IEEE Baltimore Technical Colloquium, Baltimore, Maryland, United States, November 15, 2025

MediScan AI : A Computer Vision and Deep Learning-Based Application for Pharmaceutical Pill Recognition

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I. INTRODUCTION

This project presents a deep learning-based pill recognition system that uses Convolutional Neural Networks (CNNs) to identify pharmaceutical pills from images with over 90% accuracy. A Streamlit-powered web application operationalizes this model, enabling users, including pharmacists, patients, and supply chain professionals to verify pills in real time using uploaded images.

II. PROBLEM STATEMENT

Medication errors, dispensing the wrong drug, mislabeling, or misidentification, remain a major global safety concern. Despite safeguards like barcoding and electronic prescribing, errors persist, particularly in contexts involving polypharmacy, look-alike drugs, and fragmented supply chains. The World Health Organization estimates that 1 in 20 patients experiences medication-related harm, much of it preventable. Current safeguards do not extend to pill-level verification, creating a critical gap. Dispensing errors are not rare; studies suggest that 5–10% of prescriptions contain some form of error. The impact can be devastating, patients may experience adverse drug reactions, treatment failure, or even death. Hospitals face longer stays, costly readmissions, and litigation risks, while pharmacies and healthcare systems see erosion of patient trust. These risks are magnified for vulnerable populations such as the elderly, who often manage multiple prescriptions and are at higher risk of confusion or misidentification. In global supply chains, the risks extend beyond pharmacies. For example, during bulk distribution across borders, look-alike analgesics from different manufacturers may be repackaged or mislabeled, making it difficult to guarantee authenticity at the pill level. A single labeling error in a shipment can cascade through wholesalers, pharmacies, and patients, undetected until harm occurs.

III. SOLUTION

We developed a CNN-based recognition engine using EfficientNetB0, trained on a dataset of 10,020 pill images representing ten common medications. The model achieved 91.2% Top-1 and 98.2% Top-3 classification accuracy. The system analyzes visual features such as shape, color, and imprint, and returns the top three likely matches with confidence scores and drug metadata. A user-friendly Streamlit app enables interactive use for clinical or personal environments. This tool enhances medication safety, reduces human error, and supports global pharmacovigilance efforts.

Core Features:

- Upload pill images to receive Top-3 predictions with confidence scores.
- Integrated metadata includes drug name, active ingredient, and therapeutic application.
- Accessible via a lightweight, user-friendly Streamlit web application.

This tool enhances medication safety by reducing reliance on human verification, supporting pharmacists in high-pressure environments, and empowering patients to confirm their medications at home.

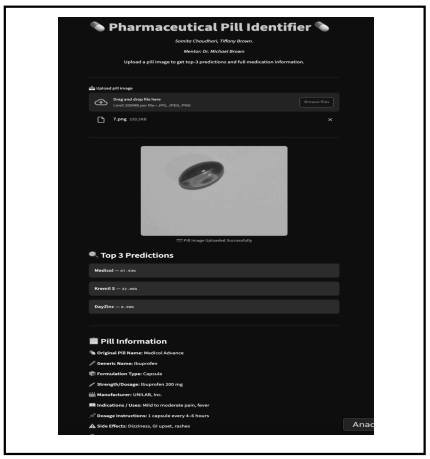

Fig. 1. Pill Recognition Output Displaying Top-3 Matches and Confidence Scores

IV. EQUIPMENT

- Electric Outlet
- Poster Board
- Internet Connection