

Language Models Meet Anomaly Detection for Better Interpretability and Generalizability

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Can we utilize LMs to help explain UAD?

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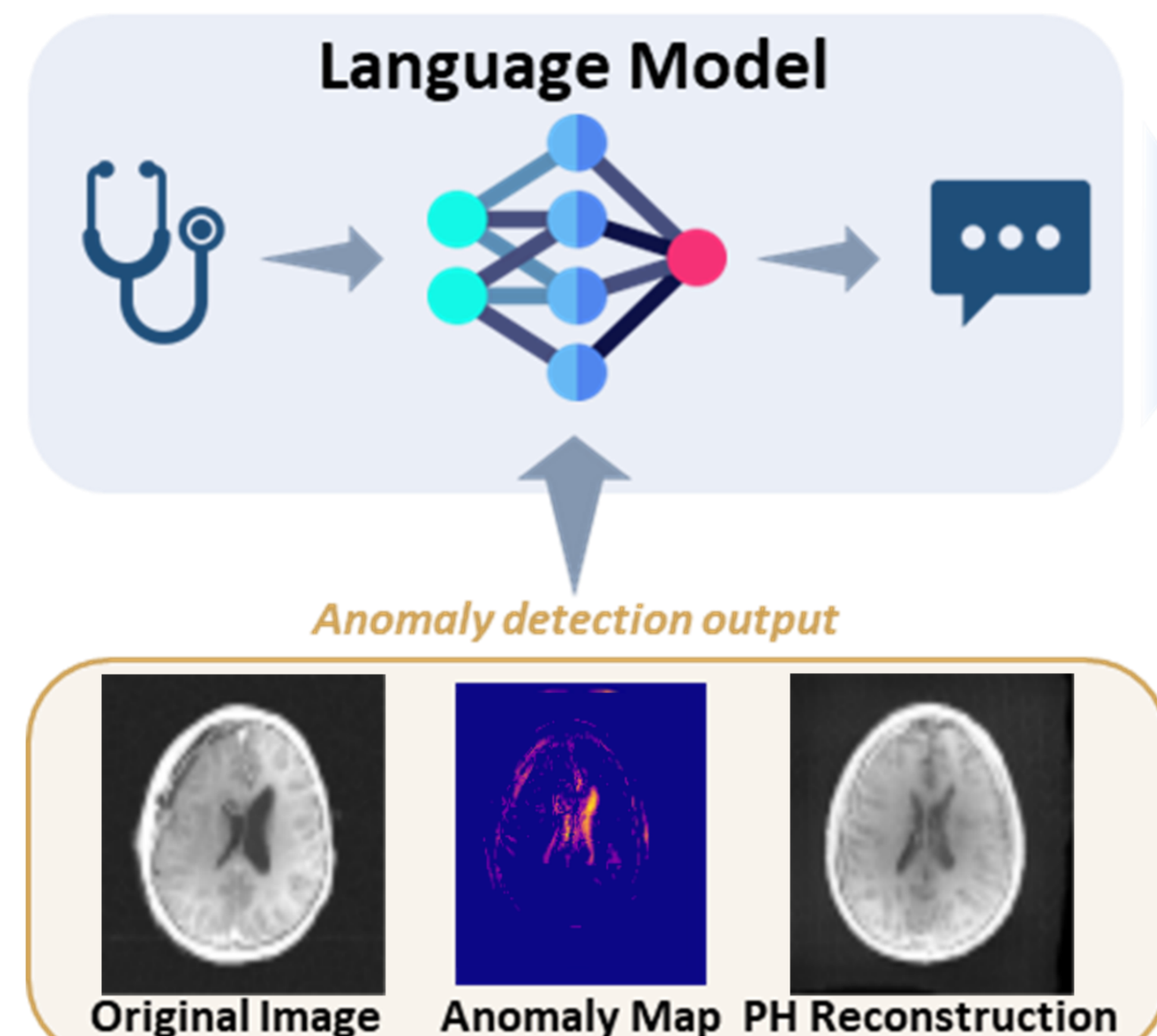
Clinician

Question

Is the case normal?

Please describe the condition of the brain.

Do the anomaly maps accurately reflect the selected disease?



Answer

No.

It's posttreatment change.

Yes, but with low contrast. Some of the sulci parts of the left scalp appear normal...

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.

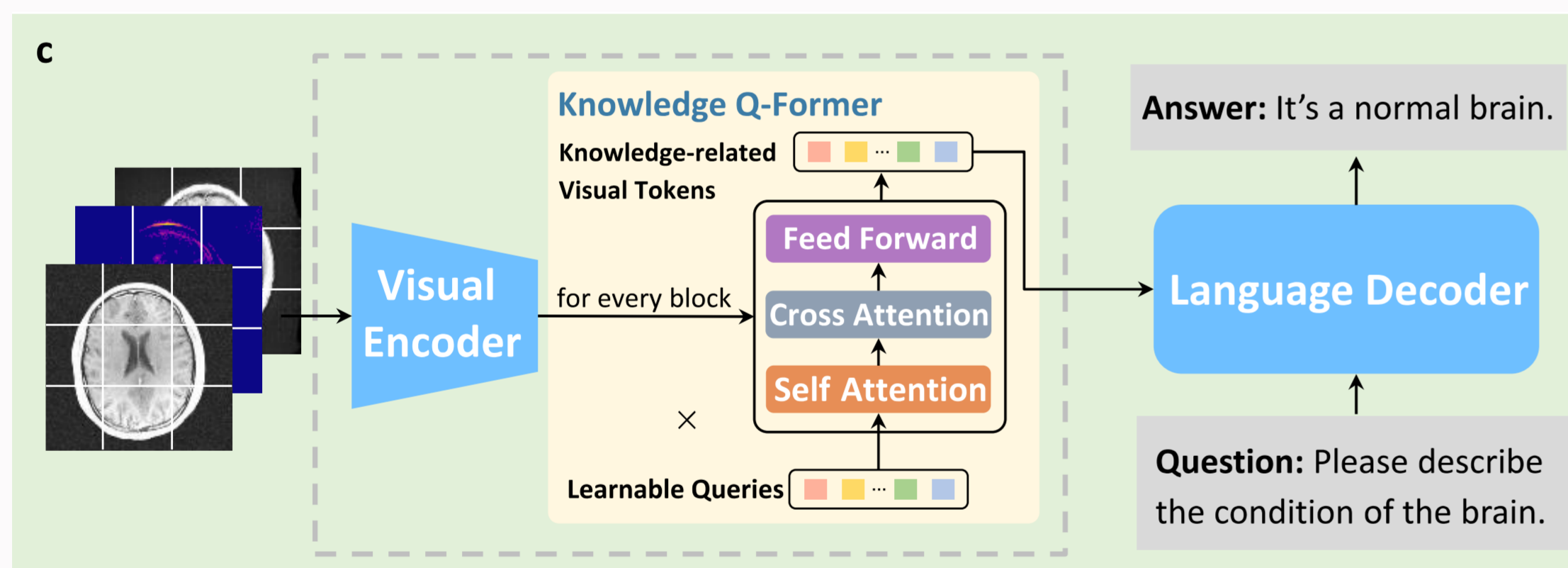
Why LMs + UAD?

Need for Generalizability:

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

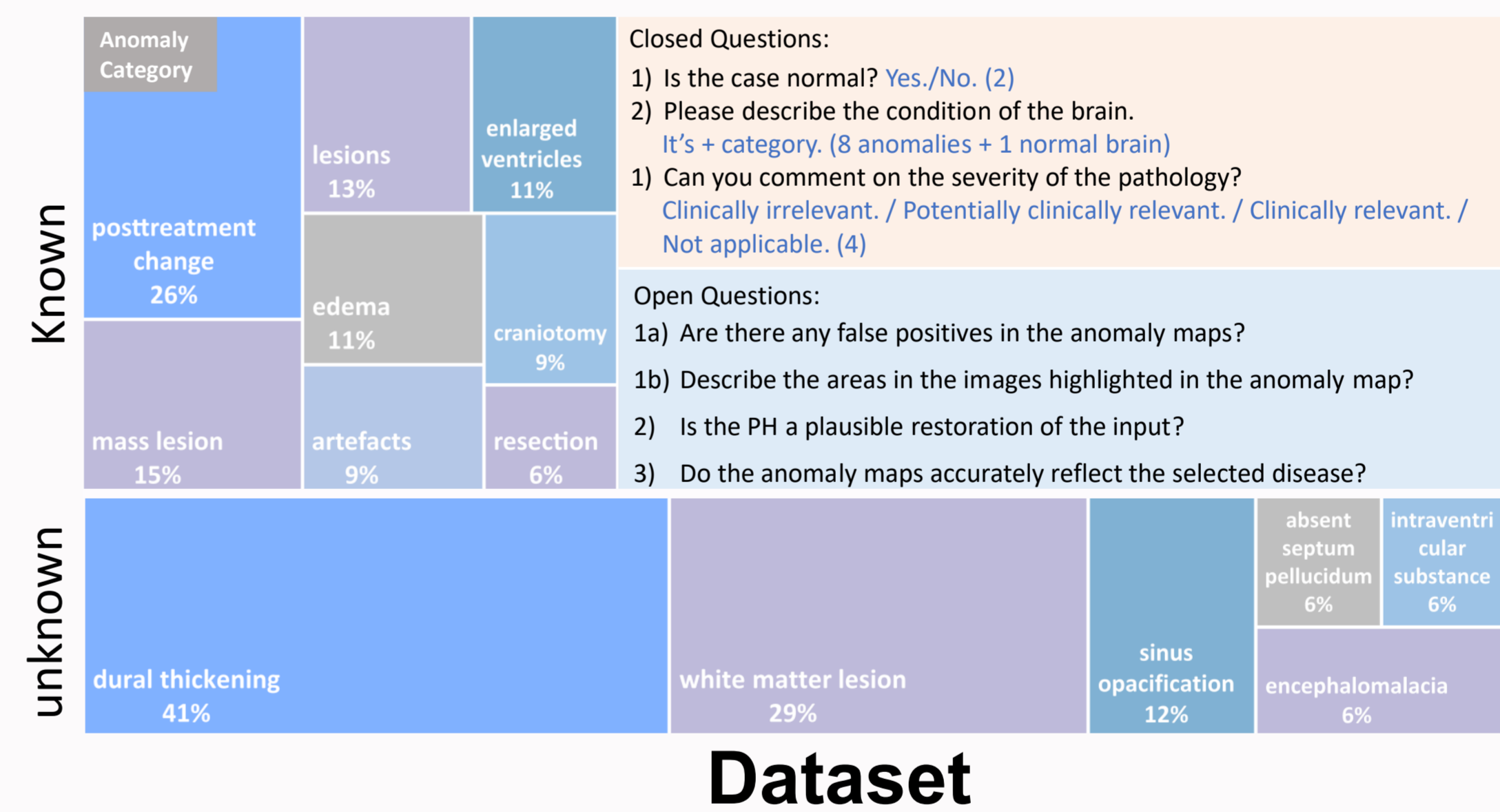
How?

Methodology



Knowledge Querying Transformer (KQ-Former):

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



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.

Results: UAD + LMs

Positive and Negative Visualizations of Our Framework

	<p>CQ: Please describe the condition of the brain. Ground Truth: It's mass lesion. Predicted Answer: It's mass lesion. ✓</p>		<p>CQ: Is the case normal? Ground Truth: Yes. Predicted Answer: No. ✗</p>
	<p>OQ: Can you comment on the severity of the pathology? Ground Truth: Clinically relevant. Predicted Answer: Clinically relevant. ✓</p>		<p>OQ: Do the anomaly maps accurately reflect the selected disease? Ground Truth: No (not marked). Predicted Answer: Not applicable. ✗</p>
	<p>OQ: Are there areas in the anomaly maps that highlight a normal variation of the healthy, rather than pathological areas (false positives)? Ground Truth: Yes. Anomalies are observed in the left frontal sub-calvarial region. Predicted Answer: Yes. Anomalies are observed in the left frontal sub-calvarial region. ✓</p>		<p>OQ: Can you describe the differences highlighted between anomaly maps and origin image and why it is the healthy region? Ground Truth: Ventricles probably appear narrow because of the height of the slice. Predicted Answer: Lateral ventricles are likely not depicted due to the presence of an anomaly. ✗</p>

LMs + UAD

Anomaly Maps enhance VQA performance

Method	Known Overall		Overall		Unknown Unhealthy (17%)		Healthy (83%)		
	ACC ↑	F1 ↑	ACC ↑	F1 ↑	ACC ↑	F1 ↑	ACC ↑	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

