

AllTrials.info



Making the clinical trial discovery process more accessible for patients through personalized trial matching using large language models



Dylan Fletcher, Conrad Chan, Shaki Pothini, Angela Ingram, Jonathan Hodges

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Image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.istockphoto.com%2Fphotos%2Ftwo-people-smiling-at-computer&psig=AOvVaw1U_QvG4LOQV87bT6PUs8LI&ust=1727206425565000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxqFwoTCLjS9cLn2YgDFQAAAAAdAAAAABAE

Note: The AllTrials logo was generated by DALL-E with ChatGPT.

Our Team



Dylan Fletcher



Conrad Chan



Shaki Pothini



Angela Ingram



Jonathan Hodges

Solving Inequitable Access to Clinical Trials



- **Project:** AllTrials.info increases trial access.
- **Barriers:** Geographic locations of rural areas.
- **Solution:** Easier trial discovery for patients.
- **Impact:** Reduces costs, speeds access to life-saving treatments, potential increase in diversity.



Note: image was generated by DALL-E with ChatGPT.

AllTrials.info is a differentiated solution

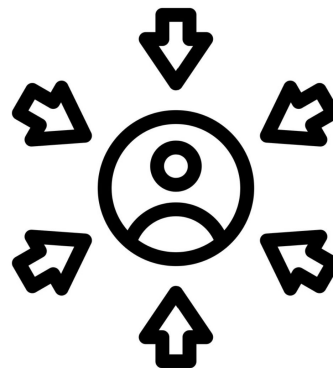


AllTrials

By utilizing large language models, we make it easier to find clinical trials that are right for patients.

[Link to AllTrials.info](https://www.alltrials.info)

Patient focused

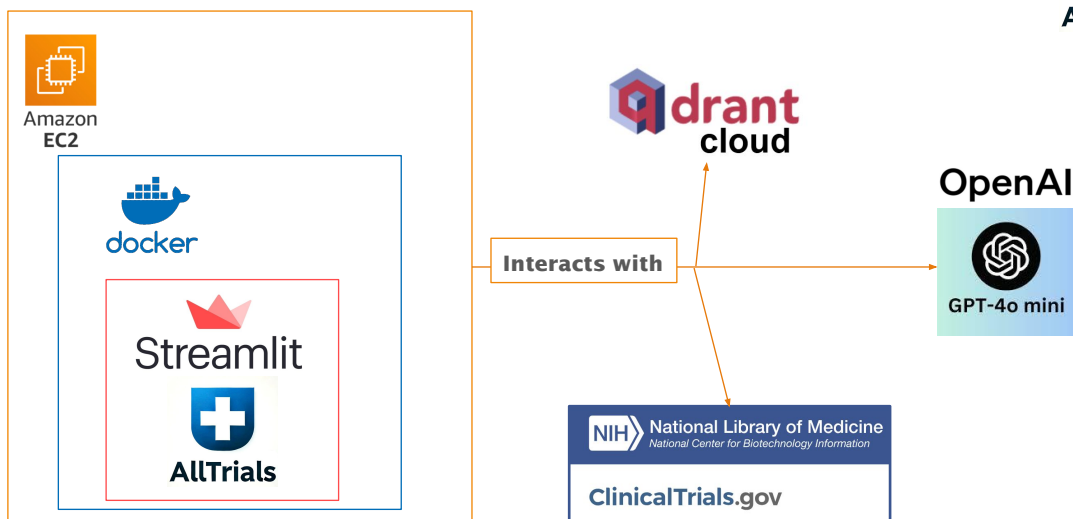


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Icon link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.vectorstock.com%2Froyalty-free-vector%2Fuser-centered-design-thick-line-icon-for-personal-vector-46444533&psig=AOvVaw3gTyCAoQk7_4YhjRK1lr4&ust=1730302831847000&source=images&cd=vfe&opi=89978449&ved=0CBcQjhxqFwoTClix2cn2s4kDFQAAAAAdAAAAABAE

How AllTrials.info Works



Docker image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fmedium.com%2F%40anshulganvir%2Fintroduction-to-docker-337b9d09a079&psig=AOvVaw3Lsf_P-IKRXSZJAdOf0R5&ust=1733340784638000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCMCQjeKriLoDFQAAAAAdAAAAABAX

Amazon EC2 image link:

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Streamlit app image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20200616005364%2Fen%2FStreamlit-Raises-21M-in-Series-A-Funding-From-GGV-Capital-and-Gradient-Ventures-to-Amplify-the-Impact-of-Data-Science-and-Machine-Learning&psig=AOvVaw0IRcEe9gMsYw2D_eLTa3c&ust=1733340935460000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCNiW2qisiloDFQAAAAAdAAAAABAE

ClinicalTrials image link: <https://clinicaltrials.gov/>

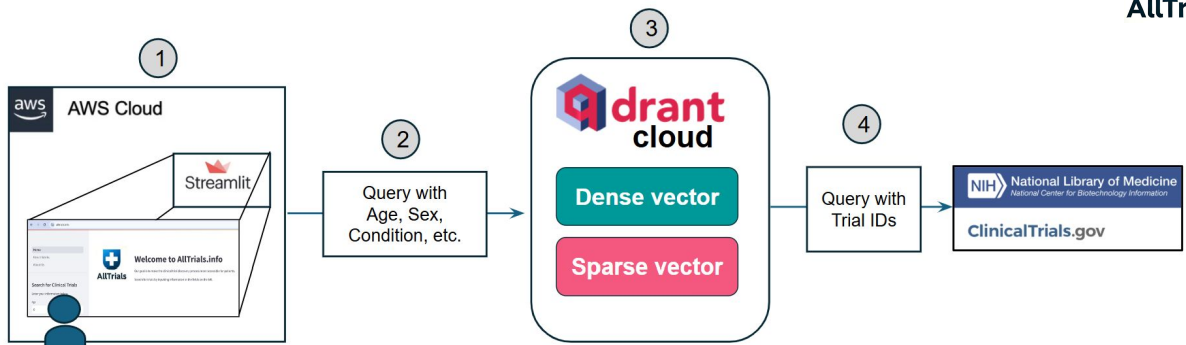
GPT-4o mini image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.hixx.ai%2Fblog%2Fxxai-news%2Fsurfacing-gpt-4o-mini&psig=AOvVaw2mC2Aifz_HJaa1RsKH0moC&ust=1733417021000000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCNio-t_HjooDFQAAAAAdAAAAABAE

Qdrant image link:

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20240416934769%2Fen%2FQdrant-Announces-an-Industry-First-Hybrid-Cloud-Offering-For-Enterprise-AI-Applications&psig=AOvVaw1FkUwSB9q2ctSAlwQFK41V&ust=1733417256764000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCMid2NLjooDFQAAAAAdAAAAABAE>

Qdrant used for initial trial matching



- 1 User enters age, sex, condition, and other medical data into the AllTrials.info website (Streamlit app)
- 2 Patient data is sent as a query to Qdrant
- 3 Qdrant dense and sparse embeddings of trial data are searched with the patient data to get matching trials
- 4 Trial IDs from matching trials are sent as a query to the clinicalTrials.gov API

Streamlit app image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20200616005364%2Fen%2FStreamlit-Raises-21M-in-Series-A-Funding-From-GG-V-Capital-and-Gradient-Ventures-to-Amplify-the-Impact-of-Data-Science-and-Machine-Learning&psig=AOvVaw0IRcEe9gMsYw2D_eLTa3c&ust=1733340935460000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCNiW2qisjloDFQAAAAAdAAAAABAE

ClinicalTrials image link: <https://clinicaltrials.gov/>

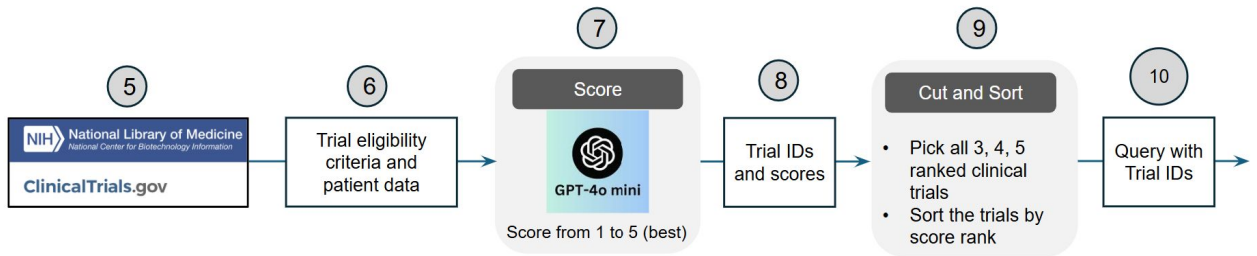
AWS Cloud image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Ftwitter.com%2Fjerryjliu0%2Fstatus%2F1744755577518256321&psig=AOvVaw1j0jO9YE_NB68w8R4KDI53&ust=1733417623940000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCKCMv4nKjooDFQAAAAAdAAAAABAb

Qdrant image link:

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20240416934769%2Fen%2FQdrant-Announces-an-Industry-First-Hybrid-Cloud-Of-fering-For-Enterprise-AI-Applications&psig=AOvVaw1FkUwSB9g2ctSAlwQFK41V&ust=1733417256764000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCMid2NLjooDFQAAAAAdAAAAABAE>

LLM used to score trials



- 5 Eligibility criteria is fetched from clinicalTrials.gov for each trial
- 6 Trial eligibility criteria and patient data is fed into an LLM (GPT-4o mini)
- 7 The LLM scores the trials from 1 to 5 on how well the trial is suited to the patient, with 5 being the best

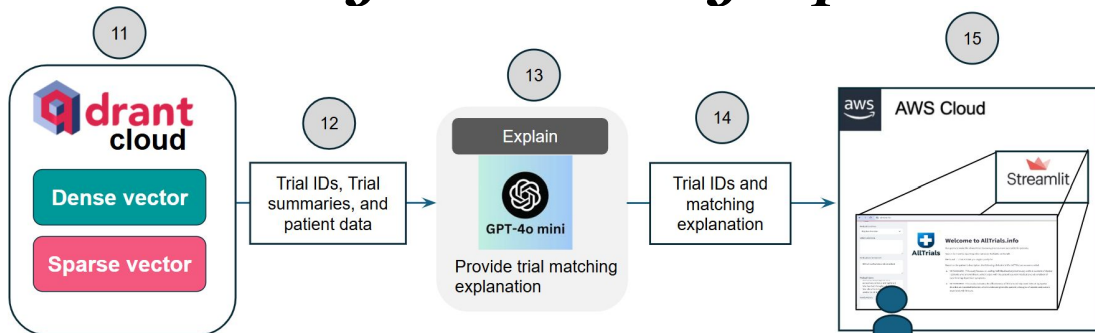
- 8 Trial IDs and scores are sent to an algorithm for processing
- 9 The algorithm cuts the trials with the lowest scores and sorts the remaining trials from highest to lowest
- 10 Trial IDs of sorted trials are sent to Qdrant

ClinicalTrials image link: <https://clinicaltrials.gov/>

GPT-4o mini image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.hixx.ai%2Fblog%2Fxxai-news%2Fsurfacing-gpt-4o-mini&psig=AOvVaw2mC2Aifz_HJaa1RsKH0moC&ust=1733417021000000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxoFwoTCNio-t_HjooDFQAAAAAdAAAAABAE

LLM used to give matching explanation



11 Trial IDs are used to retrieve trial summaries from Qdrant

12 Trial IDs and summaries are fed into LLM as contexts along with patient data

13 LLM provides an explanation of how the trial is relevant to the patient

14 Trial IDs and explanation of trial matching relevance are sent back to AllTrials.info (Streamlit app)

15 User sees trial matching results and explanation

Streamlit app image link:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20200616005364%2Fen%2FStreamlit-Raises-21M-in-Series-A-Funding-From-GGV-Capital-and-Gradient-Ventures-to-Amplify-the-Impact-of-Data-Science-and-Machine-Learning&psig=AOvVaw0IRcEe9gMsYw2D_eLLTa3c&ust=1733340935460000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCNiW2qisjloDFQAAAAAdAAAAABAE

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Qdrant image link:

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20240416934769%2Fen%2FQdrant-Announces-an-Industry-First-Hybrid-Cloud-Of-ferring-For-Enterprise-AI-Applications&psig=AOvVaw1FkUwSB9g2ctSAlwQFK41V&ust=1733417256764000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxxqFwoTCMid2NLljooDFQAAAAAdAAAAABAE>

GPT-4o mini image link:

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Qdrant Trial Data for AllTrials.info



Name	Status	Points (Approx)	Vectors Configuration (Name, Size, Distance)
w210-clinical-trial-hybrid-index	● green	2915	fast-all-minilm-l6-v2 384 Cosine fast-sparse-splade_pp_en_v1 Sparse

Created sparse and dense embeddings from trial data fields including:

- Nctid
- Brief and detailed summary
- Min age, Max age, and Sex
- Condition-based fields like mesh id, mesh term, and ancestor term

Total of **2,915** trials



Qdrant image link:

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.businesswire.com%2Fnews%2Fhome%2F20240416934769%2Fen%2FQdrant-Announces-an-Industry-First-Hybrid-Cloud-Of-fering-For-Enterprise-AI-Applications&psig=AOvVaw1FkUwSB9g2ctSAlwQFK41V&ust=1733417256764000&source=images&cd=vfe&opi=89978449&ved=0CBQQjRxqFwoTCMid2NLLjooD FQAAAAAdAAAAABAE>

Data for creation of MVP



AllTrials

Trials were chosen based on labeled patient evaluation data in two areas:

1. Publicly available trial matching sources
2. Ophthalmologist SME evaluated trials

Qdrant database data

2,915 trials total

2,890 trials

- Bipolar disorder, ALS, Hemophilia type A, Parkinson disease, etc.

25 trials

- Amblyopia and Retinitis Pigmentosa

Patient input data for evaluation

12 patients, 12 conditions total

10 patients, 10 conditions

- SIGIR 2016, TREC 2021, and TREC 2022 synthetic patient data

2 patients, 2 conditions

- Ophthalmologist created patient data

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SIGIR 2016 data source: <https://data.csiro.au/collection/csiro:17152>

- Koopman, Bevan and Zuccon, Guido (2016). 'A test collection for matching patients to clinical trials' in *Proceedings of the 39th International ACM SIGIR conference on Research and Development in Information Retrieval*, p.669-672

TREC 2021 data source: <https://www.trec-cds.org/2021.html>

- Roberts, Kirk and Demner-Fushman, Dina and Voorhees, Ellen M and Bedrick, Steven and Hersh, William R (2021). 'Overview of the TREC 2021 clinical trials track' in *Proceedings of the Thirtieth Text REtrieval Conference (TREC 2021)*

TREC 2022 data source: <https://www.trec-cds.org/2022.html>

- Roberts, Kirk and Demner-Fushman, Dina and Voorhees, Ellen M and Bedrick, Steven and Hersh, William R (2022). 'Overview of the TREC 2022 clinical trials track' in *Proceedings of the Thirty-first Text REtrieval Conference (TREC 2022)*

Top Performing MVP Solution Results



For 10 synthetic patients using GPT-4o mini LLM

MODEL	Answer Correctness	Context Recall	Context Precision	Faithfulness	Noise Sensitivity
Qdrant Hybrid Search + LLM-based Eligibility Criteria Re-ranking	0.9293	0.9420	0.9280	0.9333	0.176

- **Answer Correctness** - compares and evaluates the factual accuracy of the generated response with the ground truth answer
- **Context Recall** - measures number of relevant chunks in context
- **Context Precision** - measures proportion of relevant chunks in context
- **Faithfulness** - measures the factual consistency of the generated response against the given context
- **Noise Sensitivity** - how often a system makes errors by providing incorrect responses when utilizing either relevant or irrelevant chunks in context

[RAGAS site](#) for information on RAGAS metrics.

Final MVP Solution Journey



We compared different systems as candidates for the initial trial matching stage of our final solution.

MODELS	Answer Correctness	Context Recall	Context Precision	Faithfulness	Noise Sensitivity
1 RAG - Static Neo4j Graph	0.8671	0.8631	0.8396	0.8118	0.2088
2 Qdrant Hybrid Search	0.8843	0.9160	0.9080	0.8315	0.1868
3 GraphRAG - Parquet	0.8458	0.4183	0.8057	0.3667	0.2433
4 GraphRAG - Neo4j	0.6943	0.3694	0.7813	0.3051	0.2882



Top 3 Technical Challenges



1. Re-ranking Trials Based on Free-Form Eligibility Criteria
2. Evaluation of Stochastic Systems with Natural Language Outputs
3. Scaling from Laptop to Full Application on AWS



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Brain Coach, Dr. Sunita Punjabi
San Antonio Woman Magazine:

<https://www.instagram.com/sanantoniowoman/p/DBbhf3OJnO8/>

Future Roadmap



- **Automate Trial Upload to Qdrant and Expand Trial Coverage**
 - Directly source active trials from ClinicalTrials.gov API
 - Include more trials and conditions
- **Improve Eligibility Scoring**
 - Parse individual criteria
 - Add user feedback option to site to improve model performance
- **Make UI more flexible**
 - Support user interactivity such as feedback inputs and navigation session storage
 - Investigate other platforms besides Streamlit for more customization



Note: image was generated by DALL-E with ChatGPT.

Our Mission: Equitable Access to Clinical Trials for All



- **Mission:** Break down barriers to clinical trial access.
- **Impact:** Streamline access, accelerate treatments, foster diversity, and improve patient outcomes.



Note: image was generated by DALL-E with ChatGPT.

Appendix

Acknowledgements



We would like to thank our instructors, Korin Reid and Ramesh Sarukkai, for their guidance.

We would also like to thank Kevin Lee, M.D. for creating synthetic patients and identifying clinical trials for which those patients are eligible.