**Teeth Disease Classification with CNN and GUI**

**1. Introduction**

This project implements a **Convolutional Neural Network (CNN)** to classify dental images into seven disease categories: *CaS, CoS, Gum, MC, OC, OLP, OT*.  
To make the system user-friendly, a **Graphical User Interface (GUI)** was developed using **Tkinter** and **OpenCV**, allowing predictions from both static images and live camera input.

**2. Methodology**

**2.1 Dataset & Preprocessing**

* Dataset structured into **Training, Validation, and Testing** sets.
* **ImageDataGenerator** used for augmentation: rescaling, rotation, zooming, horizontal flips.
* Target size standardized to **128×128 RGB**.

**2.2 CNN Architecture**

The CNN was designed with the following layers:

* **Conv2D + Batch Normalization + MaxPooling** (progressively increasing filters: 32 → 64 → 128 → 256).
* **Flatten** + **Dense Layers (256, 128)** with **Dropout** for regularization.
* **Softmax Output** with 7 neurons (one per class).

**Optimizer:** Adam (lr=1e-4)  
**Loss Function:** Categorical Crossentropy  
**Callbacks:** EarlyStopping & ReduceLROnPlateau

**3. GUI System**

**3.1 Features**

* **Upload Image**: User selects a local image for prediction.
* **Live Camera**: Real-time classification with probability overlay.
* **Prediction Output**: Displays predicted class and confidence percentage.

**3.2 Technologies**

* **Tkinter**: GUI framework.
* **PIL (Pillow)**: Image rendering.
* **OpenCV**: Camera streaming and real-time prediction.

**4. Results**

* Training and validation accuracy improved through augmentation and dropout.
* GUI successfully integrates the trained model with real-time interaction.
* Example output: *“Class: Gum (87.3%)”* displayed on GUI and video stream.

**5. Conclusion**

This project demonstrates the integration of **deep learning with a modern GUI** for medical image classification.  
The system is extendable to:

* Larger and more balanced datasets.
* Deployment as a **desktop app or web app** for clinical use.