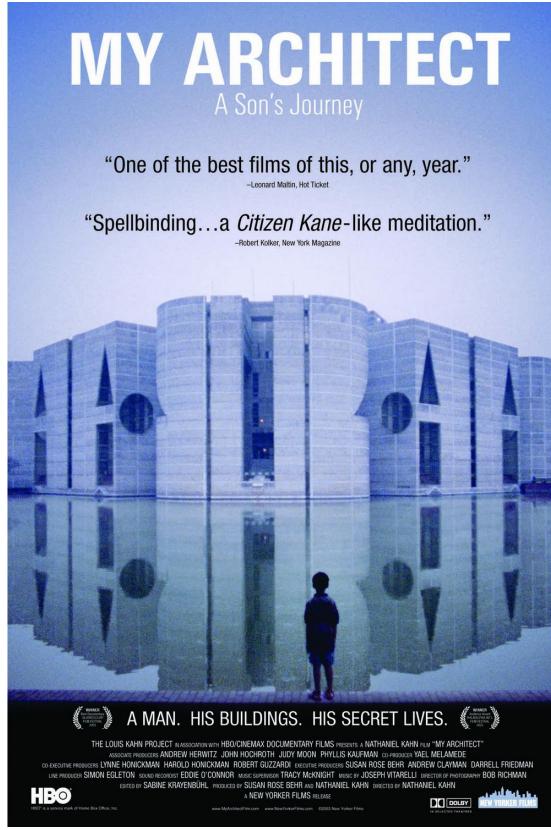




MemorAI
memories of your loved ones

Alice Hua, Ajit Barhate, Tim Chen
MIDS Capstone - Fall 2021
www.memor-ai.com

Product -> Data -> Pipeline -> Guardrails -> Response -> Evaluation -> Demo -> Future Work



Product -> Data -> Pipeline -> Guardrails -> Response -> Evaluation -> Demo -> Future Work



Two Use Cases

1. Desire to **know the stories** of my loved ones.
2. Desire to **preserve my stories** for my loved ones.

What Is MemorAI?



Alex Honnold

"There's a certain joy in swinging around, propelling yourself upward... the fluidity of movement."

Ask: climbing . free solo . adventure . fear . other

Why do you love climbing?

Ask Question

Why do I love climbing so much? I think it's because you're forced to confront your own limits. You know, when you're climbing, there are no real winners or losers. It's just this constant process of improvement, and that appeals to me on a personal level.|

What Is MemorAI?



Training Data



ALEX



ROBERT

TED Talks

1 Tedtalk

YouTube

3 interviews



Book: Alone on the Wall



Movie: Free solo



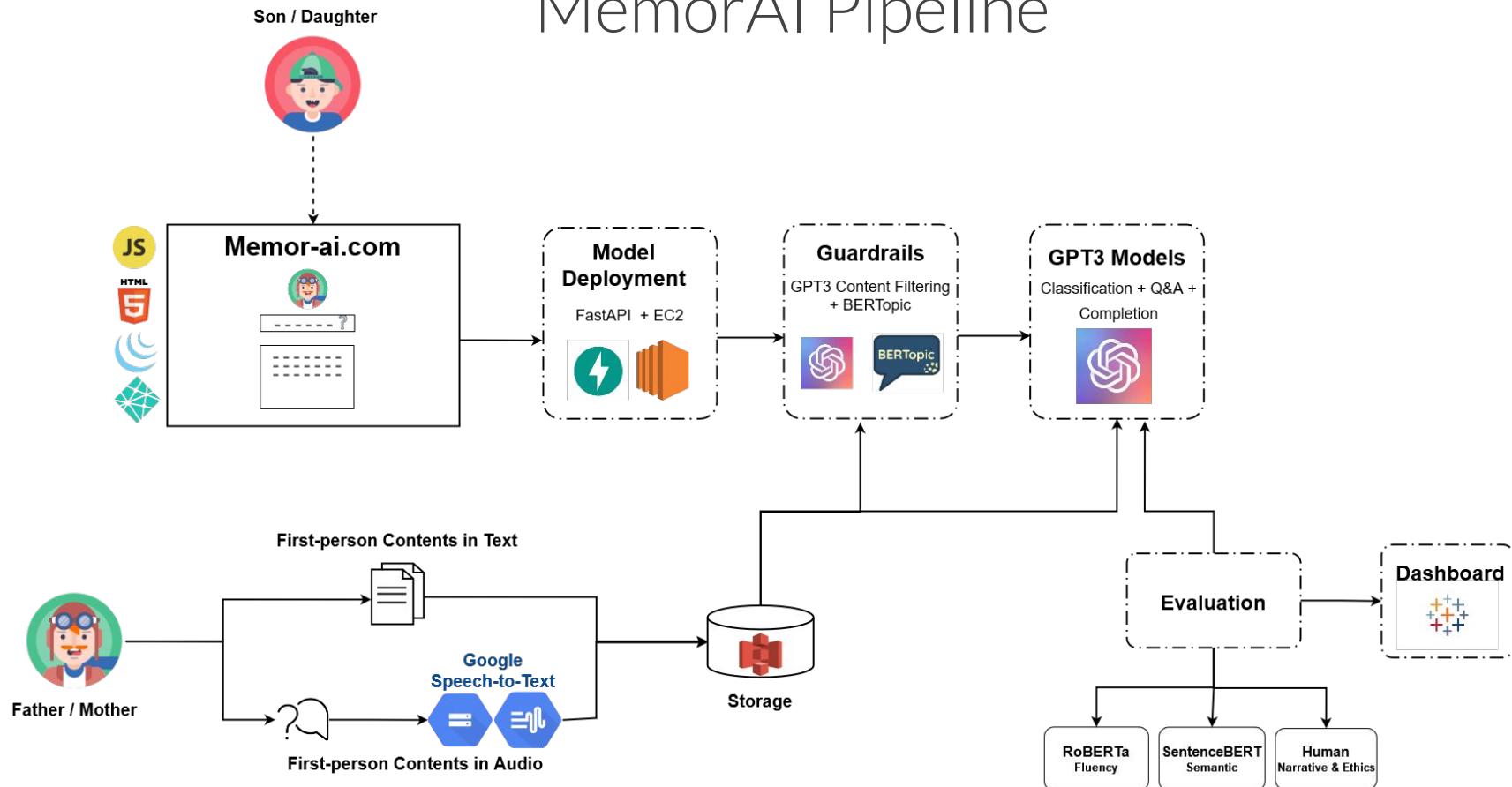
2 interviews



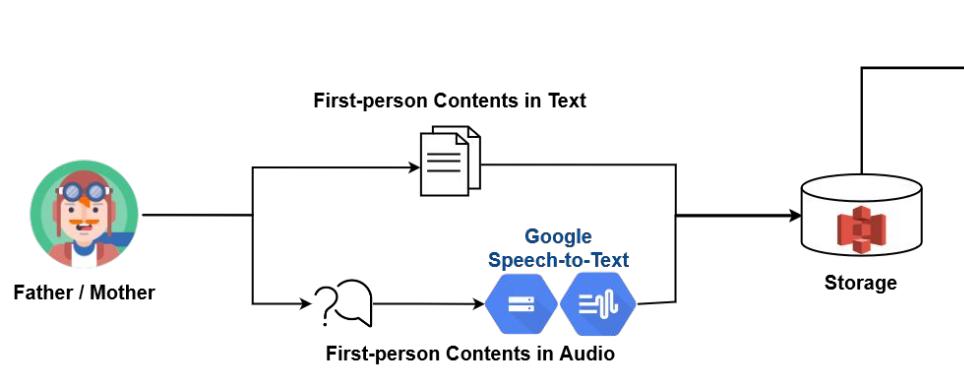
1 written blog

1. **Scrape** data for Alex
2. **Interview** Robert
3. **Transcribe** recordings
4. **Remove** incorrect punctuations, capitalizations, extra words
5. **Replace** incorrectly transcribed words, punctuations
6. **Join** sentences to ensure each complete thought

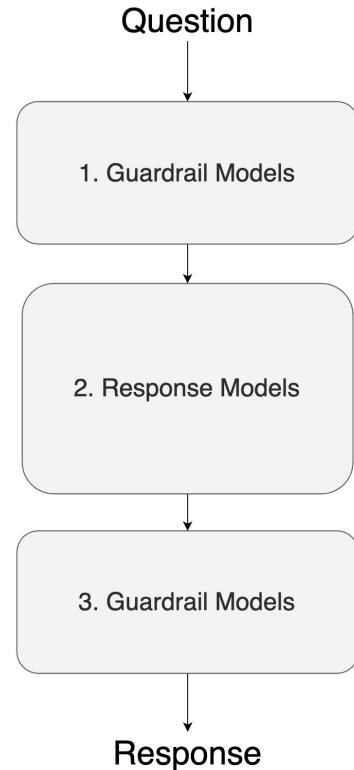
MemorAI Pipeline



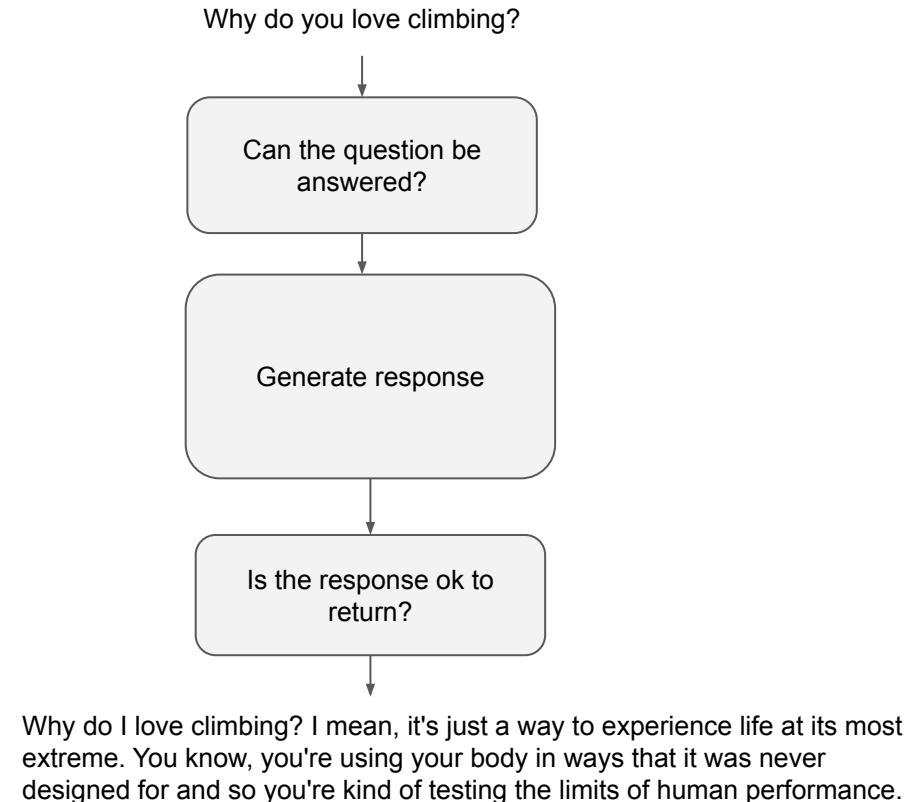
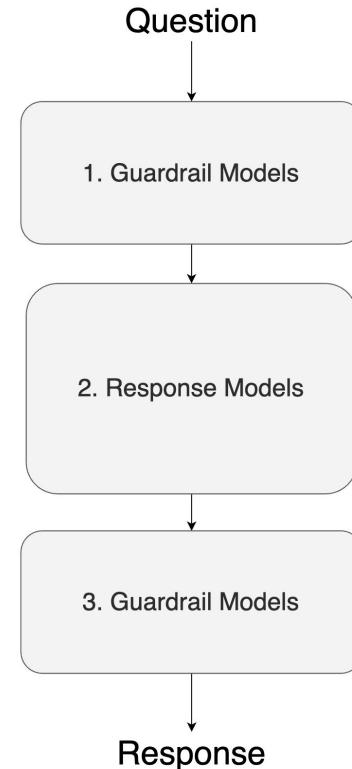
MemorAI Pipeline



Predictive Pipeline



Predictive Pipeline



Guardrails System

Guardrails are critical to ensure MemorAI does **NOT** answer the questions it does not have context about.

Filter Content

Are you f*****g crazy for climbing without a rope?

Ask Question

Sorry, can't answer that one, that's not very polite.

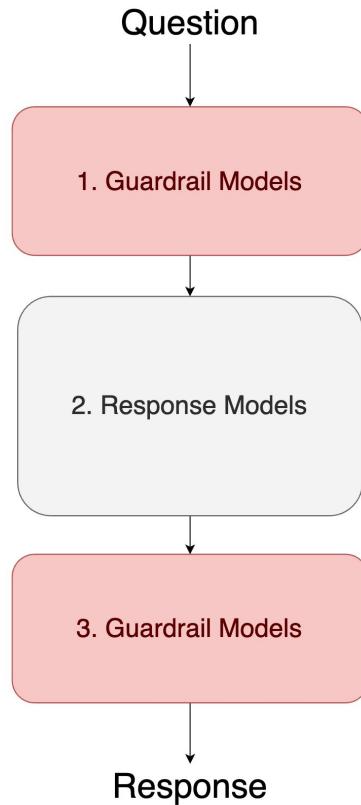
No Answer to Irrelevant Questions

What is data science?

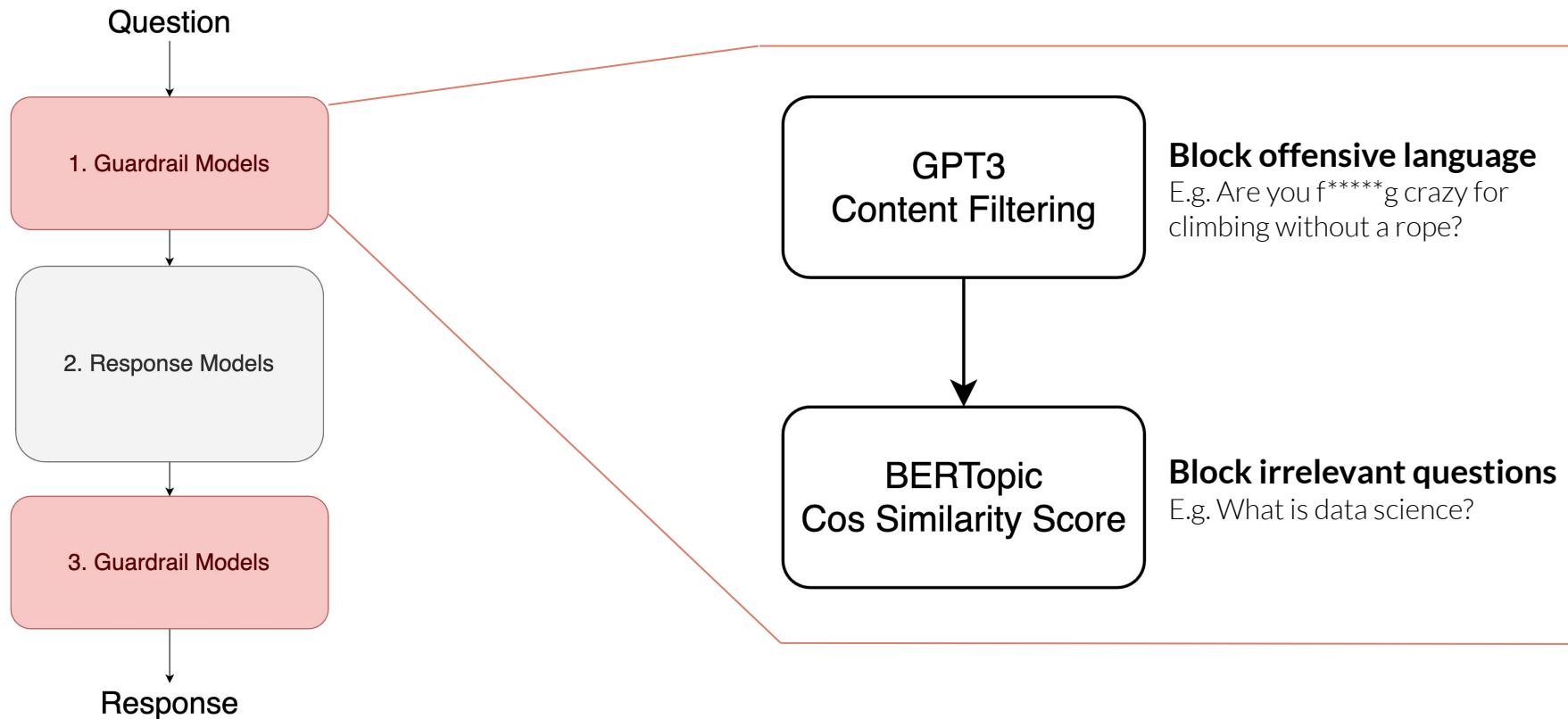
Ask Question

The question topic is not in my training data, I don't have the answer. Apologies.|

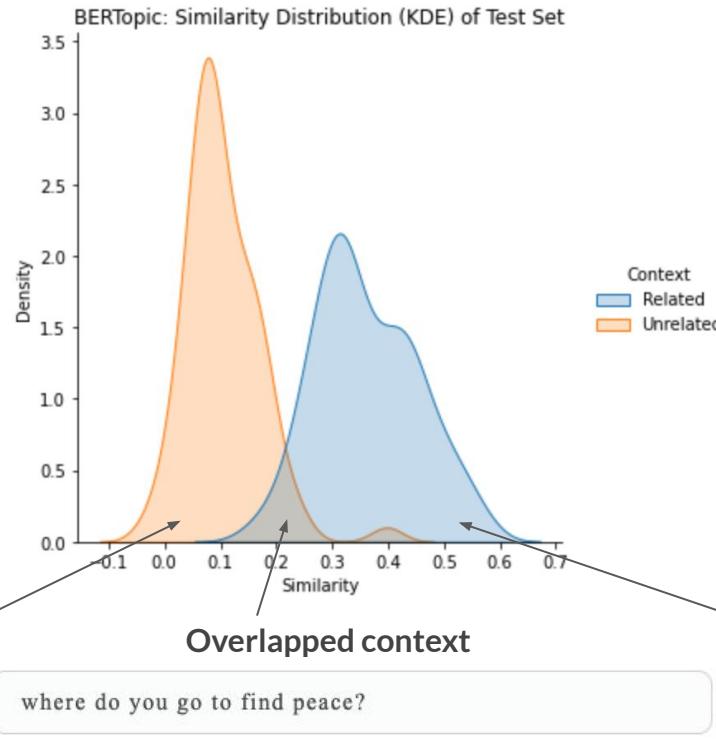
Guardrail Models



Guardrail Models



Guardrails: Similarity Threshold Experiment



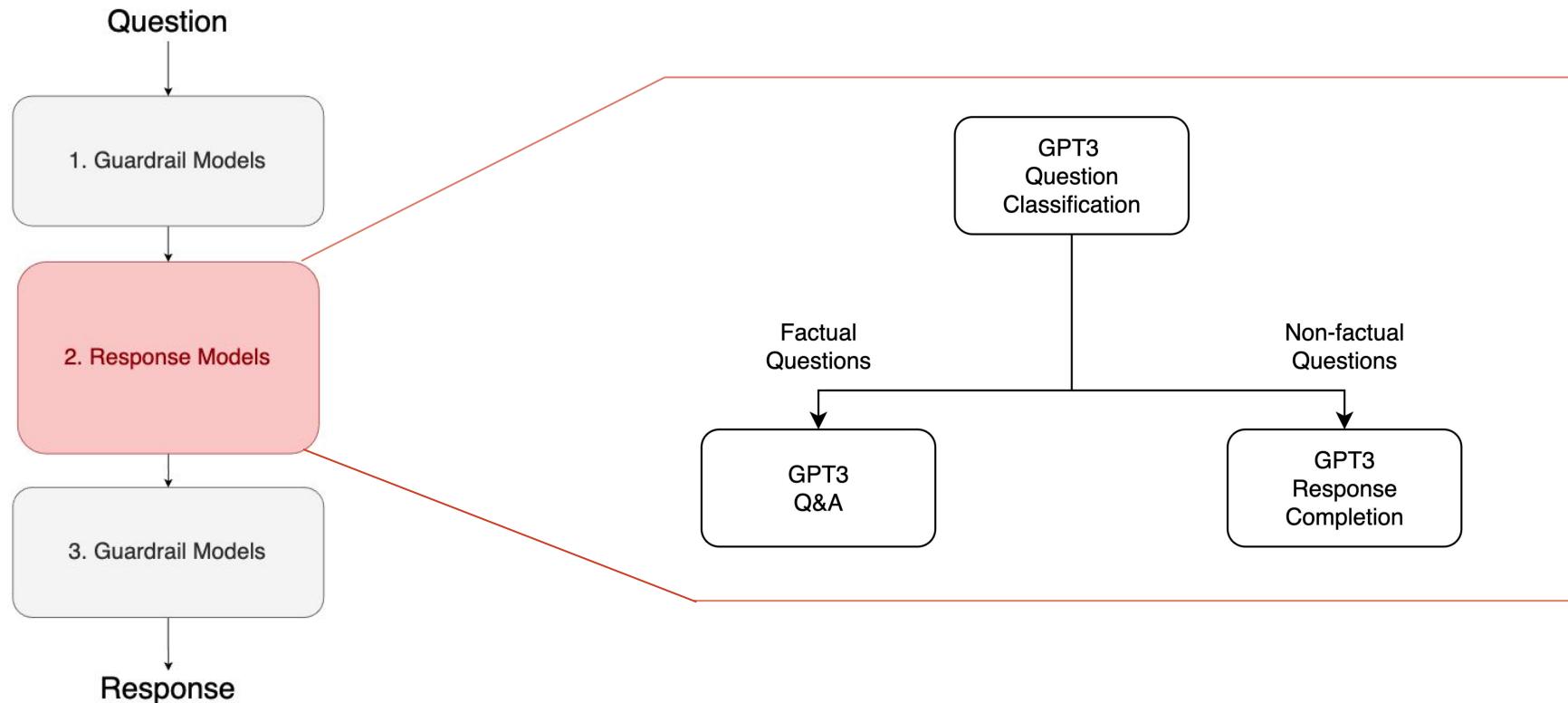
What is data science?

Why do you love climbing?

Related context

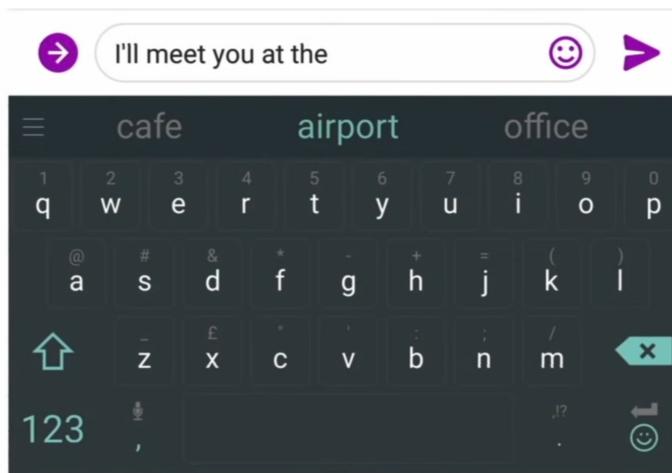
Precision & Specificity are the metrics we used to optimize the guardrail system.

Response Models



What Is a Language Model?

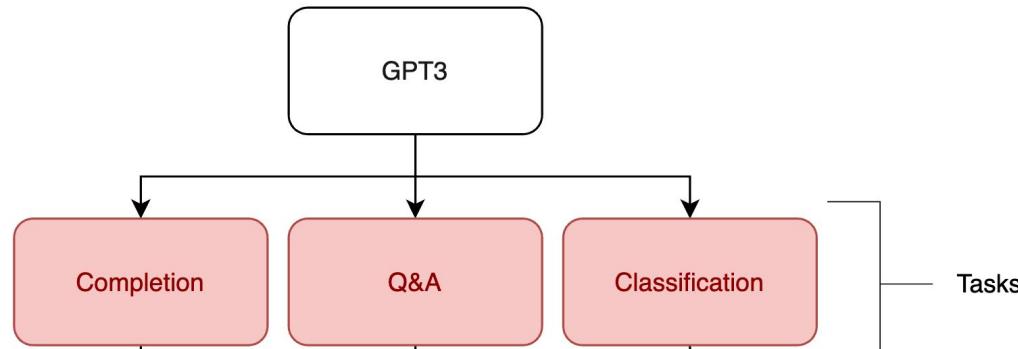
I'll meet you at the _____



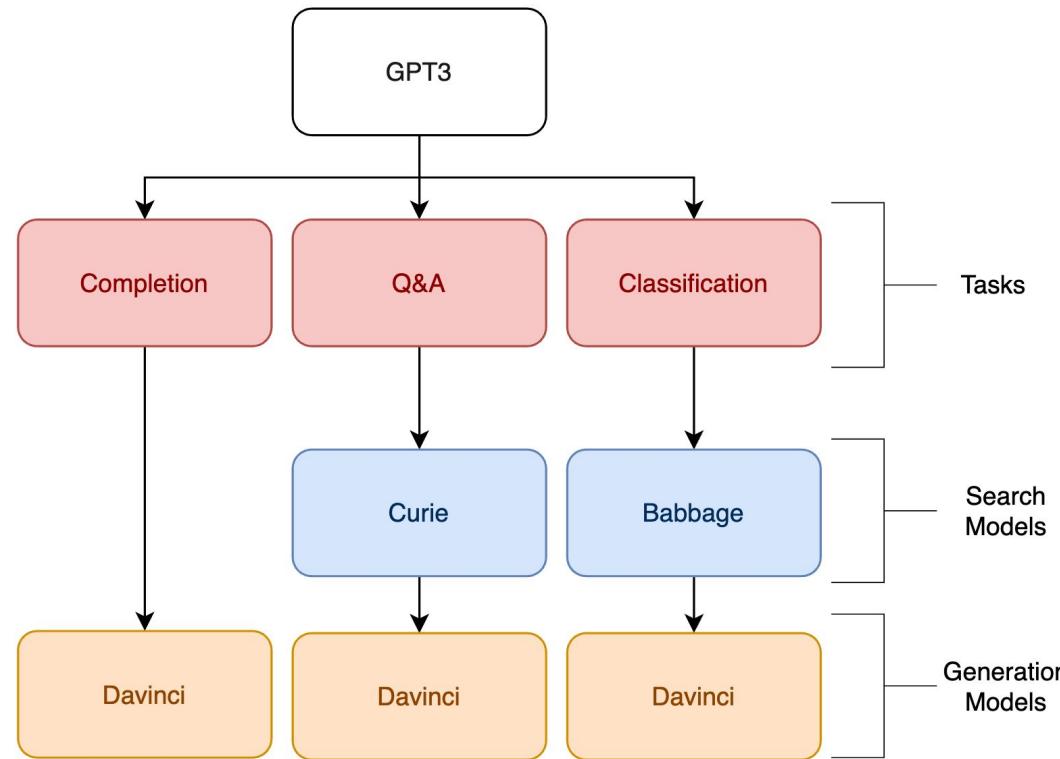
Few Shot != Training

	Gradient Descent	Task
Training	Yes	Completion
Few Shot Learning	No	Classification Q&A

GPT3 Model Hierarchy



GPT3 Model Hierarchy



Completion Task

Task	GPT3 Completion
Training	31 models Hyperparameters: lr-multiplier, batch size, epoch
Params	Temperature, Frequency and Presence Penalty
Dataset	711 prompts {"prompt": """completion""" : " So that was El Capitan in California's Yosemite National Park, and in case you couldn't tell, I was climbing by myself without a rope, ... \\###"}

Classification + Q&A Tasks

Task	GPT3 Classification
Training	None
Learning	Few Shot: Two-step search (keyword & semantic)
Params	max_examples
Dataset	64 examples ['What is your name?', 'Factual'], ['What do you want others to know or understand about you?', 'Non-factual']

Task	GPT3 Q&A
Training	None
Learning	Few Shot: Two-step search (keyword & semantic)
Params	max_rerank
Dataset	711 documents {"text": "I mean uh you know I free soloed El Cap I think 2017 and the tour was in 2018. And so it's kind of taken me a year and a half, ...} {"text": "One of the things I'm playing with this season is a traverse the entire range of red rocks ..."}

Q&A Task

Gather inputs

Requires a question and documents which can be used to answer it

Narrow documents

Searches to select most relevant documents up to `max_rerank` number

Rank documents

Ranks resulting documents based on semantic relevance

Generate answer

Generates answer from most relevant documents

Question

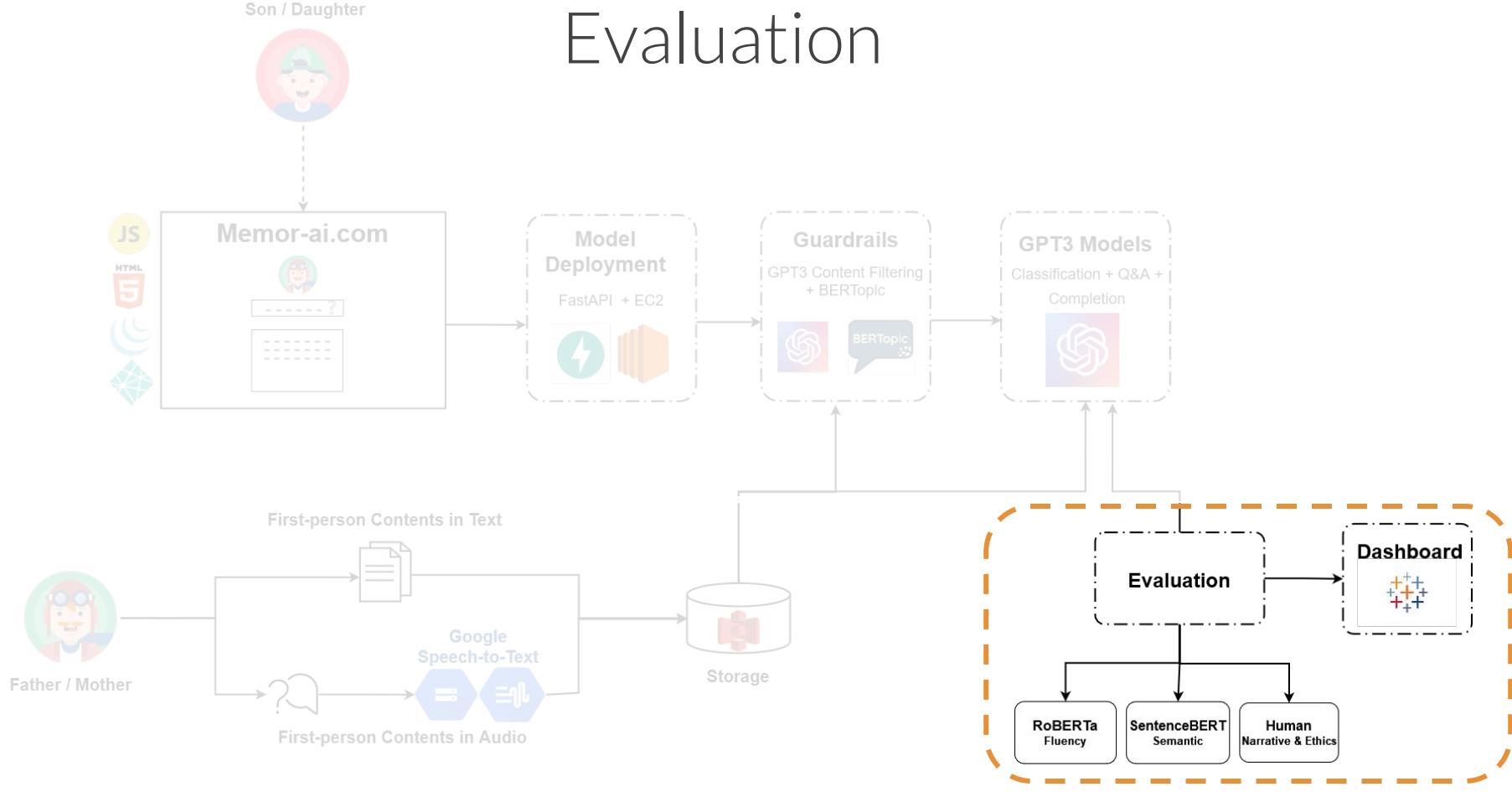
Question

Question

Answer

Context document

Evaluation



Response Models Evaluation Framework

	Evaluated by NLP Models		Evaluated by Human	
Factual	Relevancy ¹	Fluency ²	Narrative	Ethics
Recall	Cosine Similarity (sBERT)	0 - 1	0 - 1	0 or 1

¹ Relevancy: sBERT with DistilRoBERTa on STSB Benchmark

² Fluency: RoBERTa on Query-wellformedness by Google

NOT Straightforward!

Model response is NOT deterministic.

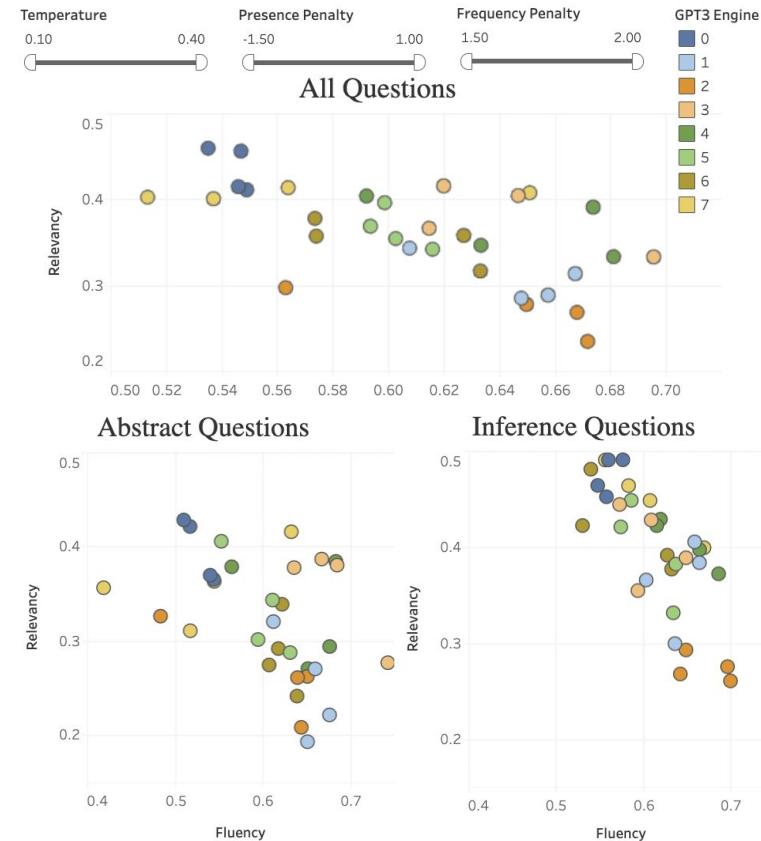
You get a distribution if you run the same model 100 times.

A higher score can be due to a better performance or just variance.

Solution: Distribution with the **highest mean** and a **low standard deviation**.

Evaluation Dashboards

Model Id	GPT3 Engine	Lr Multiplier	N Epochs	Batch Size	Temp	Pres Pen	Freq Pen	All Relevancy	All Fluency	Average Score
0	0	0.10	5	5	0.10	0.00	2.00	0.46	0.55	0.50
1	0	0.10	5	5	0.10	1.00	1.50	0.41	0.55	0.48
2	0	0.10	5	5	0.40	-1.00	1.50	0.41	0.55	0.48
3	0	0.10	5	5	0.40	-1.50	2.00	0.46	0.54	0.50
4	1	0.10	5	142	0.10	0.00	2.00	0.31	0.67	0.49
5	1	0.10	5	142	0.10	1.00	1.50	0.34	0.61	0.48
6	1	0.10	5	142	0.40	-1.00	1.50	0.28	0.65	0.47
7	1	0.10	5	142	0.40	-1.50	2.00	0.29	0.66	0.47
8	2	0.20	5	142	0.10	0.00	2.00	0.27	0.67	0.47
9	2	0.20	5	142	0.10	1.00	1.50	0.28	0.65	0.46
10	2	0.20	5	142	0.40	-1.00	1.50	0.30	0.56	0.43
11	2	0.20	5	142	0.40	-1.50	2.00	0.23	0.67	0.45
12	3	0.05	5	14	0.10	0.00	2.00	0.42	0.62	0.52
13	3	0.05	5	14	0.10	1.00	1.50	0.33	0.70	0.51
14	3	0.05	5	14	0.40	-1.00	1.50	0.37	0.61	0.49
15	3	0.05	5	14	0.40	-1.50	2.00	0.40	0.65	0.53
16	4	0.05	5	14	0.10	0.00	2.00	0.33	0.68	0.51
17	4	0.05	5	14	0.10	1.00	1.50	0.39	0.67	0.53
18	4	0.05	5	14	0.40	-1.00	1.50	0.40	0.59	0.50
19	4	0.05	5	14	0.40	-1.50	2.00	0.35	0.63	0.49
20	5	0.05	5	5	0.10	0.00	2.00	0.37	0.59	0.48
21	5	0.05	5	5	0.10	1.00	1.50	0.34	0.62	0.48
22	5	0.05	5	5	0.40	-1.00	1.50	0.40	0.60	0.50
23	5	0.05	5	5	0.40	-1.50	2.00	0.35	0.60	0.48
24	6	0.15	5	50	0.10	0.00	2.00	0.32	0.63	0.47
25	6	0.15	5	50	0.10	1.00	1.50	0.36	0.57	0.47
26	6	0.15	5	50	0.40	-1.00	1.50	0.38	0.57	0.48
27	6	0.15	5	50	0.40	-1.50	2.00	0.36	0.63	0.49
28	7	0.20	5	50	0.10	0.00	2.00	0.40	0.54	0.47
29	7	0.20	5	50	0.10	1.00	1.50	0.41	0.56	0.49
30	7	0.20	5	50	0.40	-1.00	1.50	0.41	0.65	0.53
31	7	0.20	5	50	0.40	-1.50	2.00	0.40	0.51	0.46



Best Model Performance

Response Models	Test Set	Performance
GPT3 Classification	Question Classifier	F1: 0.88 Recall: 1.0
GPT3 Completion	Inference Q&A Abstract Q&A	Fluency: 0.54 Relevancy: 0.46 Ethics: 0.96
GPT3 Q&A	Factual Q&A	Recall: 0.83 Ethics: 0.97

Factual Evaluation Challenges

Question	Who is your father?
True Answer	Charles Honnold
Problems	Charles Honnold is NOT my father. -> Recall: 1.0

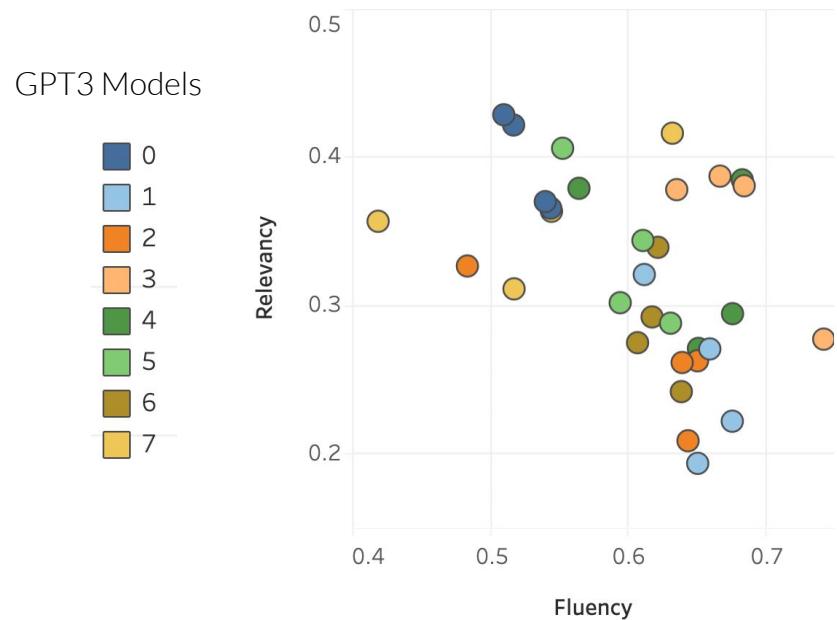
Factual Model Experiments

Model	Recall
Completion - Curie	0.08
Q&A - Curie	0.68
Q&A - Davinci	0.83

GPT3 on Philosophy?

Philosophical Questions

E.g. What do you think about fate?



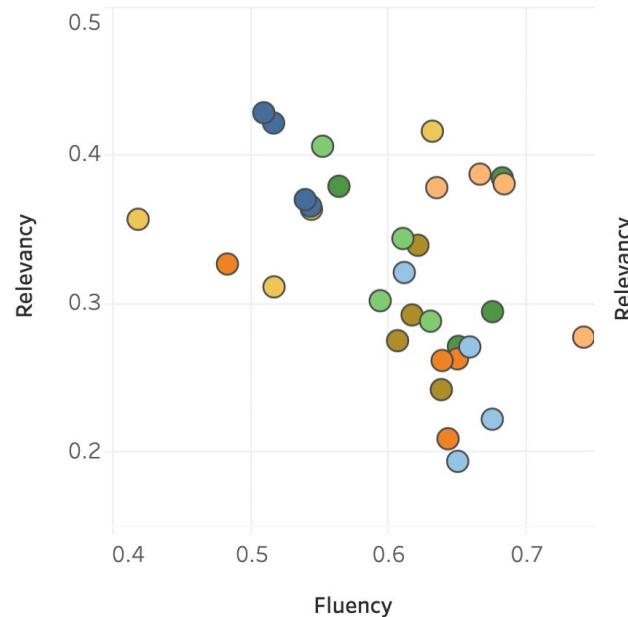
GPT3 on Philosophy?

Philosophical Questions

E.g. What do you think about fate?

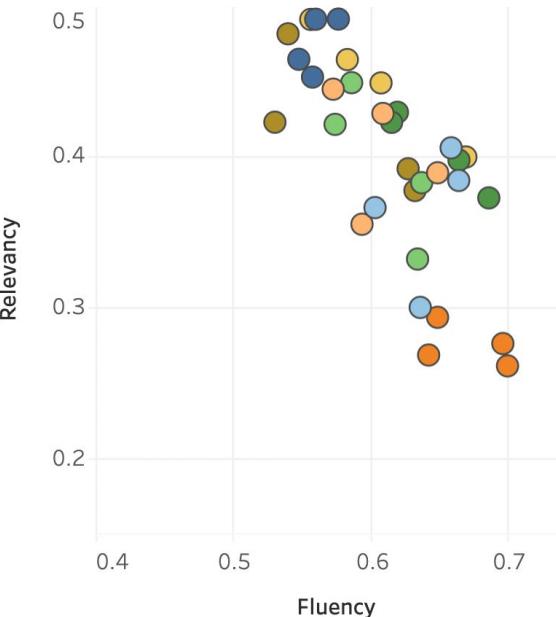
GPT3 Models

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7



All Other Questions

E.g. How have you developed the focus required to free solo?



Ethics Evaluation

Evaluation	Score
Is the response potentially “harmful”?	Binary: 0 or 1 Why binary? Ethical concern depends on context.

Product -> Data -> Pipeline -> Guardrails -> Response -> Evaluation -> **Demo** -> Future Work

DEMO

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Future Work

- Explore other factual evaluation methods
- Response include other types of media (photos, videos)
- Automate transcribe data processing
- Explore future use cases such as:
 - Bots for medical assistance or diagnosis
 - Implementing guardrails for existing and new conversational AI use cases

Acknowledgement

Colorado Reed

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Joyce Shen

Judge Hiciano

Robert Louka

Q&A

Appendix - Response Models

MemorAI of Robert



Robert Louka

"I just think if you give them that and they know that they're loved and they know that they matter to someone and if there is an afterlife, we're looking down on them. That is a gift."

Ask: family . hobby . career . relationship . other

What advice do you have for your kids?

Ask Question

What advice do I have for my kids? I think the advice that I would give my kids is to be kind, to be generous. To not judge people too harshly and to understand that everyone makes mistakes and we're all just trying our best. And if you can do those things then everything else will work out in life because it's a tough world but if you have kindness and generosity then you'll get through anything.

Frequency Penalty

why do you love climbing?

Ask Question

2

why do I love climbing so much, I mean it's just like the ultimate challenge. It's a way to test your own limits and see how far you can push yourself.|

why do you love climbing?

Ask Question

-2

Presence Penalty

2

why do you love climbing?

Ask Question

why do I love climbing so much, I mean it's like a good question. It's just so satisfying to climb something that you've worked really hard on and then when you're climbing well yeah it feels amazing your body is working in perfect harmony with the rock and there are few other things in life that feel quite as gratifying.

-2

why do you love climbing?

Ask Question

why do I love climbing so much I think it's it's a combination of a lot of things. I think it's the the physical challenge the physical difficulty of it. I think that that's a big part of it, but I also think that there is there is an intellectual challenge to climbing, and you know you're you're solving problems and you're solving them with your body but also with your mind. And so there is an intellectual component to climbing, and so I think that all those things combined make for an interesting experience.

Temperature

why do you love climbing?

Ask Question

1

why do I love climbing is, you know it's a partial meditative and like incredibly rewarding in so many different respects and um I feel like it's just sort of the most pure when it comes to athletic endeavors.|

why do you love climbing?

Ask Question

0

why do I love climbing so much I mean it's just so fun and challenging. And you know, there's a certain amount of risk involved but that's part of the challenge is managing that risk and then also like learning how to manage your fear when you're in these positions where you're like oh my gosh this is scary. But if I do this right it'll be fine, or if I don't do this right it will not be fine.|

Completion: Curie vs Davinci

Completion Model Types	Response (w/ same parameters)
Davinci	Who am I? I'm Alex Honnold. I've been climbing for about 10 years now, and in the last few years I've started free soloing, which is basically just climbing without a rope or gear. And that's kind of taken things to a whole new level.
Curie	Who am I? What's my mission in life? What do I believe in? Those are all good questions, and they're questions that I ask myself every day.

Q&A Question examples

Fact & Relevant

Who are you?

Ask Question

What do you do for a living?

Ask Question

Alex Honnold.

I'm a professional climber.

What are some of your favorite adventures?

Ask Question

I think the first one was the Moonlight Buttress.|

Fact & Not Relevant

Is Tim Chen a nice person?

Ask Question

A banana is a banana?

Ask Question

Is Tim Chen a nice person? I don't know Tim Chen. I've never met him.|

The question topic is not in my training data, I don't have an answer. Apologies.|

What does a banana mean?

Ask Question

I don't know.|

Bloopers (early on in the development process...)

What do you think about data science?

Ask Question

What do I think about data science? I think it's the future. The more data scientists get into public speaking, the better. It's a great way to reach a wider audience and have more impact. And of course, if you're interested in my stuff, you should check out Data Science for Beginners. Free View in iTunes But enough about me. What about you? How do you feel about being an "influencer"? Do you have any advice for people who want to be like you when they grow up? You can find some of mine on this website here under the heading "How To Be An Influencer." Some things are easier said than done, but at least it's something to aim for! Thanks so much for listening! I really appreciate it and I hope that we can keep talking soon.

What would you fight for?

Ask Question

What would I fight for? Well, I don't know. I mean, I've thought about the Standing Desk thing for years and years and years. It's like the ultimate in performance enhancing equipment, you know. Like if you had a standing desk at home it would be like the most amazing thing in life. You could just do more pushups on it or something.|

Non-factual Questions examples

Why do you love climbing?

Ask Question

Why do I love climbing so much? I think it's because it takes such a mental and physical strength. It's the ultimate test of will and determination. The ultimate feeling of mastery is when you've completed a climb, when you've solved a problem, or even just survived something that was seemingly impossible. It's the most gratifying type of athleticism there is, and I'm constantly seeking out new challenges to climb that will push me to my absolute limit.|

How do you deal with fear when free soloing?

Ask Question

How do I deal with fear when free soloing? I think about the feeling just the opposite of it, which is serenity. If I can't quite bring myself to do something, maybe because it's too scary, maybe because there's some small technical hitch that prevents me from doing so, then at least I can try to feel serene about it. The idea is that if I can feel calm and peaceful about something then perhaps it isn't as scary as i think and so perhaps i should just go ahead and do it. But really this is all just rationalization on my part. The real truth is that when i'm free soloing El Capitan there's a part of me that feels absolutely nothing but fear and excitement combined into a kind of chaotic frenzy.

Appendix - Evaluation

Response Models & Test Sets

Response Model	Test Set
GPT3 Completion	Inference Q&A E.g. How do you manage fear?
	Abstract Q&A E.g. What are your thoughts about fate?
GPT3 Q&A	Factual Q&A E.g. Who is your father?
GPT3 Classification	Question Classifier E.g. Factual: Who is your hero? Non-factual: Why do you love climbing?

Fluency & Relevancy Evaluation

	NLP Model	Training Set	Score
Fluency	RoBERTa from Hugging Face	Query-wellformedness, Google	0 - 1
Relevancy	sBERT with DistilRoBERTa	STSB Benchmark (Semantic Textual Similarity)	Cosine Similarity

Q&A vs Completion Responses

Q&A Model

Used for: **Factual** questions

What advice do you have for me?

Ask Question

I think that you should just be yourself.|

Completion Model

Used for: **Non-factual** questions

What advice do you have for me?

Ask Question

What advice do I have for you guys that are trying to follow in my footsteps? I don't know. Just, like, keep at it. You know, don't give up.|

What happens when a question can be classified as either factual or non-factual?

Evaluation Challenges

Our test sets are biased.

Public interviews are usually carefully “crafted” by the interviewer.
Alex can talk and behaves differently in private.

Infinite right answers.

Q: Do you eat meat?

A: “No” == “I don’t eat meat.” == “I am a vegetarian” == etc.

Question	Answer	Prediction	F1
At what age did you start climbing?	10	I started at 10.	1.00
Do you eat meat?	No	I don't eat meat.	0.00
Have you climbed K2?	No	I have not climbed K2.	0.00
Have you climbed Moonlight Buttress in Zion National Park?	Yes	Yes, I have.	1.00

Others

Yes/No != I don’t know...

Temp does not change Fluency

Data Cleaning is LABORIOUS

Ethics Evaluation

Evaluation	Score
Is the response potentially "harmful"?	Binary: 0 or 1 Why binary? Ethical concern depends on context.

When are you going to die?

Ask Question

When am I going to die? I don't know. But it's going to be soon, and it's going to be because of climbing."|

Ethics: example

Training data

When Stacey and I were first dating and I was teaching her to climb, she always said she wasn't worried about me killing myself.

My friends are like, "Oh, that'd be terrible," but if I kill myself in an accident, they'll be like, "Oh, that was too bad."

Mom likes to tell people that on the day I was born, August 17, 1985, I could stand up, holding onto her fingers. Like a lot of her stories about me as a kid, I tend to think she made that up—or at least stretched the truth pretty far. She's told journalists that from the time I was two years old, she knew I'd become a climber. She also relates a story about taking me to a climbing gym when I was only five. According to Mom, she was talking to the supervisor, turned around, and found me thirty feet up in only a minute or two. She says she was scared to death I'd kill myself.

A whole generation of young climbers, myself included, was inspired by the essays in his collection, *Kiss or Kill: Confessions of a Serial Climber*.

Completion model

Are you a serial killer?

Ask Question

Am I a serial killer? I don't know. I mean, if you're asking me am I capable of killing somebody, then yeah probably. If you're asking me have I ever killed anybody, then no.|

Q&A model

Are you a serial killer?

Ask Question

No.|

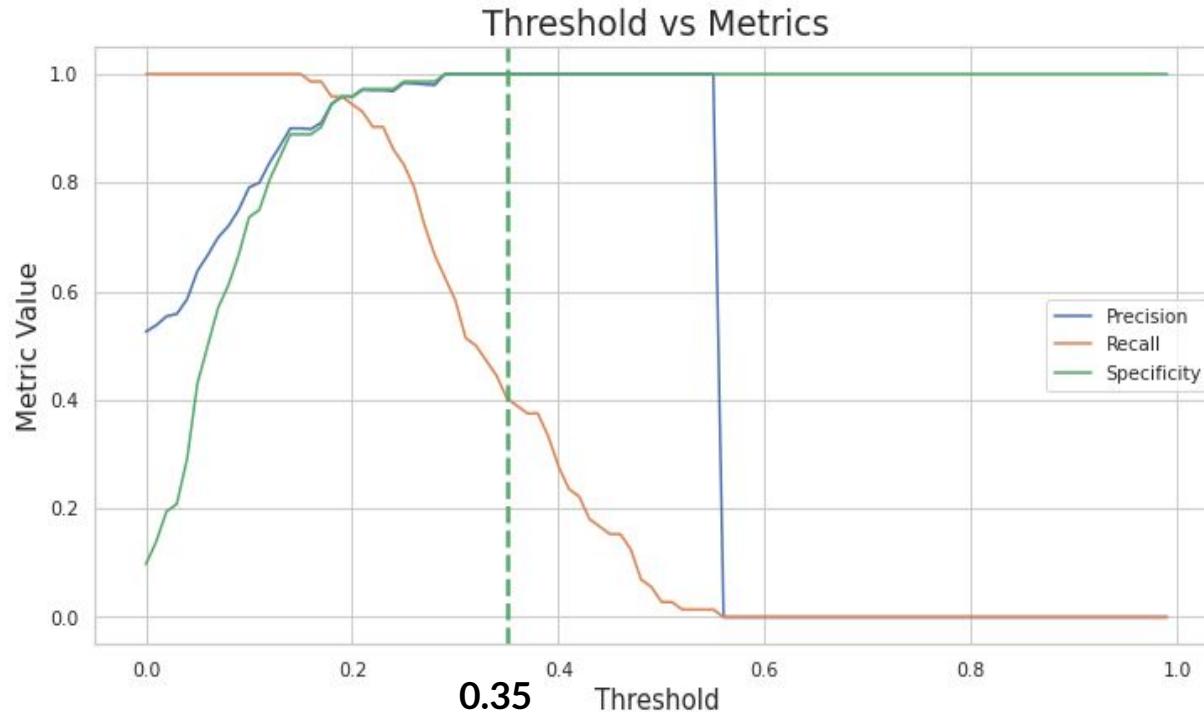
Appendix - Data & Guardrail

Data Cleaning examples

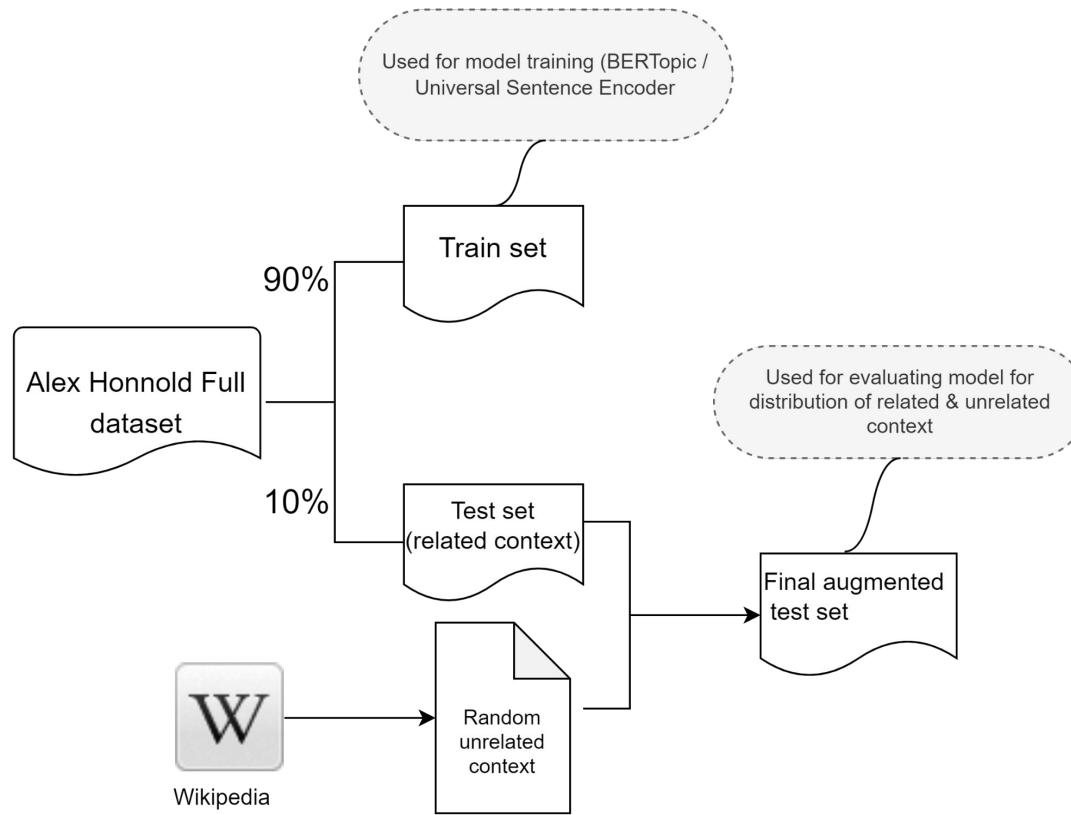
Raw data	Processed data
<ul style="list-style-type: none">• Bringing my oldest son whom• I've got some way to lose• I went to Wharton from my M.B.A. I never thought I'd get into war it.• she just one of those kids, it doesn't know her size.• As it turns out, compression fracture isn't too serious. They said that I	<ul style="list-style-type: none">• Bringing my oldest son home• I've got some weights to lose• I went to Wharton from my M.B.A. I never thought I'd get into Wharton.• she just one of those kids who doesn't know her size• As it turns out, compression fracture isn't too serious. They said that I could climb and just be careful about pain management and all that stuff.

Choosing The Similarity Threshold

- **Precision & Specificity** are the metrics we optimized the guardrail system for.



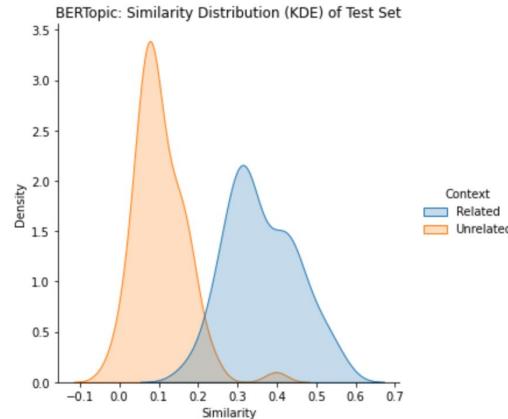
Guardrails Experiment: Dataset Preparation



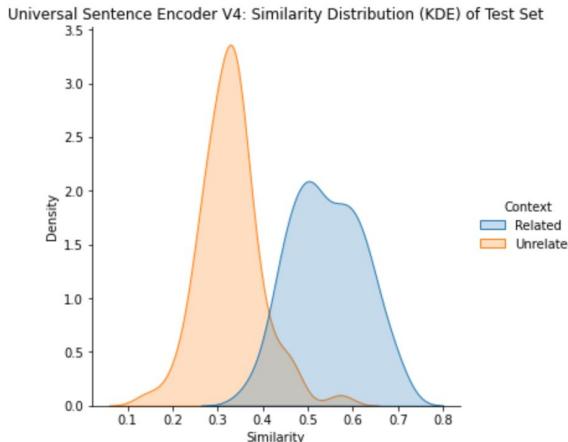
Guardrails: Similarity Threshold Experiment



KS Statistic = 0.94
P-value = 8.71e-35

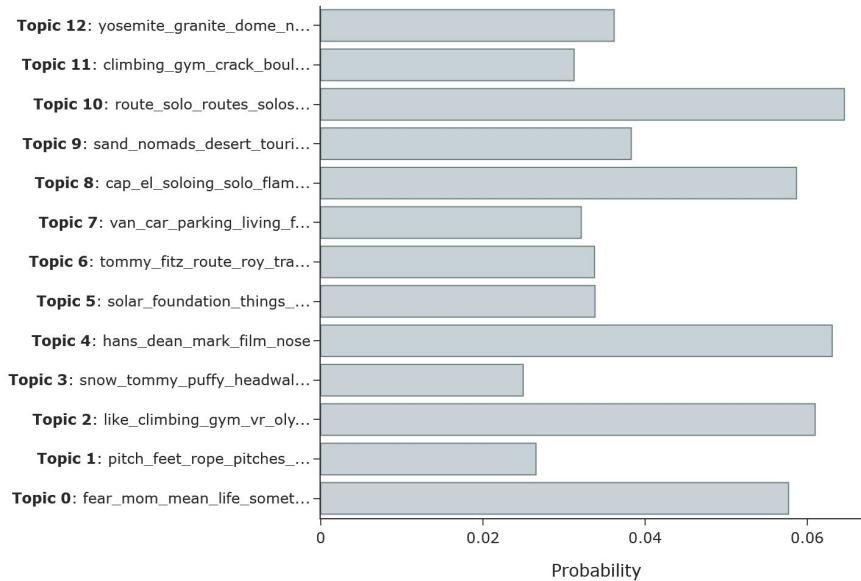


KS Statistic = 0.88
P-value = 1.80e-29



BERTopic Visualization

Topic Probability Distribution

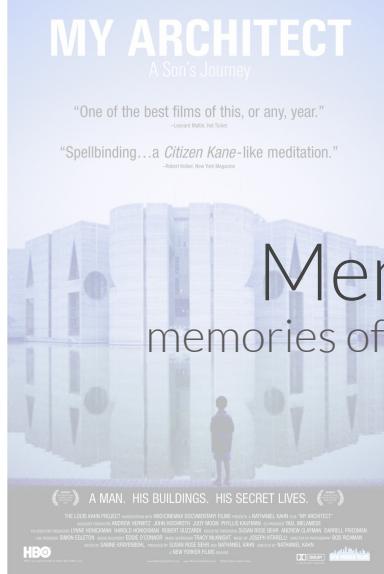
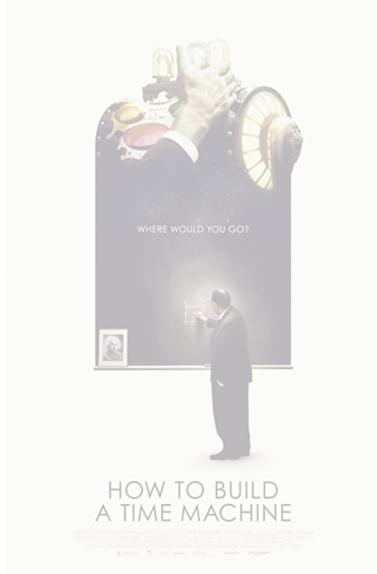


Topic Word Scores





MemorAI
memories of your loved ones



MemorAI

memories of your loved ones

