Teeth Classification Using Deep Learning

Introduction

This project focuses on classifying different types of teeth conditions using a deep learning-based image classification model. The dataset contains images of various teeth conditions, which are categorized into multiple classes.

Dataset

- The dataset consists of images categorized into seven classes:
  - CaS
  - CoS
  - Gum
  - MC
  - OC
  - OLP
  - OT
- Data is split into:
  - Training Set
  - Validation Set
  - Testing Set
- Images are preprocessed and augmented to improve model performance.

Preprocessing

- Images are resized to (224, 224) pixels.
- Applied data augmentation techniques:
  - Rotation, Width/Height Shift, Shear, Zoom, Horizontal Flip.
- Normalization applied (rescale pixel values to [0,1]).

Model Architecture

The model is a Convolutional Neural Network (CNN) built using TensorFlow/Keras. It consists of:

1. Convolutional layers (32, 64, 128 filters)
2. MaxPooling layers to downsample feature maps
3. Batch Normalization for stability
4. Fully connected layers with ReLU activation
5. Softmax output layer with seven classes

Training & Evaluation

- The model is compiled with:
  - Optimizer: Adam
  - Loss Function: Categorical Crossentropy

    - Metrics: Accuracy
- Early stopping and learning rate reduction were applied to enhance training stability.
- Training involved 50 epochs with checkpointing for the best model.

Performance Analysis

- The model achieved:
    - **Test Accuracy:** 97.28%
    - **Test Loss:** 0.1191
- Confusion Matrix and Classification Report were generated to analyze misclassifications.
- Some misclassifications were found, possibly due to overlapping features in similar conditions.

Conclusion

The deep learning model successfully classifies teeth conditions with high accuracy. Future improvements may include:

- Expanding the dataset for better generalization.
- Using transfer learning with pre-trained models.
- Implementing advanced augmentation techniques.

References

- TensorFlow/Keras Documentation
- Machine Learning Research Papers on Image Classification