Med-KG: A General-Purpose Knowledge Graph for Understanding Clinical Interactions
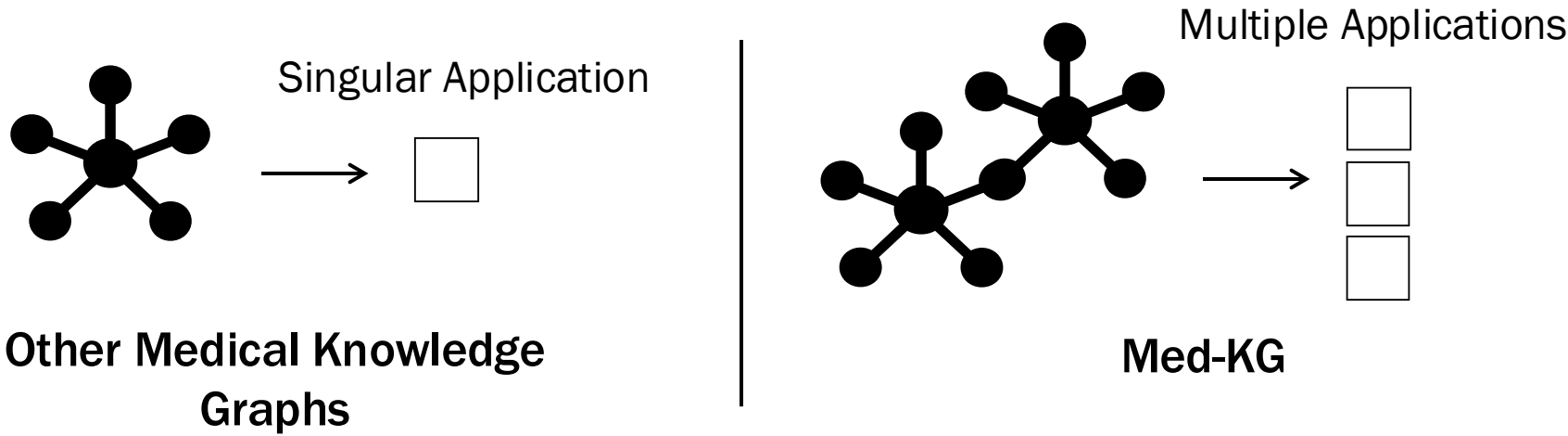
Caltech

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Bridging structured knowledge and language understanding for broad clinical insights using Knowledge Graphs & Large Language Models

Motivation

MIMIC-IV contains rich, multimodal data (e.g., notes, labs, prescriptions) that is decentralized across multiple files → knowledge graph enables structure
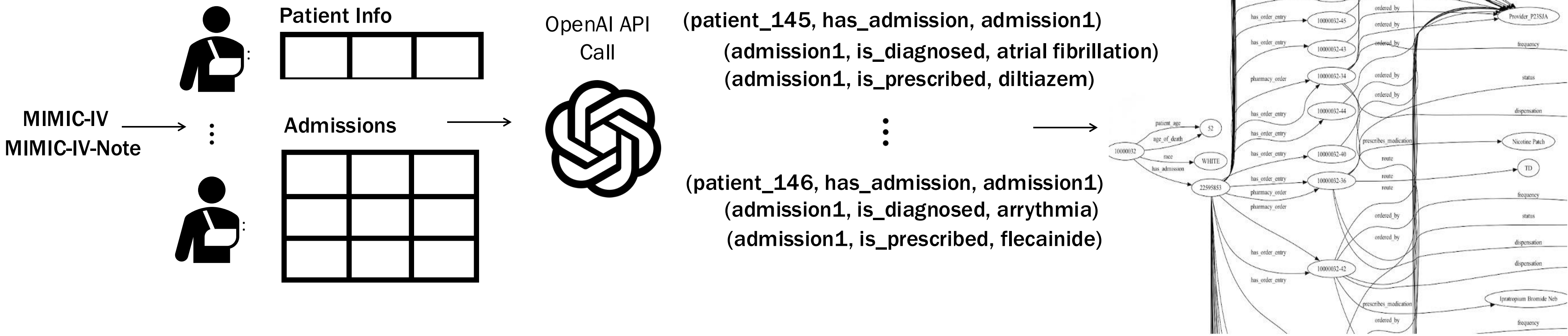

Other Medical Knowledge Graphs — Singular Application

Med-KG — Multiple Applications

Data

Incorporating tabular, textual and image data

MIMIC-IV
- admissions.csv.gz
- d_hcpcs.csv.gz
- d_icd_diagnoses.csv.gz
- d_icd_procedures.csv.gz
- d_labitems.csv.gz
- diagnoses_icd.csv.gz
- drgcodes.csv.gz
- emar.csv.gz
- emar_detail.csv.gz
- hcpcsevents.csv.gz
- labevents.csv.gz

- microbiologyevents.csv.gz
- omr.csv.gz
- patients.csv.gz
- pharmacy.csv.gz
- poe.csv.gz
- poe_detail.csv.gz
- prescriptions.csv.gz
- procedures_icd.csv.gz
- provider.csv.gz
- services.csv.gz
- transfers.csv.gz

MIMIC-IV-Note
- discharge.csv.gz
- discharge_detail.csv.gz
- radiology.csv.gz
- radiology_detail.csv.gz

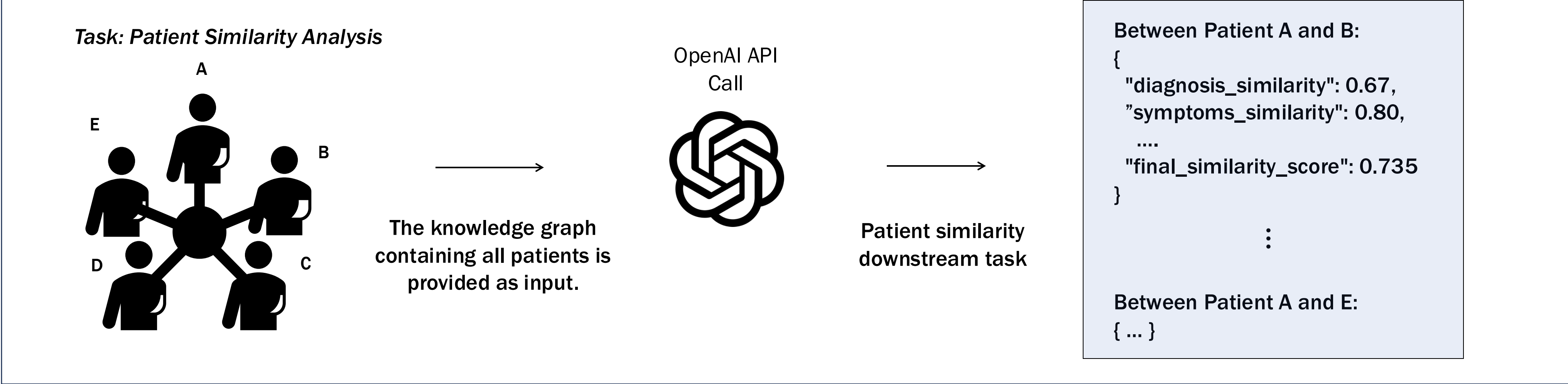## Method

Med-KG Implementation: A General-Purpose Knowledge Graph for Understanding Clinical Interactions

1) Knowledge Graph Generation

MIMIC-IV / MIMIC-IV-Note → Patient Info, Admissions → OpenAI API Call →

(patient_145, has_admission, admission1)
(admission1, is_diagnosed, atrial fibrillation)
(admission1, is_prescribed, diltiazem)
⋮
(patient_146, has_admission, admission1)
(admission1, is_diagnosed, arrythmia)
(admission1, is_prescribed, flecainide)

2) LLM Analysis for various Downstream Tasks

Task: Patient Similarity Analysis

The knowledge graph containing all patients is provided as input. → OpenAI API Call → Patient similarity downstream task →

```
Between Patient A and B:
{
    "diagnosis_similarity": 0.67,
    "symptoms_similarity": 0.80,
    ....
    "final_similarity_score": 0.735
}
⋮
Between Patient A and E:
{ ... }
```

Applications

Patient Similarity Analysis
How to identify similar patients to provide clinical decision-making support?
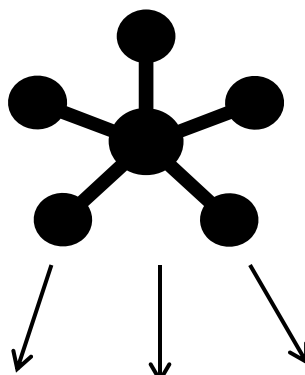Are there differences in treatment among similar patients?

Provider
Are there anomalies in provider behavior (overprescribing, upcoding, etc.)?
How to quantify provider success rate?

Answer Clinical Research Questions
What types of physician order entries are discontinued?
What types of admissions result in inter-hospital transfers?

Future Work

Expand Tasks

% More Quantitative Evaluations

Mental Health Data: NIMH Archive

Acknowledgements