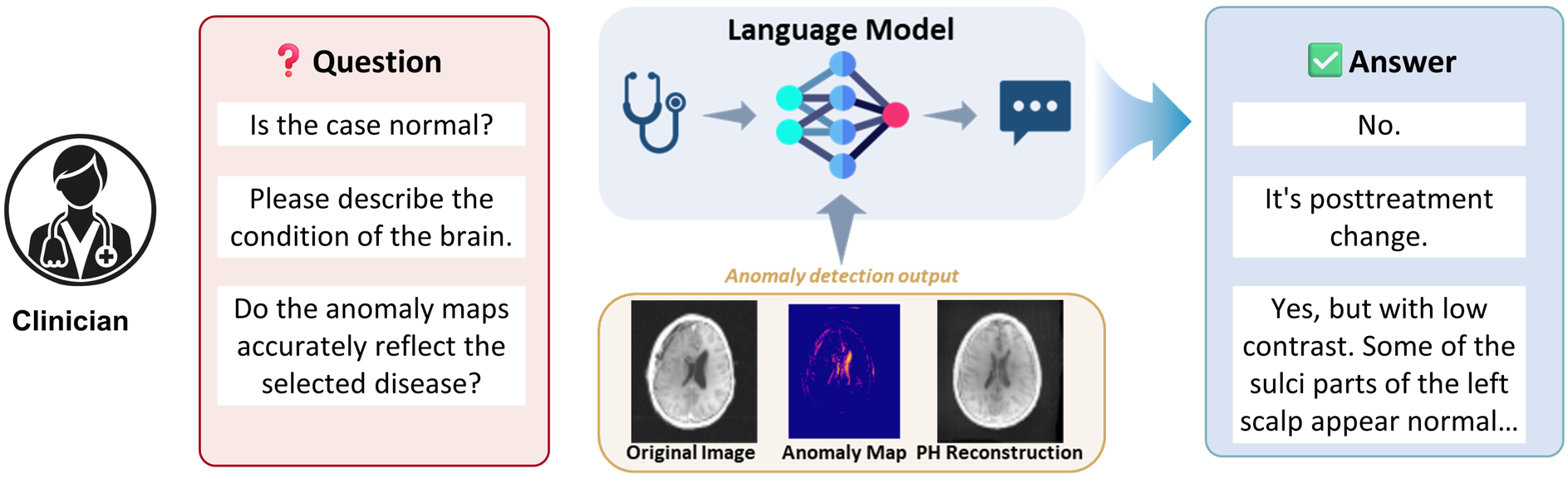
Language Models Meet Anomaly Detection for Better Interpretability and Generalizability

Jun Li[1,2], Su Hwan Kim[4], Philip Müller[1], Lina Felsner[1], Daniel Rueckert[1,2,4,5]
Benedikt Wiestler[1,4], Julia A. Schnabel[*1,2,3,6 (✉)], Cosmin I. Bercea[*1,3 (✉)]

Can we utilize LMs to help explain UAD?



Takeaway

Integrating LMs with UAD enhances interpretability and the detection of unseen anomalies.

Why UAD + LMs?

🔍 **Lack of Interpretability**:

Traditional UAD models create anomaly maps but do not explain the findings, leaving clinicians with a limited understanding of what the anomalies represent.

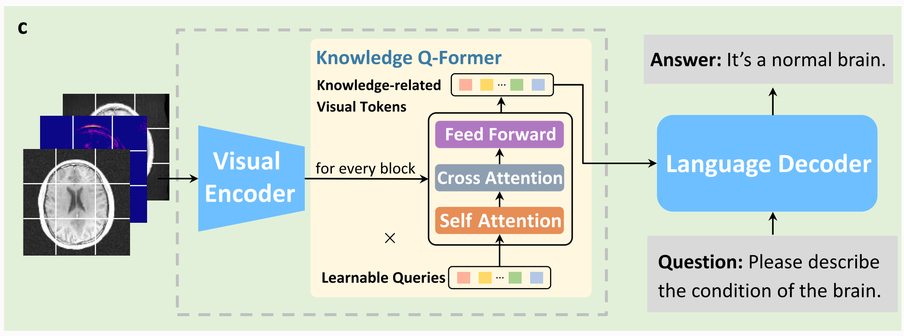
Why LMs + UAD?

🔧 **Need for Generalizability**:

Existing models struggle to detect unseen anomalies (open-set anomalies), which is critical for real-world applications in medical diagnostics.

How?

Methodology

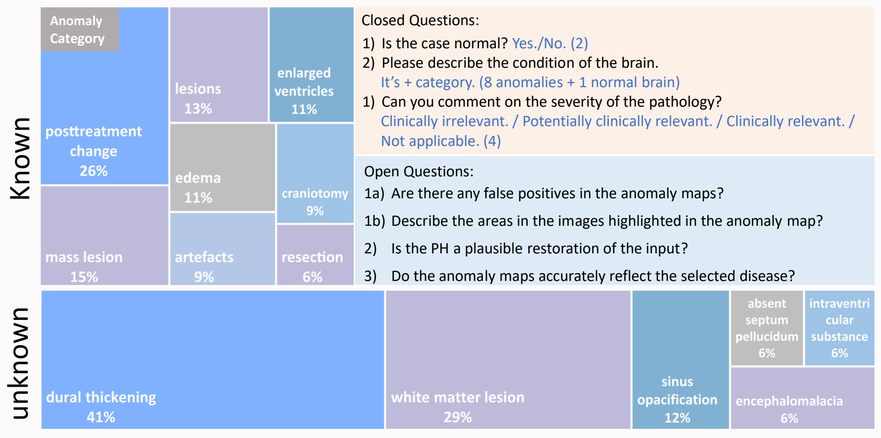


🖼️ **Multi-Image Visual Question Answering (VQA)**:

The model processes multiple types of images (original, anomaly map, and pseudo-healthy reconstruction) to answer questions and explain the detected anomalies.

🧠 **Knowledge Querying Transformer (KQ-Former)**:

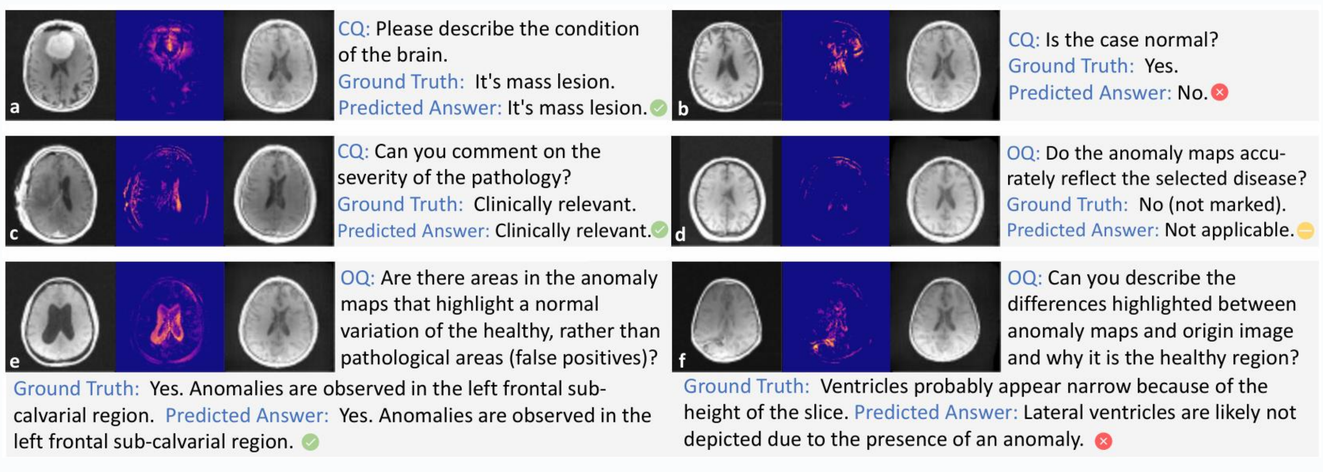
Aligns visual and textual features, improving anomaly map interpretability and detection accuracy.



Dataset

Results: UAD + LMs

Positive and Negative Visualizations of Our Framework

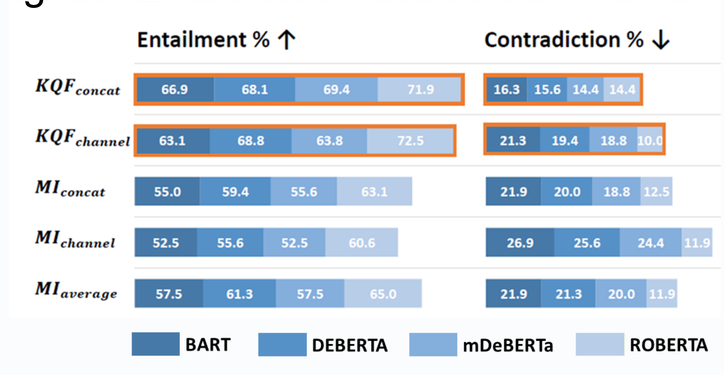


LMs + UAD

Anomaly Maps enhance VQA performance

	Method	Known Overall ACC ↑	Known Overall F1 ↑	Unknown Overall ACC ↑	Unknown Overall F1 ↑	Unknown Unhealthy (17%) ACC ↑	Unknown Unhealthy (17%) F1 ↑	Unknown Healthy (83%) ACC ↑	Unknown Healthy (83%) F1 ↑
Conc.	w/o Ano	85.29	85.29	84.13	87.50	69.67	80.00	**98.70**	95.00
	w Ano.	**88.24**	**88.19**	**89.37**	**89.37**	**82.35**▲ 18%	**82.35**▲ 3%	96.39	**96.39**
Chan.	w/o Ano	89.71	89.69	84.45	87.00	71.43	78.95	97.47	95.06
	w Ano.	**91.18**	**91.15**	**85.72**	**88.85**	**72.73**▲ 2%	**82.05**▲ 4%	**98.72**	**95.65**

Highest Entailment Ratio in Our Framework



1 Technical University of Munich, Germany
2 Munich Center for Machine Learning, Germany
3 Helmholtz AI & Helmholtz Center Munich, Germany
4 Klinikum Rechts der Isar, Munich, Germany
5 Imperial College London, UK
6 King's College London, UK