

# **ORAL DISEASE CLASSIFICATION USING DENTAL IMAGES: A HYBRID MODEL**

*A Mini Project report submitted in partial fulfillment of the requirement  
for the Award of degree*

## **BACHELOR OF TECHNOLOGY *in* COMPUTER SCIENCE AND ENGINEERING**

*Submitted By*

**T.U.S.S.N.L Durga Devi (21341A05I2)**

**Pichchika Balaji (21341A05D9)**

**Yegireddi Eswari (21341A05J7)**

**Gadi Jagadeesh (22345A0519)**

**Rajana Prasad (22345A0517)**

*Under the esteemed guidance of*

**Ms S. Nirmla**

Assistant Professor,  
Dept. of Computer Science & Engineering

## **GMR Institute of Technology**

**An Autonomous Institute Affiliated to JNTU-GV, Vizianagaram**

(Accredited by NBA, NAAC with 'A' Grade & ISO 9001:2015 Certified Institution)

**GMR Nagar, Rajam – 532127**

**Andhra Pradesh, India**

**June 2024**

## **Department of Computer Science and Engineering**

### **CERTIFICATE**

This is to certify that mini project report titled “**Oral Disease Classification using Dental Images: A Hybrid Model**” submitted by **T.U.S.S.N.L Durga Devi (21341A05I2), Pichchika Balaji (21341A05D9), Yegireddi Eswari (21341A05J7), Gadi Jagadeesh (22345A0519), Rajana Prasad (22345A0517)** has been carried out in partial fulfillment for the award of **Bachelor of Technology in Computer Science and Engineering of GMRIT, Rajam** affiliated to **JNTUGV, Vizianagaram** is a record of bonafide work carried out by them under my guidance & supervision. The results embodied in this report have not been submitted to any other University or Institute for the award of any degree.

**Signature of Supervisor**

**Ms. S. Nirmla**

Assistant Professor  
Department of CSE  
GMRIT, Rajam.

**Signature of HOD**

**Dr. A. V. Ramana**

Professor & Head  
Department of CSE  
GMRIT, Rajam.

The report is submitted for the viva-voce examination held on .....

Signature of Internal Examiner

Signature of External Examiner

# ACKNOWLEDGEMENT

It gives us an immense pleasure to express deep sense of gratitude to our guide, **Ms S. Nirmla Assistant Professor**, Department of Computer Science and Engineering of whole hearted and invaluable guidance throughout the report. Without her sustained and sincere effort, this report would not have taken this shape. She encouraged and helped us to overcome various difficulties that we have faced at various stages of our report.

We would like to sincerely thank **Dr. A V Ramana**, Professor & HOD, Department of Computer Science and Engineering, for providing all the necessary facilities that led to the successful completion of our report.

We take privilege to thank our Principal **Dr C.L.V.R.S.V. Prasad**, who has made the atmosphere so easy to work. We shall always be indebted to them.

We would like to thank all the faculty members of the Department of Computer Science and Engineering for their direct or indirect support and also all the lab technicians for their valuable suggestions and providing excellent opportunities in completion of this report.

**T.U.S.S.N.L Durga Devi (21341A05I2)**  
**Pichchika Balaji (21341A05D9)**  
**Yegireddi Eswari (21341A05J7)**  
**Gadi Jagadeesh (22345A0519)**  
**Rajana Prasad (22345A0517)**

# ABSTRACT

Oral diseases often go undetected, leading to serious health implications. In this research, we propose an intelligent machine for oral disease detection using teeth images. Our approach aims to utilize a hybrid methodology combining EfficientNet for feature extraction and CBAM channel attention for classification. We employ a two-step process: first, extracting last layer features using EfficientNet, and then utilizing CBAM for classification. The hybrid methodology enhances accuracy by leveraging feature extraction and attention mechanisms. We incorporate machine learning algorithms, specifically XGBoost, for symptom-based disease classification and precaution recommendation. The proposed intelligent machine offers a rapid and accurate method for oral disease detection. By utilizing teeth images and machine learning techniques, it facilitates early diagnosis and preventive measures. The integration of hybrid methodology significantly improves disease classification accuracy compared to individual model training. Our hybrid model achieves superior accuracy in oral disease classification, outperforming individual model training. The web platform successfully classifies uploaded images into the five disease classes and provides relevant precautions for disease prevention. The proposed intelligent machine demonstrates promising results in oral disease detection using teeth images. By leveraging hybrid methodology and machine learning algorithms, it offers a valuable tool for healthcare professionals and individuals alike in combating oral diseases.

**KEYWORDS:** Healthcare, Dentistry, Classification, Image analysis, oral diseases, Deep learning, Hybrid methodology.

# TABLE OF CONTENTS

<b>ACKNOWLEDGEMENT</b>	<b>iii</b>
<b>ABSTRACT</b>	<b>iv</b>
<b>LIST OF TABLES</b>	<b>viii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>LIST OF EQUATIONS</b>	<b>xi</b>
<b>LIST OF SYMBOLS &amp; ABBREVIATIONS</b>	<b>xii</b>
<b>1. INTRODUCTION</b>	<b>1</b>
1.1. Gingivitis	
1.2. Mouth Ulcer	
1.3. Data caries	
1.4. Tooth Discoloration	
1.5. Major Challenges	
1.6. Solutions to challenges	
1.7. Overview of dataset	
1.7.1. Image Sources	
<b>2. LITERATURE SURVEY</b>	<b>6</b>
<b>3. REQUIREMENTS SPECIFICATION</b>	<b>21</b>
3.1. Functional Requirements	
3.1.1. User Authentication and Authorization	
3.1.2. Oral Disease Classification using Images	
3.1.3. Oral Disease Classification using Symptoms	
3.1.4. Data Management	
3.1.5. Reporting and Visualization	
3.1.6. Notifications and Alerts	
3.2. Non-Functional Requirements	
3.2.1. Performance	

3.2.2. Usability	
3.2.3. Security	
3.2.4. Scalability	
3.2.5. Reliability	
3.3. Technical Requirements	
3.3.1. Technology Stack	
3.3.2. Database	
3.3.3. Integration	
3.3.4. Testing and Validation	
3.3.5. Deployment and Maintenance	
<b>4. SYSTEM ANALYSIS AND DESIGN</b>	<b>24</b>
4.1. Use case diagram for Oral Disease Classification	
4.2. Architecture of proposed model	
4.2.1. Initial Phase	
4.2.2. Phase 1	
4.2.3. Phase 2	
4.2.4. Phase 3	
4.2.5. Phase 4	
4.2.6. Phase 5	
4.2.7. Output Phase	
<b>5. IMPLEMENTATION</b>	<b>33</b>
5.1. Dataset Preparation	
5.2. Data Augmentation	
5.3. Data Pre-processing	
5.4. Model Training	
5.4.1. EfficientNet	
5.4.2. CBAM- Channel Attention	
5.4.3. Hybrid Model	

5.5. Model Evaluation	
5.5.1. Accuracy	
5.5.2. Precision	
5.5.3. Recall	
5.6. Implementation code	
5.6.1. Displaying the class labels	
5.6.2. Loading images and preprocessing	
5.6.3. Import necessary libraries	
5.6.4. Preprocessing the data	
5.6.5. Model for feature extraction is EfficientNet	
5.6.6. Model for classification is CBAM	
5.6.7. Compiling the model	
5.6.8. Training the model	
5.6.9. Testing the model	
5.6.10. Random Prediction	
<b>6. RESULTS AND DISCUSSION</b>	<b>49</b>
6.1. Website pictures	
6.2. Discussion	
<b>7. CONCLUSION AND FUTURE SCOPE</b>	<b>53</b>
<b>REFERENCES</b>	<b>54</b>

## LIST OF TABLES

Table No	Title	Page No
1	Literature Survey Table	13-20
2	Values of Metrics	40
3	Comparison of different Models	49



# LIST OF FIGURES

Figure No	Page No
<b>1. INTRODUCTION</b>	
1.1Gingivitis Disease	2
1.2 Mouth Ulcer	3
1.3 Data Caries	3
1.4 Tooth Discoloration	4
1.5 Images of Dataset	5
<b>2. LITERATURE SURVEY</b>	
2.1 Algorithm and Accuracy	11
2.2 No. of Papers Graph	12
<b>4. SYSTEM ANALYSIS AND DESIGN</b>	
4.1 Use case Diagram	24
4.2 Architecture of Initial Phase	24
4.3 Architecture of Phase 1	25
4.4 Architecture of Phase 2	26
4.5 Architecture of Phase 3	27
4.6 Architecture of Phase 4	28
4.7 Architecture of Phase 5	29
4.8 Architecture of Output Phase	30
4.9 Model Architecture	31
4.10 Existing Methodology	32
4.11 Proposed Methodology	32
<b>5. METHODOLOGY</b>	
5.1 Methodology diagram	33
5.2 Dataset before augmentation	34
5.3 Sample Augmented Images	34
5.4 Classes performed augmentation	35

<b>Figure No</b>	<b>Page No</b>
5.5 Dataset after augmentation	35
5.6 Explaining the EfficientNetB0 Architecture	37
5.7 Layer EfficientNetB0 architecture	37
5.8 CBAM architecture	39
5.9 CBAM channel attention	39
5.10 A graph Accuracy across	41
5.11 A graph Precision across	41
5.12 A graph Loss across	42
5.13 A graph Recall across	42
<b>6. RESULTS</b>	
6.1 Home Page	50
6.2 About page	50
6.3 Image Based Predication	51
6.4 Predication Result	51
6.5 Symptoms based prediction	52

## LIST OF EQUATIONS

Equation No	Page No
<b>5.5 MODEL EVALUATION</b>	
5.5.1 Accuracy	40
5.5.2 Precision	40
5.5.3 Recall	40

## **LIST OF SYMBOLS & ABBREVIATIONS**

CBAM	: Channel Attention Block Module
CAM	: Channel Attention Module
CNN	: Convolution Neural Network