

MOTIVATION / INTRODUCTION

Oral diseases like caries, periodontal disease, and oral cancer require better diagnostics, as traditional methods can be subjective and pose radiation risks. AI-powered multispectral imaging offers a non-invasive, accurate solution for early detection, transforming oral healthcare.

OBJECTIVES

This project aims to develop an AI-based system for analyzing multispectral dental images to improve early detection of oral diseases. It focuses on identifying abnormalities and differentiating conditions like caries, periodontal disease, and oral cancer. The system's effectiveness will be validated using clinical datasets based on accuracy, sensitivity, and specificity.

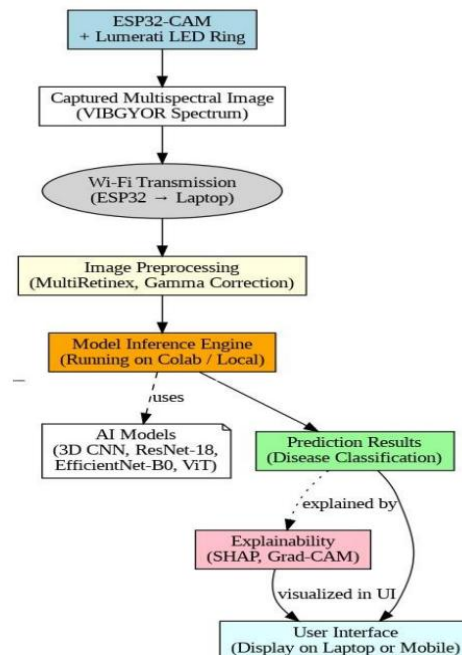
SCOPE OF THE PROJECT

This project aims to develop an AI-powered diagnostic system using multispectral dental images for early detection of oral diseases.

METHODOLOGY

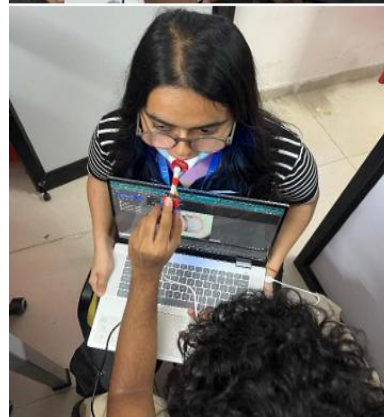
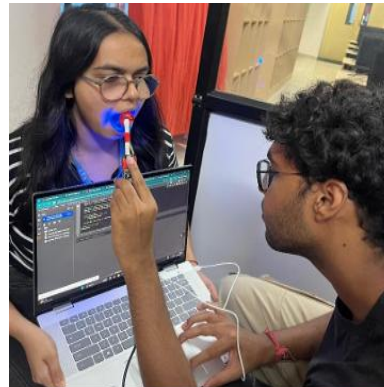
The preprocessing involves noise reduction, spectral alignment, and normalization to enhance image quality and consistency across wavelengths. These steps enable precise feature extraction, allowing AI models to accurately detect and classify oral diseases.

ARCHITECTURE



Multispectral dental images are captured using an ESP32-CAM with a Lumerati LED ring, transmitted via Wi-Fi, preprocessed, and analyzed by AI models (3D CNN, ResNet-18) for disease classification with explainability shown on a user interface.

CUSTOM BUILT CAMERA



VIBGYOR IMAGES

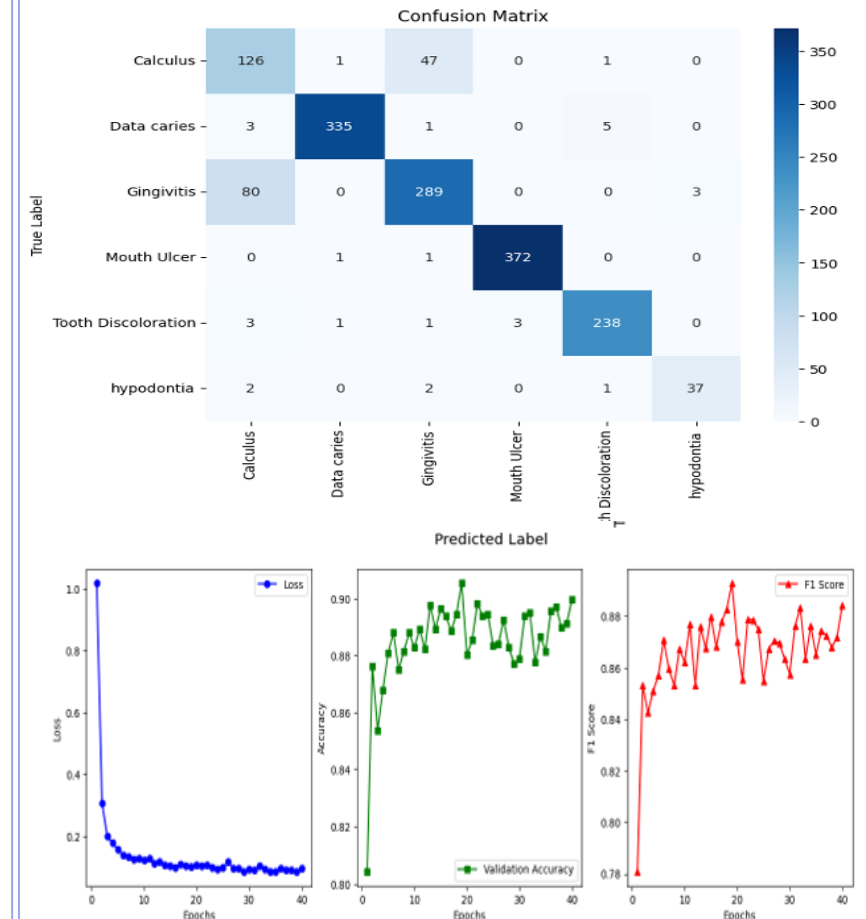
RESULTS(ALL MODELS)

Model	Accuracy (%)	Precision	Recall	F1-Score
3D CNN	73.16	0.6955	0.5782	0.6080
EfficientNet-B3	90.00	0.9440	0.9011	0.9124
Vision Transformer (ViT)	74.00	0.7024	0.5815	0.6240

RESULTS(EfficientNet B3)

Classification Report:				
	precision	recall	f1-score	support
Calculus	0.59	0.72	0.65	175
Data caries	0.99	0.97	0.98	344
Gingivitis	0.85	0.78	0.81	372
Mouth Ulcer	0.99	0.99	0.99	374
Tooth Discoloration	0.97	0.97	0.97	246
hypodontia	0.93	0.88	0.90	42
accuracy			0.90	1553
macro avg	0.89	0.89	0.88	1553
weighted avg	0.91	0.90	0.90	1553

RESULTS(EfficientNet B3)



CONCLUSION

This study presents an AI-based approach for detecting oral diseases using a synthetic dataset of 52,000+ multispectral images captured with an ESP32-CAM and Lumerati LED ring. Among the tested models, EfficientNet-B3 performed best with 90% accuracy and a 0.91 F1 score, highlighting its diagnostic potential.

CONTACT DETAILS

MAIL ID- tiya.rajesh2021@vitstudent.ac.in,
adityavikram.singhbhati2021@vitstudent.ac.in,
pullagurlavedith.reddy2021@vitstudent.ac.in
MOBILE NO-8130629486,9515350425,9872628481

REFERENCES

- M. Litjens et al., "A survey on deep learning in medical image analysis," Medical Image Analysis, vol. 42, pp. 60–88, 2017.
- Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," Nature, vol. 521, pp. 436–444, 2015.
- S. Shickel et al., "Deep learning in clinical diagnosis: Applications and challenges," IEEE Access, vol. 7, pp. 110209–110229, 2019.