

# AI-Based Detection of Counterfeit Medicines

## Abstract:

The rise of counterfeit medicines poses a significant risk to public health worldwide. This project presents an AI-based approach to detect counterfeit medicines using computer vision techniques. A convolutional neural network (CNN)-based object detection model was trained on a dataset of medicine packaging images to distinguish between genuine and counterfeit products. The model achieved a mean Average Precision (mAP) of [Your Value]%, demonstrating its potential to assist in automated quality control and counterfeit detection in pharmaceutical supply chains.

## 1. Introduction

Counterfeit medicines cause severe harm by delivering ineffective or dangerous treatments to patients. Identifying counterfeit products using manual inspection is time-consuming and error-prone. This project aims to develop an automated AI-based counterfeit detection system using deep learning for image classification and object detection.

### Objectives:

- Collect and preprocess images of genuine and counterfeit medicines.
- Train a machine learning model capable of distinguishing counterfeit products.
- Evaluate the model's performance using industry-standard metrics.

## 2. Dataset

**Source:** Roboflow

The dataset contains [X] images, divided into training, validation, and testing sets. The images include different brands and packaging variations to improve model generalization.

### Data Preprocessing:

- Image resizing to [Size, e.g., 640×640]
- Data augmentation: rotation, flipping, brightness adjustments
- Labeling of regions containing medicine packaging

### 3. Methodology

**Model:** YOLOv8 (choose your version)

**Training Parameters:**

- Epochs: 50
- Batch Size: 16
- Learning Rate: 0.01
- Optimizer: AdamW

**Steps:**

- Load and preprocess dataset.
- Configure data.yaml with class names: ['genuine', 'counterfeit'].
- Train YOLO model on annotated data.
- Validate model and calculate performance metrics.

### 4. Results

**Performance Metrics:**

- mAP: **70.2%**
- Precision: **69.1%**
- Recall: **67.9%**

### 5. Conclusion

An AI-based counterfeit medicine detection system was developed and tested. The model achieved promising accuracy and can serve as a baseline for future pharmaceutical authentication tools.

### 6. Future Work

- Expand dataset with more brands and packaging designs.
- Integrate model into a mobile application for on-site verification.
- Use multimodal data (e.g., text, QR codes) to improve detection.