Journal Homepage: www.ijarpr.com ISSN: 3049-0103 (Online)

International Journal of Advance Research Publication and Reviews

Vol 03, Issue 10, pp 51-56, October, 2026

RxScan: An AI-Powered OCR and Machine Learning Framework for Medicine Safety and Drug Interaction Analysis

Assistant Professor Smita Mangesh Junnarkar[1] ,Suhani Shukla[2]

Department of Data Science, SIES College of Arts, Science and Commerce (Empowered Autonomous), Sion (W), Mumbai, India
[1]smitaj@sies.edu.in [2]suhaniiiii.27@gmail.com

DOI : https://doi.org/10.5281/zenodo.23180952

ABSTRACT :

Medication safety is an important concern because users may have difficulty interpreting medicine labels, understanding side effects, identifying precautions, or recognizing possible interactions between medicines. This paper presents RxScan, an AI-powered medicine safety platform that combines Optical Character Recognition (OCR), a structured real-medicine dataset, and machine learning based safety analysis in a web-based application. The system allows a user to upload a photograph of a medicine strip, extracts the medicine name using OCR, and retrieves relevant information such as composition, uses, side effects, warnings, precautions, and dosage-related information from the medicine dataset. RxScan further provides a personalized safety-checking module in which user information such as age, gender, pregnancy status where applicable, medical conditions, allergies, and current medicines can be considered. An interaction module compares the identified medicine with existing medicines entered by the user and presents possible drug-drug interactions together with their severity and a simple explanation. The system also generates an understandable compatibility or safety score and can display suitable alternatives from the dataset with an appropriate medical disclaimer. The proposed framework is intended as an informational and decision-support tool and does not replace professional medical advice, diagnosis, or prescription.

Keywords: *RxScan, Optical Character Recognition, OCR, Medicine Safety, Drug Interaction, Machine Learning, Medicine Dataset, Personalized Healthcare.*

1. Introduction

Medicines are an essential part of healthcare, but their safe use requires correct identification and an understanding of relevant information. Users may encounter medicine strips whose text is difficult to read, may not know the purpose of a medicine, or may be unaware of precautions and possible interactions with medicines they are already taking. Searching for each piece of information separately can also make the process inconvenient.

Artificial intelligence and data-driven systems provide an opportunity to make medicine information more accessible. Optical Character Recognition (OCR) can convert text appearing on a medicine strip into machine-readable text. Once the medicine name is obtained, a structured dataset can be used to retrieve information about the medicine.

Machine learning and rule-based analysis can then be used to organize relevant safety information according to user-provided inputs.

RxScan is designed as a unified medicine safety platform following this approach. The primary identification workflow begins with an image of a medicine strip. OCR extracts the medicine name from the image, after which the application searches its medicine dataset and displays relevant medicine details. The system then allows the user to perform a personalized safety check and compare the identified medicine with medicines they are already taking.

The purpose of RxScan is not to make an independent clinical decision or provide a prescription. Instead, it aims to provide an understandable information layer that can help users identify medicines and become aware of possible safety considerations before consulting a qualified healthcare professional.

2. Problem Statement

Medicine-related information is often distributed across different sources. A user may need to separately determine the medicine name, its composition, uses, side effects, precautions, and possible interactions with other medicines. This becomes more challenging when the medicine name must first be read from a photograph of its packaging.

The problem addressed by RxScan is the development of a unified system that can extract a medicine name from a strip image, retrieve structured medicine information, consider relevant user-provided information, identify possible drug interactions, and present the resulting safety information through a simple web interface.

3. Objectives

The objectives of the proposed RxScan platform are:

1. To identify medicines from medicine-strip photographs using OCR.
2. To maintain and query a structured dataset containing real medicine information.
3. To provide medicine details including composition, uses, side effects, warnings, precautions, and dosage-related information where available.
4. To perform a personalized safety check using relevant user-provided information.
5. To compare an identified medicine with the user's current or regular medicines.
6. To detect and explain possible drug-drug interactions and indicate their severity or risk level.
7. To generate an easy-to-understand compatibility or safety score based on the available information.
8. To display possible alternatives where appropriate while clearly stating that changing medication requires professional advice.
9. To integrate the above functions into a modern, responsive, and user-friendly web application.

4. Literature Review

OCR has been widely studied as a method for extracting text from images and documents. Smith introduced Tesseract as an OCR engine capable of recognizing printed text and converting it into digital form [4]. Modern OCR systems can therefore be applied to medicine packaging where the medicine name is printed as text.

Deep learning has significantly improved the performance of image and pattern recognition systems. LeCun, Bengio, and Hinton discussed the broader development of deep learning and its applications to recognition tasks [3]. Although RxScan does not use pill-image classification in its current implementation, machine learning is incorporated at the safety-analysis level to process available medicine and user-related information.

Medication safety is also an established healthcare concern. The World Health Organization's Medication Without Harm initiative highlights the importance of reducing avoidable medication-related harm [1]. Drug databases such as DrugBank provide structured information about drugs and drug-drug interactions and demonstrate the usefulness of computationally accessible medicine information [5].

Existing systems often focus on a single task, such as OCR, medicine information retrieval, or interaction checking. RxScan combines these functions into one workflow: medicine-strip image processing, medicine-data retrieval, personalized safety analysis, interaction checking, and user-oriented result presentation.

5. Proposed RxScan Framework

5.1 Overview

RxScan consists of interconnected modules that transform a medicine-strip photograph into an informative safety report. The major components are:

1. Medicine-strip image input.
2. OCR-based medicine-name extraction.
3. Medicine dataset matching and information retrieval.
4. Personalized safety analysis.
5. Drug interaction checking.
6. Compatibility/safety scoring.
7. Alternative-medicine information.
8. Web-based results dashboard.

5.2 System Workflow

The primary workflow is:

Medicine Strip Image → OCR → Medicine Name → Medicine Dataset → Personalized Safety Analysis → Interaction Checking → Safety Score and Results

The user first uploads a medicine-strip photograph. The OCR component processes the image and extracts text. After cleaning and matching the extracted text, the application identifies the corresponding medicine record. The user can then provide additional information and current medicines. The system uses these inputs to identify relevant warnings and possible interactions and presents the results in a consolidated dashboard.

6. Methodology

6.1 Medicine Strip Image Input

The system accepts an image of a medicine strip captured or selected by the user. The quality of the input image affects OCR performance; therefore, the application is designed to process the image before extracting the medicine name.

6.2 OCR-Based Medicine Identification

OCR is the main identification mechanism in the current RxScan workflow. Text printed on the medicine strip is extracted from the uploaded image. The extracted text may contain additional words or formatting characters, so the system performs text cleaning and matching before searching the medicine dataset.

The final matched medicine name becomes the key used to retrieve the corresponding medicine record.

6.3 Medicine Dataset

RxScan uses a CSV-based dataset containing real medicine records. The dataset is structured so that additional records can be added later. The relevant attributes include:

- Medicine name
- Composition or active ingredients
- Uses
- Side effects
- Dosage-related information where available
- Warnings and precautions
- Drug interaction information
- Possible alternatives where applicable

The use of a structured dataset allows the application to retrieve medicine information consistently instead of relying on manually entered sample descriptions.

6.4 Personalized Safety Check

After medicine identification, the system collects relevant user information. Depending on the application workflow, the information may include age, gender, pregnancy status where applicable, existing medical conditions, allergies, and current or regular medicines.

The system evaluates the available medicine information against these inputs and highlights relevant safety considerations. The output includes a risk or safety indication, important warnings, possible side effects, and precautions.

6.5 Drug Interaction Analysis

The user can enter medicines that they are currently taking. RxScan compares these medicines with the identified medicine using the available interaction information.

If a possible interaction is found, the system presents:

- the medicines involved,
- the possible interaction,
- an indication of interaction severity or risk, and
- a simple explanation for the user.

This module is intended to improve awareness of potential interactions and does not replace a pharmacist or physician’s clinical assessment.

6.6 Compatibility and Safety Score

RxScan converts the available safety information into an easy-to-understand compatibility or safety score. The score is intended to summarize the identified risk factors rather than replace the underlying information.

To improve interpretability, the result is accompanied by the factors contributing to the score, such as detected interaction information, relevant warnings, or user-specific precautions. This prevents the score from being treated as a standalone medical decision.

6.7 Machine Learning-Based Risk Analysis

The proposed platform includes an ML-based risk or safety prediction component using available medicine and user-related features. The model is intended to support the organization and interpretation of risk information.

The application emphasizes understandable output rather than presenting complex model statistics to end users. Model performance should be reported only using measurements obtained from actual testing of the implemented model.

6.8 Alternative Medicines

Where suitable alternatives are available in the dataset, RxScan can display them as informational options. Alternatives are not presented as prescriptions. The interface clearly advises users to consult a qualified doctor or pharmacist before changing, stopping, or starting medication.

7. System Architecture

The logical architecture of RxScan is represented below:

User
↓
RxScan Web Interface
↓
Medicine Strip Image Upload
↓
OCR Processing
↓
Medicine Name Extraction and Matching
↓
Real Medicine Dataset / Database
↓
Personalized Safety Analysis
↓
Drug Interaction Analysis
↓
ML-Based Risk/Safety Analysis
↓
Safety Score + Warnings + Interactions + Alternatives

8. System Modules

8.1 Home Module

The Home page introduces RxScan, explains its purpose, provides access to the scanning workflow, and displays the medical safety disclaimer.

8.2 Scan Medicine Module

This module allows the user to upload a medicine-strip image. OCR is used to extract the medicine name, which is then matched with the medicine dataset.

8.3 Medicine Details Module

After identification, the application displays the medicine name, composition, uses, side effects, warnings, precautions, and other available information.

8.4 Safety Check Module

This module collects user information and presents a personalized safety/risk result, together with relevant warnings and the compatibility score.

8.5 Drug Interaction Module

This module accepts existing medicines and checks them against the identified medicine. Possible interactions and their severity are displayed in understandable language.

8.6 Results Dashboard

The dashboard consolidates the identified medicine, medicine details, safety score, risk level, warnings, interaction results, and alternatives into a single interface.

9. Implementation and Technologies

The current implementation follows a modular web architecture consisting of a responsive frontend, application/API logic, an OCR component, a medicine catalogue, and a safety-analysis component. Medicine-strip text is processed using **Tesseract.js** in the browser. The extracted text is cleaned and compared with the medicine catalogue using fuzzy matching so that minor OCR variations do not immediately prevent identification. The safety-analysis component uses a transparent **Decision Tree / CART-style** approach together with rule-based checks to organize user-specific safety information. The application presents the output as three understandable risk states—Safe, Caution, or Avoid—along with a compatibility score on a 0–100 scale.

The system is designed as a practical final-year Data Science project and can be extended without changing the overall workflow.

10. Results and Discussion

The implemented RxScan workflow demonstrates an end-to-end path from medicine-strip image input to medicine information and personalized safety output. The application supports OCR-based identification, medicine-record retrieval, user-profile based safety analysis, drug-interaction checking, compatibility scoring, warnings, and alternative-medicine information.

10.1 Descriptive Statistical Analysis

The current prototype contains a catalogue of more than 50 real medicines, three user-facing risk categories (Safe, Caution, and Avoid), and a compatibility score ranging from 0 to 100. These values describe the implemented system design and should not be interpreted as model-accuracy percentages. Formal performance statistics are reserved for labelled testing of OCR, medicine matching, safety classification, and interaction detection.

10.2 Performance Evaluation Framework

The prototype can be evaluated using labelled medicine-strip images and patient test cases. The main measures include OCR success/matching rate, medicine-matching accuracy, and classification measures such as accuracy, precision, recall, and F1-score.

Table 1: Quantitative Evaluation Measures

Module	Measure	Status
OCR	Correct extraction/match rate	Test required
Medicine matching	Accuracy	Test required
Safety classifier	Accuracy, Precision, Recall, F1	Test required
Interaction checker	Detection accuracy	Test required
End-to-end workflow	Successful complete cases	Test required

No fabricated performance values are reported. Once a labelled test set is available, the above measures can be calculated and included as numerical results.

11. Limitations

The current framework has several limitations. OCR performance can be affected by blurred photographs, reflections, unusual fonts, poor lighting, and partially visible medicine names. Medicine matching is dependent on the completeness and consistency of the dataset. Interaction and safety results are limited by the information encoded in the underlying data and rules. The ML-based component also requires appropriate training and validation data to provide reliable predictions.

The system should therefore be considered an informational tool and not an independent clinical decision-making system.

12. Future Scope

Future work can include expansion of the medicine dataset, improved OCR accuracy, multilingual medicine-strip recognition, integration with trusted and regularly updated medicine information sources, broader interaction coverage, and more comprehensive model validation. The platform can also be extended to support additional patient-specific factors and improved visualization of risk information.

Further research can evaluate the system using a larger set of medicine-strip images captured under different lighting and image-quality conditions. The ML component can also be compared with alternative classification and prediction techniques using appropriate evaluation metrics.

13. Conclusion

RxScan presents an integrated AI-powered framework for medicine identification and safety information using OCR, a real medicine dataset, personalized analysis, drug interaction checking, and machine learning. The system begins with a medicine-strip image, extracts the medicine name using OCR, retrieves structured medicine information, and then uses user-provided information and current medicines to highlight possible safety considerations.

The platform also provides an understandable compatibility or safety score and can display possible alternatives with an appropriate professional-advice disclaimer. By combining these functions into a single web application, RxScan provides a practical approach to organizing medicine information for users. The system is intended to support awareness and information access and should be used alongside guidance from qualified healthcare professionals.

Acknowledgment

The authors would like to express their sincere gratitude to the Department of Data Science, SIES College of Arts, Science and Commerce (Empowered Autonomous), Sion (W), Mumbai, and to Assistant Professor Smita Mangesh Junnarkar for her guidance and support throughout the project.

REFERENCES

[1] World Health Organization, “Medication Without Harm: WHO Global Patient Safety Challenge on Medication Safety,” World Health Organization, Geneva, 2017.
[2] World Health Organization, “Medication Safety in High-risk Situations,” World Health Organization, Geneva, 2019.
[3] Y. LeCun, Y. Bengio, and G. Hinton, “Deep learning,” Nature, vol. 521, pp. 436–444, 2015.
[4] R. Smith, “An overview of the Tesseract OCR engine,” in Proceedings of the Ninth International Conference on Document Analysis and Recognition (ICDAR), 2007, pp. 629–633.
[5] D. S. Wishart et al., “DrugBank 5.0: A major update to the DrugBank database for 2018,” Nucleic Acids Research, vol. 46, no. D1, pp. D1074–D1082, 2018.
[6] L. Breiman, J. H. Friedman, R. A. Olshen, and C. J. Stone, Classification and Regression Trees. Belmont, CA: Wadsworth International Group, 1984.
[7] World Health Organization, “Global Patient Safety Action Plan 2021–2030: Towards Eliminating Avoidable Harm in Health Care,” World Health Organization, Geneva, 2021.