OncoMatch-AI: Advancing an Agent-Based Trial-Matching System for Clinical Use

An approach to automate patient study eligibility evaluation in the field of oncology

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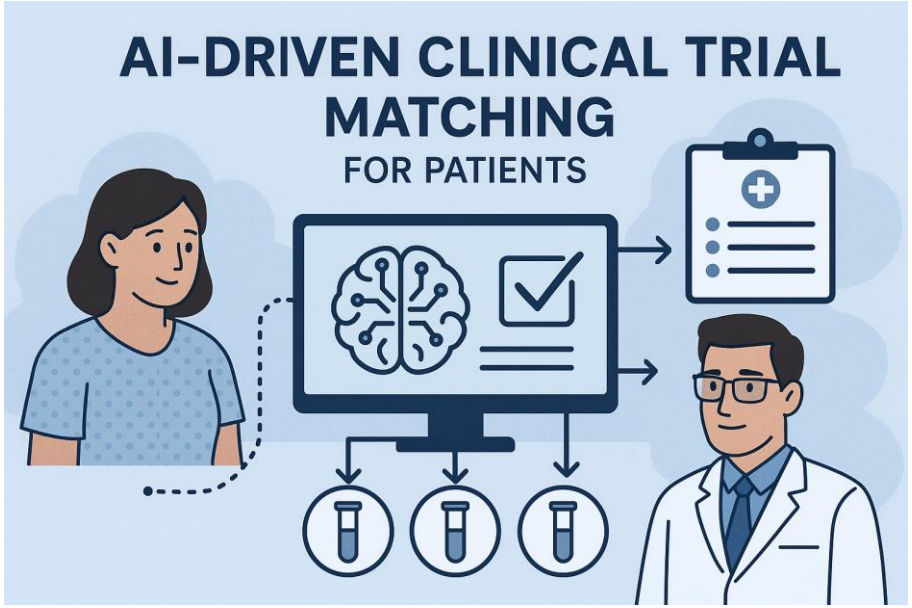
Motivation

- The number of oncology clinical trials worldwide has grown significantly:
  - > 35,000 oncology studies initiated since 2007
  - New trials started annually rose from ~2,500 (2007) to nearly 4,000 (2017)
- Patients with active cancer who have exhausted standard treatment are in particular need of information on clinical trials
- Worldwide, only about 3-5% of adult cancer patients participate in a clinical trial at any point in their care
  - Acceptance rates for cancer trials range from 14% to 52%
- A major barrier
  - 77.9% of patients report never discussing clinical trials with their doctor during hospital visits



Advancing the OncoMatch-AI Foundation

- You build on an existing, already-evaluated student project that is provided as a basis for this continuation
- OncoMatch-AI matches patients to clinical trials based on
  - European and US oncology trial databases
    - ~4,000 oncology trials, each with 300+ data elements (eligibility criteria, trial site locations)
  - Patient data in health documents, e.g.
    - Molecular pathology reports
    - Physician letters summarizing condition and tumor manifestations
- Agentic approach with a Knowledge Graph
  - An LLM agent orchestrates multiple search tools via tool calling (vector search, full-text search, structured trial search, graph traversals)
  - Promising results with local LLM obtained
- Importantly, the existing approach can be extended, or more advanced approaches can be developed on top of it
  - We explicitly invite these extensions!

Possible Directions

Core Objectives

- Extend functionality and software architecture
- Design and implement the user interface (impractical for clinical use so far)
- Extend / advance the agent-based approach - add tools, improve or swap RAG models, or develop advanced agent strategies on top of the existing foundation
- Validate and test (incl. benchmarks)
- Broaden clinical impact beyond the current scope

Development Ideas

- Enhanced Study Medication Explanations
  - Provide detailed information on the study medications recommended to patients
- Support for Trial Centers (Pre-Screening)
  - Use OncoMatch to support study centers / clinical trial sites
- Analyze Recommendation Restrictiveness
  - Investigate whether OncoMatch is too restrictive in its suggestions
- …
- Propose your own ideas!

Benefits and Requirements

Requirements & Skills

- Language: English / German
  Duration: 6 months
  Team size: 3-5 students
- Useful background
  - Data analysis and data mining skills
  - Familiarity with LLMs and (unsupervised) machine learning
  - Understanding of data modeling and training AI models
  - Programming (web development, Python, AI frameworks)
- Challenges you tackle
  - Quantitative evaluation of such systems is genuinely hard, and the datasets used across prior work are heterogeneous and often privately held
  - Delivering a stable, robust system that scales to a broad therapy scope

What's in for you

- Deeper understanding of ML and recommender systems through real-world application
- Work on a real software project with real impact → in a field where only 3-5% of adult cancer patients enter trials!
- Cross-university collaboration & clinical access: supervision runs across Universität Heidelberg (Medizinische Fakultät) and Universität Mannheim
- Start with a working prototype, and a pre-validated recommender
- Publication potential for competitive students aiming for research careers
- Hands-on web development experience
- Flexibility: fully online participation possible

Links and People

Links

- Clinical trial databases:
  - EMA: https://www.clinicaltrialsregister.eu/ctr-search/trial/2011-000840-70/IT
  - FDA: Clinical Trials Register

Supervisors

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