Machine Translation

Jordan Boyd-Graber

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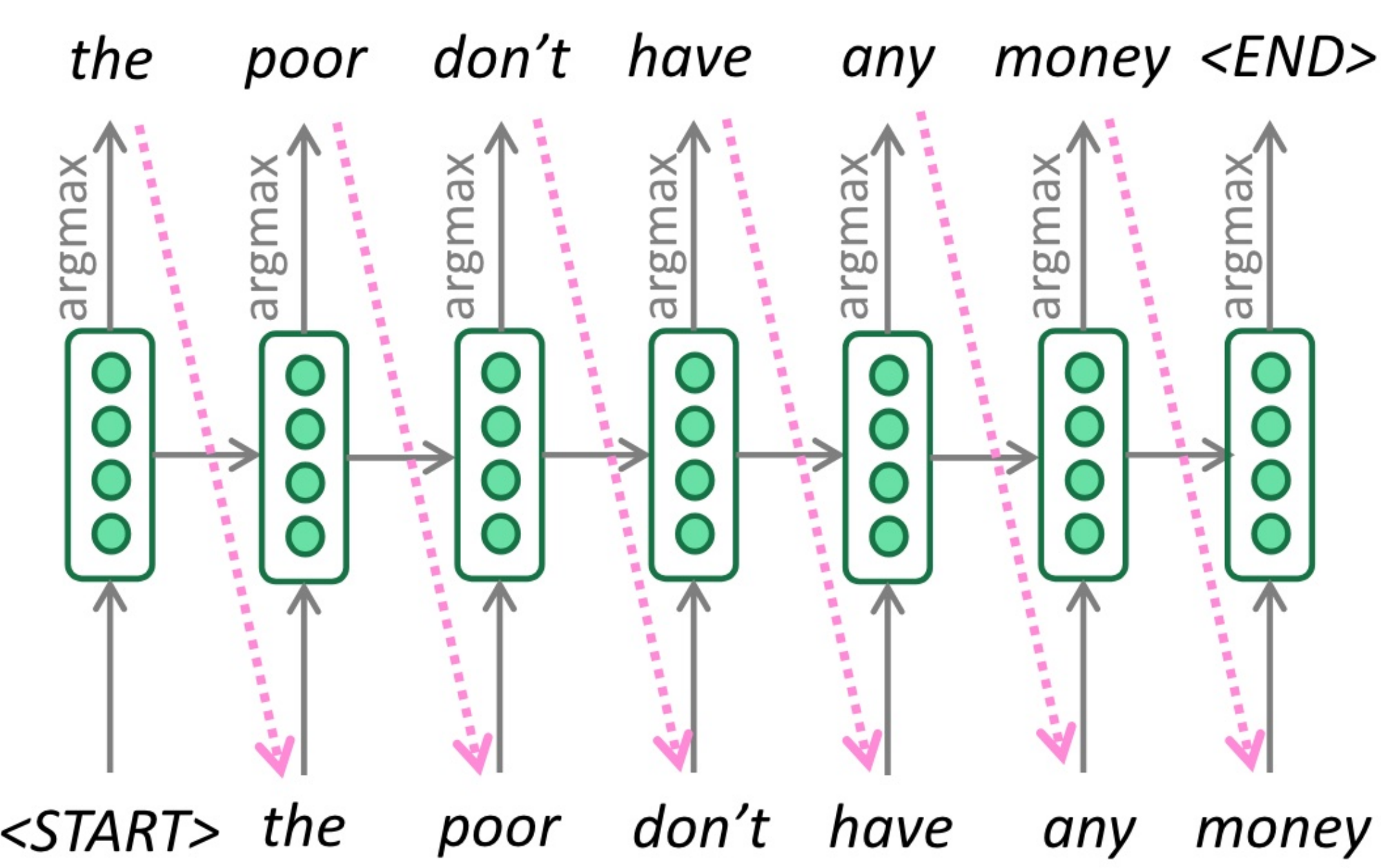
Decoding

Adapted from material by Mohit Iyyer, Luke Zettlemoyer, Kalpesh Krishna, Karthik Narasimhan, Greg Durrett, Chris Manning, Dan Jurafsky



Argmax at every time step

Sampling Methods

Softmax distribution

$$p(w) = \frac{\exp\left\{\beta \cdot \vec{f}(w)\right\}}{\sum_{w'} \exp\left\{\beta \cdot \vec{f}(w')\right\}} \tag{1}$$

- top-k
- Nucleus / top-p
- Temperature

Sampling Methods

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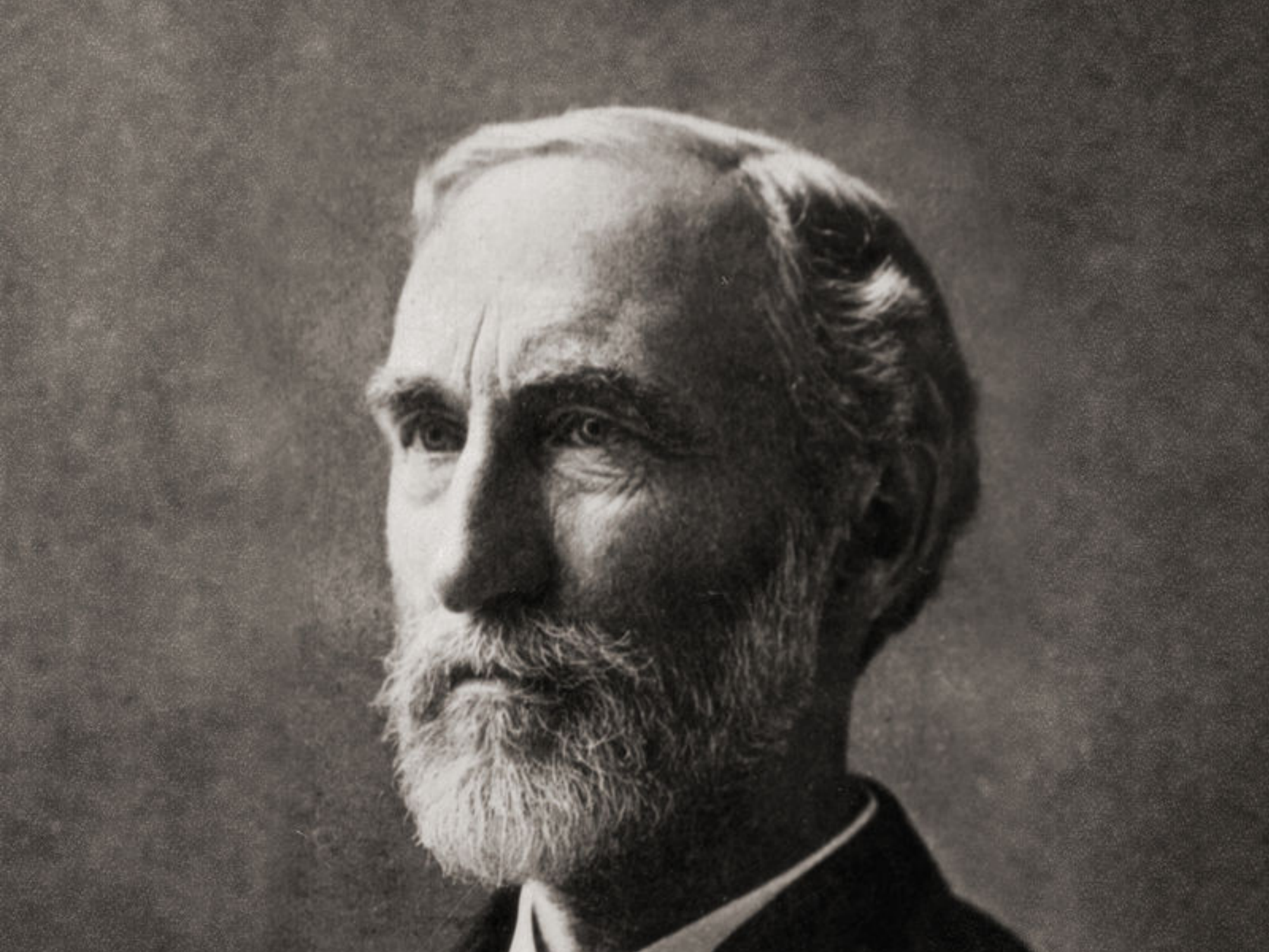
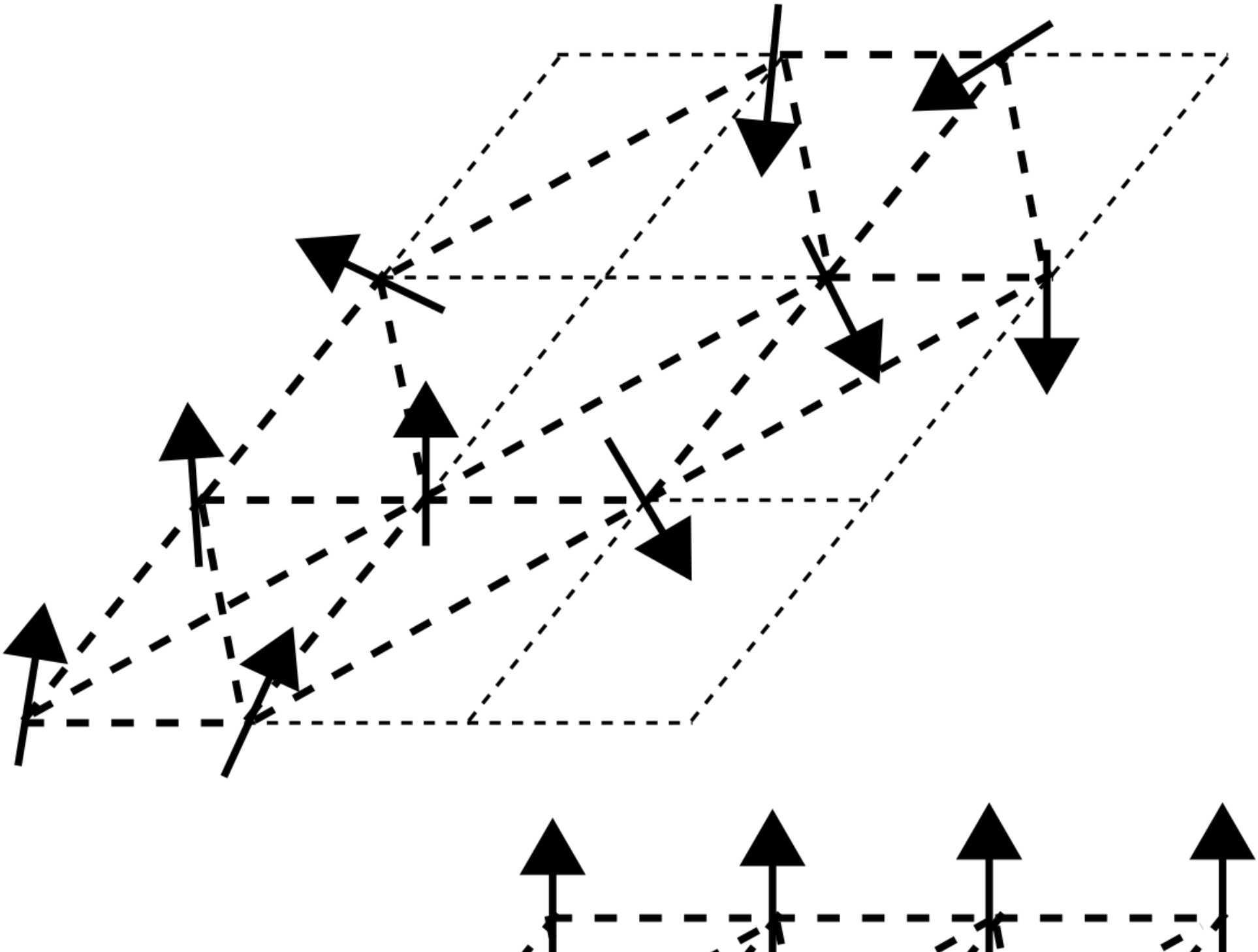
- Temperature

$$p(w) = \frac{\exp\left\{\frac{\beta \cdot \vec{f}(w)}{T}\right\}}{\sum_{w'} \exp\left\{\frac{\beta \cdot \vec{f}(w')}{T}\right\}} \tag{2}$$





Sampling Methods

Softmax distribution

$$p(w) = \frac{\exp\left\{\beta \cdot \vec{f}(w)\right\}}{\sum_{w'} \exp\left\{\beta \cdot \vec{f}(w')\right\}} \tag{3}$$

- top-k
- Nucleus / top-p
- Temperature

Sampling Methods

Softmax distribution

$$p(w) = \frac{\exp\left\{\beta \cdot \vec{f}(w)\right\}}{\sum_{w'} \exp\left\{\beta \cdot \vec{f}(w')\right\}} \tag{3}$$

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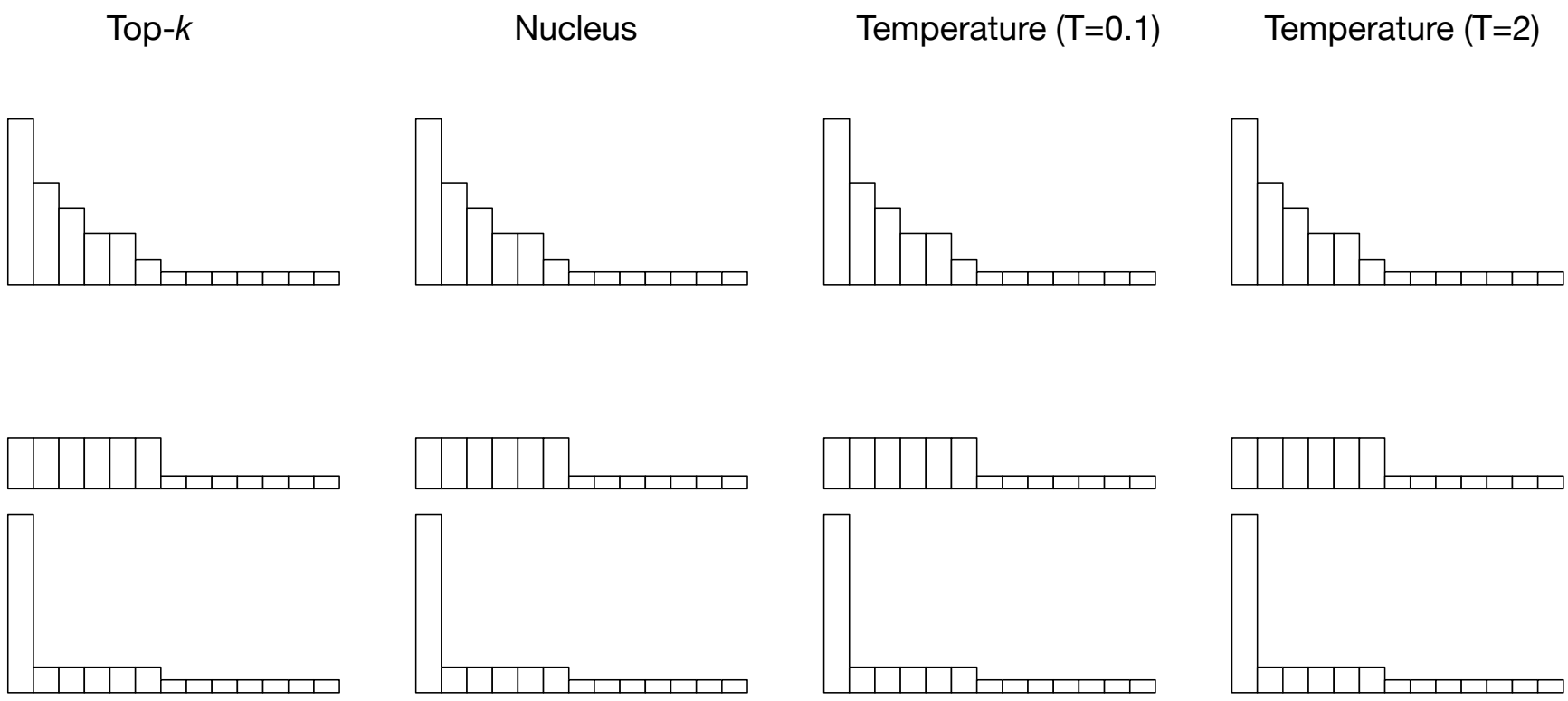
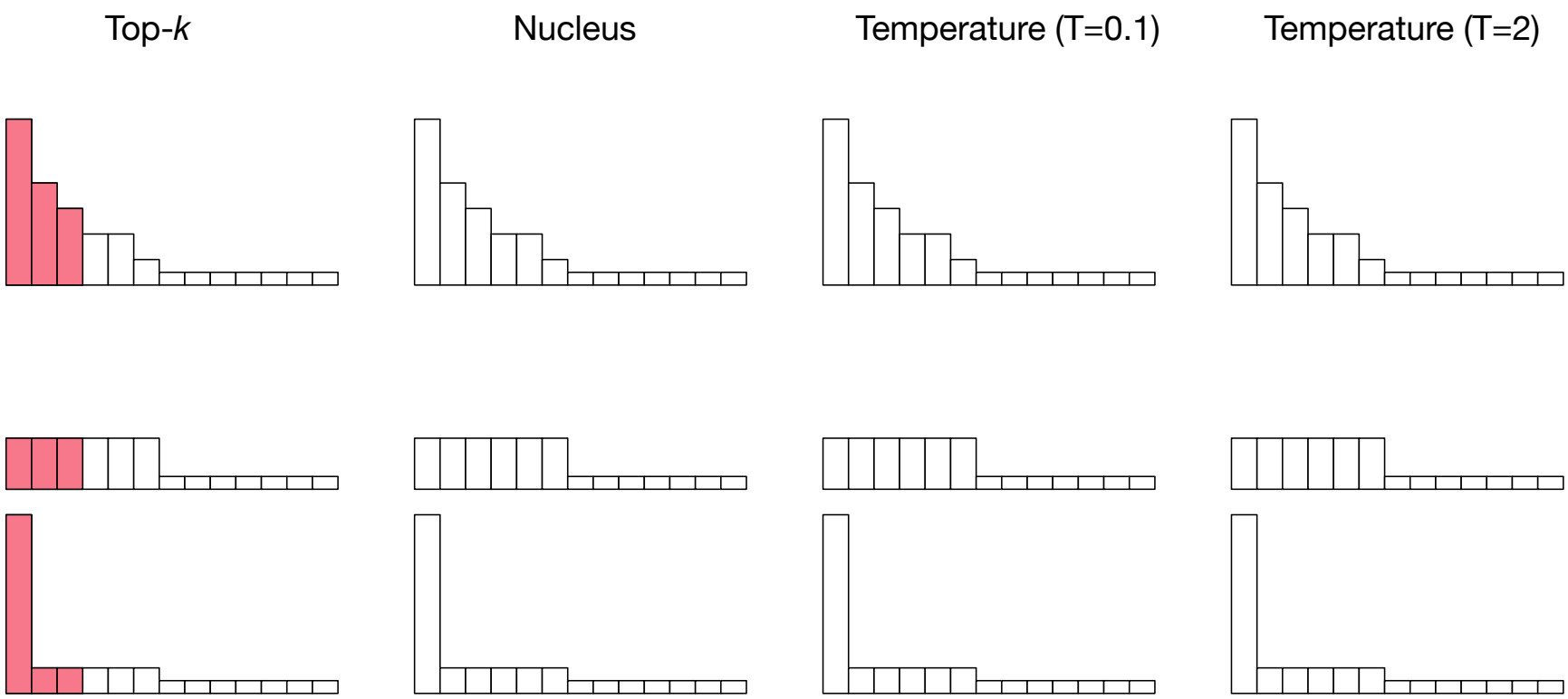
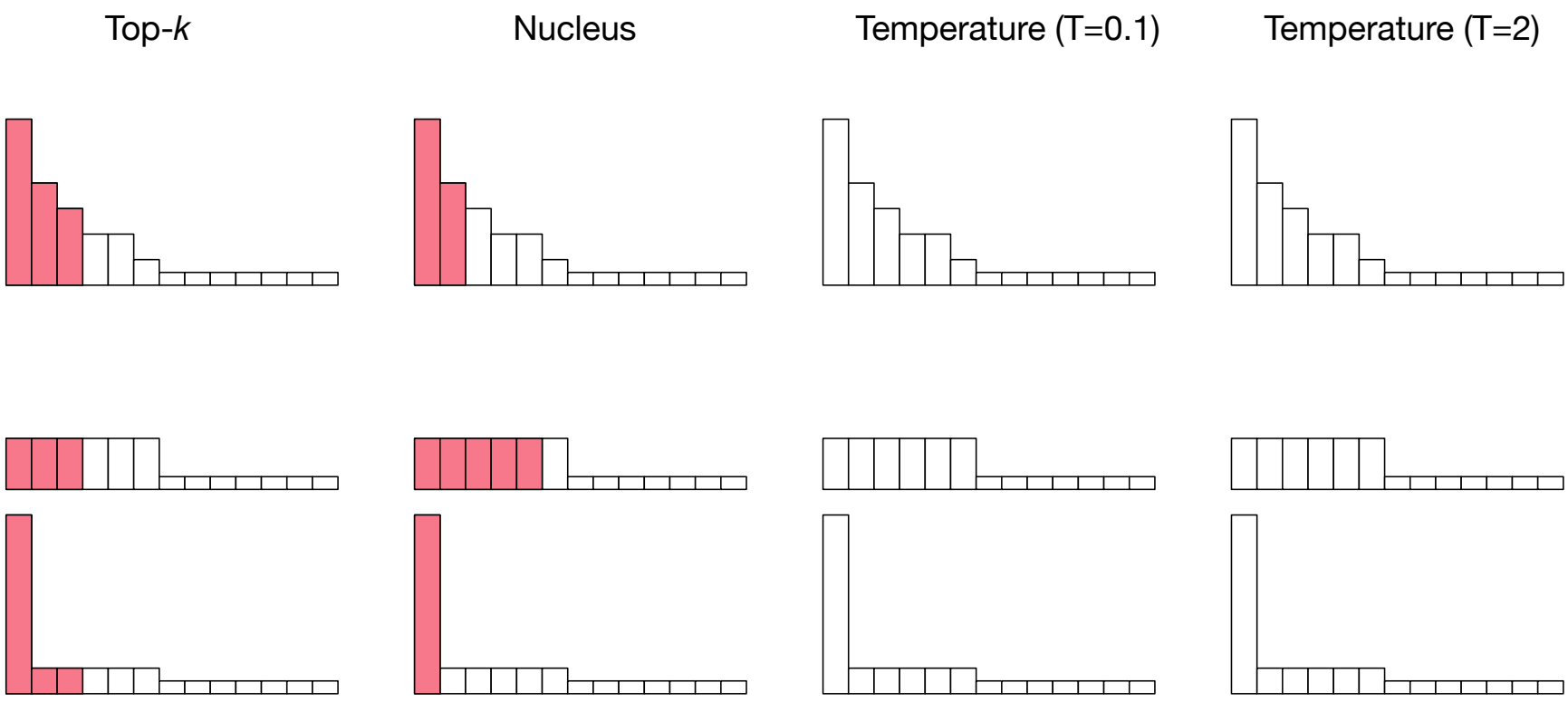
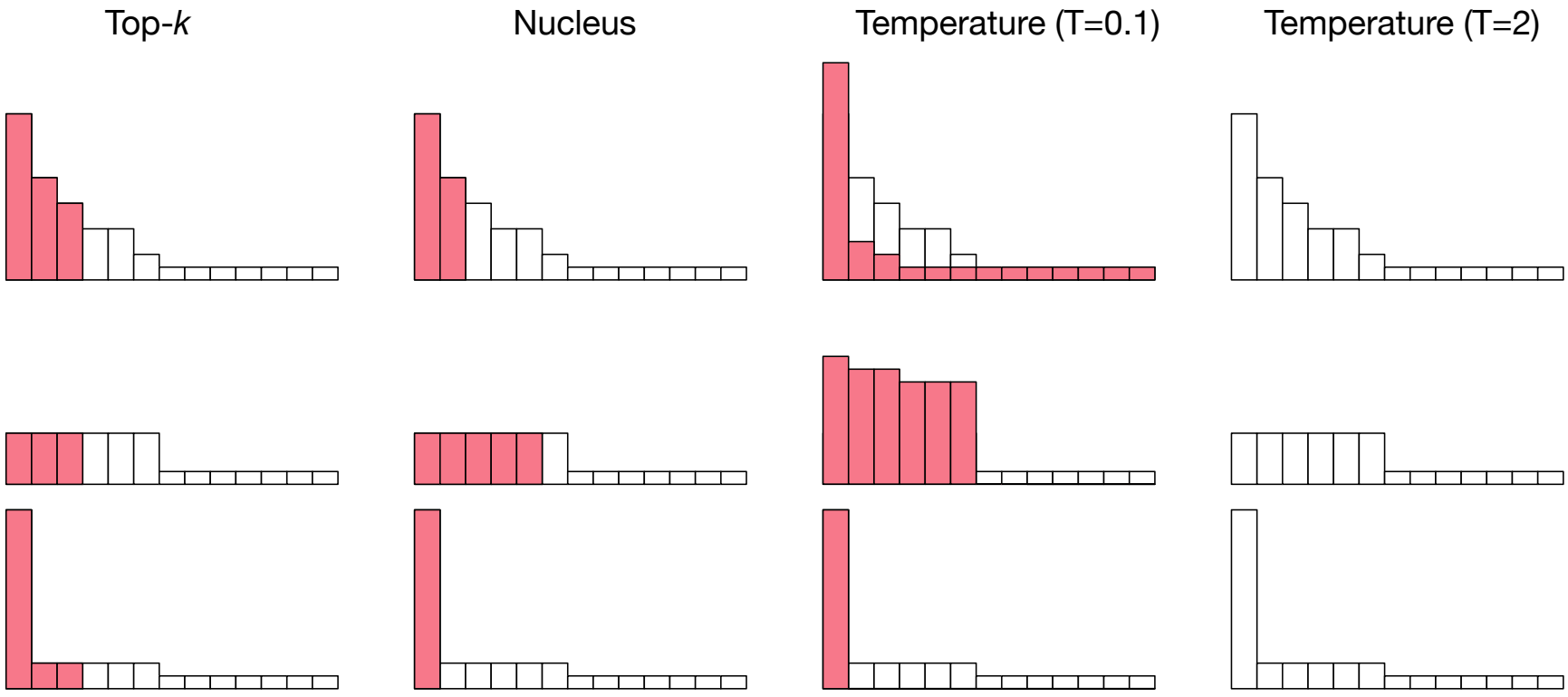
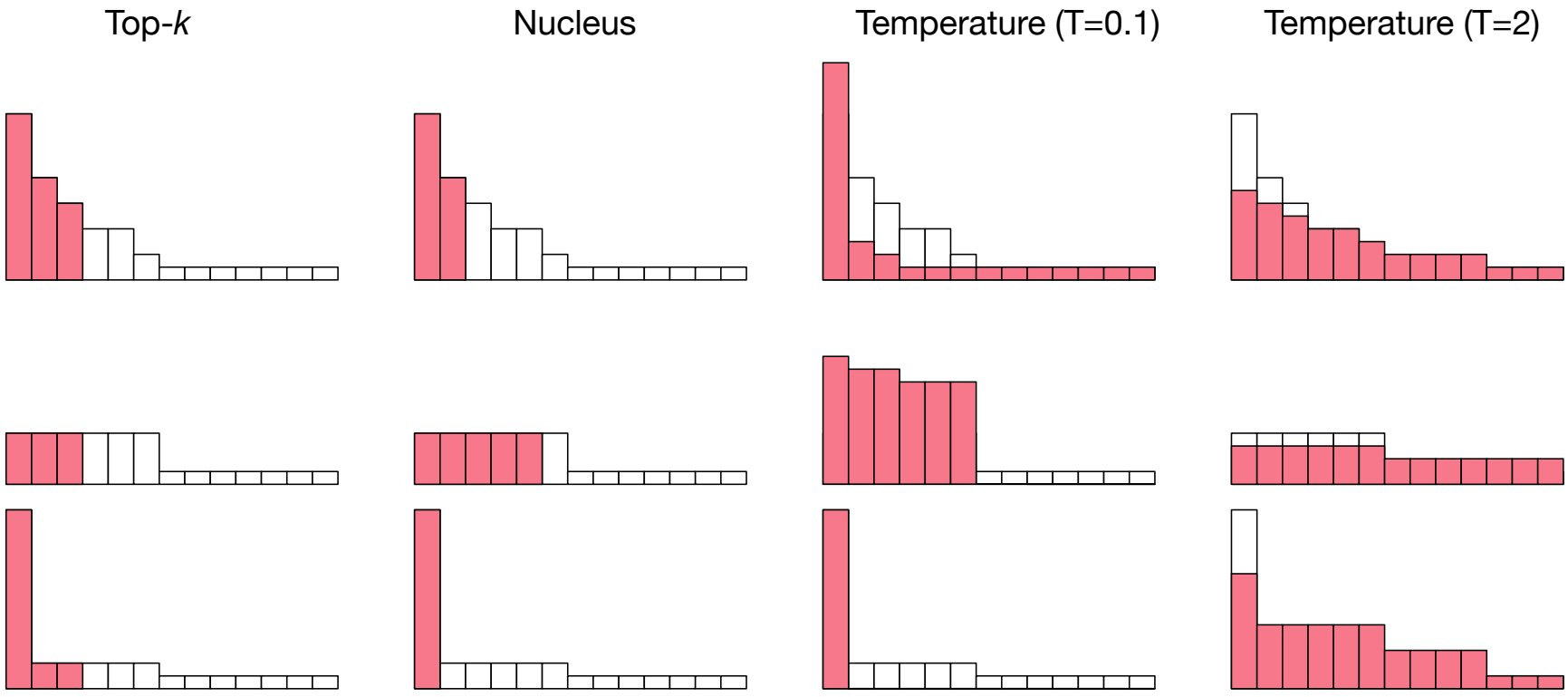
Top-*k* Nucleus Temperature (T=0.1) Temperature (T=2)

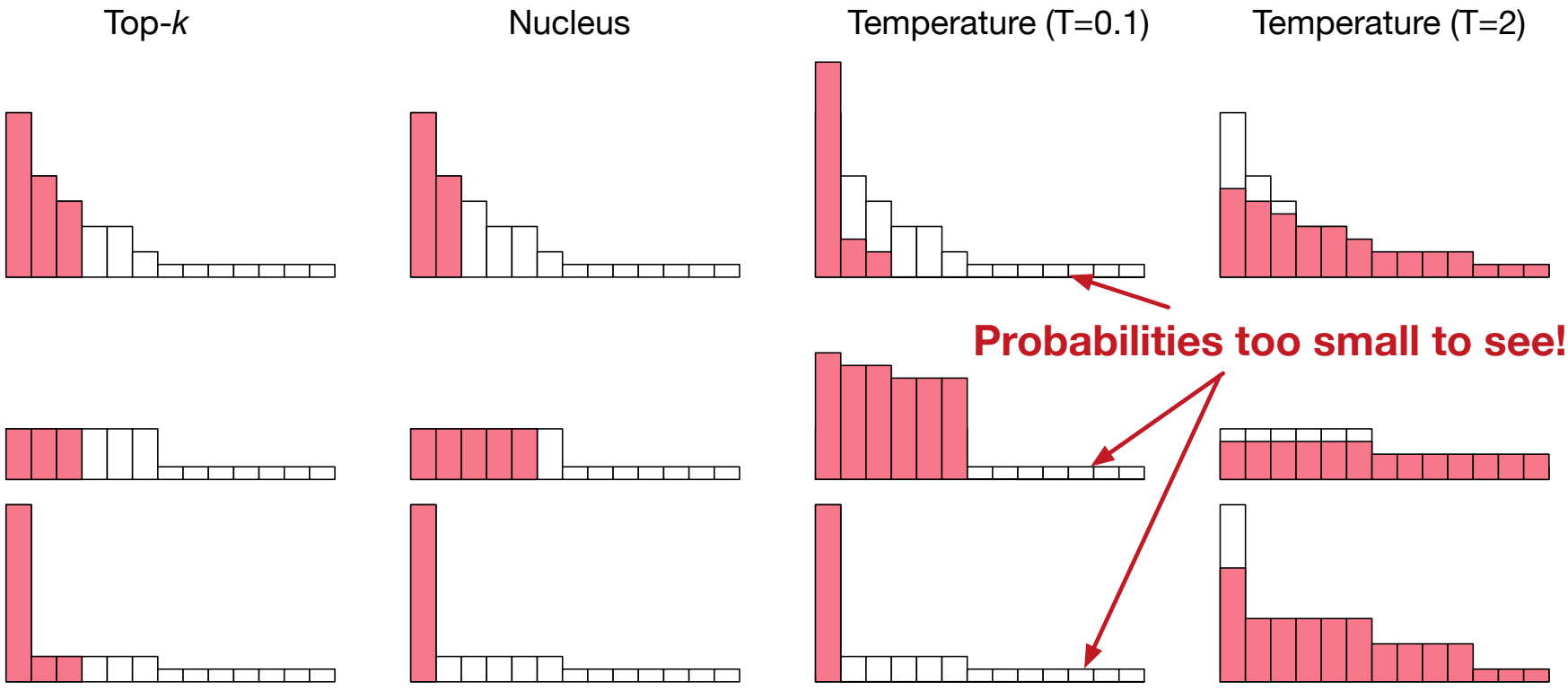

Top-*k*
Nucleus
Temperature (T=0.1)
Temperature (T=2)


Top-*k*
Nucleus
Temperature (T=0.1)
Temperature (T=2)


Top-*k*
Nucleus
Temperature (T=0.1)
Temperature (T=2)

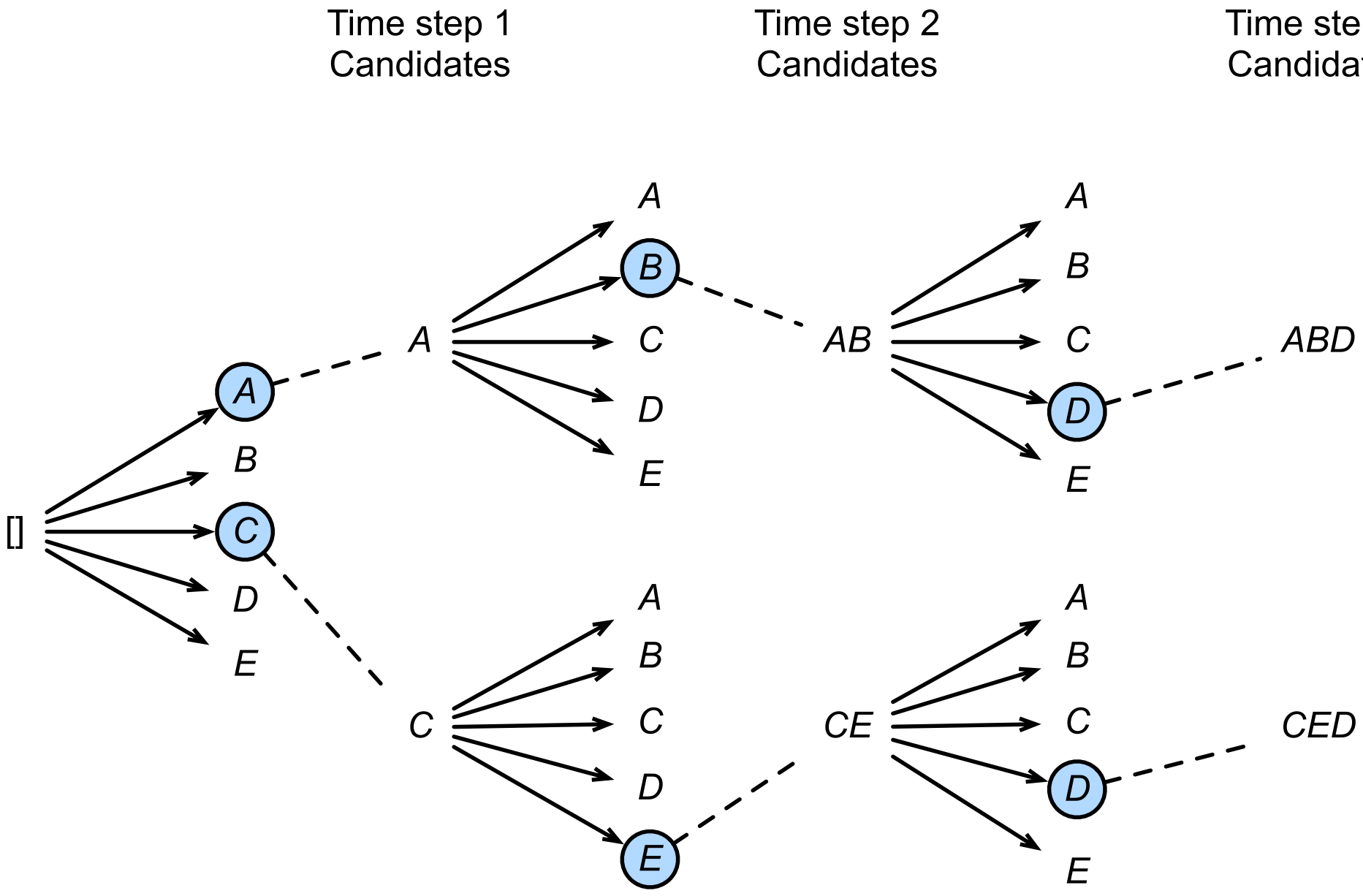

Top-*k*
Nucleus
Temperature (T=0.1)
Temperature (T=2)


Top-*k*
Nucleus
Temperature (T=0.1)
Temperature (T=2)


Top-k
Nucleus
Temperature (T=0.1)
Temperature (T=2)
Probabilities too small to see!

What do you do with samples?

- Getting out of being stuck in a garden path
- Getting diverse outputs
- Combining multiple models together
- Rescoring by a non-probability metric



From Zhang et al. (Dive into Deep Learning)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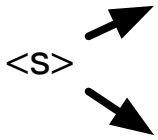
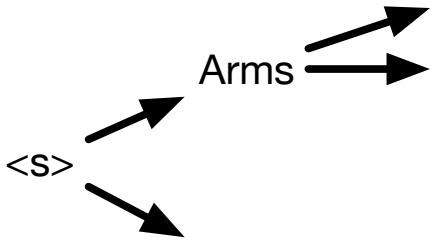
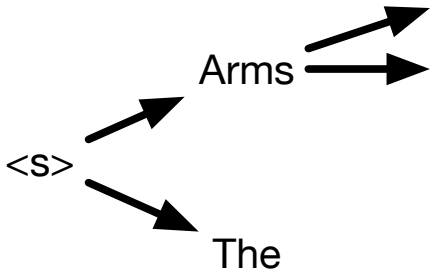
Beam Search Decoding for: Die Arme haben kein Geld



Beam Search Decoding for: Die Arme haben kein Geld



Beam Search Decoding for: Die Arme haben kein Geld



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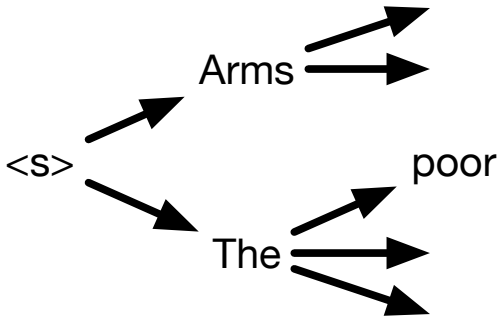

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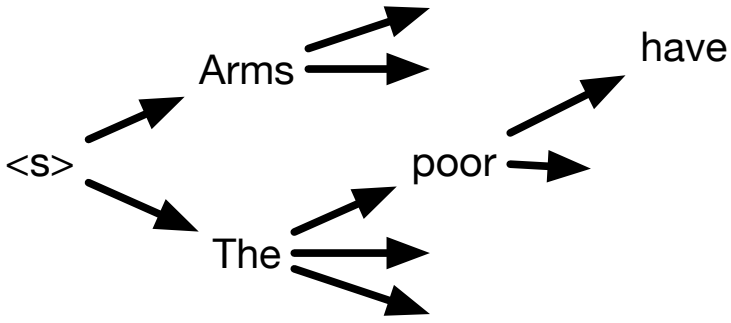

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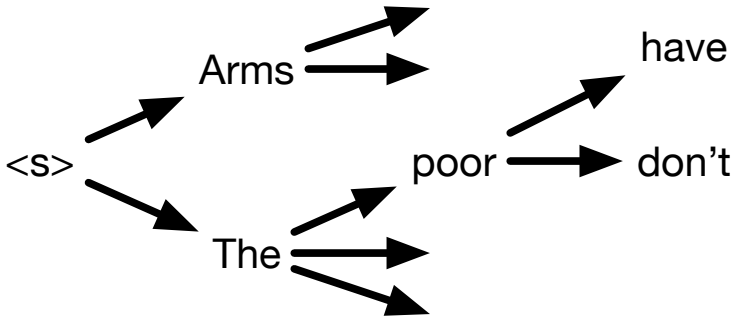

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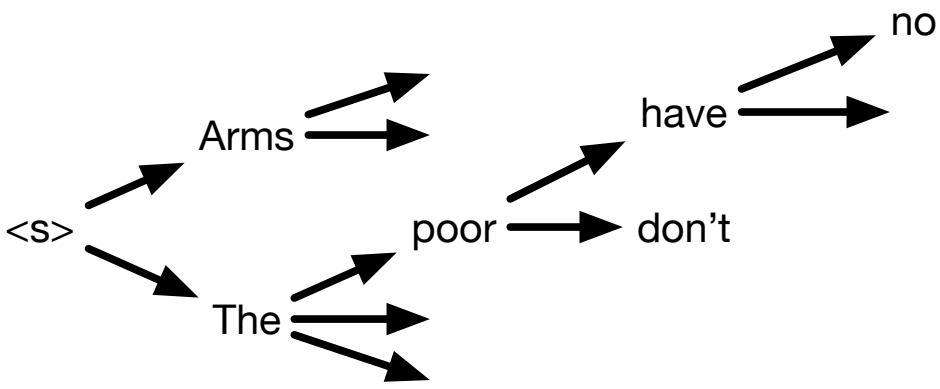

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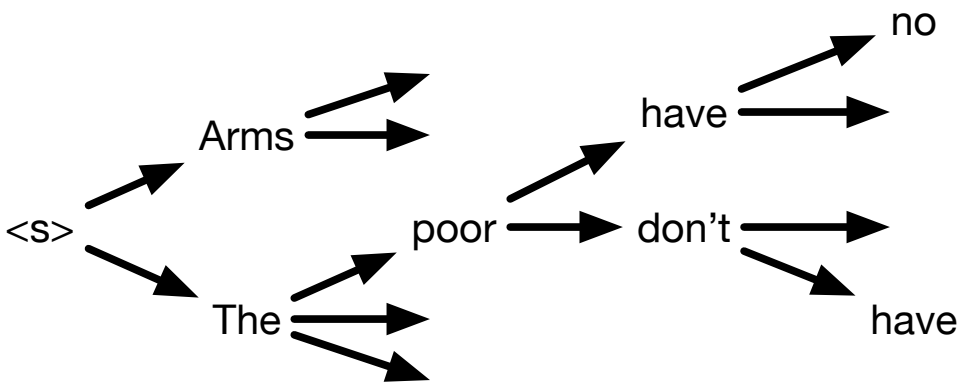

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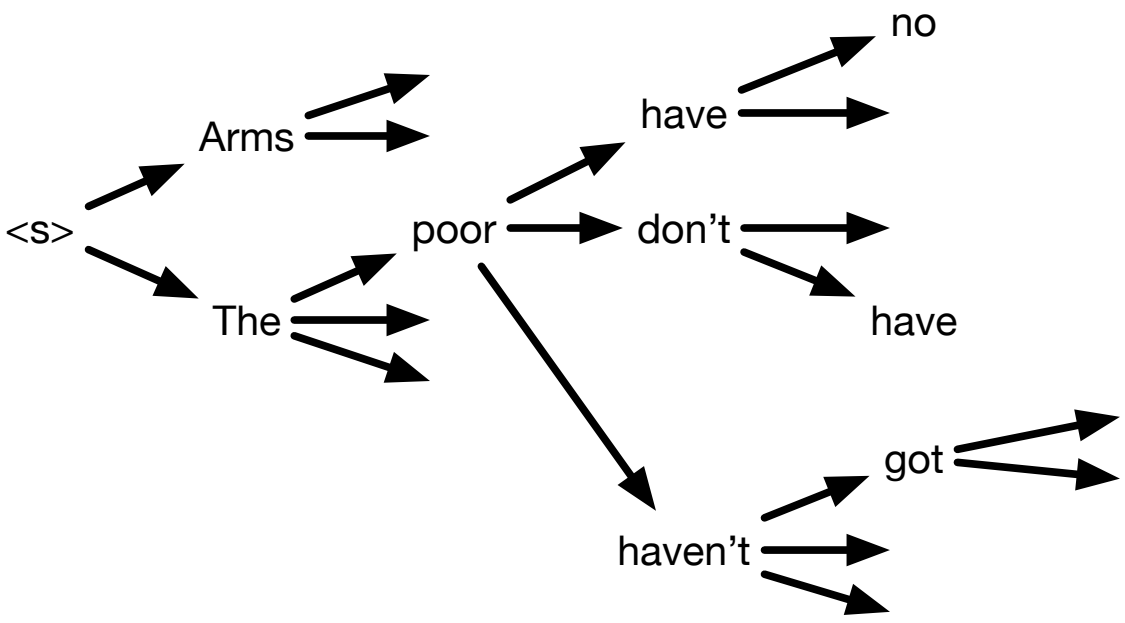

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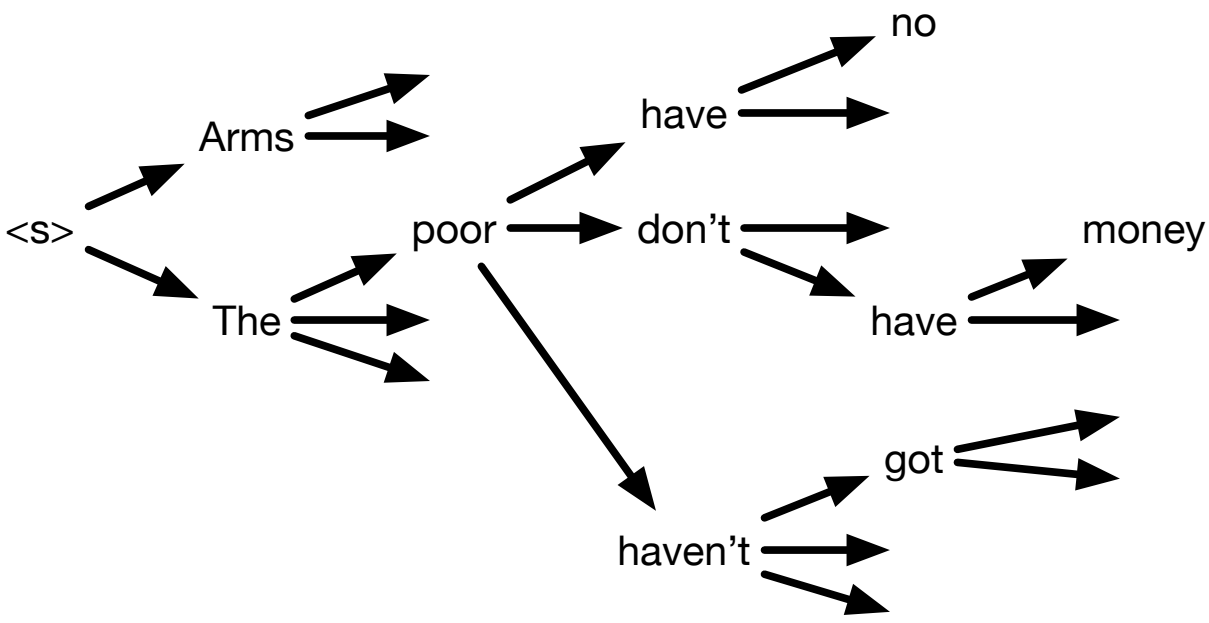

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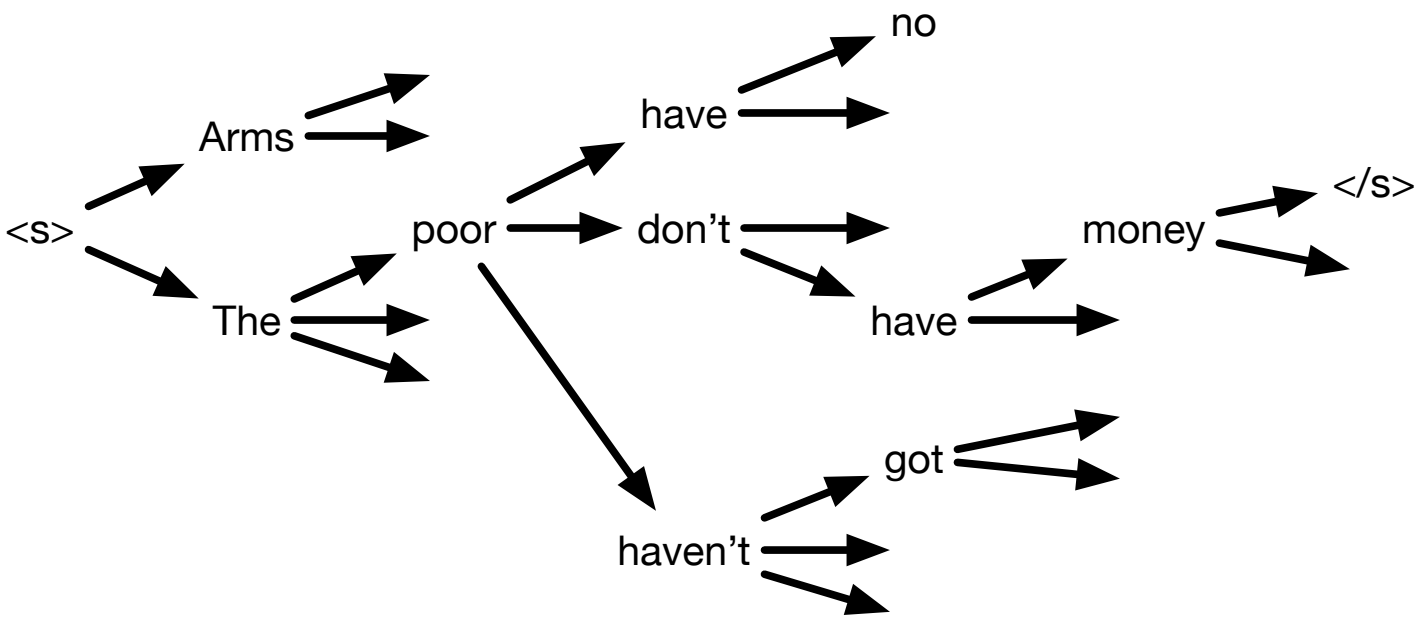

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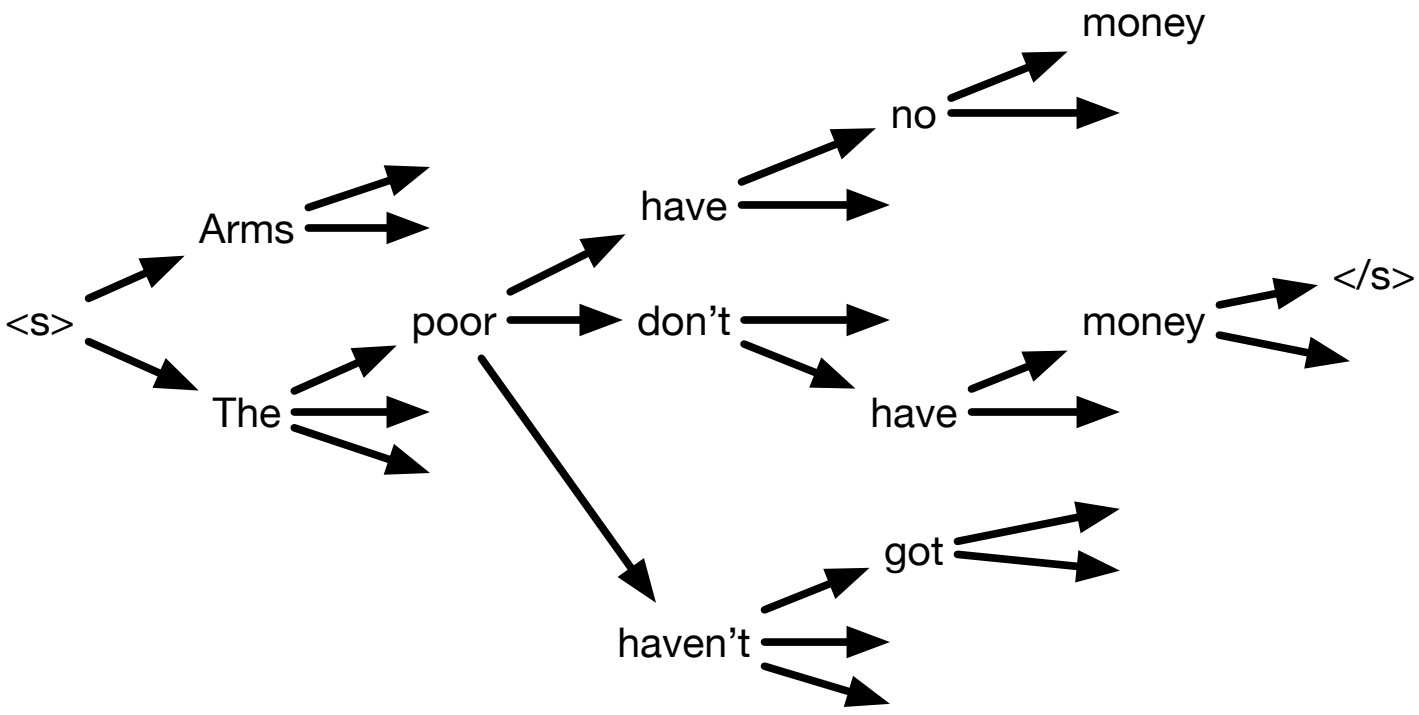

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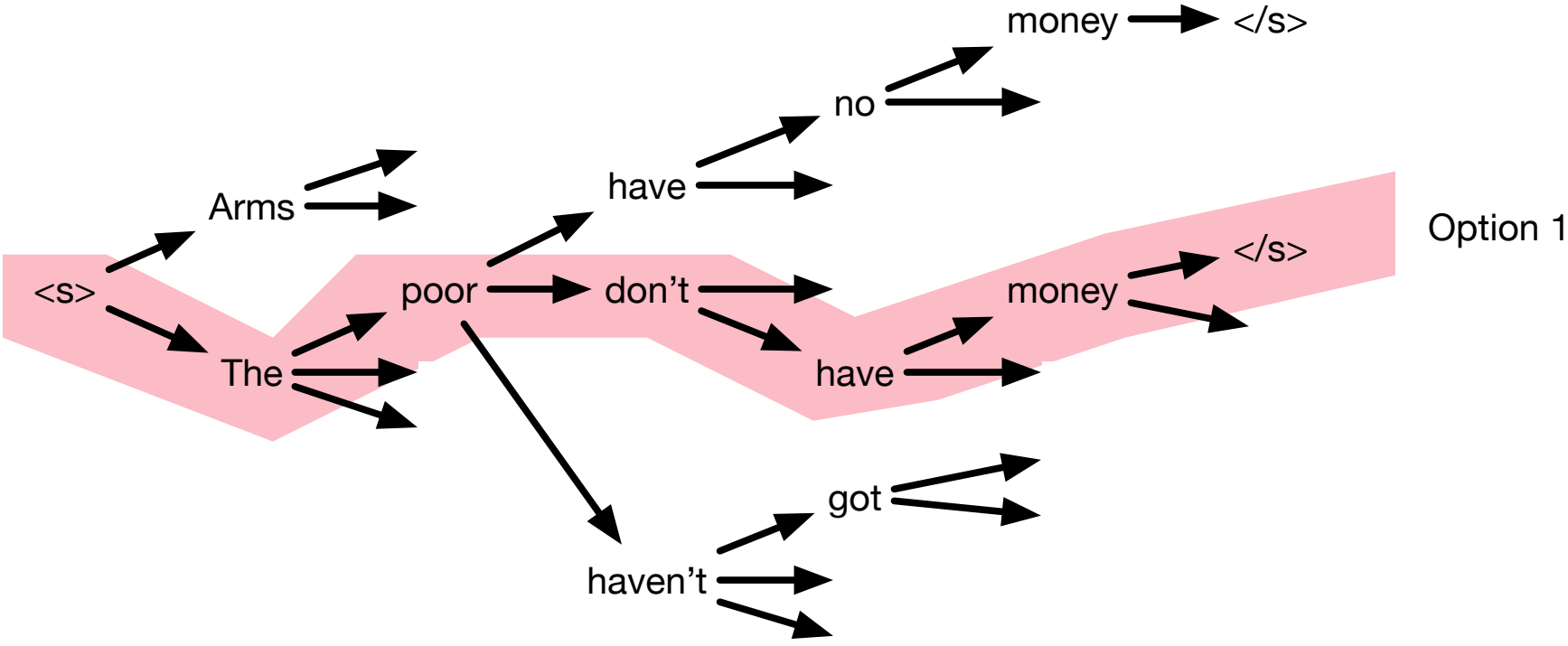

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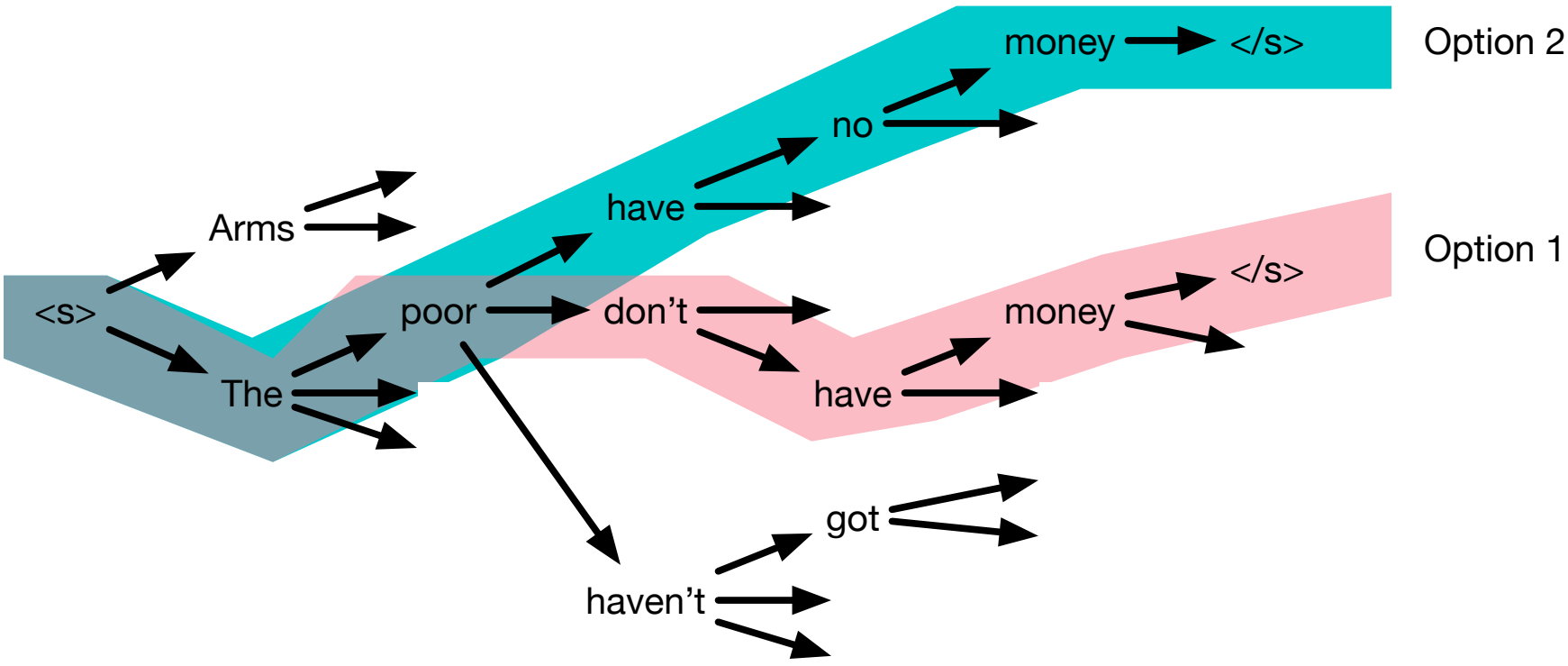

Beam Search Decoding for: Die Arme haben kein Geld

Using multiple sources

- Generate from multiple models
- Generate from multiple directions
- Generate from multiple data
- Generate from multiple temperatures

How to pick?

- Show to a user

How to pick?

- Show to a user
- Take highest probability

How to pick?

- Show to a user
- Take highest probability
- Rerank

Reinforcement Learning for Bandit Neural Machine Translation with Simulated Human Feedback

Khanh Nguyen[⊙♢] and **Hal Daumé III**[⊙♠♢♡] and **Jordan Boyd-Graber**[⊙♠♣♢]
University of Maryland: Computer Science,[⊙]Language Science,[♠]iSchool,[♣]UMIACS[♢]
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Can Neural Machine Translation be Improved with User Feedback?

Julia Kreutzer[1*] and **Shahram Khadivi**[3] and **Evgeny Matusov**[3] and **Stefan Riezler**[1,2]
[1]Computational Linguistics & [2]IWR, Heidelberg University, Germany
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RankGen — Improving Text Generation with Large Ranking Models *(EMNLP 2022)*




Kalpesh Krishna Yapei Chang John Wieting Mohit Iyyer

UMassAmherst
Manning College of Information & Computer Sciences

Google AI

Decoding Method	GPT2-md PG19	GPT2-md wiki	GPT2-XL PG19	GPT2-XL wiki
Nucleus ($p = 0.9$)	73.0	74.6	74.4	75.0
Eta (Hewitt et al., 2022)	76.9	71.2	76.9	74.8
Contrastive methods				
search (Su et al., 2022)	5.3	21.2	54.0	43.2
decode (Li et al., 2022)	65.2	83.2	73.2	84.9
RANKGEN-all-XL (ours)				
rerank full ancestral	**79.0**	84.9	**79.0**	86.4
beam search nucleus	76.2	**88.9**	77.0	**89.4**

Automatic Song Translation for Tonal Languages

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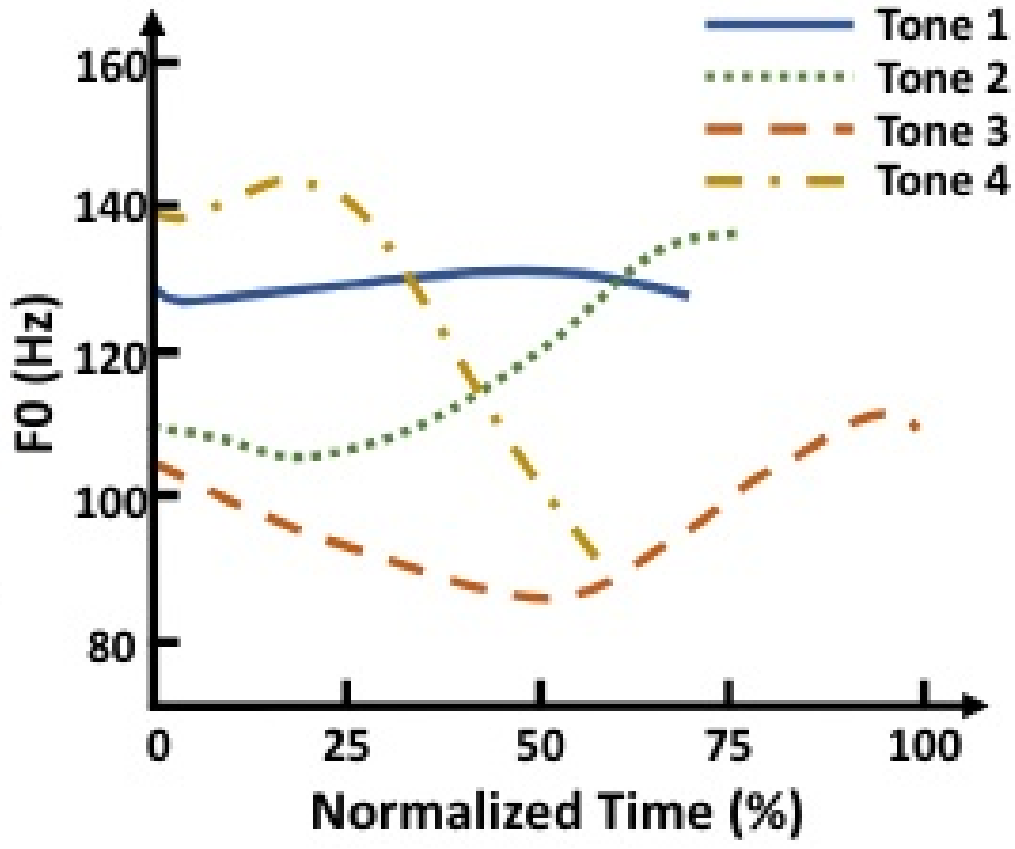
Tone 1: 叔 shū (uncle)

Tone 2: 熟 shú (cooked, familiar)

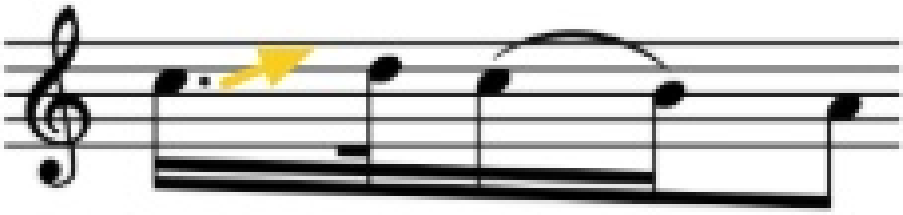
Tone 3: 鼠 shǔ (mouse, Muroidea)

Tone 4: 树 shù (tree)



Tones in Chinese (for “shu”, not “ma” like I said)

Original Lyrics (Inconsistent Tone)



sì zài yǎn qián

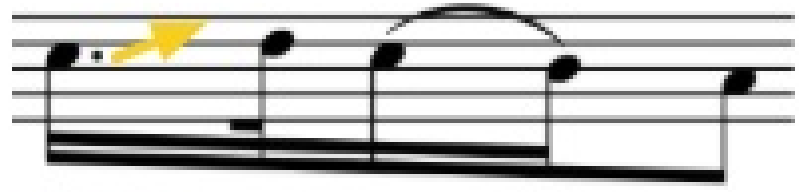
似 在 眼 前

appear where eye front

As if before my eyes

Inter-syllable pitch alignment score: 0.5

Misheard Lyrics (Consistent Tone)



sǐ zài yǎn qián

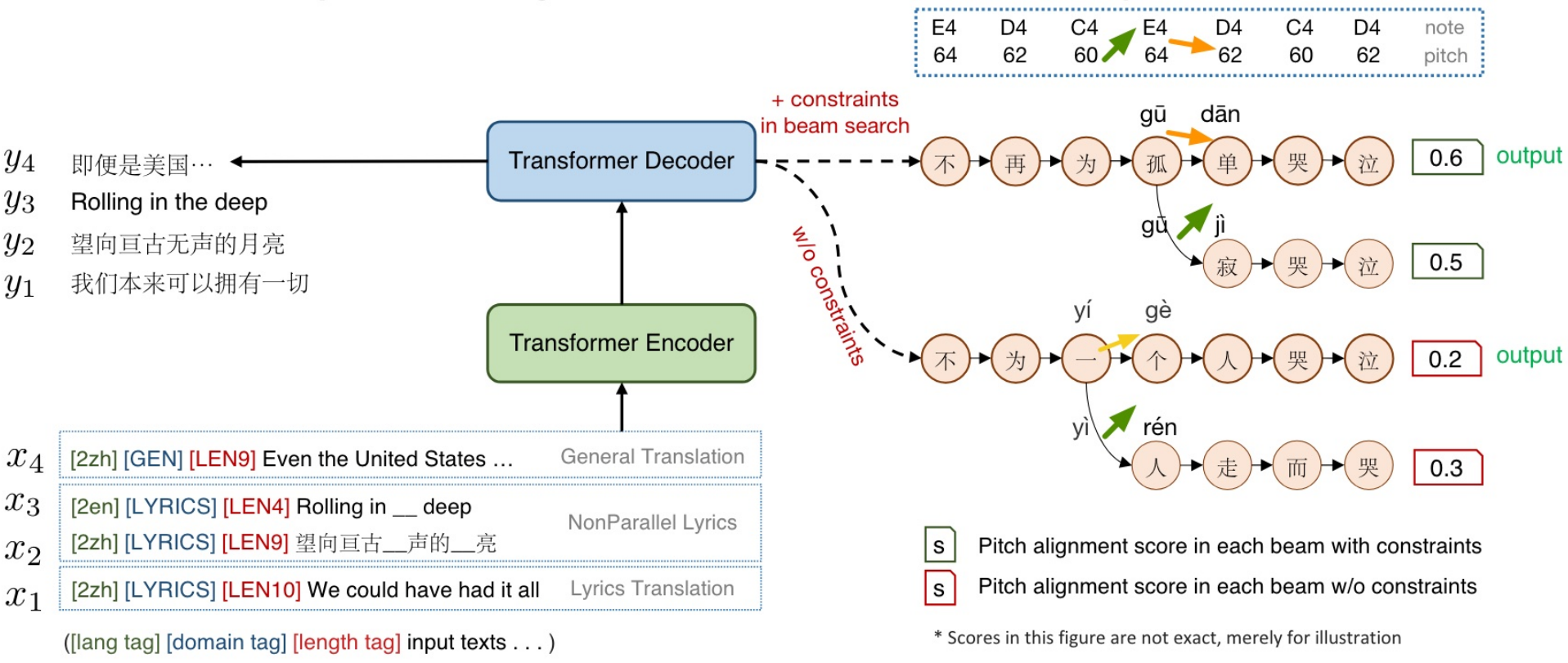
死 在 眼 前

death where eye front

Die before my eyes

Inter-syllable pitch alignment score: 0.75

Misheard lyrics when the tones are wrong



Decoding song translations with tones in decoder