DATA 340 NLP
Stochastic parrots and human communication

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Lecture overview

- Problem set 0
  - Problem set 0.1: EDA
  - Problem set 0.2: Critical Reflection
- Project ideas
- Syllabus updates
- Introduction to Large Language Models
  - Developments
  - Concerns

Problem set 0

Exploratory data analysis/critical analysis

Problem Set 0

Due Date: 11:59pm on Friday, September 22nd

Learning Objectives

Please select one of the below problem sets. You will be graded on the following:

- Correctness of your code (No bugs, correct output)
- Code readability (Comments, variable names, etc.)
- Code efficiency (No unnecessary loops, etc.)
- Code style (No unnecessary lines, etc.)
- Code organization (No unnecessary files, etc.)
- Code documentation (README.md, etc.)
- Data visualization (if applicable)
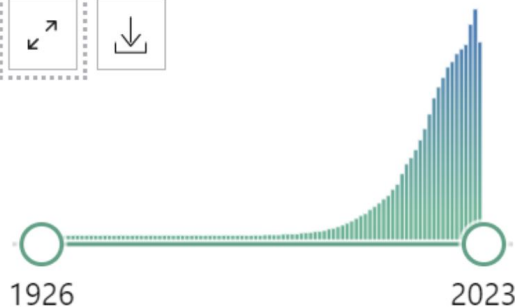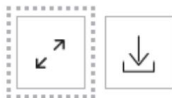- Critical reflection (if applicable)

Project ideas

Project idea: "Little is known ..."

Paul Katz
@pskatz

There seems to be an increasing use of the justification for a paper being "little is known". Here is the appearance of this phrase in PubMed. It looks like we know less as time progresses. Little is known about why this trend has developed.

RESULTS BY YEAR

1926   2023

https://twitter.com/pskatz/status/15929060650
53913090?s=20&t=_-lXlli2iEdYVCGbCRMPXQ

Paul Katz @pskatz · Nov 18, 2022

I think that "little is known about..." is not a sufficient justification for studying something. Little is known about the composition of the dirt on the floor of my office, but that is not a good enough reason to study it.

💬 1   ⟲ 4   ♡ 20   ili   ⬆

Paul Katz @pskatz · Nov 18, 2022

I also think that it is intellectually lazy to justify research by saying that "little is known". The paper or the grant should tell the reader why this is important, not just that it's unknown.
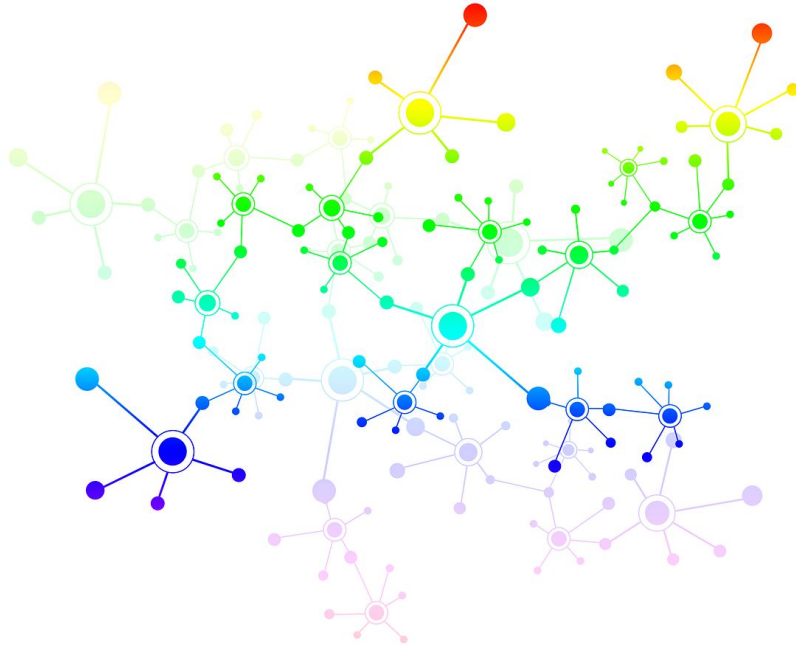
💬 2   ⟲ 4   ♡ 15   ili   ⬆

Project idea: Social networks in …

Project idea: How is the second amendment interpreted by …

Syllabus updates

- Problem set 0: Exploratory Data Analysis (EDA) and Critical Reflection on the use of terms such as 'understanding' and 'intelligence' in the context of NLP
- Problem set 1: Machine Learning Models for NLP
- Problem set 2: Vector semantics
- Problem set 3: Neural Networks for NLP

| 2023-08-31	Th.	Introduction & Syllabus		
2023-09-05	Tu.	NLP, Data Science, & Large Language Models		
2023-09-07	Th.	Stochastic Parrots & Human Communication		
2023-09-12	Tu.	Linguistic structure (Pt. I)	[JM 17, 18]	Withdrawal period begins
2023-09-14	Th.	Linguistic structure (Pt. II)	[JM 17, 18]	
2023-09-19	Tu.	Statistics & Information Theory	[S]	

Large Language Models

What is a Large Language Model (LLM)?

- Deep Neural Network based on the transformer architecture
- Trained on massive amount of text data
  - Prediction of a next word in sequence
  - Sentence similarity
- Fine-tuned on specific task
- Generative model - creates text via a prompt
- Size: often billions of parameters (GPT-3 175 billion of parameters)
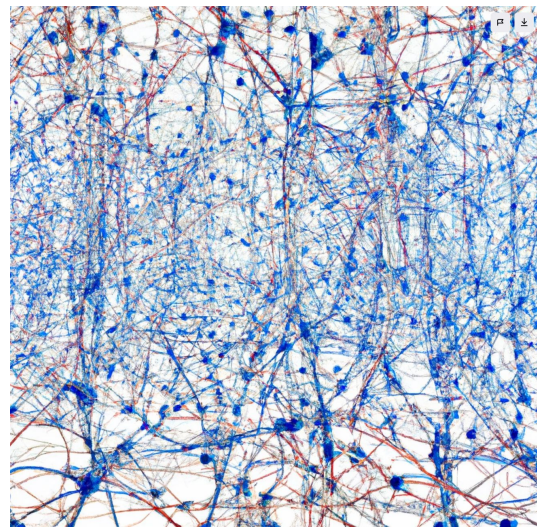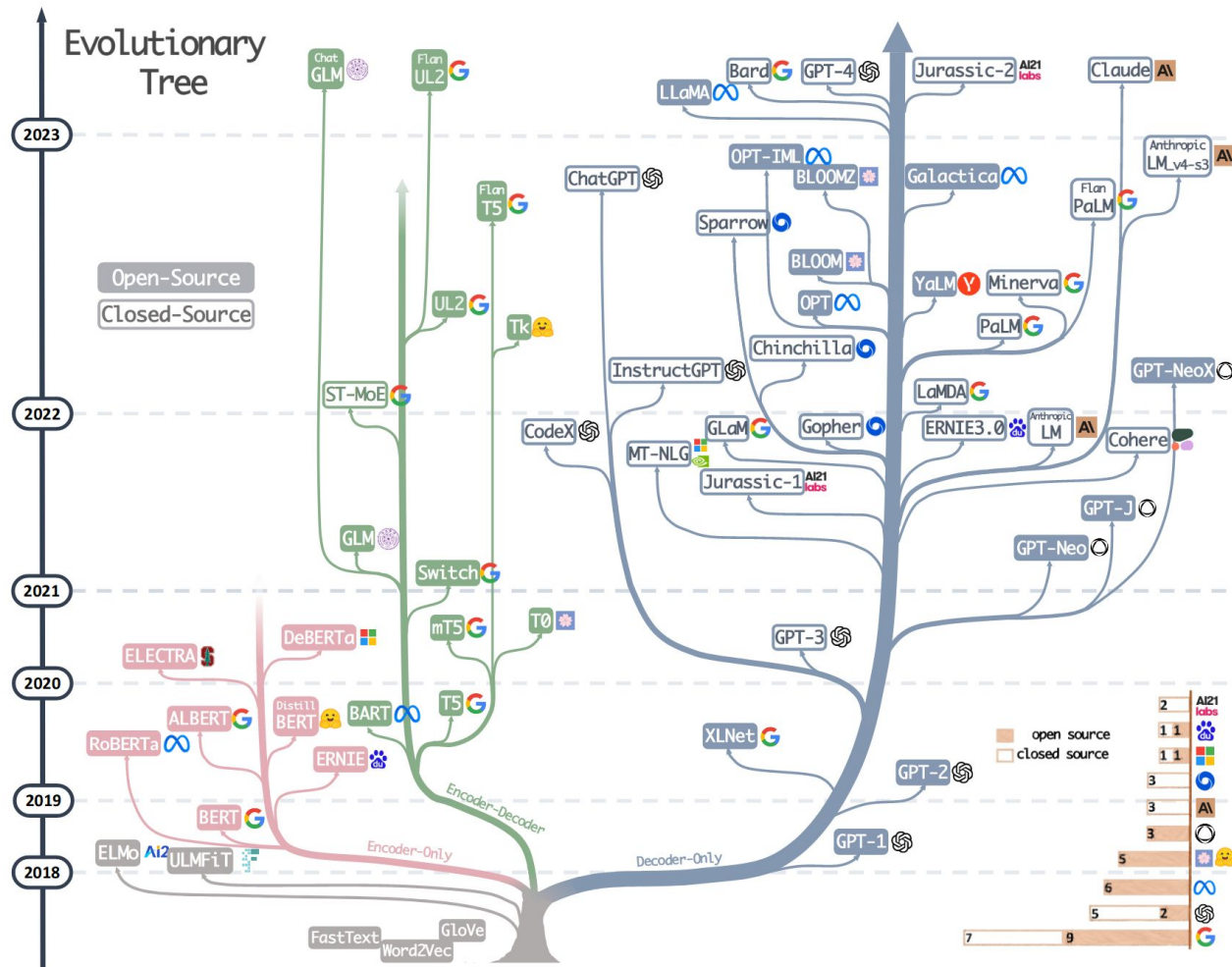
Developments of LLMs
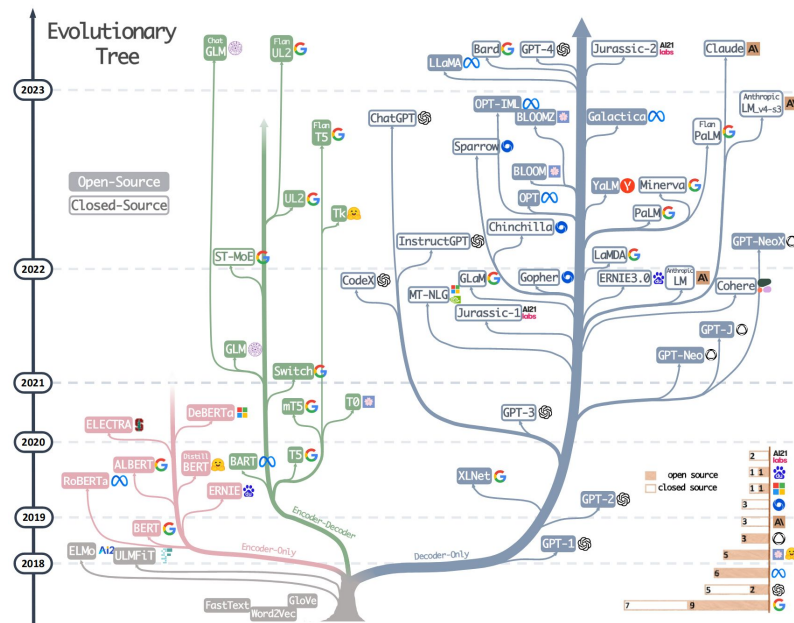
Yang, Jingfeng, et al. Harnessing the Power of LLMs in Practice: A Survey on ChatGPT and Beyond. arXiv:2304.13712, arXiv, 27 Apr. 2023. arXiv.org, https://doi.org/10.48550/arXiv.2304.13712.

Evolutionary Tree

2023
2022
2021
2020
2019
2018

Open-Source
Closed-Source

ChatGLM, Flan UL2, Bard, GPT-4, Jurassic-2, Claude, LLaMA, Anthropic LM_v4-s3, Flan T5, ChatGPT, OPT-IML, BLOOMZ, Galactica, Flan PaLM, Sparrow, BLOOM, YaLM, Minerva, UL2, OPT, PaLM, Tk, ST-MoE, InstructGPT, Chinchilla, LaMDA, ERNIE3.0, Anthropic LM, GPT-NeoX, CodeX, GLaM, Gopher, Cohere, MT-NLG, Jurassic-1, GPT-J, GLM, GPT-Neo, Switch, mT5, T0, GPT-3, ELECTRA, DeBERTa, ALBERT, Distill BERT, BART, T5, XLNet, RoBERTa, ERNIE, BERT, GPT-2, ELMo, ULMFiT, GPT-1, FastText, Word2Vec, GloVe

Encoder-Decoder
Encoder-Only
Decoder-Only

open source
closed source

2
1 1
1 1
3
3
3
5
6
5 2
7   9

Concerns about LLMs

- Bender, Emily M., et al. "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜." *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency, Association for Computing Machinery*, 2021, pp. 610–23. ACM Digital Library, https://doi.org/10.1145/3442188.3445922.
- Bender, Emily M., and Alexander Koller. "Climbing towards NLU: On Meaning, Form, and Understanding in the Age of Data." *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics, Association for Computational Linguistics*, 2020, pp. 5185–98. ACLWeb, https://doi.org/10.18653/v1/2020.acl-main.463.

On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜

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Climbing towards NLU: On Meaning, Form, and Understanding in the Age of Data

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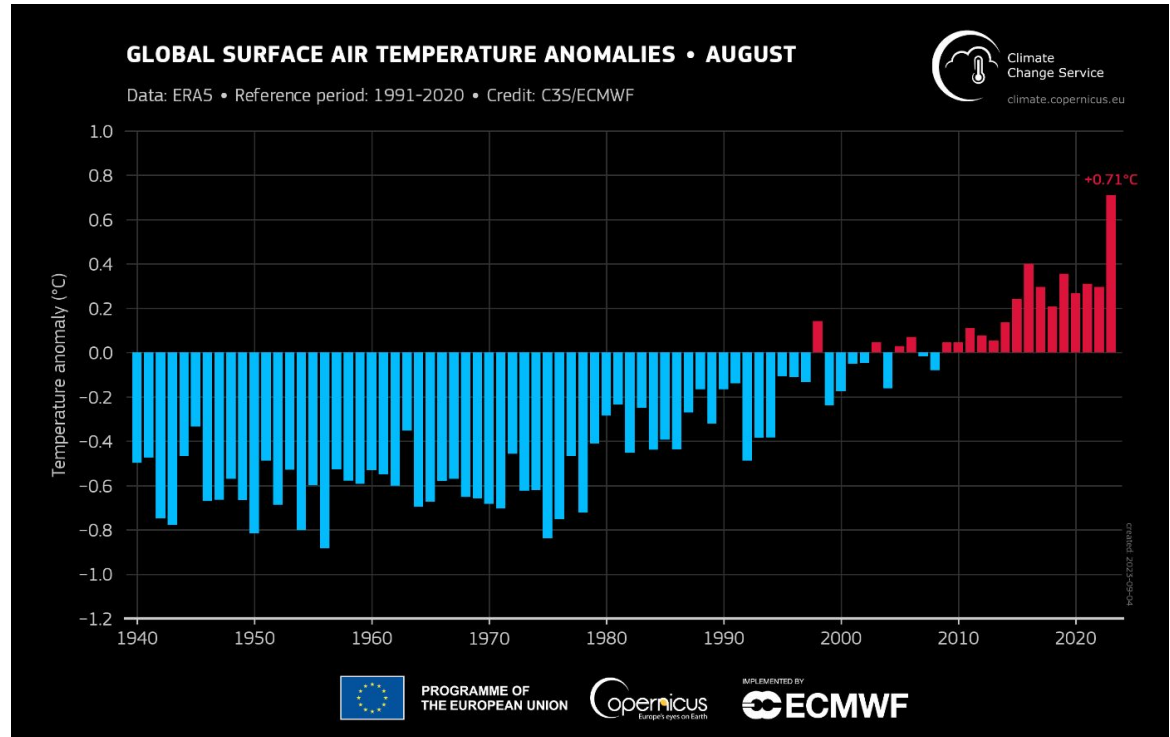koller@coli.uni-saarland.de

Concerns about LLMs: Dangers

- Environment cost and financial cost

- Training data quality (Diversity, Equity, and Inclusion)

- LLMs and General Artificial Intelligence
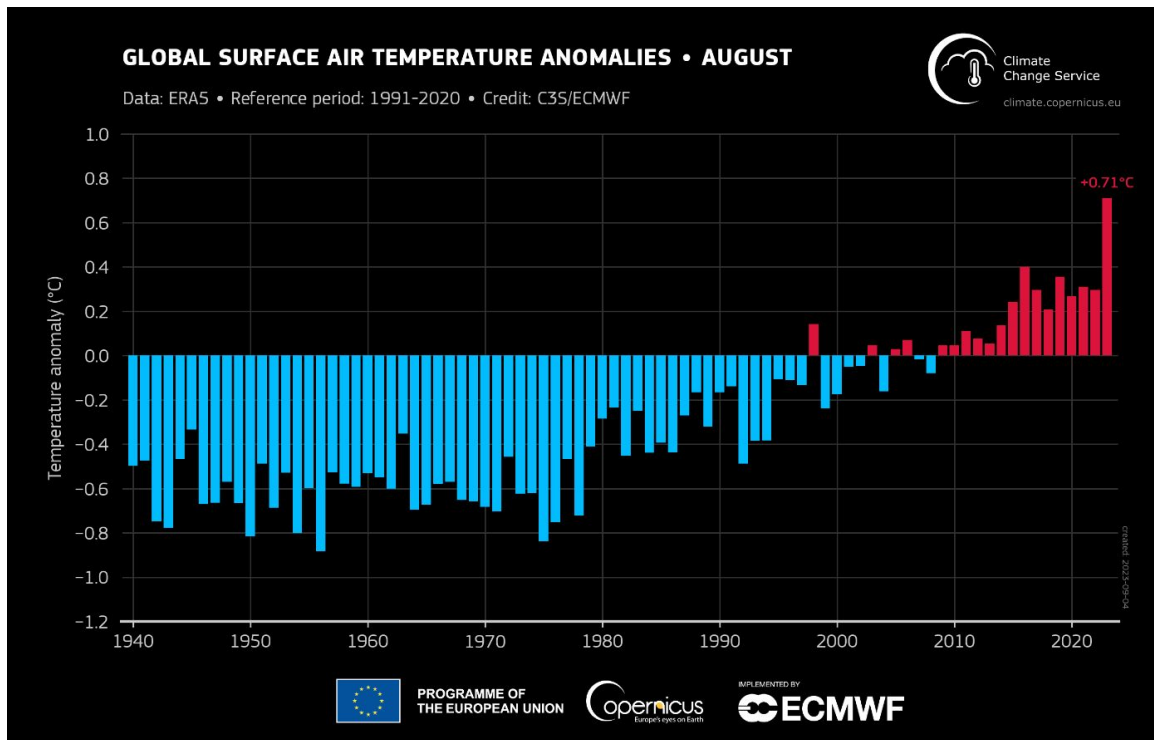
- Digital archive - static data

- Stochastic parrots

Concerns about LLMs: Environment costs

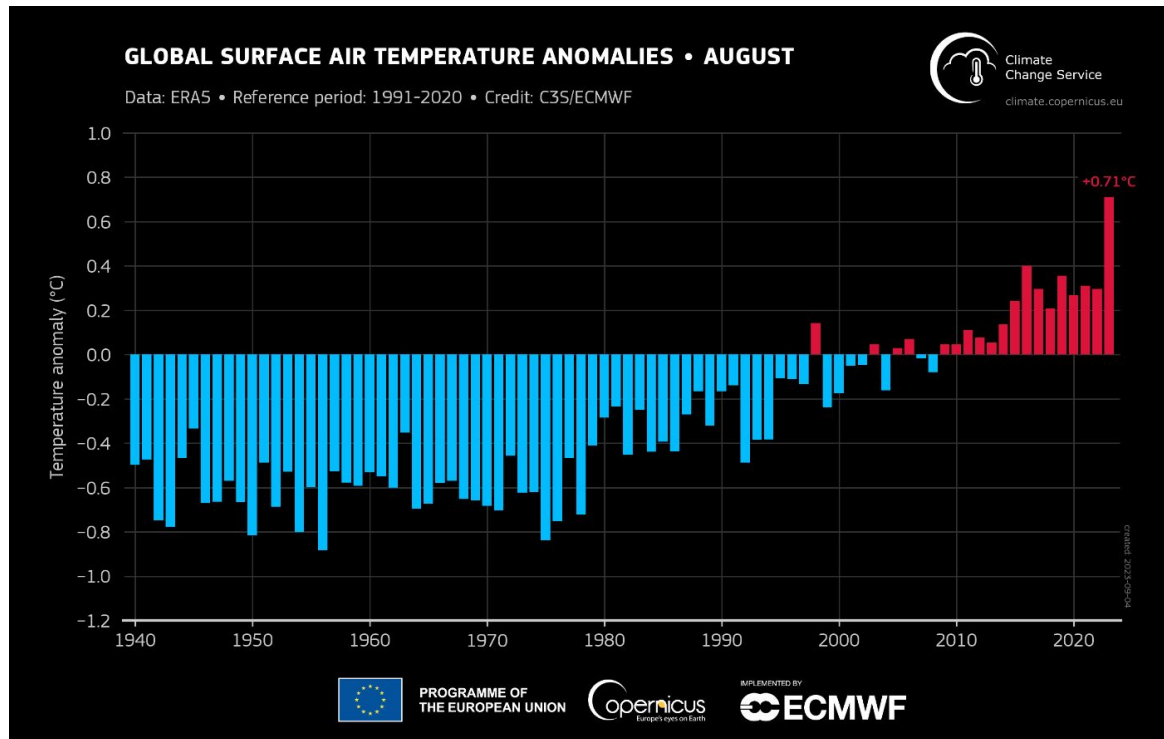- Cloud compute energy: is it renewable?
- [Source](#)

Concerns about LLMs: Environment costs

- Cloud compute energy: is it renewable?
- Document training times and hyperparameters
- [Source](#)

GLOBAL SURFACE AIR TEMPERATURE ANOMALIES • AUGUST

Data: ERA5 • Reference period: 1991-2020 • Credit: C3S/ECMWF

Climate Change Service

climate.copernicus.eu

+0.71°C

PROGRAMME OF THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

IMPLEMENTED BY
ECMWF

Concerns about LLMs: Environment costs

- Cloud compute energy: is it renewable?
- Document training times and hyperparameters
- Risk & benefit analyses
- [Source](#)

GLOBAL SURFACE AIR TEMPERATURE ANOMALIES • AUGUST

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Climate Change Service
climate.copernicus.eu

+0.71°C

Temperature anomaly (°C)

PROGRAMME OF THE EUROPEAN UNION
Copernicus — Europe's eyes on Earth
IMPLEMENTED BY ECMWF

Concerns about LLMs: Environment costs

"It is past time for researchers to prioritize energy efficiency and cost to reduce negative environmental impact and inequitable access to resources – both of which disproportionately affect people who are already in marginalized positions." Bender, et al., 613

Concerns about LLMs: Training data quality

- Internet contains a massive wealth of data (text, image, and video)

- World contains massive amounts of data to digitize (books!)

Concerns about LLMs: Training data quality

- Quantity/Quality issues
  - Hegemonic views voiced
  - Hate speech
  - Violence
  - Misogynistic forums
  - GPT-2 (Reddit, Pew Internet Research, etc.)
  - Minority groups underrepresented
- Trash in/Trash out phenomenon
- Exploratory Data Analysis: Necessary!

Concerns about LLMs: General Artificial Intelligence

- "… no actual language understanding is taking place in LM-driven approaches to these tasks, as can be shown by careful manipulation of the test data to remove spurious cues the systems are leveraging."
- "… languages are systems of signs, pairings of form and meaning." Bender, et al., 615.
- What are LLMs doing when they output strings?

Concerns about LLMs: Stochastic parrots

- "...humans mistake LM output for meaningful text ..."
- "...coherence is in fact in the eye of the beholder."
- "... human communication relies on the interpretation of implicit meaning conveyed between individuals."
- "Text generated by an LM is not grounded in communicative intent, any model of the world, or any model of the reader's state of mind." Bender, et al., 616
- Training data in – biases, hegemony, inequality out, etc.