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A Smart Multimodal Healthcare Copilot with Powerful LLM Reasoning

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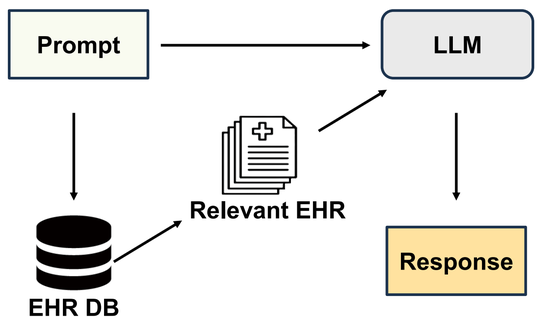
Retrieval-augmented Generation & Knowledge Graph

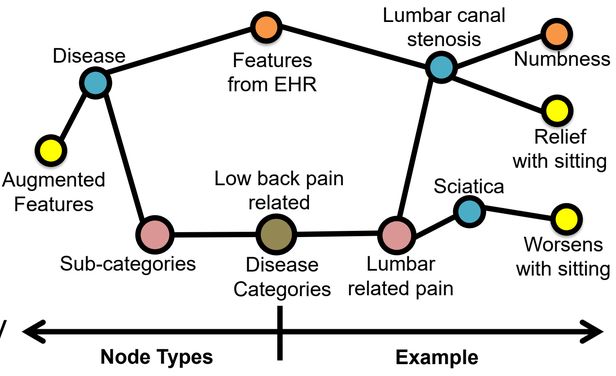
RAG (Retrieval-Augmented Generation):

- **Retrieves** relevant **local info** for **answer generation**
- **Improves** factuality and context-awareness of responses of LLMs
- **Suffers** from inaccuracies and vagueness due to heuristic-based approaches

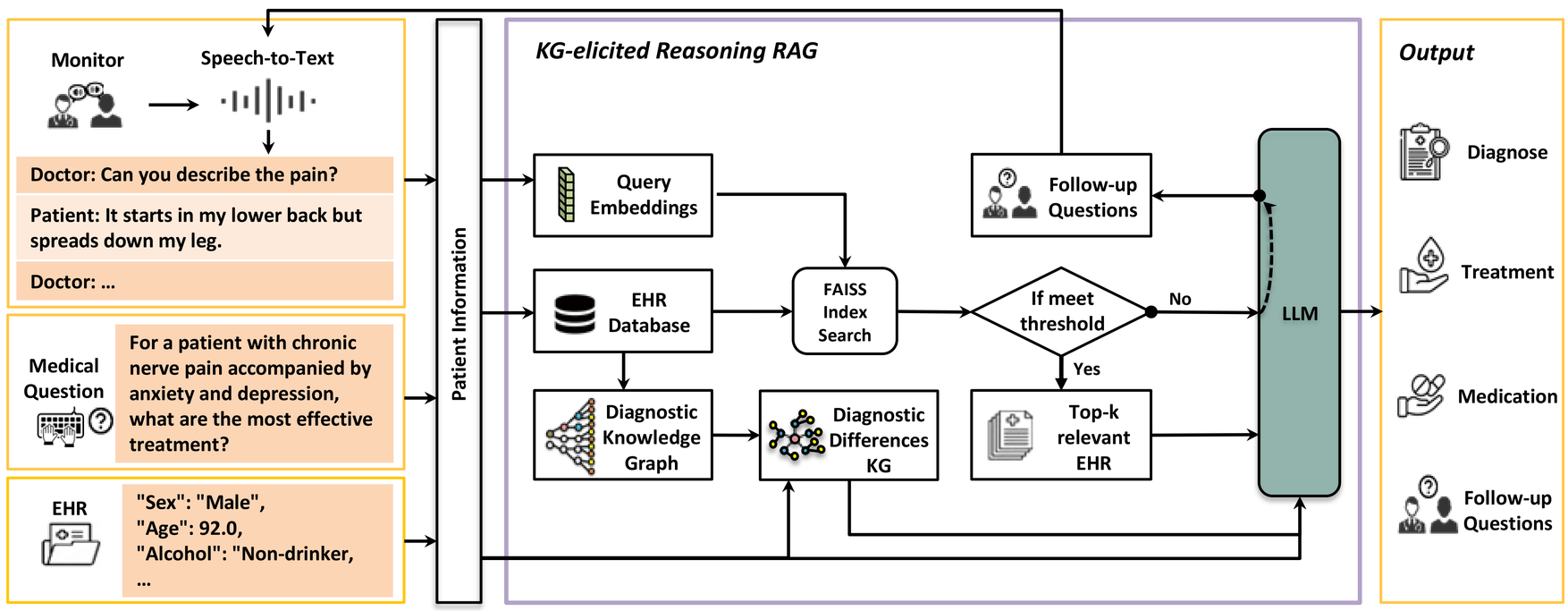


KG (Knowledge Graph):

- **Represents** medical entities (e.g., diseases, disease categories) and their relations
- **Elicits reasoning** of LLMs
- **Distinguishes** similar diseases and enhances diagnostic accuracy



Our Approach



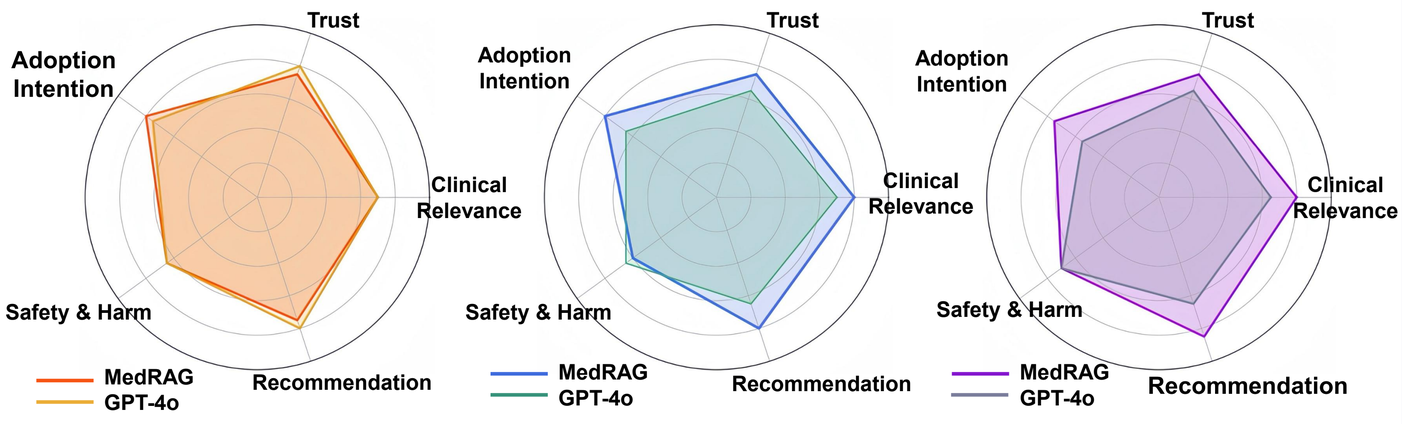
1. Diagnostic KG Construction: **A four-tier diagnostic KG** is constructed through disease clustering, hierarchical aggregation and LLM augmentation from EHR database.

2. Diagnostic Differences KG Searching: **Symptoms** are matched to the diagnostic KG via clinical feature decomposition, matching, and upward traversal to identify key **diagnostic differences**.

3. KG-elicited LLM reasoning: Based on the patient information, diagnostic difference KG and retrieved EHRs to reason precise **diagnostic suggestions and proactive questioning.**

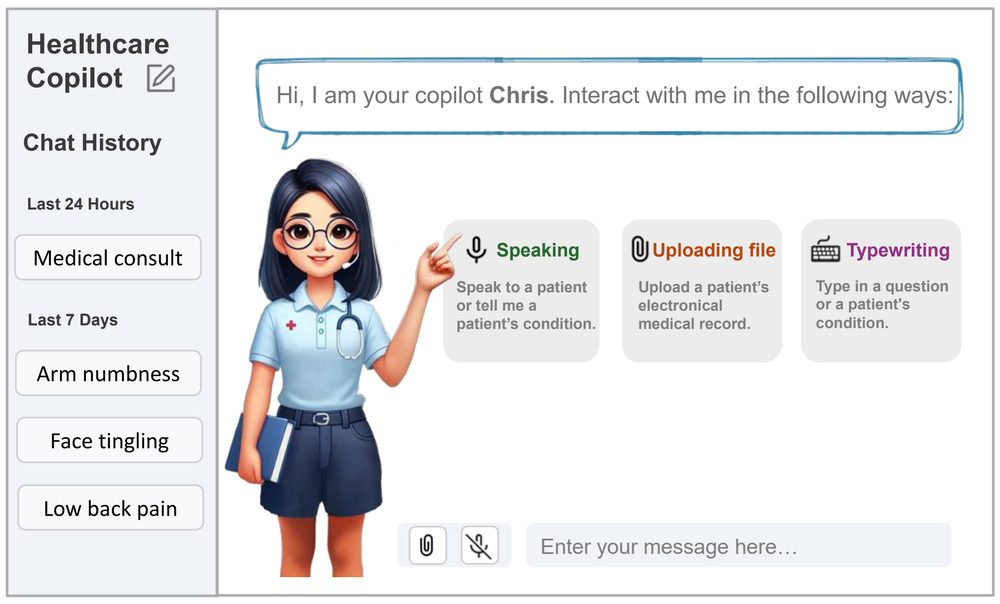
Evaluations and UI

Method	Model	CPDD			DDXPlus		
		L1	*L2*	*L3*	*L1*	*L2*	*L3*
Baselines	Naive RAG + COT	75.47	54.72	43.40	79.28	71.89	56.84
	FS-RAG	64.71	49.02	45.10	78.18	68.20	51.40
	FLARE	54.84	48.39	45.16	71.09	56.70	31.02
	FL-RAG	65.45	50.91	49.09	**90.12**	83.32	66.78
	DRAGIN	78.72	59.57	40.42	80.51	70.83	50.24
	SR-RAG	73.58	60.38	54.72	78.65	70.28	52.16
Ours	MedRAG	**79.25**	**75.47**	**66.04**	88.65	**83.46**	**68.01**



◆ **Outperform SOTA RAG methods on objective results**

◆ **Result of doctor evaluation (Human Factor Criteria)**



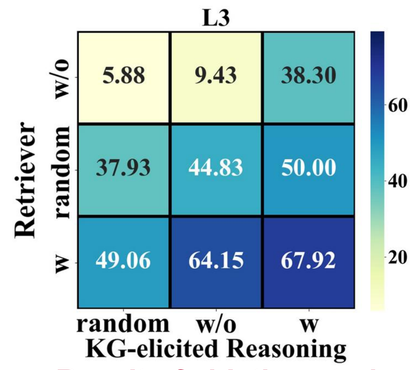
◆ **UI of MedRAG – Healthcare Copilot**

Backbone LLM	Modal	L1	L2	L3
GPT-4o	text	91.87	81.78	73.23
GPT-4o	voice	88.23	78.43	70.58
GPT-3.5-turbo	text	70.56	68.68	50.57
GPT-3.5-turbo	voice	64.70	60.78	45.09

◆ **Evaluation of different modal on CPDD**

Manifestation Masking Ratio	*L1*	*L2*	*L3*
100%	60.38	56.60	52.83
66.6%	69.39	67.35	55.10
33.3%	71.43	67.35	61.22
0%	79.25	75.47	66.04

◆ **Proactive diagnostic questioning**



◆ **Result of ablation study**

Demo on Bilibil

Code of MedRAG