# CLASSIFICATION OF DIGITAL DENTAL X-RAY IMAGES USING MACHINE LEARNING

Mrs. C. Prudhvini[1], K. Sanjay[2], Ch.Mrudula[3], G. Akhila[4], G.Adithya[5]
[1]Assistant Professor, Department of CSE
[2345] UG Students, Department Of CSE

chadaprudvini123@gmail.com, sanjayk21057@gmail.com, mrudula.ch1564@gmail.com, akhilareddy0525@gmail.com, adithyagajvelli@gmail.com

Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India

**Abstract:**

College Event Management System represents a comprehensive software solution designed to optimize and streamline the planning, organization, and management of events within college. This research project addresses the challenges encountered by academic institutions in coordinating and executing a diverse range of events, including conferences, seminars, cultural festivals, and sports tournaments, with a primary focus on enhancing efficiency, communication, and collaboration. The objective of this study is to explore the development and implementation of the College Event Management System, underscoring its potential to transform event management within educational institutions. By combining user insights, case studies, and in depth analysis. The findings underscore the importance of modernized event management tools in promoting student engagement, fostering effective communication, and facilitating the successful execution of events within the college environment. Ultimately, this research project aims to provide valuable insights for academic institutions seeking to optimize their event management processes, thereby enhancing the overall campus experience.

***Keywords:*** *Dental X-ray Classification, Machine Learning, Image Segmentation, Medical Imaging*

# 1.INTRODUCTION

Dental X-ray Classification, Machine Learning, Image Segmentation, Medical Imaging. The human tooth, a dense anatomical structure, is prone to decay due to multiple causes. Conditions like dental decay, periodontal disease, periapical abscess, impacted teeth, and others can be effectively identified through X-ray imaging. With the increasing complexity in diagnosing dental issues, digital image analysis has emerged as a critical aspect of modern dental healthcare. X-rays are a widely used imaging modality for visualizing hard tissues. Digital radiographic techniques utilize X-ray-sensitive plates or sensors to produce instant digital images. These advancements enhance diagnostic precision and support real-time clinical decisions. However, variations in resolution, contrast, and noise due to differences in imaging equipment can affect diagnostic accuracy. Hence, preprocessing steps such as contrast enhancement, noise reduction, and normalization are essential. Techniques like k-means clustering, histogram-based segmentation, and region-growing are employed for accurate identification of pathological features. The use of machine learning techniques significantly enhances segmentation and classification performance. Algorithms such as Support Vector Machines (SVM), Artificial Neural Networks (ANN), and K-Nearest Neighbors (KNN) have proven effective in medical image classification, including dental radiograph.

# 2.LITERATURE SURVEY

- **Wook Joo Park & Jun-Beom Park** – *History and Application of Artificial Neural Networks in Dentistry*: This study outlines the development of AI in healthcare, particularly the growing role of artificial neural networks in dental diagnostics, imaging, and decision support systems.
- **Pedro Henrique Marques Lira et al.** – *Dental X-Ray Image Segmentation Using Texture Recognition*: The paper proposes a supervised learning approach using Bayesian classifiers for teeth segmentation in panoramic X-rays, showing promising results for automating dental diagnosis.
- **Anuj Kumar et al.** – *Fuzzy Clustering with Level Set Segmentation for Detection of Dental Restoration Area*: Introduces a hybrid method combining fuzzy clustering and active contours to accurately identify dental restoration areas from X-rays, achieving over 98% accuracy.
- **Bethanney Janney** – *Classification and Detection of Skin Cancer Using Hybrid Texture Features*: Applies GLCM and ABCD features along with ANN for classifying skin lesions, offering a model with high precision in early skin cancer detection.

- **Bethanney Janney** – *Analysis of Skin Cancer Using K-Means and Hybrid Classification Model*: Proposes a hybrid Genetic Algorithm and ANN model for early skin cancer detection using LBP, GLCM, and color-based texture features, with improved segmentation and classification accuracy.

## 3. PROPOSED SYSTEM

This project introduces a machine learning-based model to classify digital dental X-ray images into categories based on dental conditions. The objective is to aid early diagnosis and support clinicians by automating part of the image interpretation process. A curated dataset of 500 X-ray images covering conditions such as vertical impaction, periapical abscess, caries, missed canals, and healthy teeth was compiled from hospitals and dental clinics. These images were split evenly for training and testing. Preprocessing steps included grayscale conversion, image resizing, and feature extraction. The extracted features were used to train models using SVM, KNN, and ANN classifiers. Python libraries such as scikit-learn and NumPy supported the implementation. The goal is to reduce diagnostic errors and enhance classification efficiency using AI tools in dental radiology.

## MODULES USED

**1. User Module**: Users register with personal credentials and upload X-ray images. The system processes these images and displays classification results, including segmented jaw regions.

**2. Admin Module**: The admin activates user accounts, monitors data uploads, and manages the training and testing sets.

**3. Data Preprocessing**: Uploaded images are standardized and enhanced to ensure uniformity in analysis. Techniques include noise filtering and contrast adjustment.

**4. Machine Learning Module**: Trained on 80% of the dataset, the module applies SVM, ANN, and KNN for accurate classification of unseen data. Results are visualized for user interpretation.

## ADVANTAGES OF PROPOSED SYSTEM

1.Support Vector Machine (SVM), Artificial Neural Network (ANN), and K-Nearest Neighbor (KNN) classification algorithms are used to determine whether there are pathological signs of dental diseases in the analyzed image.

2.Image-based medical diagnosis is made possible by allowing the user to upload a dental X
ray image to the model, which then predicts whether the person is affected by any dental abnormalities or infections.

## 4.ARCHITECTURE

The system architecture illustrates the workflow of a dental image classification platform involving both user and admin roles. Users begin by logging into the system and uploading dental X-ray images, which are then preprocessed to enhance image quality and remove noise. The processed data is analyzed to detect dental pathologies such as caries or jaw abnormalities. Users can then view the diagnostic results, including specific views like the lower jaw. Meanwhile, the admin has dedicated functions such as loading data, activating users, and monitoring user activities. This structured flow ensures accurate image analysis, efficient data handling, and a user-friendly interface for both users and administrators.

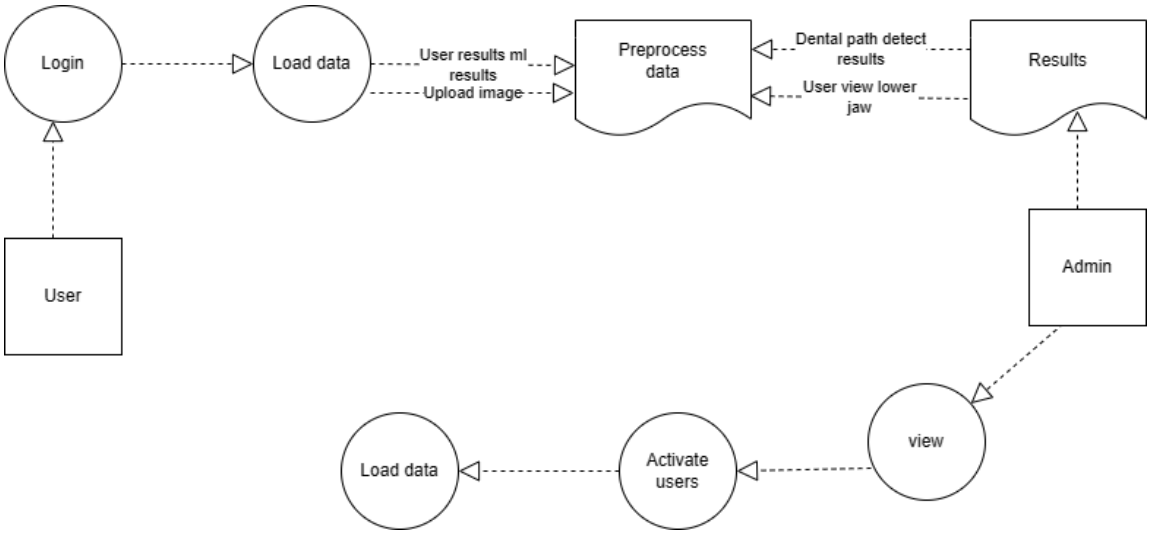



Fig 4.1 Architecture Diagram

# 5.OUTPUT SCREENS

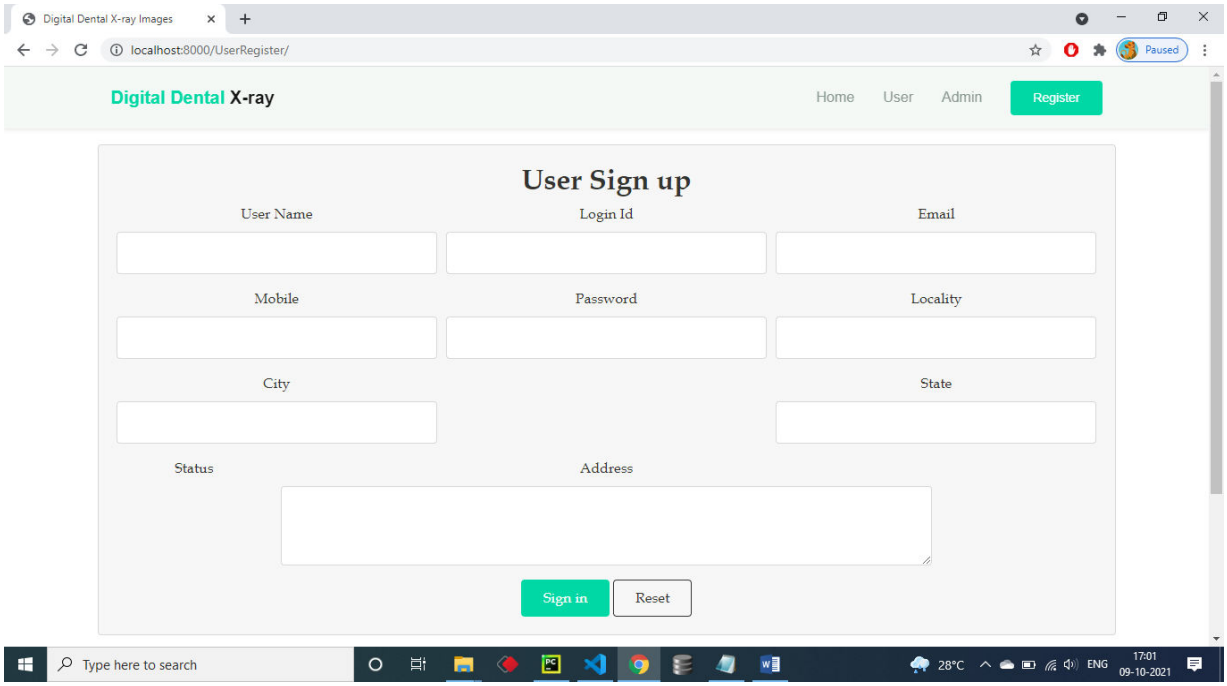



Fig 5.1:User registration

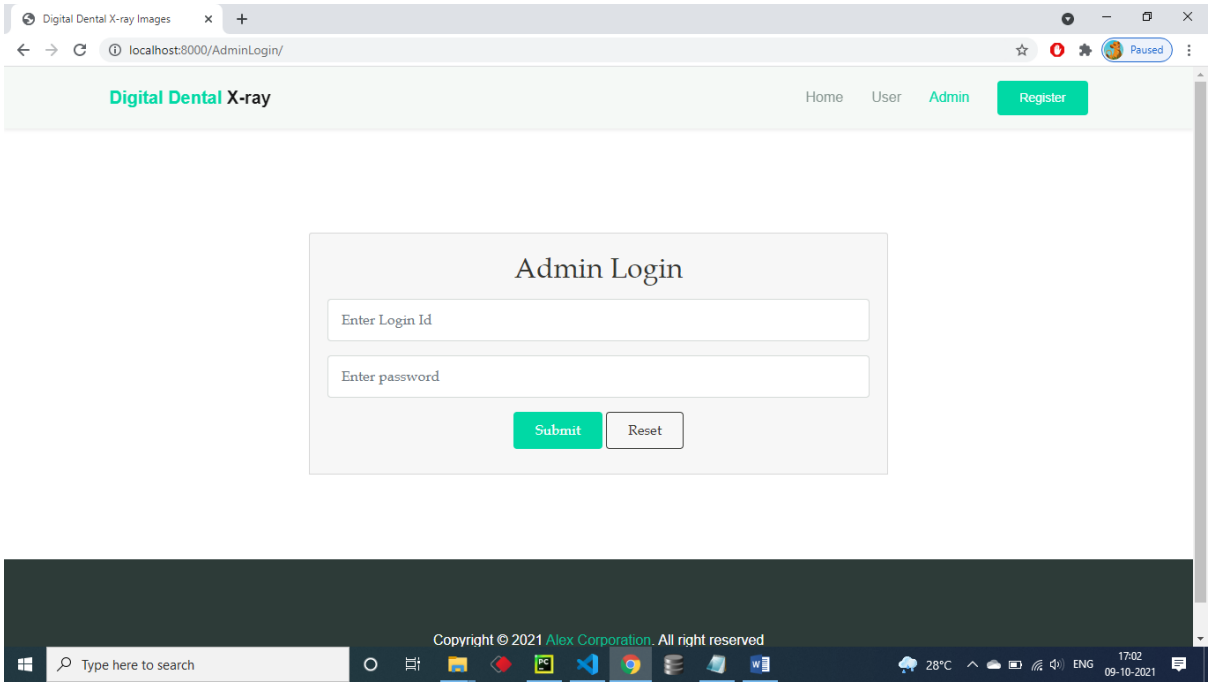



Fig 5.2: Admin login

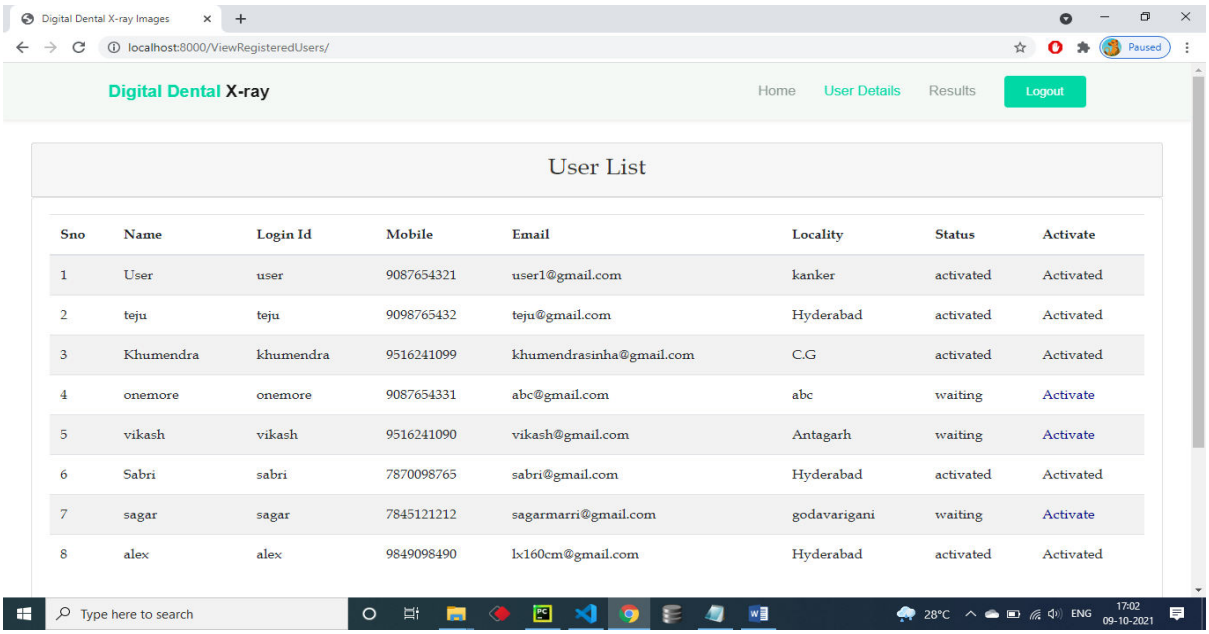



Fig 5.3: User details

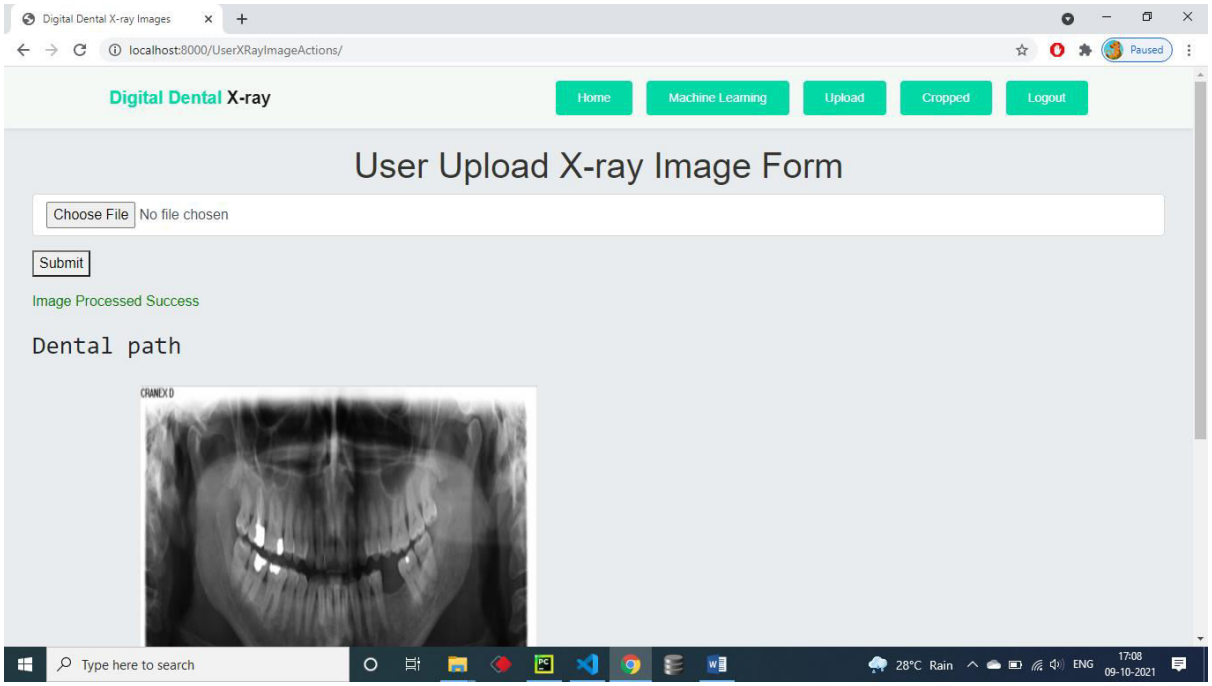



Fig 5.4: User image upload

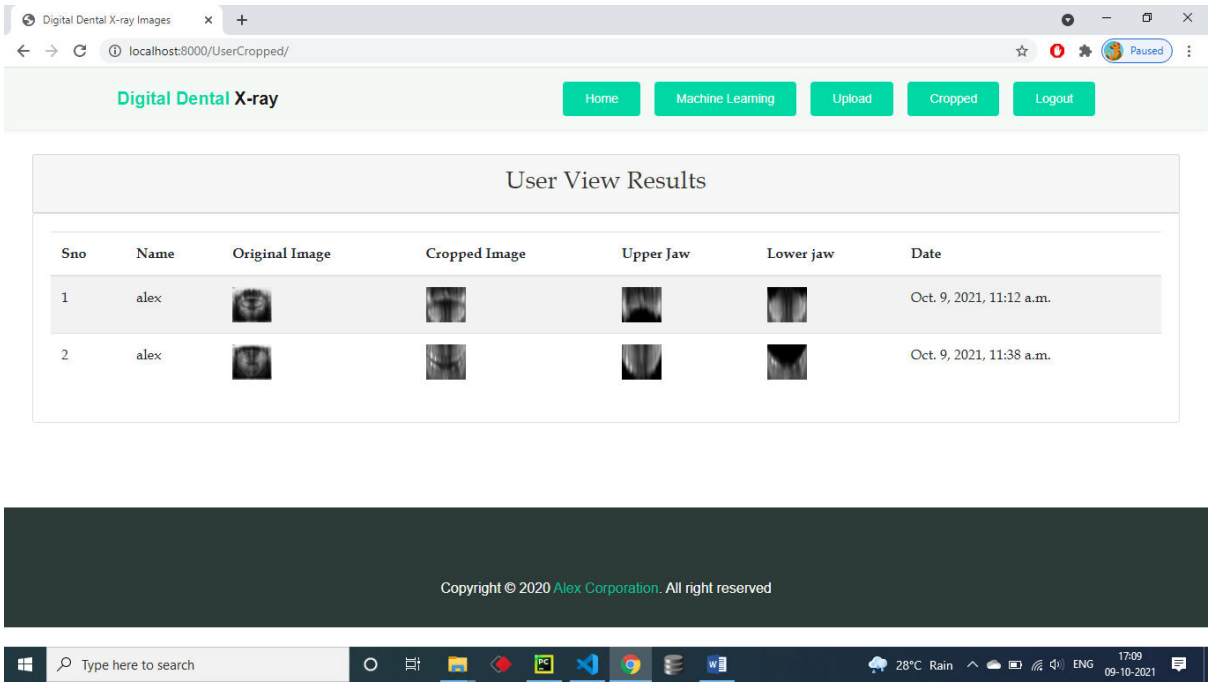
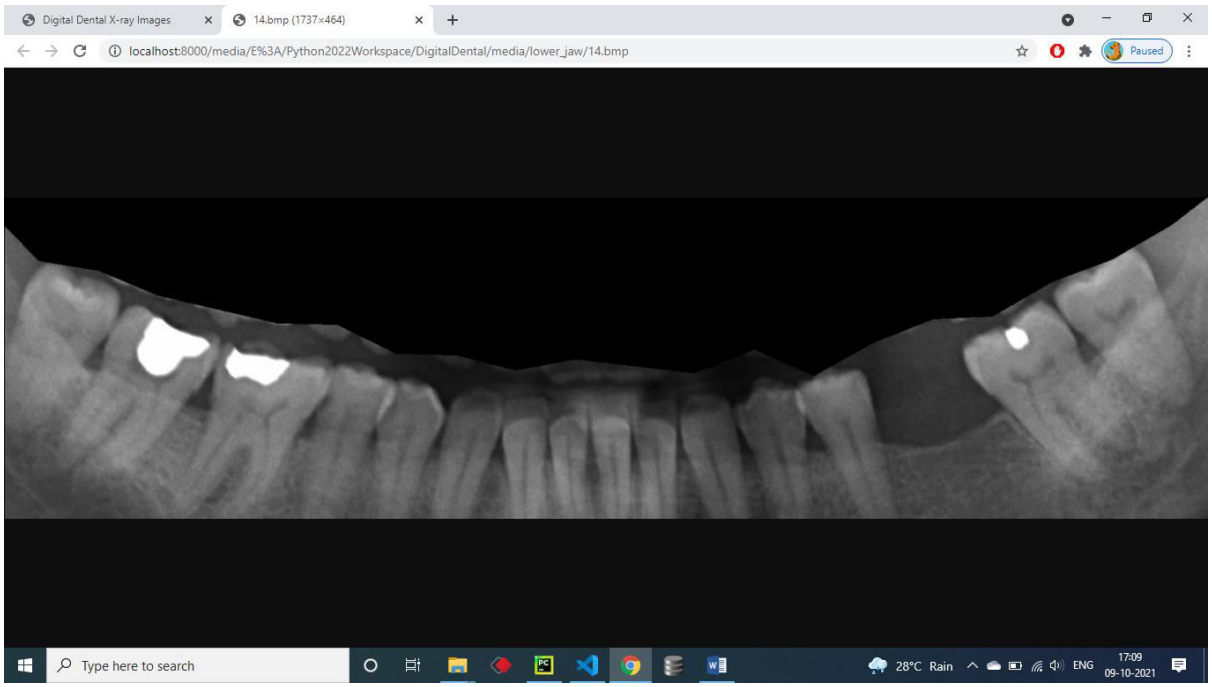



Fig 5.5: View results Fig




5.6:Classified Dental X-ray of the Lower Jaw

## 6. CONCLUSION

This study presents a machine learning-based approach for classifying dental X-ray images to identify conditions such as dental caries and other abnormalities. By extracting GLCM texture features and applying classification algorithms like SVM, KNN, and ANN, the system successfully distinguishes between healthy and affected teeth. The automated segmentation and classification process supports radiologists and dental professionals by providing faster, more consistent diagnoses. It serves as a reliable second opinion, enhancing the accuracy and efficiency of dental disease detection. Overall, the proposed system demonstrates the potential to reduce manual workload and improve early diagnosis in dental care.

## 7. FUTURE SCOPE

The proposed system for classifying dental X-ray images has strong potential for expansion in both functionality and application. In the future, the model can be integrated with advanced deep learning architectures like Convolutional Neural Networks (CNNs) to improve classification accuracy and robustness, particularly in detecting subtle anomalies in dental radiographs. Additionally, this system can be adapted to support real-time diagnostics in dental clinics, assisting practitioners in quick decision-making and reducing human error.

Beyond caries detection, the model can be extended to identify a wider range of dental conditions such as periodontal disease, bone loss, and impacted teeth. It may also be linked with electronic health records (EHR) to provide a more holistic view of the patient's oral health. With sufficient data and training, this system could evolve into a comprehensive diagnostic tool used not only in dentistry but also in broader medical imaging applications. Incorporating cloud-based deployment and mobile access can further enhance its usability and accessibility, especially in rural or under-resourced areas.

# 8. REFERENCES

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