DENTAL VISION

Final Deep Learning Project Presentation

Dataset

Condition	Number of Images
Hypodontia	1251
Gingivitis	2349
Caries	2601
Mouth Ulcer	2806
Healthy	2680
Calculus	1296
Tooth Discoloration	2017

Dataset

- Kaggle: Oral Disease Dataset
- Kaggle: Healthy Tooth Dataset

Data Summary: Hypodontia & Calculus has less images comparing other classes

Models

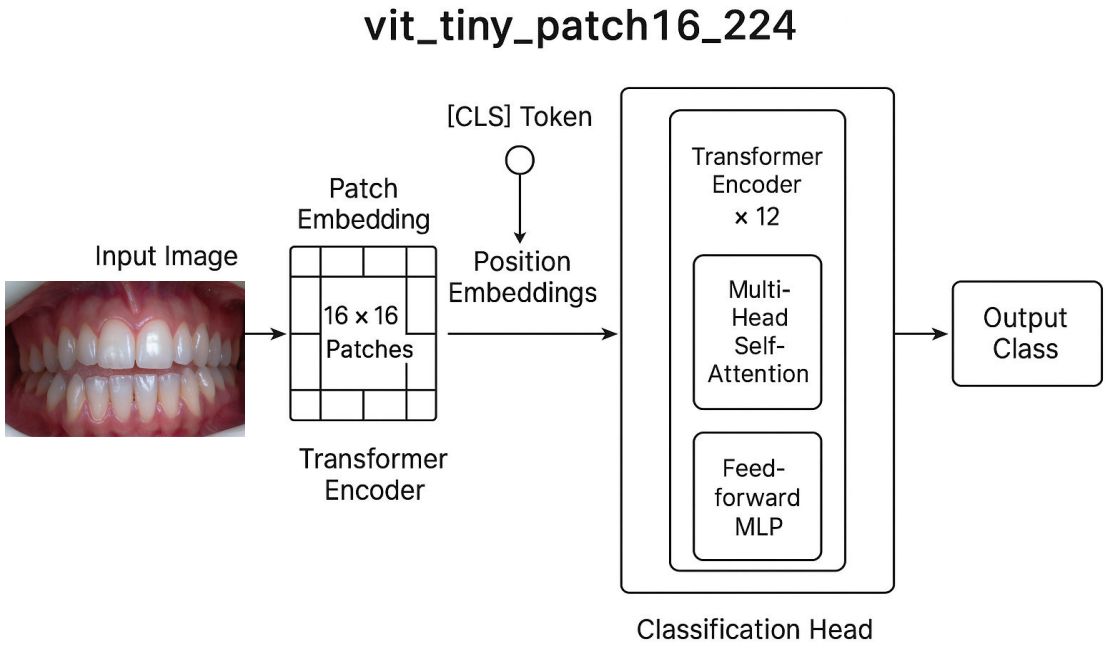
Trained 5 model

- Pre-Trained Vision Transformer
- CNN with Attention
- Efficient Net
- Vanilla CNN
- Vision Transformer

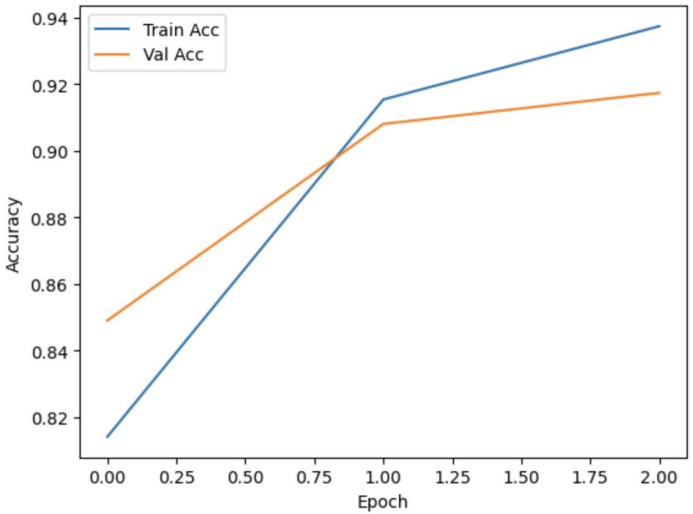
Image to Tensor

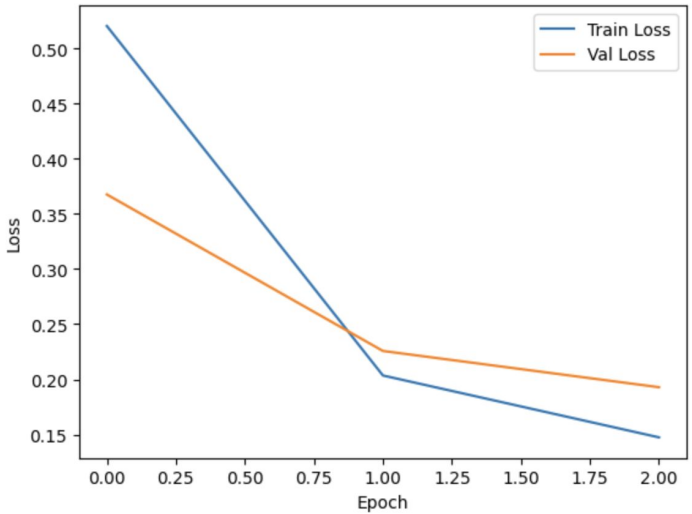
- Resize image to 224 x 224
- Scaling image from [0, 225] to [0, 1]
- Converting the image to a tensor of size [3 x 224 x 224]
- Normalizing each channel from [0, 1] to [-1, 1]

Pre-Trained ViT - Architecture



Pre-Trained ViT - Curves

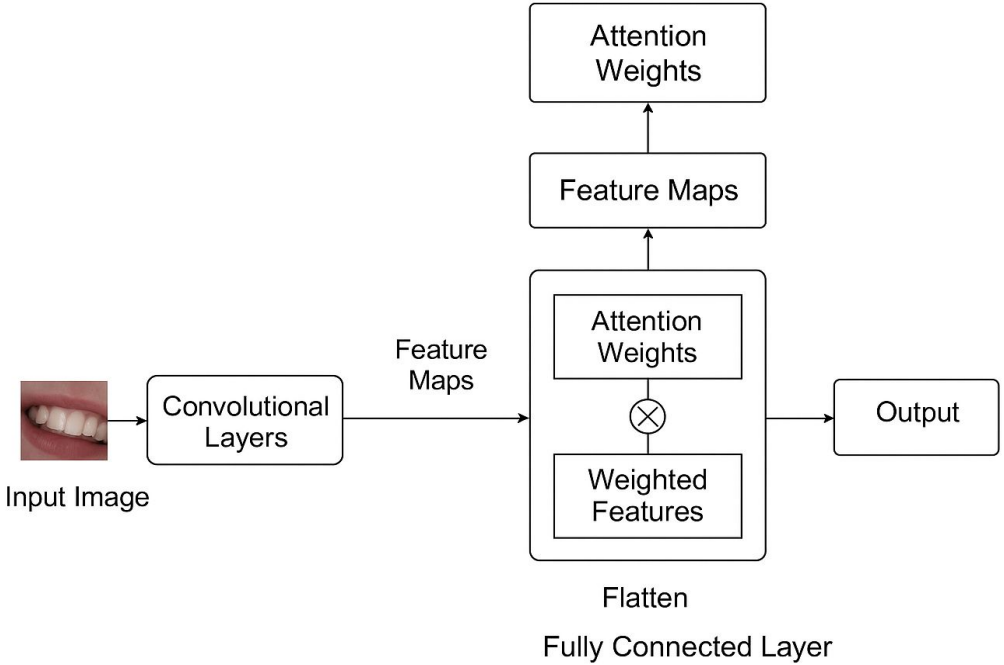




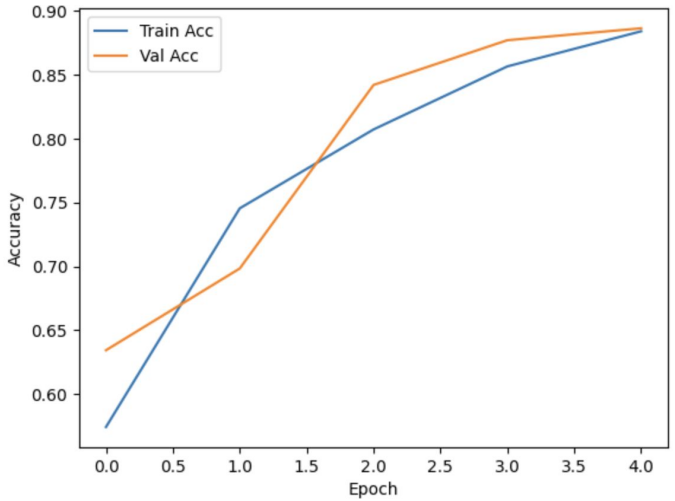
Pre-Trained ViT - Classification report

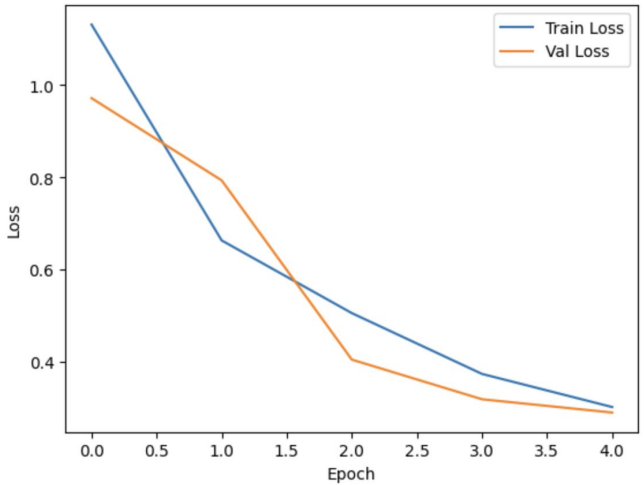
Condition	Precision	Recall	F1-Score
Calculus	0.93	0.32	0.48
Caries	0.98	0.95	0.96
Gingivitis	0.71	0.97	0.82
Hypodontia	0.97	0.95	0.96
Mouth Ulcer	0.99	1.00	1.00
Tooth Discoloration	0.96	0.96	0.96
Healthy	0.97	1.00	0.99

CNN + Attention Architecture



CNN + Attention - Curves

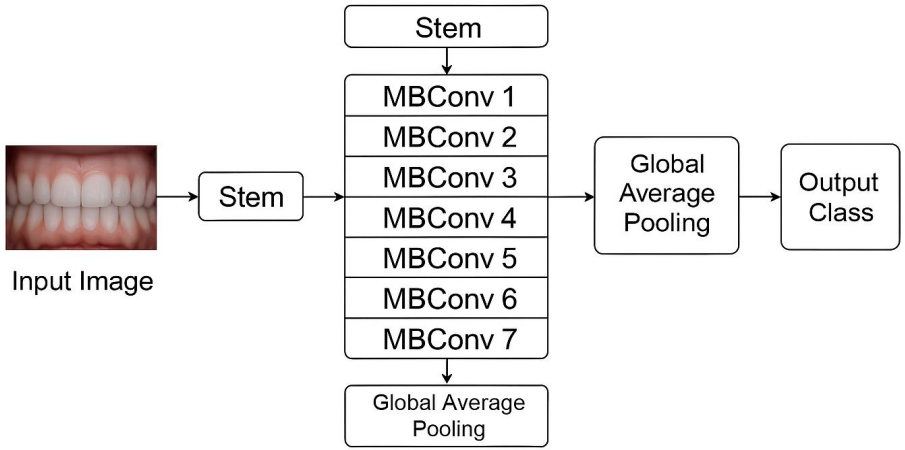




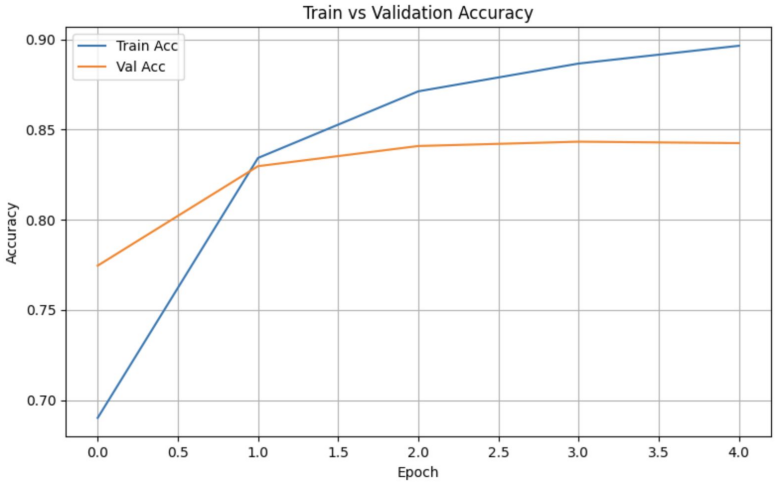
CNN + Attention - Classification Report

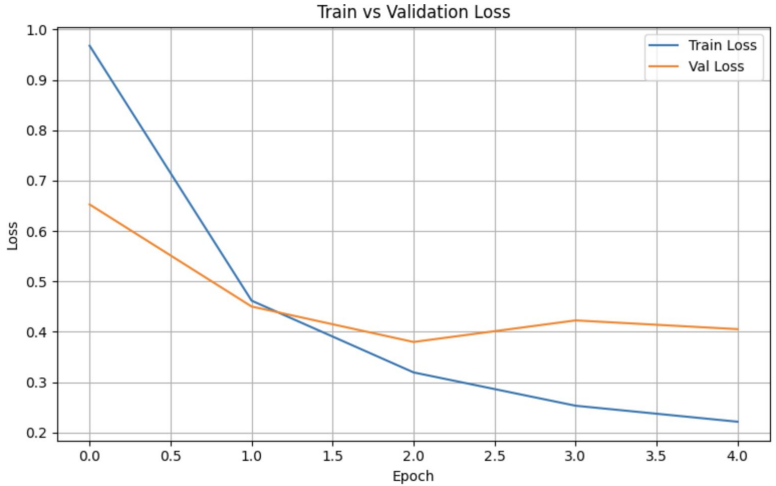
Condition	Precision	Recall	F1-Score
Calculus	0.66	0.53	0.59
Caries	0.88	0.89	0.88
Gingivitis	0.74	0.81	0.77
Hypodontia	0.94	0.90	0.92
Mouth Ulcer	0.94	0.97	0.96
Tooth Discoloration	0.89	0.90	0.90
Healthy	0.99	0.98	0.99

EfficientNet-B0 Architecture



EfficientNet-B0 curves

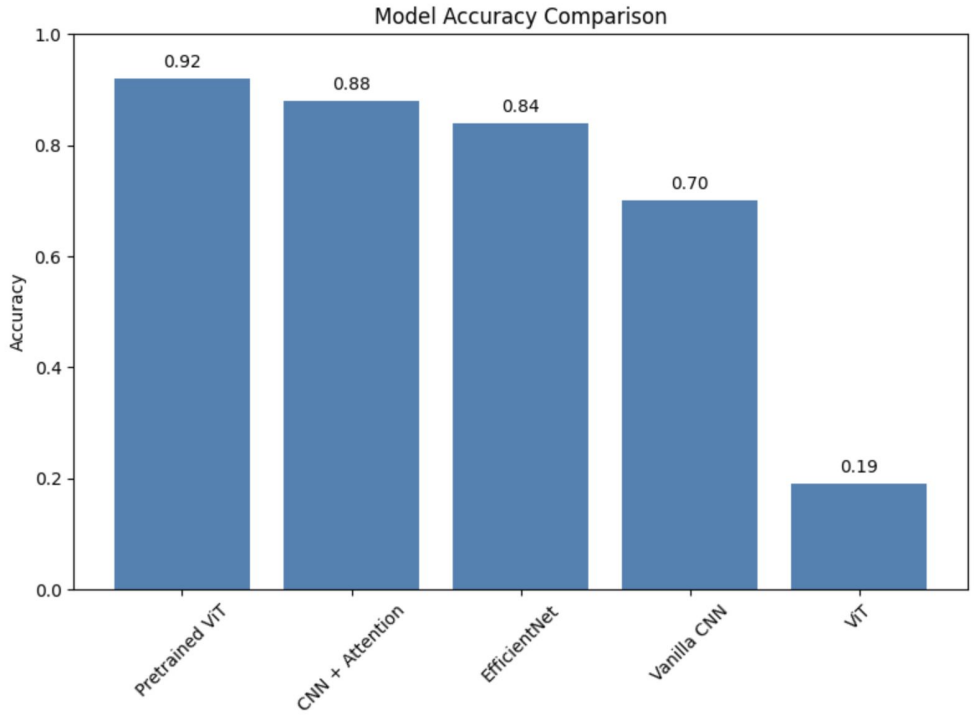




EfficientNet-B0

Condition	Precision	Recall	F1-Score
Calculus	0.66	0.68	0.67
Caries	0.89	0.73	0.80
Gingivitis	0.73	0.83	0.78
Healthy	1.00	0.56	0.72
Hypodontia	0.86	0.89	0.87
Tooth Discoloration	0.99	1.00	1.00
Ulcers	0.96	1.00	0.98

Model Accuracies



Limitations of Current Model

- Poor Performance on Phone-Captured images
- Limited Angle Diversity in Training Data
- Assumes Every Image as a Dental Image

Addressing these limitations through data augmentation, diverse healthy class examples can significantly improve real-world performance.

Demo

dentavision.onrender.com

Thank you !

Future Scope

- Multi-Label Classification using bounding box method
- Enhanced Healthy Class Representation
- Robustness to Edge Cases
  - Tooth with braces
  - images with lipstick
  - non-dental images
- Data Augmentation using GANs and Real-World Scenarios
- Deployment & Feedback Loop