An Improved Saliency Map that Shows Trustworthiness for Localizing Abnormalities in Medical Imaging

Author: Nolan C. Skelly, M.S. Student, Department of Operational Sciences, Air Force Institute of Technology
Advisor: Nathan B. Gaw, Assistant Professor, Department of Operational Sciences, Air Force Institute of Technology

Saliency Maps:
- Visual representations highlighting key image regions, derived from internal model features guiding further analysis in computer vision tasks
- Many CNN medical imaging studies have used saliency maps to rationalize model prediction and provide localization

Evaluation: Evaluating the trustworthiness of 10 widely used saliency map techniques

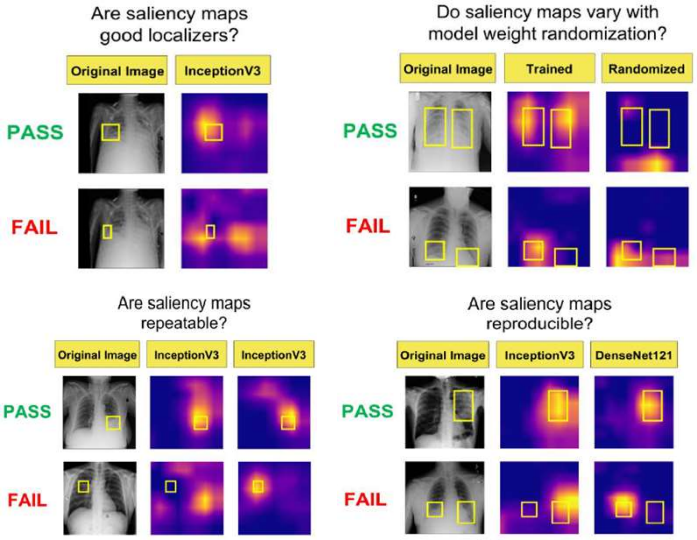


Table 9: Pneumonia Dataset

Method	Utility	Sensitivity	Repeatability	Reproducibility
Grad	FAIL	PASS	FAIL	FAIL
SG	FAIL	PASS	FAIL	FAIL
IG	FAIL	FAIL	FAIL	FAIL
SIG	FAIL	PASS	FAIL	FAIL
GCAM	FAIL	PASS	PASS	PASS
XRAI	PASS	PASS	PASS	PASS
GBP	FAIL	FAIL	FAIL	FAIL
GGCAM	FAIL	FAIL	FAIL	FAIL
GCAM++	FAIL	PASS	PASS	PASS
SCAM	FAIL	FAIL	PASS	PASS

Table 10: Pneumothorax Dataset

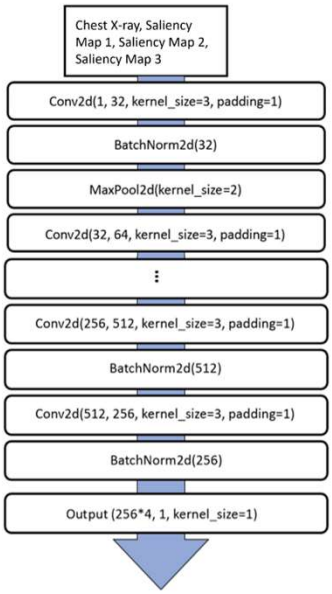
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Problem: All ten commonly used saliency maps fail to meet the evaluation criteria. Except for XRAI, none of the saliency maps meet the "PASS" criteria for localization utility.

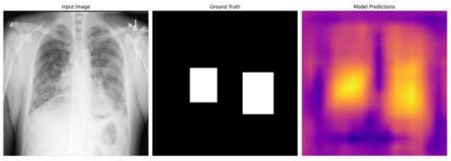
Contributions:

- **SALIENET** (Saliency Enhancement via Integration Network), a novel approach to generate saliency maps by ensembling the highest performing maps through CNN training
- **ELIST** (Error Localization and Identification Saliency Technique), Introduced an error prediction map that evaluates the accuracy and reliability of the saliency map, trained on the same CNN architecture

Architecture

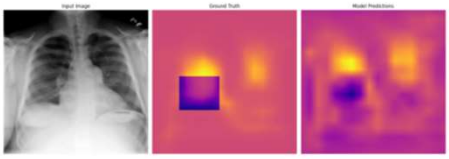


SALIENET



Method	AUPRC (± SD)
SALIENET	0.68 ± 0.14
RetinaNet	0.59 ± 0.26
XRAI	0.56 ± 0.05
AVG (Average of all Masks)	0.47 ± 0.27

ELIST



Metric	Results (± SD)
MAE	0.10 ± 0.02
SSIM	0.81 ± 0.06

Conclusions:

- Produced a saliency map technique that outperforms all 10 of the tested methods on the basis of localization utility and created an error map that for precise error assessment - Enhance the study of medical imaging interpretability, identifying the limitations of existing saliency maps but also in proposing novel, more reliable alternatives