

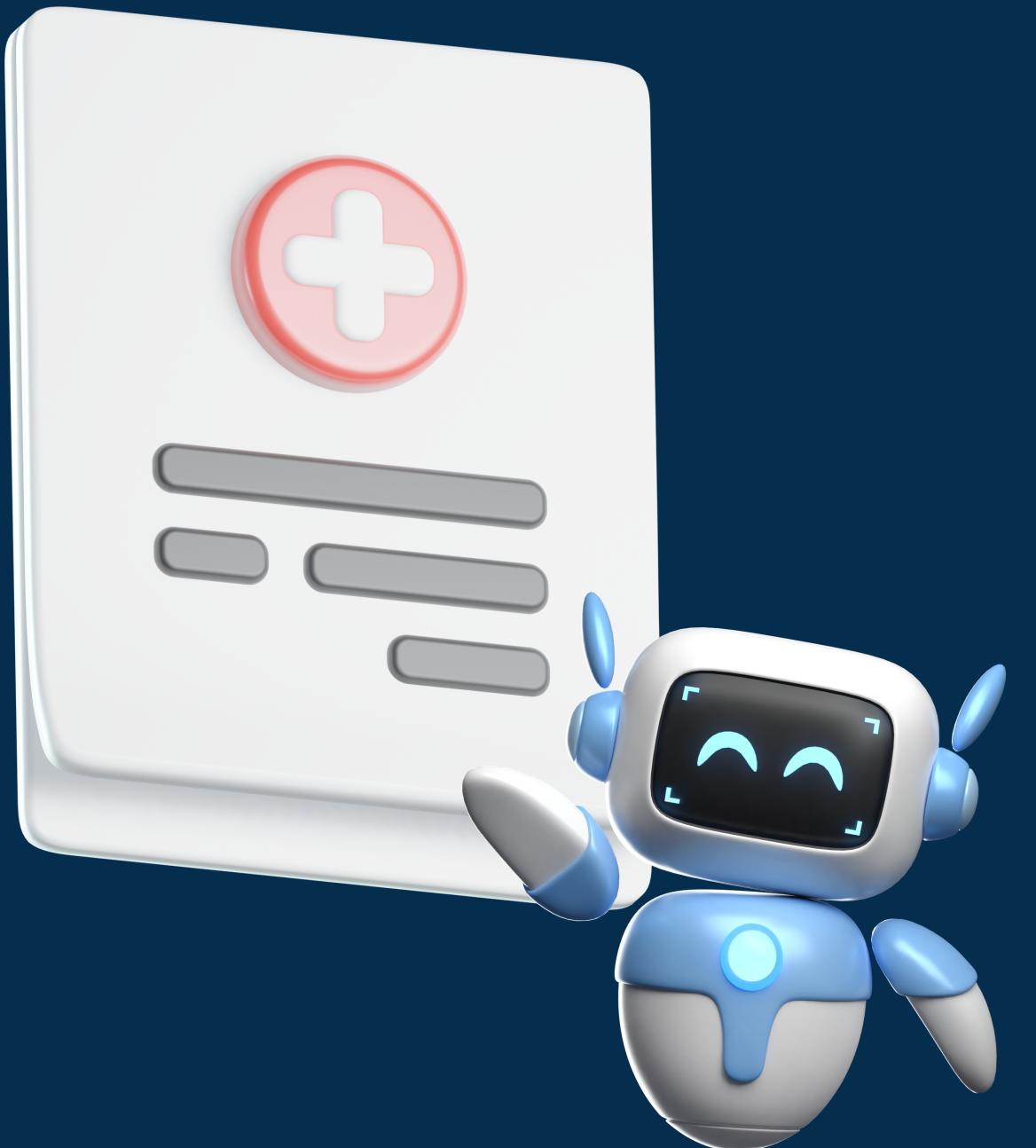
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DENTAL CAVITIES DETECTION APP

USING DEEP LEARNING MODEL

January 2024





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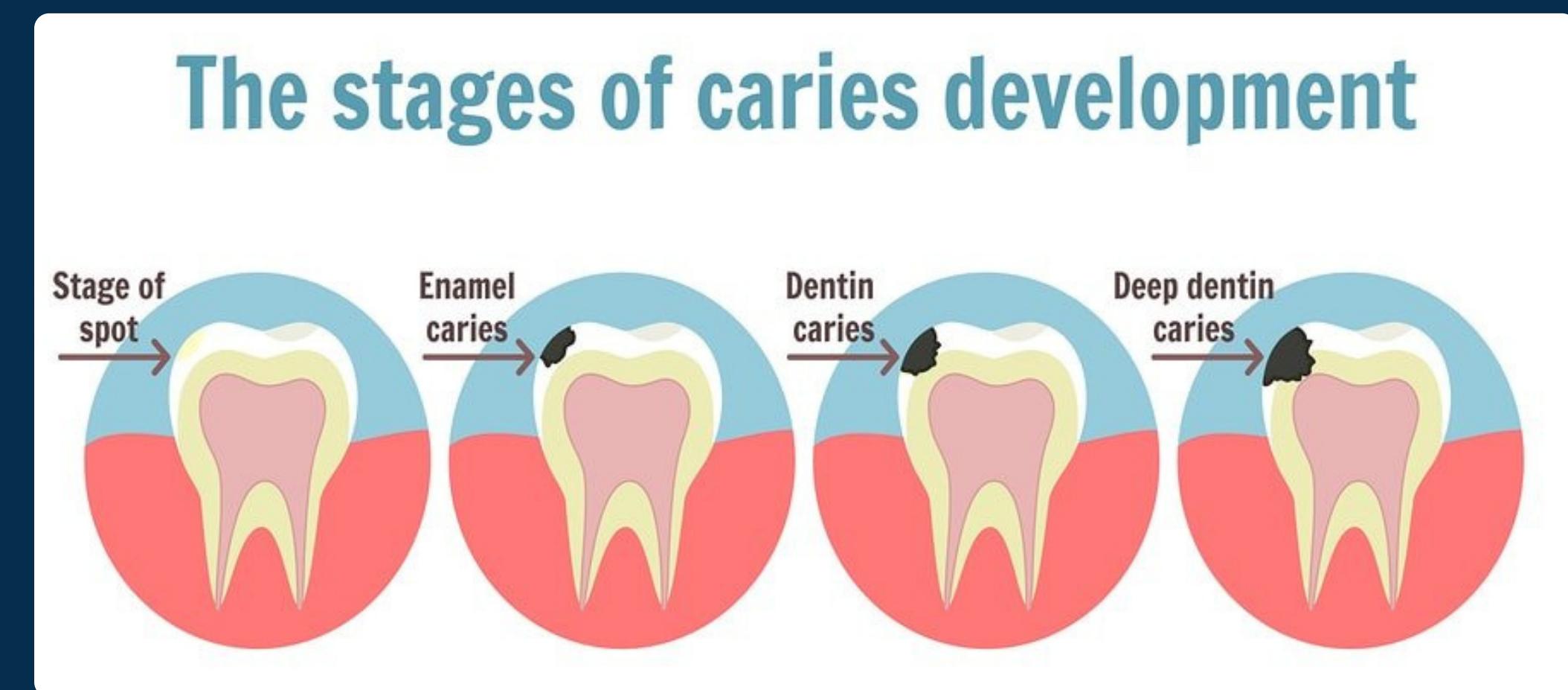
- ① INTRODUCTION
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INTRODUCTION

The 'DentXpert' app aims to provide patients with features like Caries Detection, Caries Report Access, Notifications, and Appointment Seeking.

The objective is to revolutionize dental care by enhancing patient engagement, early caries detection and enabling efficient dentist-patient interactions.



PROBLEM STATEMENT



The identification of dental caries, especially at an early stage, allows the preservation of healthy dental hard tissue. Detecting cavities early poses a significant challenge. Our aim is to develop a user-friendly system that seamlessly integrates advanced caries detection tool, along with easy appointment seeking.

OBJECTIVES

1. Early Caries Detection

by using accurate Deep Learning Model.



2. Enhanced Patient Engagement

by enabling patients to access dental reports, reminders, and caries detection tools.

3. Easy Appointment Access

by assisting patients in booking an appointment effortlessly and assisting dentists in managing appointments and accessing patient reports seamlessly.

METHODOLOGY

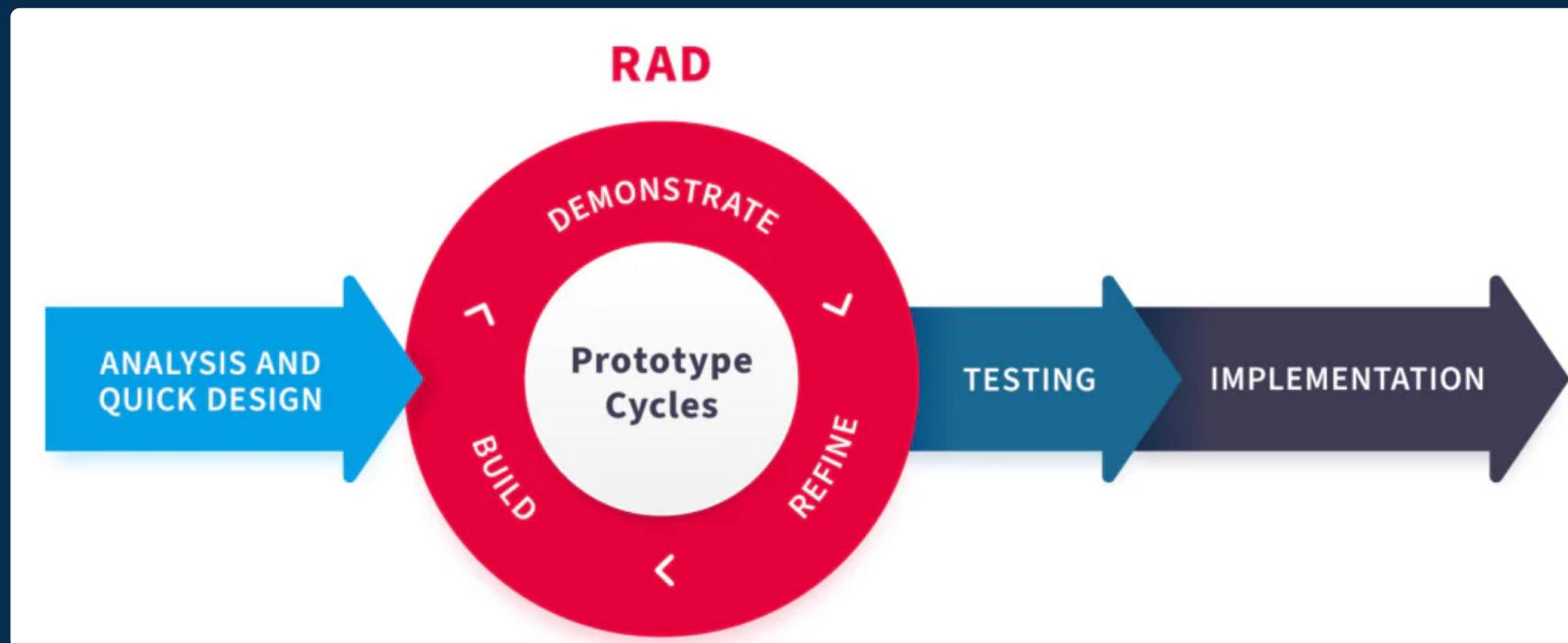
MODEL DEVELOPMENT

Annotate a comprehensive dataset to facilitate model training.

Develop a YOLOv8-based deep learning model for dental caries detection.

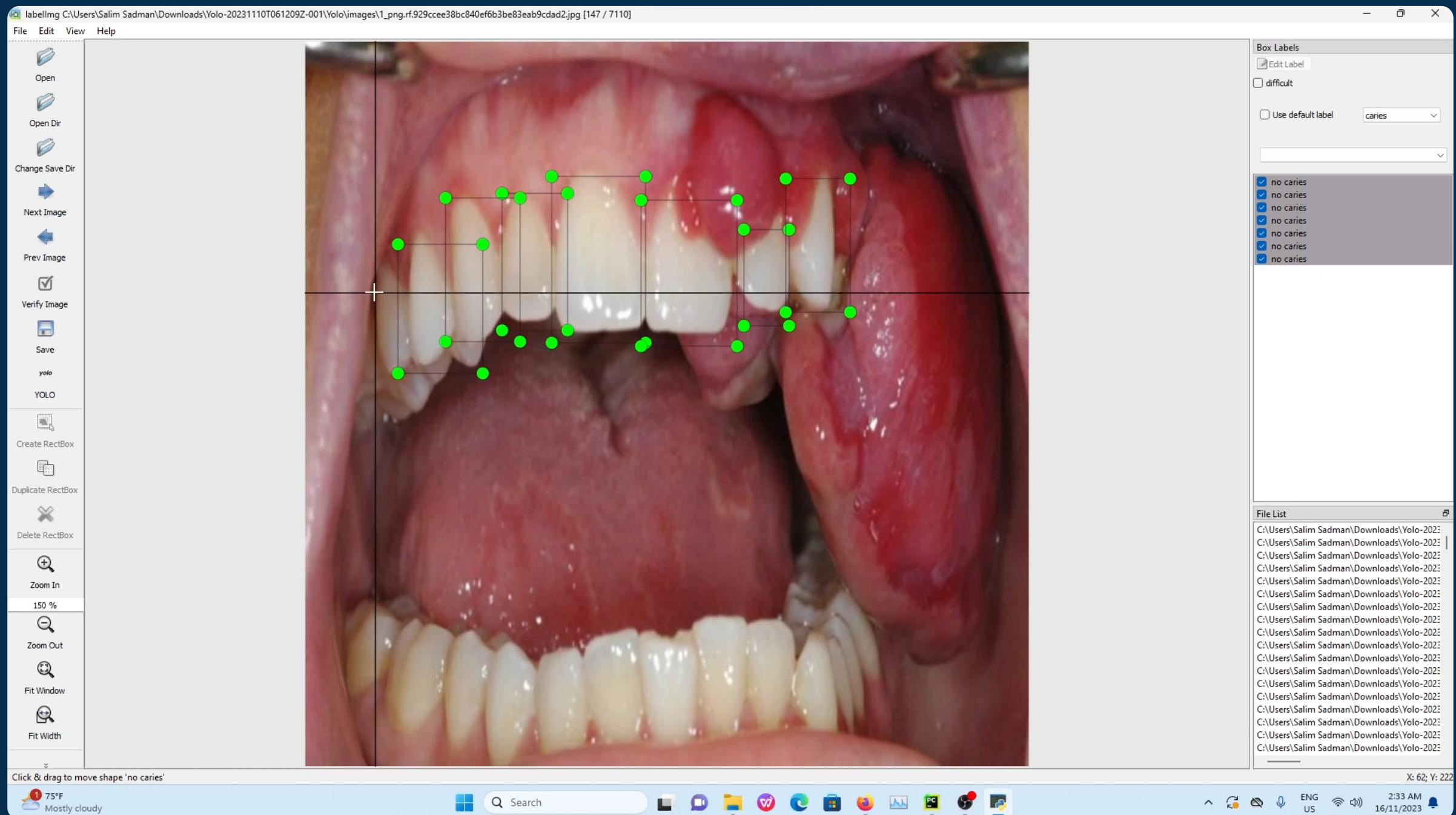
Deploy a test web service for real-time object detection in dental images.

APP DEVELOPMENT



MODEL DEVELOPMENT

LABELING IMAGES FROM DATASET



MODEL DEVELOPMENT

TRAINING THE MODEL

```
Downloading https://github.com/ultralytics/assets/releases/download/v0.0.0/yolov8x.pt to 'yolov8x.pt'...
100%|██████████| 131M/131M [01:29<00:00, 1.54MB/s]
Ultralytics YOLOv8.0.208 Python-3.11.5 torch-2.1.0 CUDA:0 (NVIDIA GeForce RTX 4060, 8188MiB)
engine\trainer: task=detect, mode=train, model=yolov8x.pt, data=customImage.yaml, epochs=50, patience=50, batch=16, imgsz=640, save=True, save_period=-1, cache=False, device=0, workers=8, project=None, name=train11, exist_ok=False, pretrained=True, optimizer=auto, verbose=True, seed=0, deterministic=True, single_cls=False, rect=False, cos_lr=False, close_mosaic=10, resume=False, amp=True, fraction=1.0, profile=False, freeze=None, overlap_mask=True, mask_ratio=4, dropout=0.0, val=True, split=val, save_json=False, conf=None, iou=0.7, max_det=300, half=False, dnn=False, plots=True, source=None, show=False, save_txt=False, save_conf=False, save_crop=False, show_labels=True, show_conf=True, vid_stride=1, stream_buffer=False, line_width=None, visualize=False, augment=False, agnostic_nms=False, classes=None, retina_masks=False, boxes=True, format=torchscript, keras=False, optimize=False, int8=False, dynamic=False, simplify=False, opset=None, workspace=4, nms=False, lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.005, warmup_epochs=3.0, warmup_momentum=0.8, warmup_bias_lr=0.1, box=7.5, cls=0.5, dfl=1.5, pose=12.0, kobj=1.0, label_smoothing=0.0, nbs=64, hsv_h=0.015, hsv_s=0.7, hsv_v=0.4, degrees=0.0, translate=0.1, scale=0.5, shear=0.0, perspective=0.0, flipud=0.0, fliplr=0.5, mosaic=1.0, mixup=0.0, copy_paste=0.0, cfg=None, tracker=botsort.yaml, save_dir=runs\detect\train11
Overriding model.yaml nc=80 with nc=2

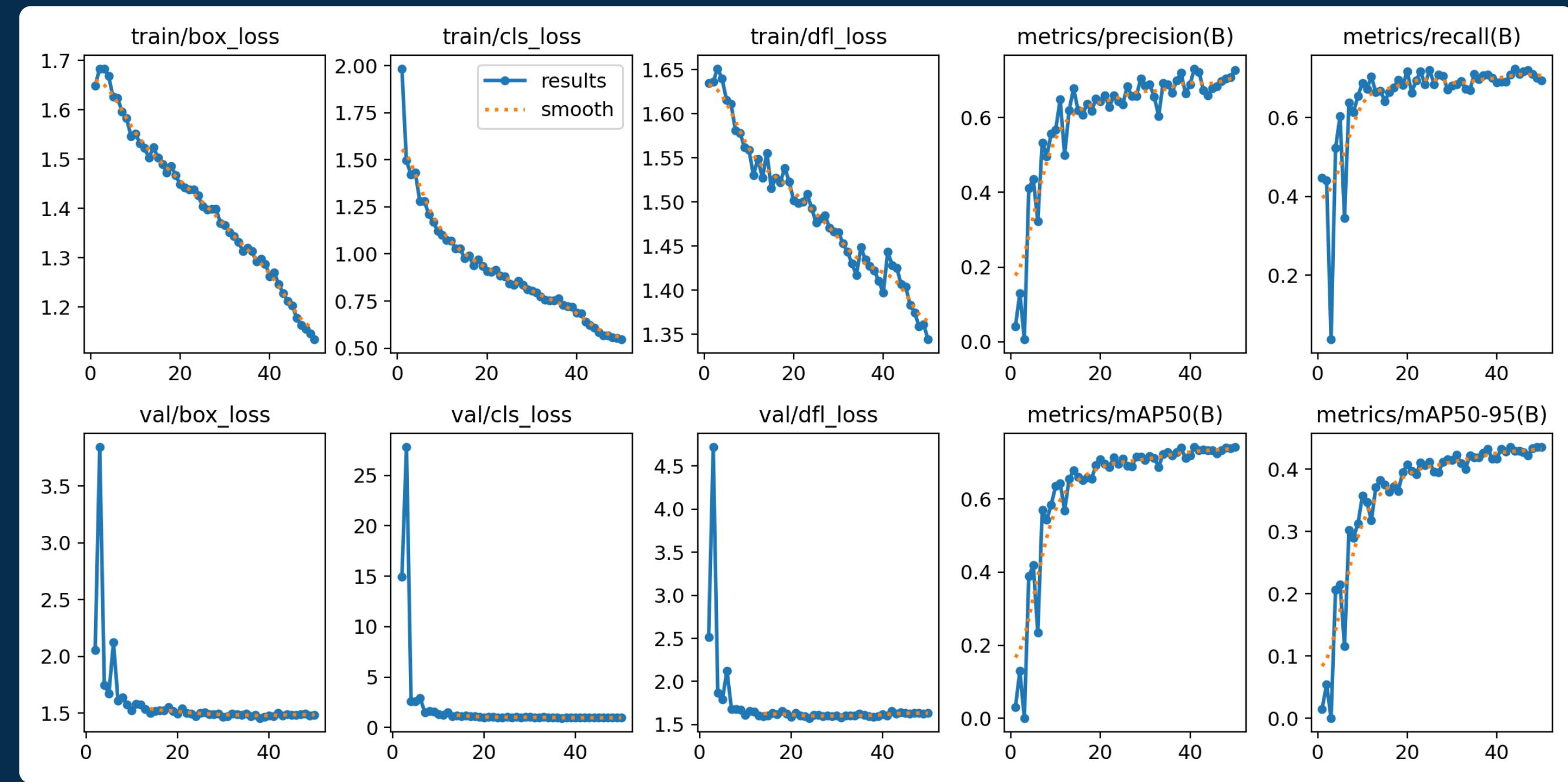
      from    n      params   module
0           -1    2320 ultralytics.nn.modules.conv.Conv
1           -1    115520 ultralytics.nn.modules.conv.Conv
2           -1    436800 ultralytics.nn.modules.block.C2f
3           -1    461440 ultralytics.nn.modules.conv.Conv
4           -1    3281920 ultralytics.nn.modules.block.C2f
5           -1    1844480 ultralytics.nn.modules.conv.Conv
6           -1    13117440 ultralytics.nn.modules.block.C2f
7           -1    3687680 ultralytics.nn.modules.conv.Conv
8           -1    6969600 ultralytics.nn.modules.block.C2f
9           -1    1025920 ultralytics.nn.modules.block.SPPF
10          -1     0 torch.nn.modules.upsampling.Upsample
11         [-1, 6]    1     0 ultralytics.nn.modules.conv.Concat
12          -1    7379200 ultralytics.nn.modules.block.C2f
13          -1     0 torch.nn.modules.upsampling.Upsample
14         [-1, 4]    1     0 ultralytics.nn.modules.conv.Concat
15          -1    1948800 ultralytics.nn.modules.block.C2f
16          -1    922240 ultralytics.nn.modules.conv.Conv
17        [-1, 12]    1     0 ultralytics.nn.modules.conv.Concat
18          -1    7174400 ultralytics.nn.modules.block.C2f
19          -1     1    3687680 ultralytics.nn.modules.conv.Conv
20        [-1, 9]    1     0 ultralytics.nn.modules.conv.Concat
21          -1    7379200 ultralytics.nn.modules.block.C2f
22      [15, 18, 21]    1   8719894 ultralytics.nn.modules.head.Detect
Model summary: 365 layers, 68154534 parameters, 68154518 gradients, 258.1 GFLOPs

Transferred 589/595 items from pretrained weights
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed
train: Scanning C:\Users\Salim Sadman\Downloads\Yolo-20231110T061209Z-001\Yolo\newModel\train\labels... 400 images, 0 b
train: New cache created: C:\Users\Salim Sadman\Downloads\Yolo-20231110T061209Z-001\Yolo\newModel\train\labels.cache
val: Scanning C:\Users\Salim Sadman\Downloads\Yolo-20231110T061209Z-001\Yolo\newModel\val\labels... 100 images, 0 backg
val: New cache created: C:\Users\Salim Sadman\Downloads\Yolo-20231110T061209Z-001\Yolo\newModel\val\labels.cache
Plotting labels to runs\detect\train11\labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'lr0' and 'momentum' automatically...
```

Activate Windows
Go to Settings to activate Windows.

MODEL DEVELOPMENT

RESULTS





MODEL DEVELOPMENT

MODEL PREDICTIONS / DEPLOYMENT



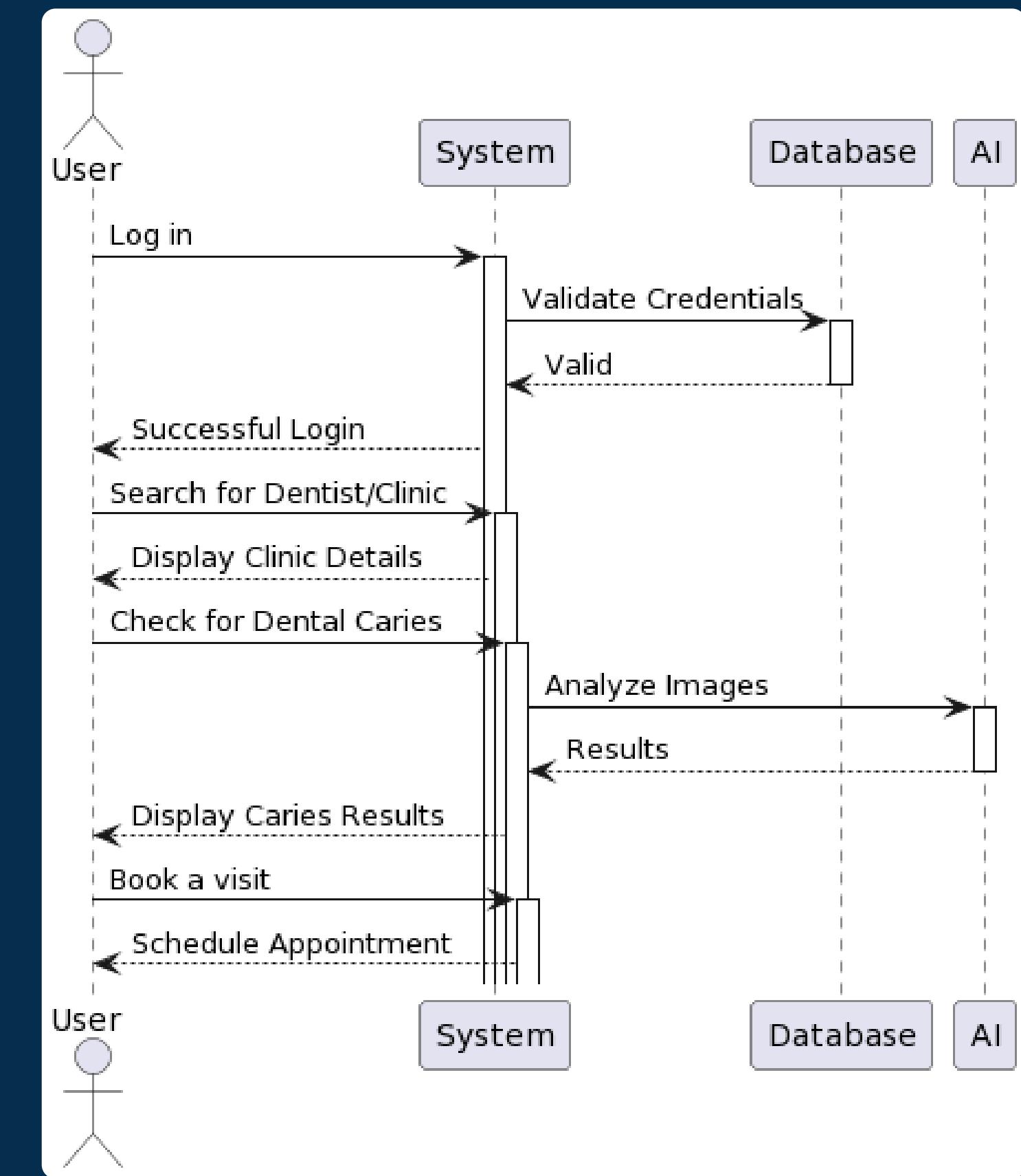
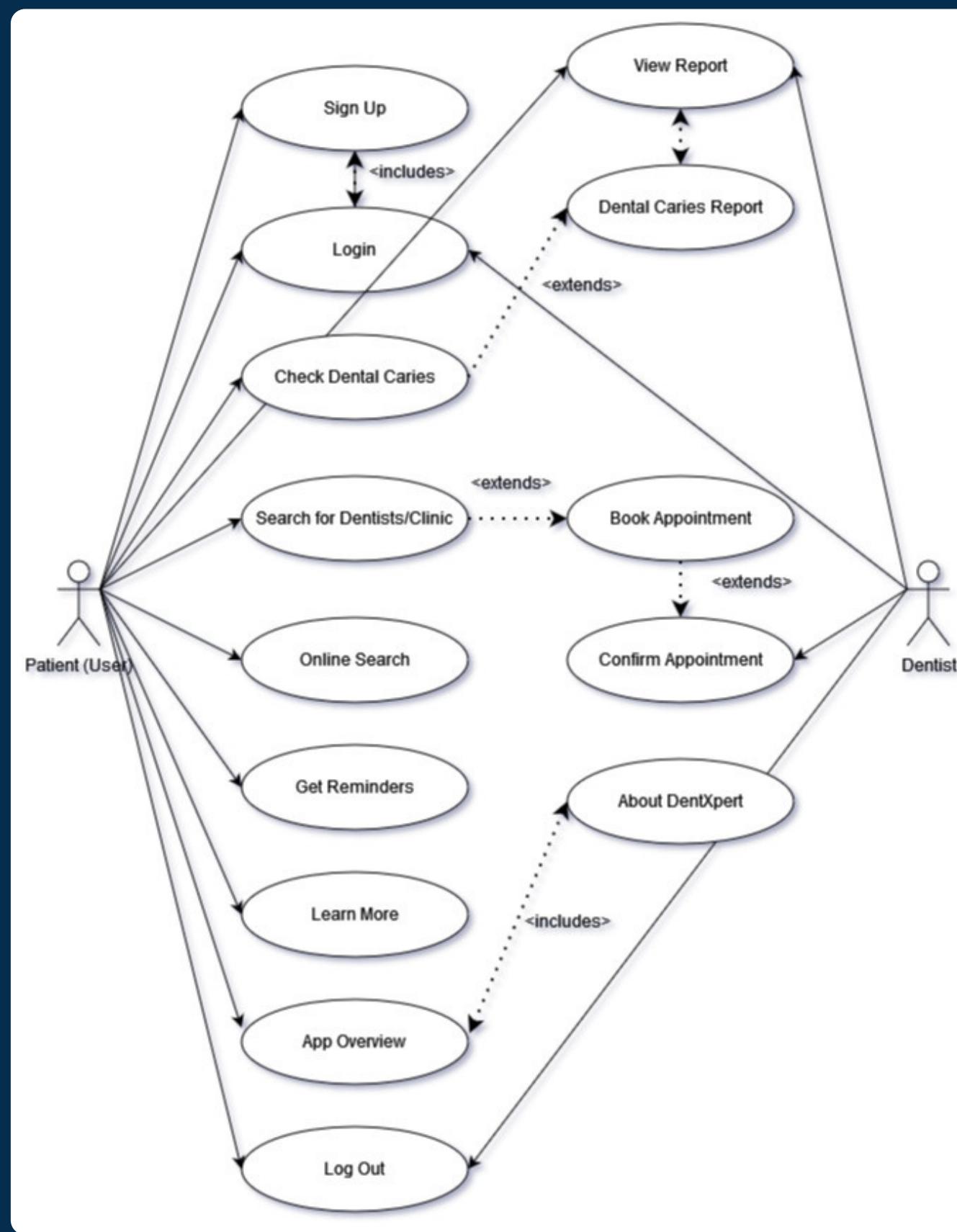
INPUT



OUTPUT



UML DIAGRAMS



UI PROTOTYPE

9:41

Menu

DENTXPERT

Email

Password

Log in as Patient

New Account?

Create new account

Facebook Login

Dentist Account?

Login/Sign Up as Dentist

9:41

Search

Hi, User

How can we help you today?

Check for Dental Caries

Search for Dentist/Clinic

Others

Dental Caries Report

Online Search

Reminders

Profile

Settings

9:41

< Check for Dental Caries

Please upload 5 images of your teeth taken from 5 different angles.

Yolo v8 Model 1

Yolo v8 Model 2

Yolo v8 Model 3

Select 5 Image(s) to Upload

Cancel Edit

Check Caries

9:41

<

Confirm Appointment!

Check your email and confirm your booking at X Dental Studio.

Check status

See all

Recommended

Learn how to perfectly clean your teeth

Video content

Watch



FINDINGS & FUTURE WORK

The dental caries detection app, built using a dataset of 7000+ labeled images, performed well with the YOLOv8 model. Training was done efficiently using Anaconda Navigator and PyCharm. The user-friendly UI, developed with RAD methodology, is prepared for practical use in healthcare. Expanding the dataset offers potential for further improvement.

Future enhancements will focus on refining model accuracy, improving the user interface, and integrating real-time data for better diagnosis.

**THANK YOU
FOR WATCHING**

