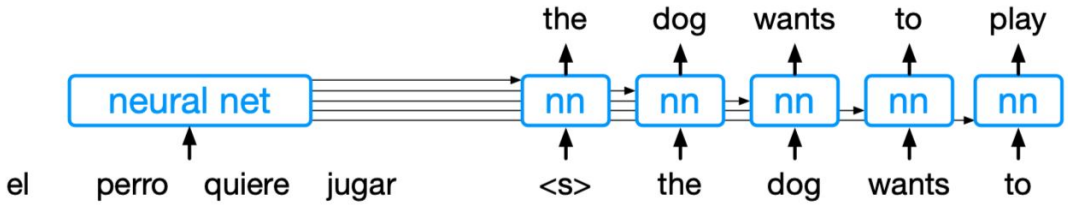
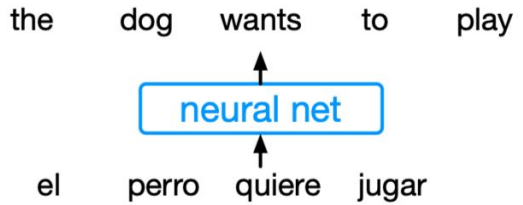
Рословец Влад 172

Autoregressive VS non-autoregressive



autoregressive

O(n)

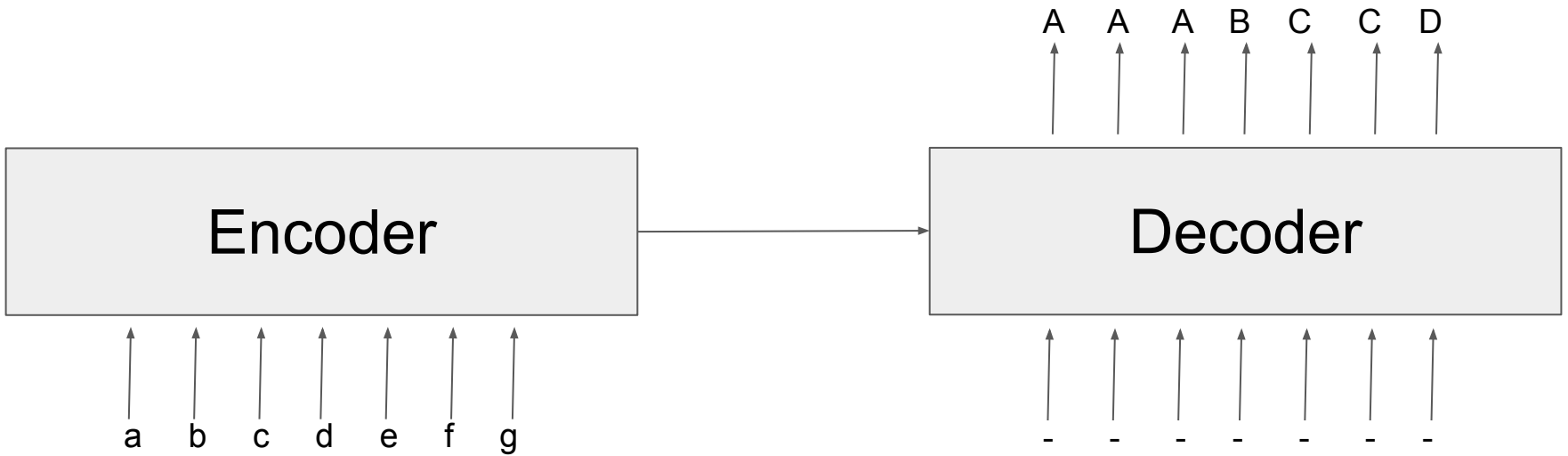


non-autoregressive

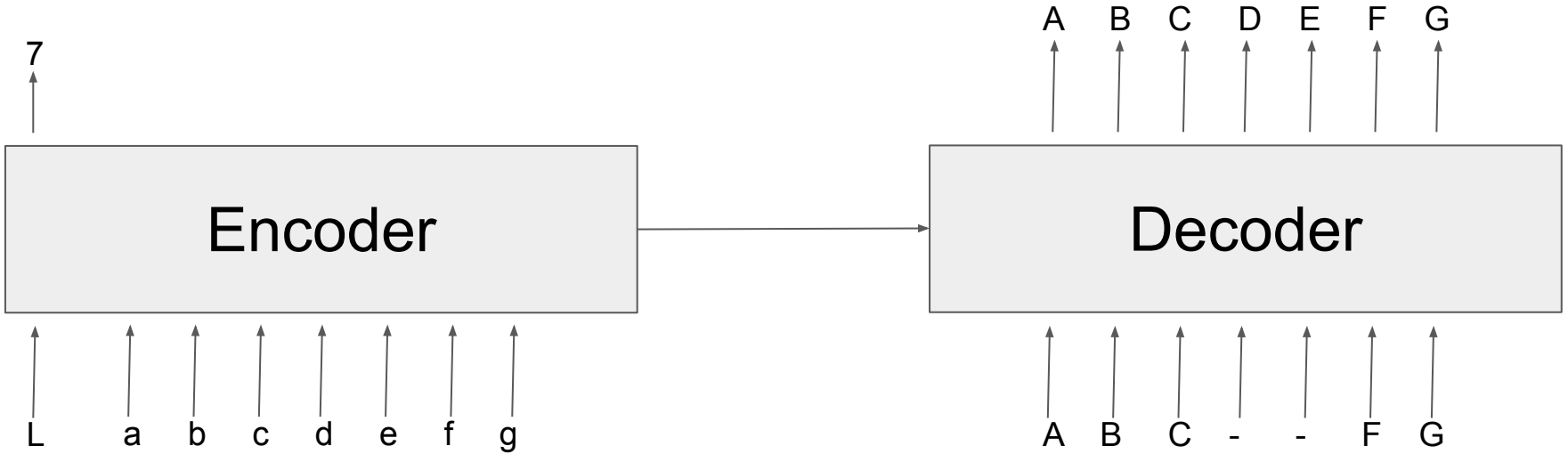
O(1)

Multimodality problem

Неавторегрессионные модели делают сильное предположение о том, что предсказание токенов условно независимо друг от друга. Как результат модель предсказывает несколько одинаковых токенов в разных позициях.



Multimodality problem



$$P(Y^{(0)}_{mask}|X, Y^{(0)}_{obs}) = P(Y|X)$$

Training

1. Encoder-decoder transformer, где разрешено смотреть decoder на весь контекст, в отличии от авторегрессионной версии.
2. Маскируем k токенов, по формуле $k = N \cdot (T-t)/T$, где T - выбранное кол-во итераций, t - текущая итерация
3. Предсказать токен длины последовательности в encoder
4. Предсказание токенов, которые были закрыты маской

Masking

src	Der Abzug der franzsischen Kampftruppen wurde am 20. November abgeschlossen .
$t = 0$	The departure of the French combat completed completed on 20 November .
$t = 1$	The departure of French combat troops was completed on 20 November .
$t = 2$	The withdrawal of French combat troops was completed on November 20th .

Analysis

Length Candidates	WMT'14 EN-DE BLEU	WMT'14 EN-DE LP	WMT'16 EN-RO BLEU	WMT'16 EN-RO LP
$\ell = 1$	26.56	16.1%	32.75	13.8%
$\ell = 2$	27.03	30.6%	33.06	26.1%
$\ell = 3$	**27.09**	43.1%	**33.11**	39.6%
$\ell = 4$	**27.09**	53.1%	32.13	49.2%
$\ell = 5$	27.03	62.2%	33.08	57.5%
$\ell = 6$	26.91	69.5%	32.91	64.3%
$\ell = 7$	26.71	75.5%	32.75	70.4%
$\ell = 8$	26.59	80.3%	32.50	74.6%
$\ell = 9$	26.42	83.8%	32.09	78.3%
Gold	27.27	—	33.20	—

Iterations	WMT'14 EN-DE BLEU	WMT'14 EN-DE Reps	WMT'16 EN-RO BLEU	WMT'16 EN-RO Reps
$T = 1$	18.05	16.72%	27.32	9.34%
$T = 2$	22.91	5.40%	31.08	2.82%
$T = 3$	24.99	2.03%	32.19	1.26%
$T = 4$	25.94	1.07%	32.53	0.87%
$T = 5$	26.30	0.72%	32.62	0.61%

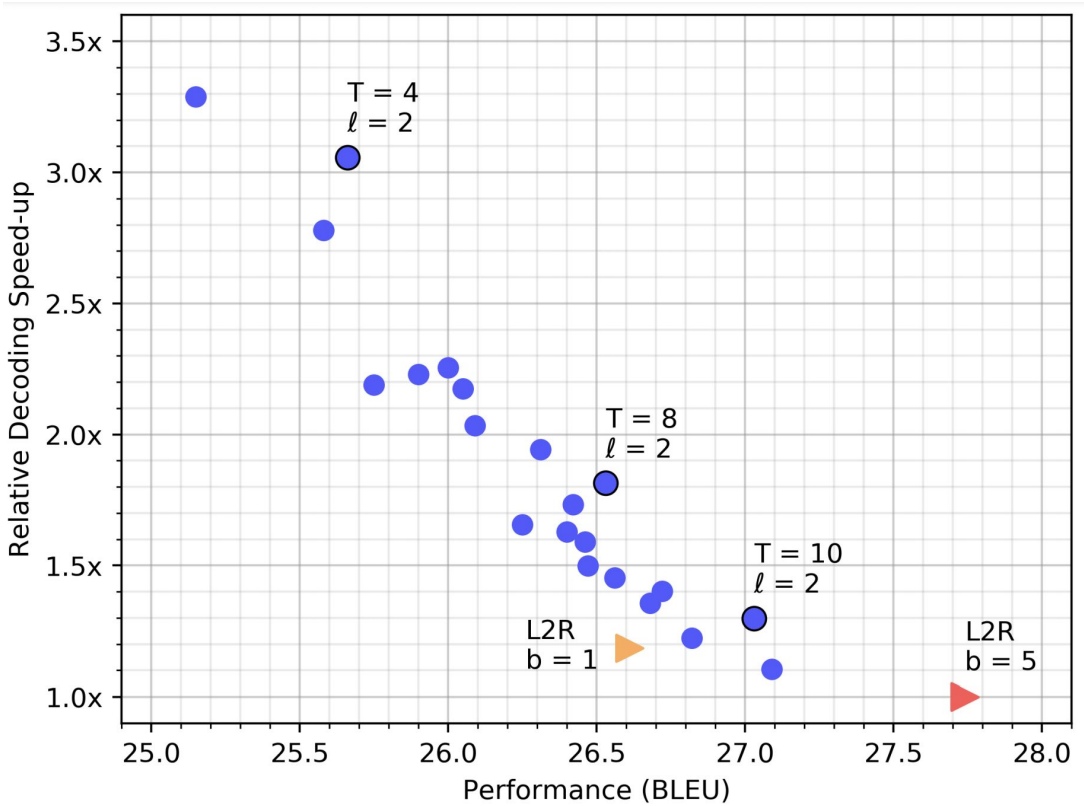
WMT'14 EN-DE

	$T = 4$	$T = 10$	$T = N$
$1 \leq N < 10$	21.8	22.4	22.4
$10 \leq N < 20$	24.6	25.9	26.0
$20 \leq N < 30$	24.9	26.7	27.1
$30 \leq N < 40$	24.9	26.7	27.6
$40 \leq N$	25.0	27.5	28.1

Model performance

Model	Dimensions (Model/Hidden)	Iterations	WMT'14 EN-DE	WMT'14 DE-EN	WMT'16 EN-RO	WMT'16 RO-EN
NAT w/ Fertility (Gu et al., 2018)	512/512	1	19.17	23.20	29.79	31.44
CTC Loss (Libovický and Helcl, 2018)	512/4096	1	17.68	19.80	19.93	24.71
Iterative Refinement (Lee et al., 2018)	512/512	1	13.91	16.77	24.45	25.73
	512/512	10	21.61	25.48	29.32	30.19
(Dynamic #Iterations)	512/512	?	21.54	25.43	29.66	30.30
Small CMLM with Mask-Predict	512/512	1	15.06	19.26	20.12	20.36
	512/512	4	**24.17**	**28.55**	**30.00**	30.43
	512/512	10	**25.51**	**29.47**	**31.65**	**32.27**
Base CMLM with Mask-Predict	512/2048	1	18.05	21.83	27.32	28.20
	512/2048	4	**25.94**	**29.90**	**32.53**	**33.23**
	512/2048	10	**27.03**	**30.53**	**33.08**	**33.31**
Base Transformer (Vaswani et al., 2017)	512/2048	N	27.30	— —	— —	— —
Base Transformer (Our Implementation)	512/2048	N	27.74	31.09	34.28	33.99
Base Transformer (+Distillation)	512/2048	N	27.86	31.07	— —	— —
Large Transformer (Vaswani et al., 2017)	1024/4096	N	28.40	— —	— —	— —
Large Transformer (Our Implementation)	1024/4096	N	28.60	31.71	— —	— —

Model performance



Список литературы

1) https://arxiv.org/pdf/1904.09324.pdf
2) https://arxiv.org/pdf/1901.07291.pdf
3) https://github.com/zomux/lanmt
4) https://www.aclweb.org/anthology/events/emnlp-2019/

Вопросы

1) Опишите Multimodality problem.
2) В чем заключается преимущество CMLM перед one-to-one декодированием? С чем связано?
3) Как изменили стандартную архитектуру трансформера, авторы статьи.