Contrastive Language Prompting to Ease False Positives in Medical Anomaly Detection

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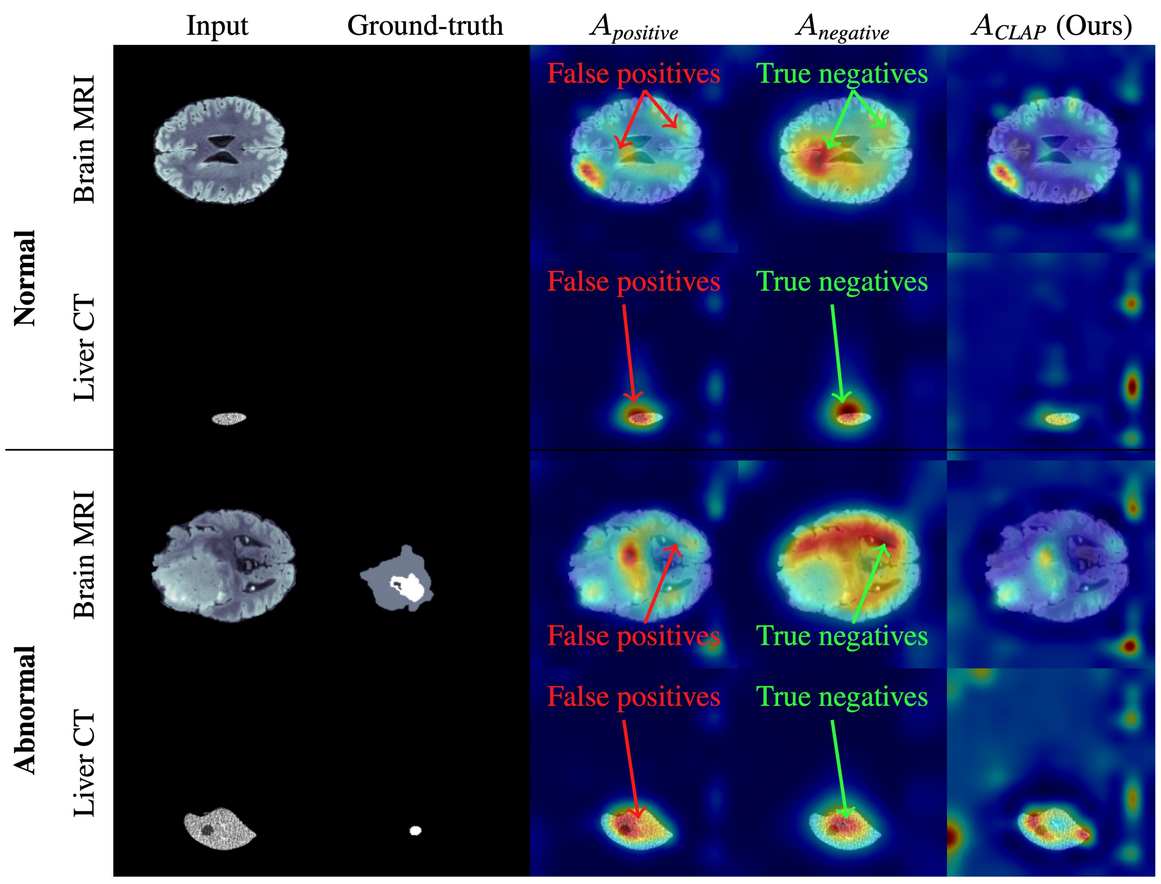
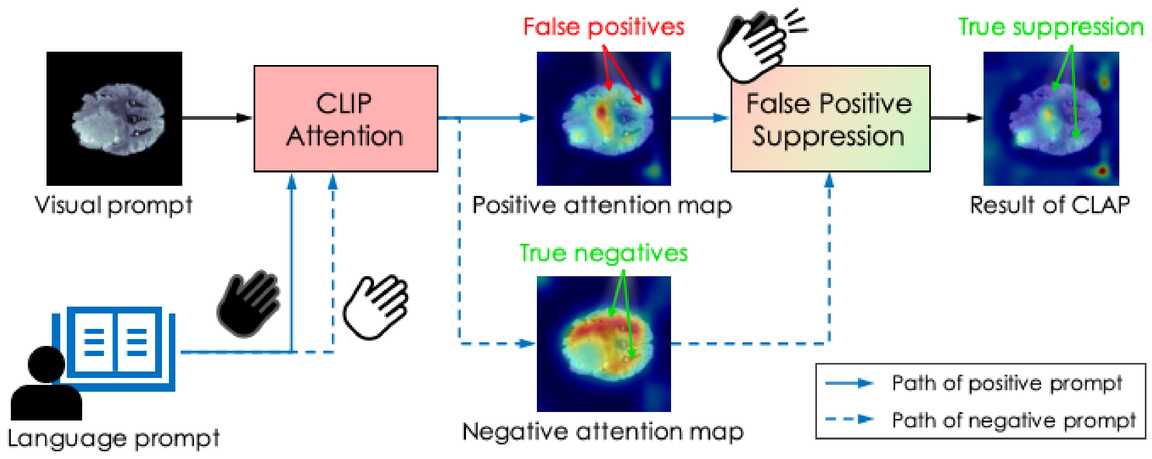
INTRODUCTION

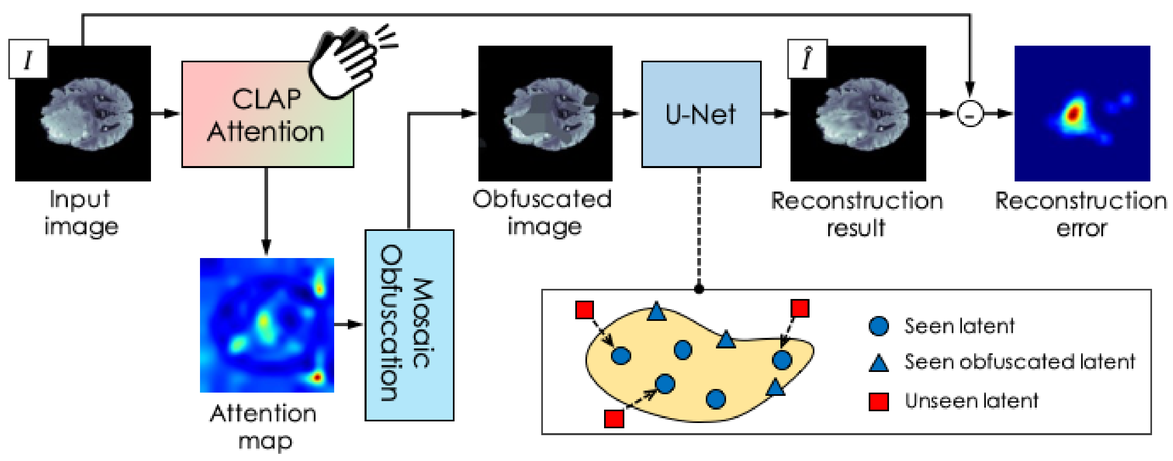


- False positives hinders accurate detection of disease regions.
- CLAP refines attention by leveraging both positive and negative text prompts.

METHODS



(a) Attention map generation by **C**ontrastive **LA**nguage **P**rompting (CLAP)



(b) Unsupervised anomaly detection (UAD) scheme

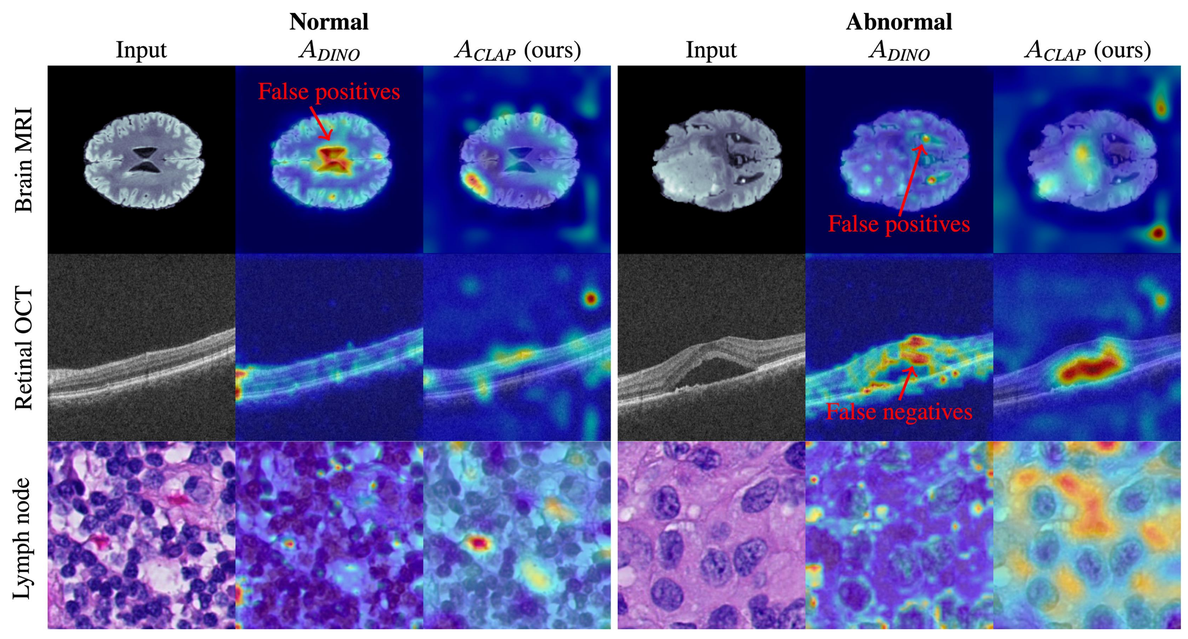
Anatomy	P/N	Language prompt
Brain MRI	P	Glioma, Astrocytoma, Oligodendroglioma ...
	N	Normal, Healthy gray matter ...
Liver CT	P	Malignant cells, Dysplasia, Hyperplasia ...
	N	Normal, Healthy, Benign ...
Retinal OCT	P	Retinal fluid, Drusen, Retinal detachment ...
	N	Normal, Healthy, Clear ...
Chest X-ray	P	Consolidation, Fibrosis, Atelectasis ...
	N	Healthy, Clear fields, Normal ...
Lymph node	P	Metastatic carcinoma, Tumor metastasis ...
	N	Normal, Healthy tissue ...

Examples of positive (P) and negative (N) language prompts

EXPERIMENTAL SETUP

- **Dataset**: BMAD benchmark covering MRI, CT, X-ray, OCT, and histopathology images.
- **Models**: EAR (U-Net), CLIP with positive language prompting (PLP) alone, and CLAP (ours).
- **Evaluation**: Image-level AUROC scores.

RESULTS



CLAP suppresses false positives effectively

Anatomy	Brain MRI	Liver CT	Retinal OCT		Chest X-ray	Lymph node	Average
Dataset	BraTS2021	BTCV + LiTs	RESC	OCT2017	RSNA	CAMELYON16	
EAR [2]	77.37	72.51	86.42	**97.46**	**71.69**	63.39	78.21
PLP	73.54	**72.76**	90.08	96.77	65.23	64.98	77.23
CLAP (ours)	**78.55**	72.60	**91.66**	96.38	65.76	**68.42**	**78.89**

CLAP improves image-level disease detection

CONCLUSION

- CLAP effectively reduces false positives to find suspected disease regions.
- Outperforms existing EAR and PLP methods in medical anomaly detection.
- Future work aims to automate fine prompt generation to enhance usability.

REFERENCES

[1] Sheng Zhang, et al., "BiomedCLIP: a multi-modal biomedical foundation model pretrained from fifteen million scientific image-text pairs," arXiv, 2023.
[2] YeongHyeon Park, et al., "Visual defect obfuscation based self-supervised anomaly detection," *Scientific Reports*, 2024.
[3] Jinan Bao, et al., "BMAD: Benchmarks for medical anomaly detection," CVPR, 2024

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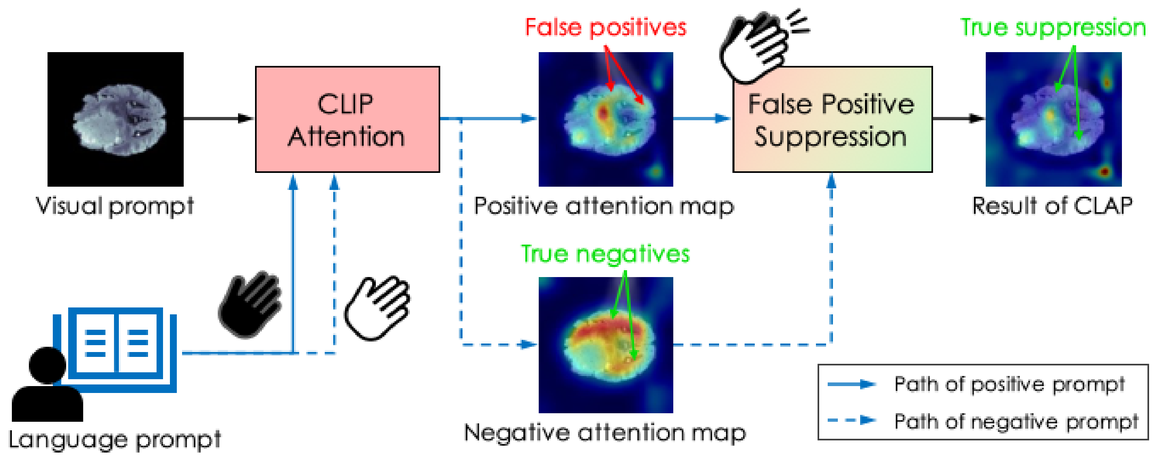

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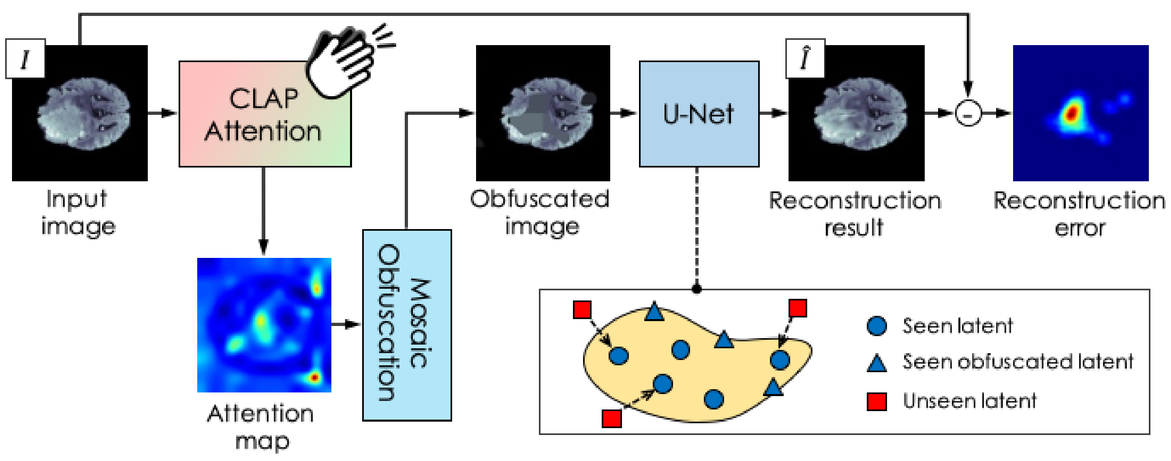

(b) Unsupervised anomaly detection (UAD) scheme

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