

A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front one is blue and the back one is a light teal color. They are positioned diagonally, with the blue one in front of the teal one.

# Hello

I'm Matt



A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front one is blue and the back one is a light green color. They are positioned diagonally, with the blue one partially covering the green one.

# Natural Language Generation

Writing stuff by getting computers to write stuff.



# NLG use-cases:

- Translation
- Speech recognition
- Chatbots/digital assistants
- Automated reporting
- Smart Compose
- AIDungeon
- Document Summary
- Music Generation :D



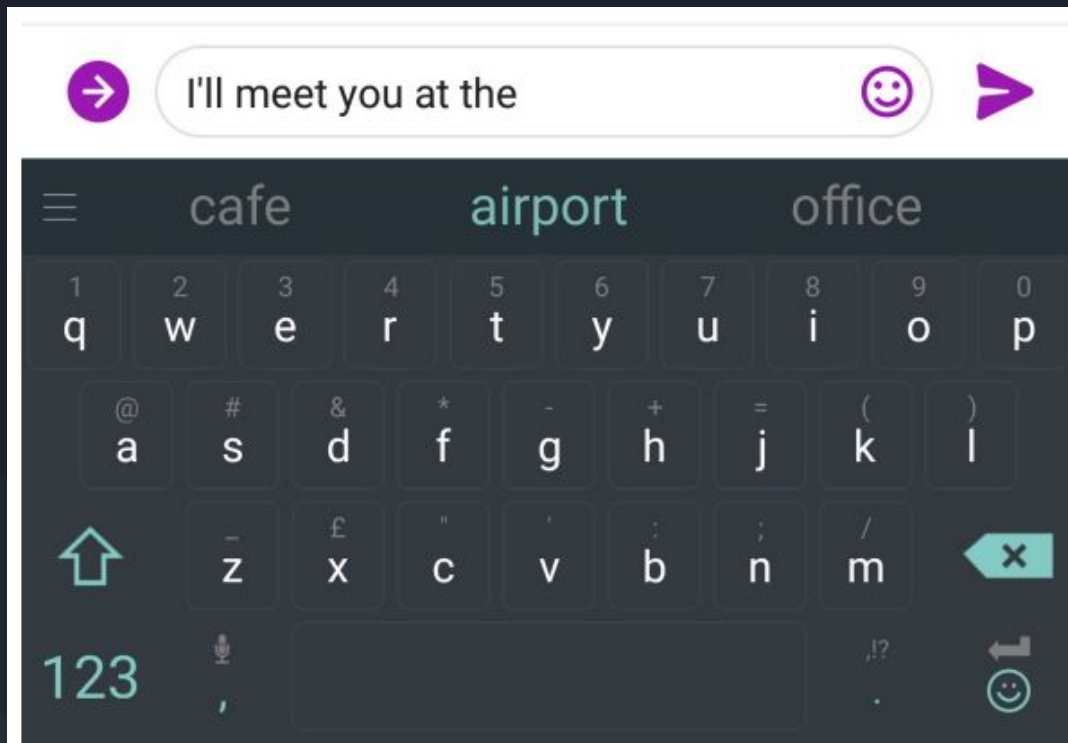
# Background

An incredibly brief introduction to NLG.

<https://web.stanford.edu/class/cs224n/slides/cs224n-2022-lecture05-rnnlm.pdf>

<https://web.stanford.edu/class/cs224n/slides/cs224n-2022-lecture06-fancy-rnn.pdf>

# Language Models



# Language Models

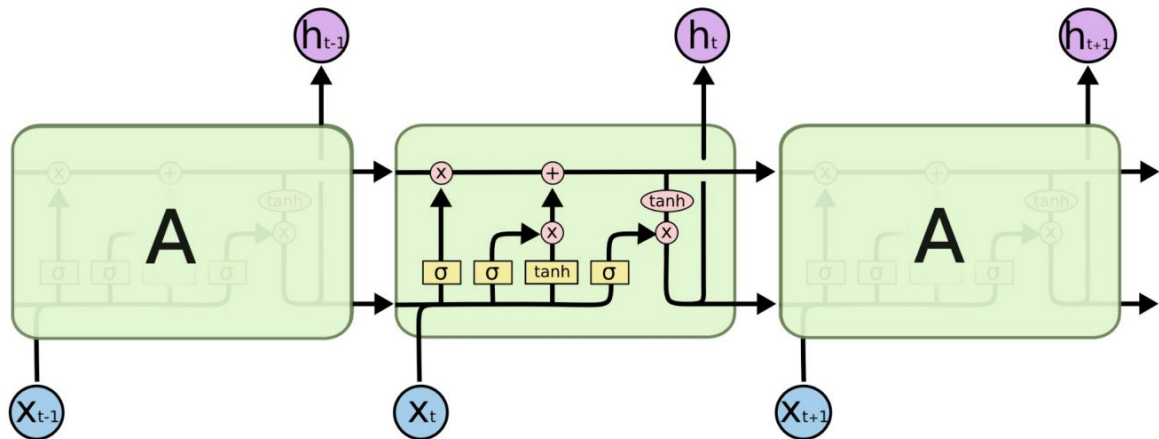
## N-Grams

~~as the proctor started the clock, the~~ students opened their \_\_\_\_\_  
discard condition on this

$$P(\mathbf{w} | \text{students opened their}) = \frac{\text{count}(\text{students opened their } \mathbf{w})}{\text{count}(\text{students opened their})}$$

# Language Models

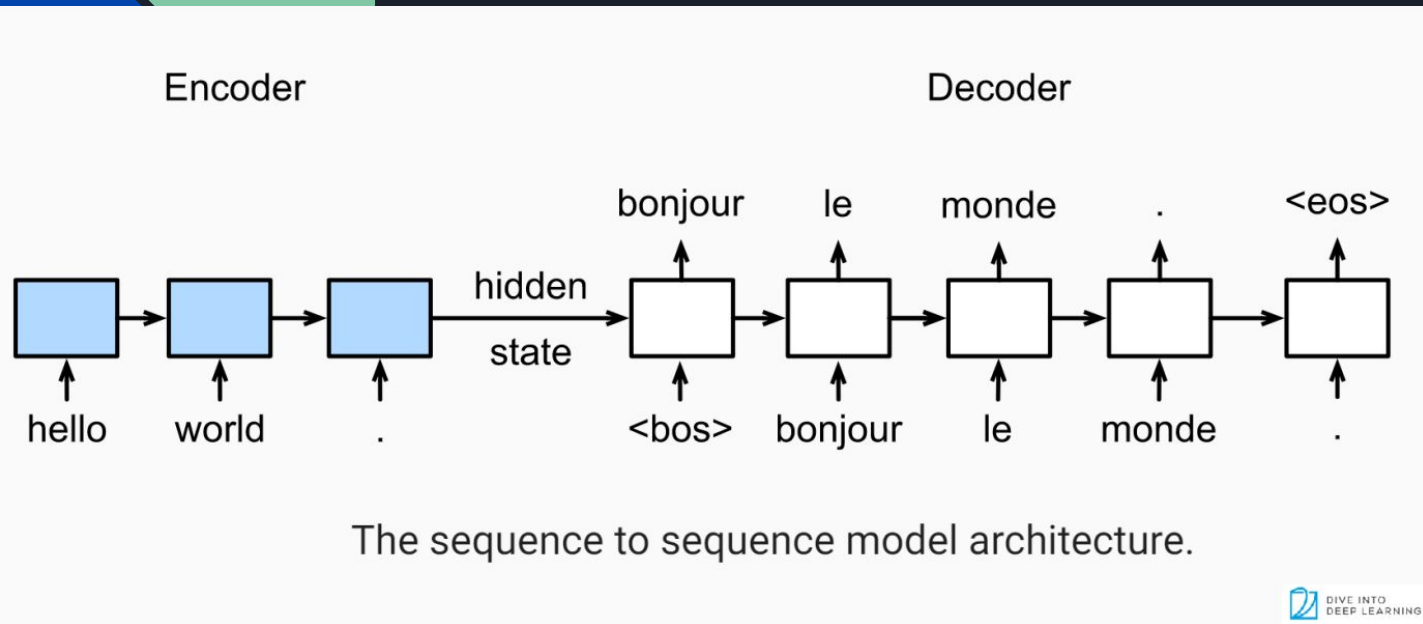
RNN / LSTM



# Language Models

Encoder / Decoder: Seq2Seq

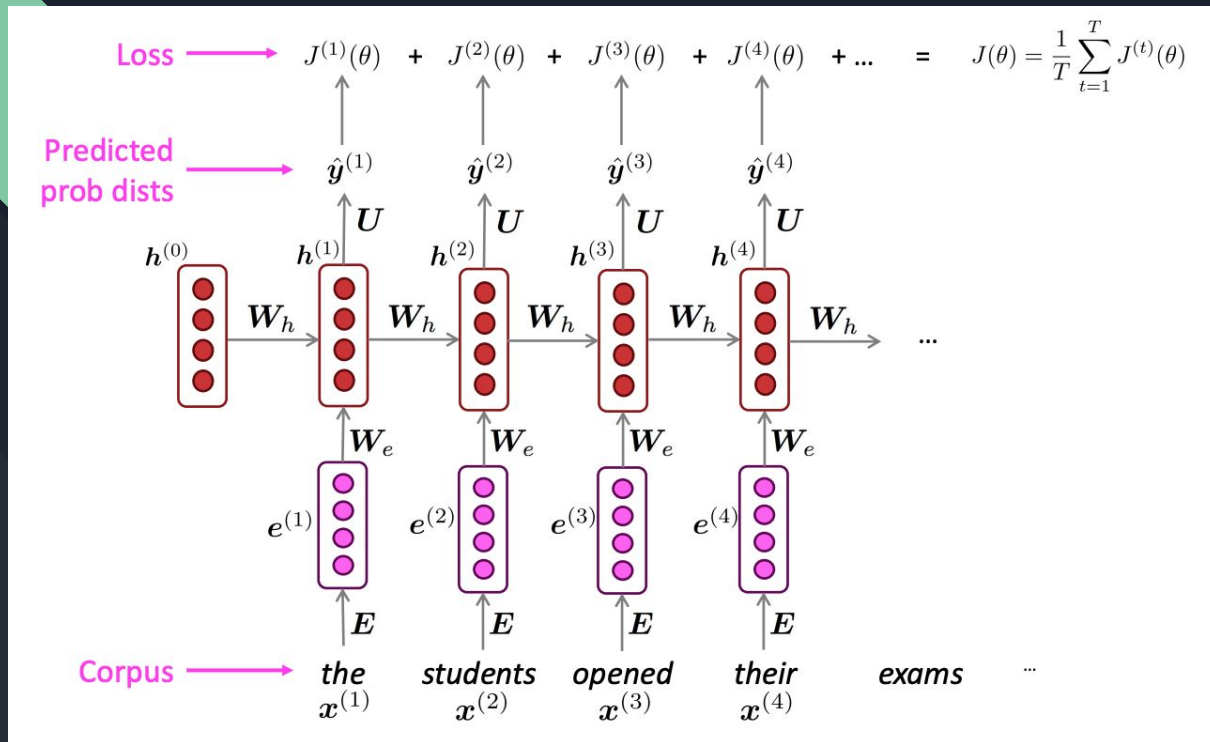
<https://www.linkedin.com/pulse/anatomy-sequence-to-sequence-machine-translation-rnn-gru-sobh-phd/>





# Language Models

## Teacher Forcing





# The Recent Past / Present

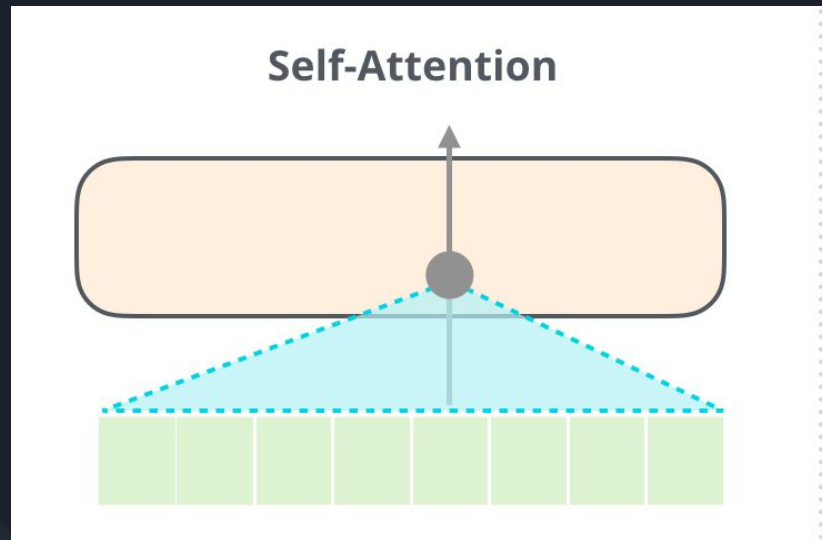
Decoupling encoding from decoding

<https://jalammar.github.io/illustrated-gpt2/>

# Encoders

BERT and pals

([twitter.com/bertsesame](https://twitter.com/bertsesame))



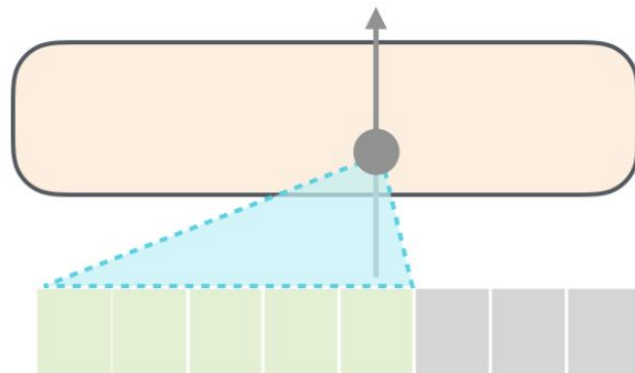
# Decoders

You down with GPT? Yeah, you know me.



The scientist  
named the  
population, after their  
distinctive horn,  
Ovid's Unicorn.

## Masked Self-Attention



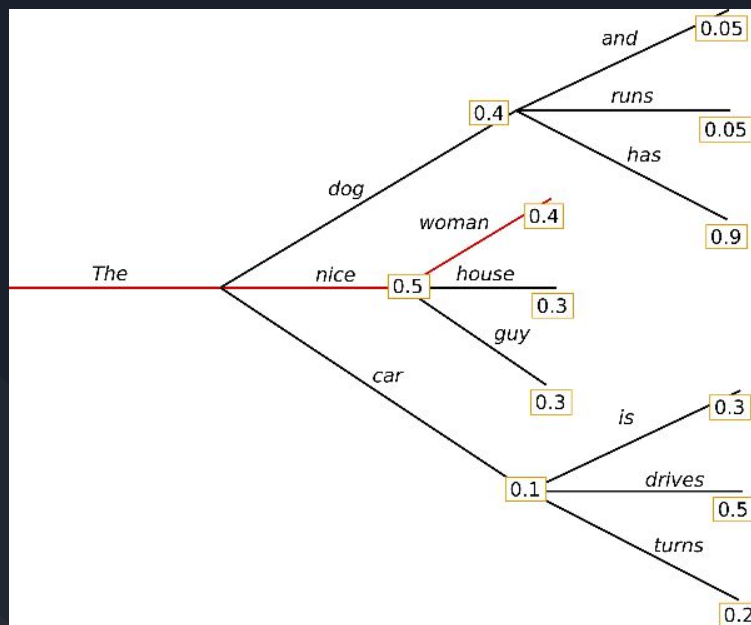


# Under the hood

<https://huggingface.co/blog/how-to-generate>

# Decoding

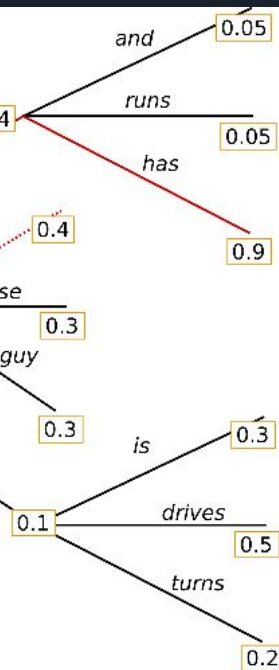
## Greedy Search



## A decorative graphic in the bottom right corner of the slide. It features a dark blue background with a large, bright blue parallelogram and a light green parallelogram overlapping it. The shapes are oriented diagonally.

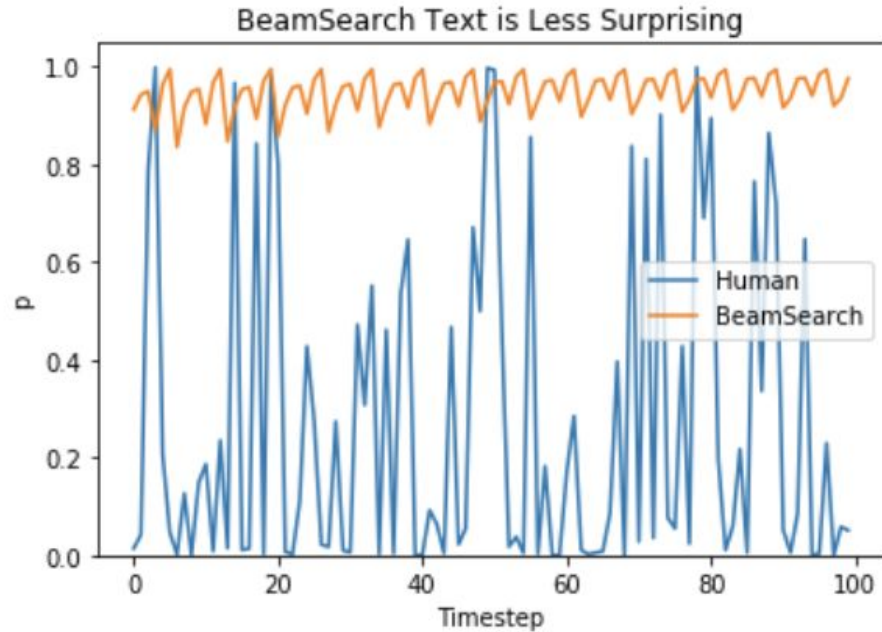
# Beam Search

Better than greedy for a lot of things!



<https://demo.allennlp.org/next-token-lm>

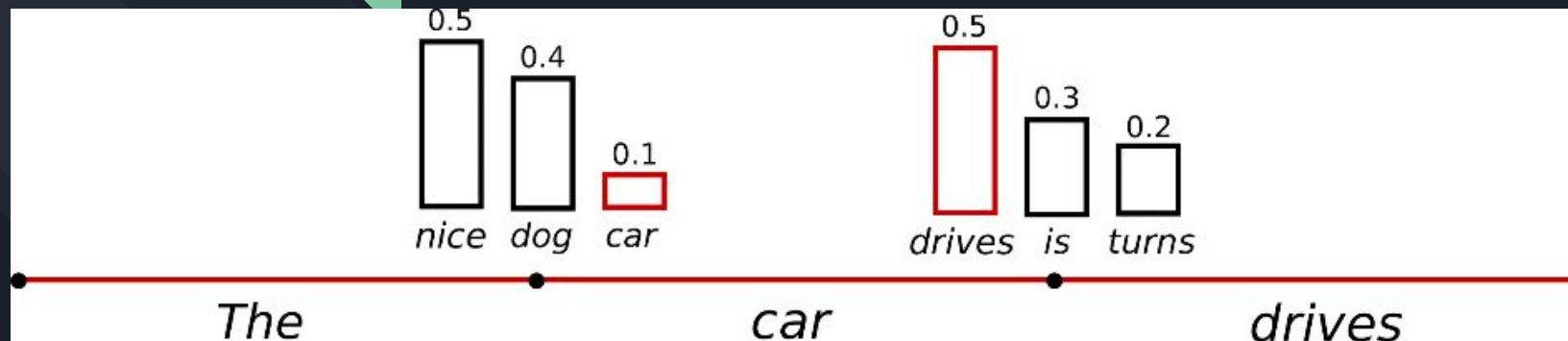
# The problems with Beam Search





# Sampling

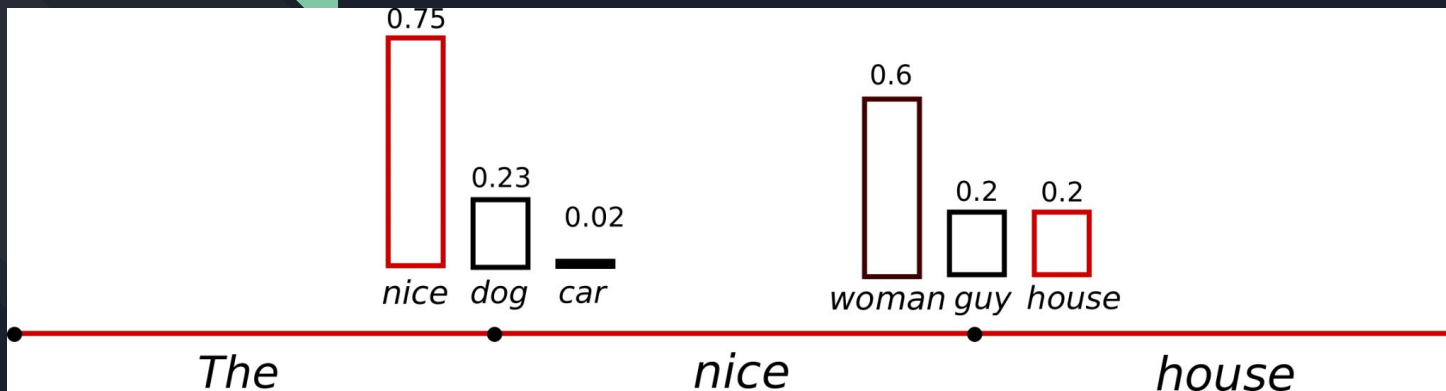
To the... rescue? Limit? Nth?



# Sampling

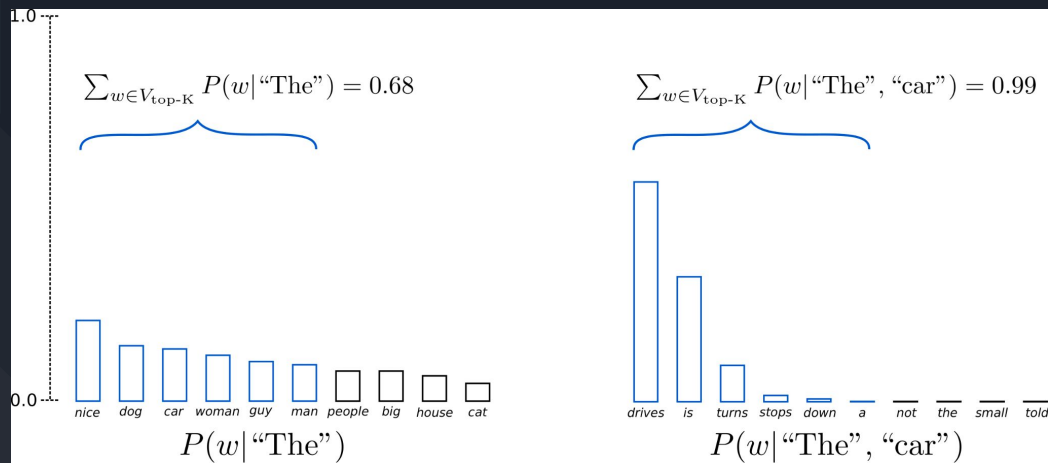
Can be kind of, um, random.

So lower the temperature!



# Top K Sampling

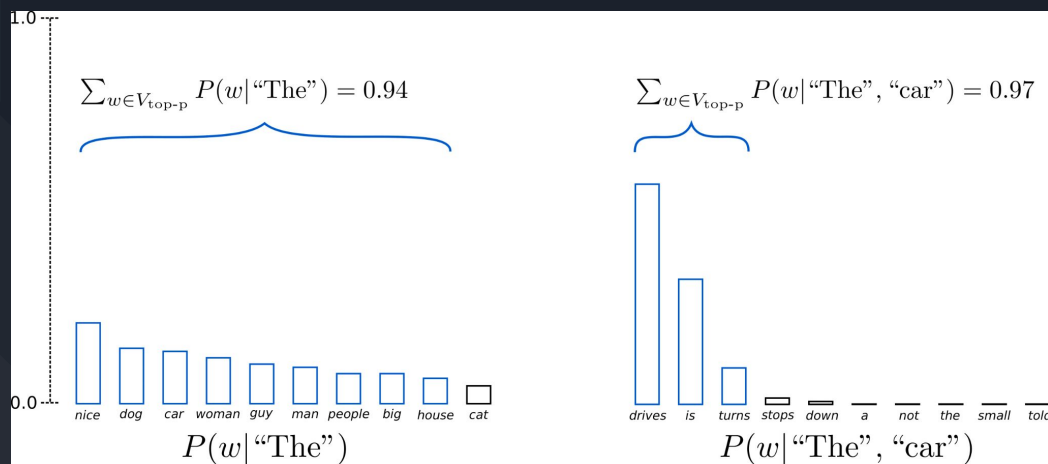
Simple and effective



# Nucleus Sampling

Aka Top P sampling

Less simple; also effective





WebText

An unprecedented number of mostly young whales have become stranded on the West Australian coast since 2008.

The number of stranded whales has increased by more than 50 per cent in the past year, with the number of stranded whales on the West Australian coast increasing by more than 50 per cent in the past year. The number of whales stranded on the West Australian coast has increased by more than 50 per cent in the past year, with the number of stranded whales on the West Australian coast increasing by more than 50 per cent in the past year.

The Australian Food Safety Authority has warned Australia's beaches may be *revitalised* this year because healthy *seabirds and seals* have been on the move. More than 50,000 seabirds, sea mammals and seahorses have been swept into the sea by the *Holden CS118 and Adelaide Airport CS300* from 2013. A major *white-bat and umidauda* migration across Australia is under way in Australia for the first time, with numbers reaching an estimated 50,000.

Last week's intense storms and a series of powerful cyclones have been officially blamed for the deaths of at least nine large fin whales near Whitsundays - the largest loss of any species globally. The fin whales; *packed in the belly of one killer whale thrashing madly* in fear as another tries to bring it to safety. When the colossal animal breached the waters of Whitsundays, *he'd been seen tagged for a decade*.

*Pumping Station #3 shut down due to construction damage* Find more at: [www.abc.net.au/environment/species-worry/in-the-top-10-killer-whale-catastrophes-in-history.html](http://www.abc.net.au/environment/species-worry/in-the-top-10-killer-whale-catastrophes-in-history.html)

"In the top 10 killer whale catastrophes in history:

1) 1986: Up to 12 orcas *struck by lightning; many drowned* and many more badly injured.

The whale's fate was confirmed late last week when the animal was found by fishermen off the coast of Bundaberg. Experts believe the whale was struck by a *fishing vessel off the coast of Bundaberg*, and died after being *sucked into the ocean*. The whale's fate was confirmed late last week when the animal was found by fishermen off the coast of Bundaberg.

There has been an unprecedented number of calves caught in the nets of whaling stations that operate in WA. Pilot whales continue to migrate to feeding grounds to feed their calves. They are now vulnerable due to the decline of wild populations; they are restricted to one breeding site each year. Image copyright Yoon Bo Kim But, with sharp decline in wild populations the size of the *Petrels* are shrinking and dwindling population means there will only be room for a few *new fowl*.

Poor nutrition has led to a rise in the number of stranded humpback whales on the West Australian coast, veterinary researchers have said. Carly Holyoake, from Murdoch University, at the Australian Veterinary Association's annual conference in Perth on Wednesday, said an unprecedented number of mostly young whales had become stranded on the coast since 2008.



Beam Search,  $b=16$



Pure Sampling



Sampling,  $t=0.9$



Top-k,  $k=640$



Top-k,  $k=40$ ,  $t=0.7$



Nucleus,  $p=0.95$



WebText

# "NATURAL LANGUAGE DOES NOT MAXIMIZE PROBABILITY"

The Curious Case of Natural Language DeGeneration

<https://arxiv.org/pdf/1904.09751.pdf>



# THE FUTURE

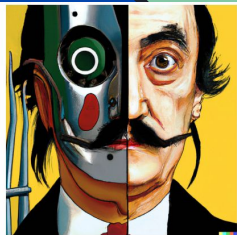
Wouldn't that be nice?

# Multimodality!

CLIP! Dall-E! Dall-E 2!

<https://cdn.openai.com/papers/dall-e-2.pdf>

<https://openai.com/dall-e-2/#demos>



a vibrant portrait painting of Salvador Dalí with a robotic half face



a shiba inu wearing a beret and black turtleneck



a close up of a handpalm with leaves growing from it



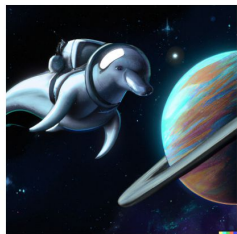
an espresso machine that makes coffee from human souls, artstation



panda mad scientist mixing sparkling chemicals, artstation



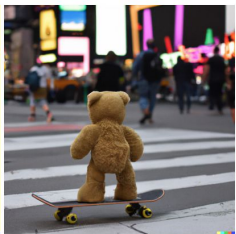
a corgi's head depicted as an explosion of a nebula



a dolphin in an astronaut suit on saturn, artstation



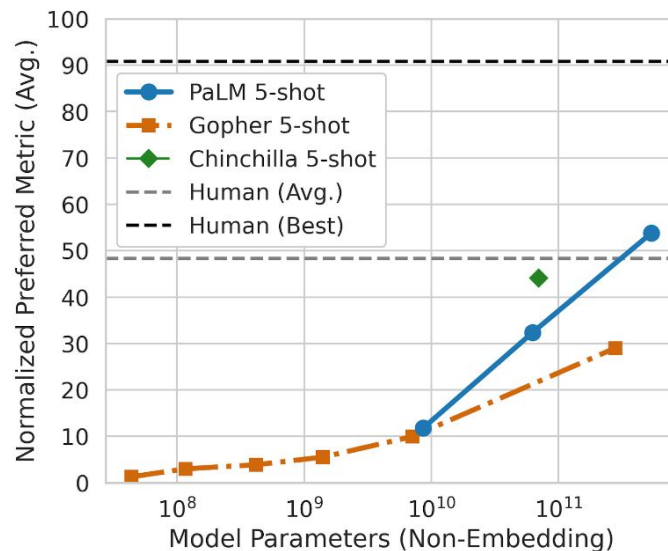
a propaganda poster depicting a cat dressed as french emperor napoleon holding a piece of cheese



a teddy bear on a skateboard in times square

# PaLM

SIZE = few/0-shot learning and extreme cross-task/domain generalization!





<https://ai.googleblog.com/2022/04/pathways-language-model-palm-scaling-to.html>



# PaLM

## Chain of Thought Prompting Elicits Reasoning in Large Language Models

Standard Prompting	Chain of thought prompting
<p>Example Input</p> <p>Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?</p> <p>Example Output</p> <p>A: The answer is 11.</p>	<p>Example Input</p> <p>Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?</p> <p>Example Output</p> <p>Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. <math>5 + 6 = 11</math>. The answer is 11.</p>
<p>Prompt</p> <p>The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?</p> <p>Model Response </p> <p>The answer is 50.</p>	<p>Prompt</p> <p>The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?</p> <p>Model Response </p> <p>The cafeteria had 23 apples originally. They used 20 to make lunch. So they had <math>23 - 20 = 3</math>. They bought 6 more apples, so they have <math>3 + 6 = 9</math>. The answer is 9.</p>

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# NLG for FUN

# NLG Exploration



Or: "I want to live in the Uncanny Valley between sense and nonsense."



# @new\_ai\_artists

**Model:** GPT-2

**Dataset/Corpus:** 10,000 most popular musical artist names, scraped from the Last.fm API.

**Bot:** A “quiz” to see if readers can correctly tell the difference between AI-gen “artists” and real recording artists.

# MtGPT2

Extremely normal Magic: the Gathering cards



# MtGPT2

**Models:** GPT-2 for NLG; Latent2Visions (CLIP + Taming Transformers) for images

**Dataset/Corpus:** Text is scraped from MTGJSON

**MULTIMODALITY:** Based on @advadnoun's pioneering work combining OpenAI's CLIP with various GANs, we can use text as a prompt for image synthesis.



Q+A