Jaypee University of Information Technology
Department of Computer Science and Engineering and Information Technology

Major Project - I (18B19CI791) | AY 2025-26

Mid-Term Evaluation | Sept 29 – Oct 03, 2025.

DIGIMEDS : AN INTELLIGENT SYSTEM FOR DIGITIZING HANDWRITTEN MEDICAL PRESCRIPTIONS

Group No.: 74

Team Member (s)

- Somya Soni (221030329)
- Gracy Tomar (221030282)
- Arpit Verma (221030238)
- Yashit Rana (221030227)

Supervisor

- Name: Mr.Prateek Thakral
  Designation: Assistant Professor (Grade-II)

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Introduction

- Handwritten medical prescriptions are still a primary method of communication in India's healthcare system.
- Illegible or misinterpreted handwriting is a significant cause of preventable medical errors, leading to incorrect medication or dosages.
- Standard Optical Character Recognition (OCR) tools are ineffective as they struggle with the high variability of handwriting styles and are not trained on specialized medical terminology.
- This project proposes an intelligent system, DigiMeds, that uses Multimodal AI to accurately digitize these prescriptions, enhancing patient safety and efficiency.

Problem Statement

- Handwritten prescriptions are often inconsistent and difficult to read, creating a high risk of misinterpretation by both patients and pharmacists.
- This ambiguity can lead to serious health risks, including patients receiving the wrong medication, incorrect dosages, or facing treatment delays.
- Existing OCR systems are not equipped to handle the domain-specific abbreviations and complex medical terms found in prescriptions.
- The lack of a reliable digitization method is a major barrier to creating and maintaining modern **Electronic Health Records (EHRs),** hindering the progress of digital healthcare in India

Objective

- To design and implement an intelligent system for the end-to-end digitization of handwritten medical prescriptions.
- To leverage Computer Vision for robust recognition of diverse and cursive handwriting styles.
- To integrate Natural Language Processing (NLP) to accurately extract key entities like drug names, dosages, and instructions.
- To incorporate a medical knowledge base for the validation and correction of extracted information, reducing errors.
- To develop a user-friendly Flutter mobile application that serves as a proof-of-concept and provides real-world value to users.

RESEARCH PAPERS

S. No.	Author & Paper Title [Citation]	Journal/ Conference (Year)	Tools/ Techniques/ Dataset	Key Findings/ Results	Limitations/ Gaps Identified
1.	**Austin JA.** The effect of digitisation on the safe management of anticoagulants.[1]	AIDH Summit / UQ Report (2022)	EMR & eMMS; hospital prescribing data	Improved anticoagulant safety & adherence; depends on system design	Observational study; generalisability limited
2.	**Bedi S, Liu Y, Orr-Ewing L, et al**. Testing and evaluation of health care applications of large language models: a systematic review.[2]	JAMA (2025)	Systematic review of LLM evaluation studies	Wide variation in testing; lack of benchmarks; few real-world safety checks	Heterogeneous studies; rapid model evolution
3.	**Peng W, Feng Y, Yao C, et al.** Evaluating AI in medicine: a comparative analysis of expert [3]	Scientific Reports (2024)	Expert vs ChatGPT Q&A; colorectal cancer dataset	AI comparable in some answers; lacks reasoning & depth vs experts	Narrow disease focus; prompt-dependent
4.	**Ullah H, Tanveer M, Jan A**. Enhancing Handwritten Prescription Recognition.[4]	Journal of Computing & Biomedical Informatics (2025)	CNN-based OCR + lexicon correction; prescription images	Higher accuracy than baseline OCR; fewer drug name errors	Small dataset; handwriting/style variability.

RESEARCH PAPERS

S. No.	Author & Paper Title [Citation]	Journal/ Conference (Year)	Tools/ Techniques/ Dataset	Key Findings/ Results	Limitations/ Gaps Identified
5.	**de Almeida SS, Fontes RS, Alves LPC, et al.** Artificial intelligence in healthcare text processing.[5]	Frontiers in Artificial Intelligence (2025)	Review of NER methods (CRF, BiLSTM, BERT, BioBERT);	Transformers outperform older methods; strong for drug/dosage entity extraction	Few annotated datasets; privacy/access barriers.
6.	**Fajardo LJ, et al.** Doctor's Cursive Handwriting Recognition System Using Deep Learning. [6]	IEEE HNICEM (2019)	CRNN, CTC	CRNN model achieved 76% accuracy; implemented in a mobile app.	Limited dataset; poor handling of duplicate characters
7.	**Pavithiran G et al.**, "Doctor's Handwritten Prescription Recognition System In Multi-Language Using Deep Learning . [7]	Research Paper (2021 or later)	CNN, RNN, LSTM, Fuzzy Search	Multi-language DL system; fuzzy search improves output	Needs more data for accuracy, speed, & cross-platform support.
8.	**Roy PP, et al.** Keyword spotting in doctor's handwriting on medical prescriptions.[8]	Expert Systems With Applications (2017)	HMM, MLP, PHOG Features, Custom dataset of 500 prescriptions.	Traditional ML achieved 85% accuracy on medicine names.	Lower accuracy than modern methods; noise sensitive.

RESEARCH PAPERS

S. No.	Author & Paper Title [Citation]	Journal/ Conference (Year)	Tools/ Techniques/ Dataset	Key Findings/ Results	Limitations/ Gaps Identified
9.	**Pritam S. Dhande & Reena Kharat**, "Character Recognition for Cursive English Handwriting to Recognize Medicine Name from Doctor's Prescription"[9]	ICCUBEA (2017)	Projection Segmentation, SVM	Traditional ML achieved 85% accuracy on medicine names.	Lower accuracy than modern methods; noise sensitive.
10.	**Carson Tao et al.**, "Prescription extraction using CRFs and word embeddings"[10]	J. Biomedical Informatics (2017)	CRFs, GloVe word embeddings	SOTA F1-score (0.864) by treating extraction as sequence labeling.	Struggles with distant or shared medical entities.
11.	**Megha Sharma, Tushar Vatsal, Srujana Merugu, Aruna Rajan .** Automated Digitization of Unstructured Medical Prescriptions. [11]	ACL Industry Track (2023)	LayoutLMv2, OCR, catalog matching	+5–6% recall/precision over baseline; modular pipeline effective	Printed focus; OCR/catalog dependent
12.	**Mankash T. et al.,** MIRAGE: Multimodal Identification and Recognition of Annotations.[12]	arXiv (2024)	Fine-tuned MLLMs; 743k simulated Rx images	~82% accuracy on med extraction; multimodal helps	Simulated data; real-world generalization untested

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13.	**Ali U. et al**. Leveraging Deep Learning with Multi-Head Attention for Accurate Extraction of Medicine from Handwritten Prescriptions[13]	arXiv (2024)	Mask R-CNN + TrOCR with attention; handwritten dataset	CER 1.4%; effective segmentation & transcription	Region-specific dataset; unknown drug handling issues
14.	**Datta A. et al.** Preserving Medical Information from Doctor's Prescription Using Weak Supervision[14]	Computers in Biology & Medicine (2025)	YOLO ROI detection; OCR + spell correction; weak supervision	99.6% ROI detection; 96% spell correction; structured EHR output	Relies on medicine lists; may fail on rare/ambiguous drugs
15.	**Nayak N. et al.** Medical Prescription Recognition Using Machine Learning[15]	IRJMETS (2023)	CNN + ML models; prescription images	Demonstrates feasibility of ML for prescription digitization	Small-scale; lacks benchmarking; generalization issues
16.	**Parinya Thetbanthad et al.,** "Generative Artificial Intelligence Models for Accurate Prescription Label Identification and Information Retrieval" [16]	J. Imaging 2025	Generative AI models, image processing	Significant improvement in accurate label identification and info retrieval for elderly users	Real-world implementation challenges remain; may require broader testing in diverse environments

RESEARCH PAPERS

S. No.	Author & Paper Title [Citation]	Journal/ Conference (Year)	Tools/ Techniques/ Dataset	Key Findings/ Results	Limitations/ Gaps Identified
17.	**Haseeb Ullah et al.**, "Enhancing Handwritten Prescription Recognition with AI-Driven OCR"[17]	Journal of Computing & Biomedical Informatics (2025)	Deep Learning, TrOCR, Roboflow	Better recognition and understanding of medical prescriptions using AI-driven OCR	High variability in handwriting can affect OCR accuracy; larger, more diverse datasets would further boost performance
18.	**Yang-Yen Ou et al.**, "AI Prescription Recognition System"[18]	IEEE 9th Int. Conf. (2021)	AI prescription recognition system	Boosts pharmacist efficiency via automated prescription recognition	Limited discussion of real-world deployment; adaptation to different languages and scripts not fully addressed
19.	**Esraa Hassan et al.**, "Medical Prescription Recognition using Machine Learning"[19]	IEEE 11th Ann. Computing Conf. (2021)	Machine Learning, image-based analysis	Addresses errors from unreadable handwriting and supports accurate medical identification	Scalability and robustness in highly dynamic hospital environments require further evaluation
20.	**A. Maiti et al.**, "Improved RNN-based System for Deciphering Doctors' Handwritten Prescriptions"[20]	American Journal of Advanced Computing (2021)	RNN (CRNN, BiLSTM+amSRF), image processing	Achieved high accuracy (up to 95%) in extracting prescriptions; superior to previous methods	Real-world prescriptions may feature rare abbreviations and poor handwriting unaddressed by model training and evaluation

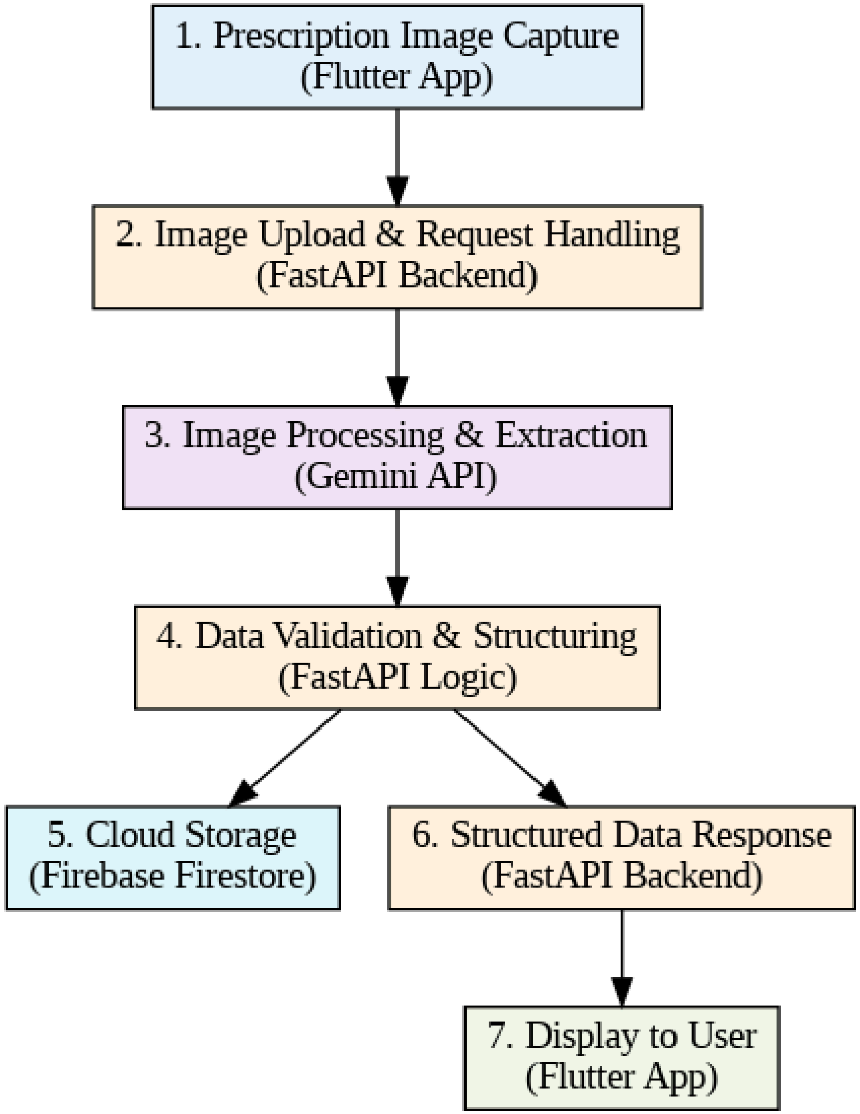
PROJECT DESIGN (SYSTEM ARCHITECTURE)

- **Architecture:** The project follows a modern two-tier client-server architecture.
- **Frontend (Client):** A cross-platform mobile application built using Flutter. This handles all user interactions, including image capture and data display.
- **Backend (Server):** A Python server built with the FastAPI framework. This acts as the central hub, managing business logic, database operations, and communication with the AI service.
- **AI Service (Semester 1):** For the initial prototype, the backend will communicate directly with the Gemini API, leveraging its powerful multimodal capabilities for handwriting recognition and information extraction.
- **Database:** Firebase Firestore will be used for its real-time capabilities and ease of integration with Flutter.

PROJECT DESIGN (DATA FLOW)

- **Step 1:** The user captures a prescription image using the Flutter App.
- **Step 2:** The app sends the image to a secure endpoint on the FastAPI Backend.
- **Step 3:** The backend constructs a prompt and sends the image to the Gemini API.
- **Step 4:** The Gemini API processes the image and returns structured JSON data.
- **Step 5**: The FastAPI backend validates the JSON and saves it to the Firebase database.
- **Step 6:** The backend sends the confirmed, structured data back to the Flutter App.
- **Step 7:** The Flutter App displays the digitized information to the user in a clean, readable format.

PROJECT FLOW



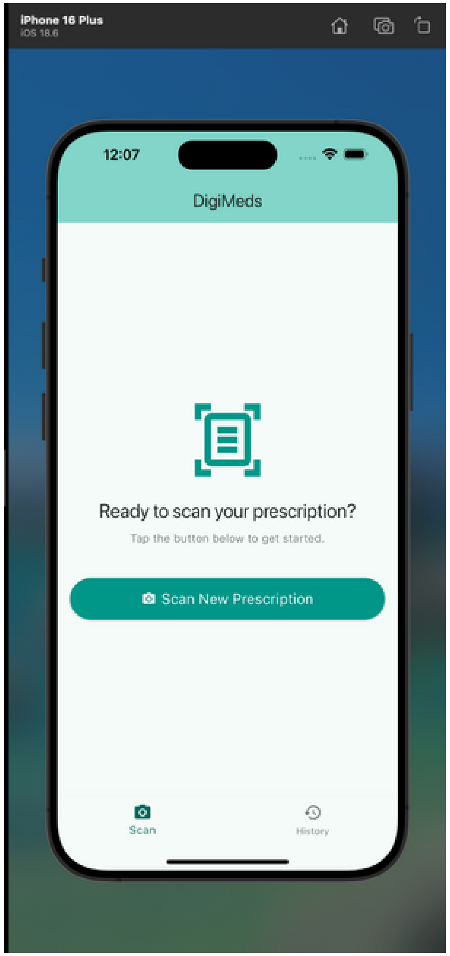
Tools, Technologies and Languages

- **Model & AI:** Gemini API (for Semester 1) and PyTorch + Hugging Face (for Semester 2),
- **Image Preprocessing:** OpenCV
- **Backend Framework:** FastAPI (Python)
- **Database:** Firebase Firestore
- **Mobile App Framework:** Flutter (Dart)
- **Notifications:** Firebase Cloud Messaging
- **Development Environment:** VS Code, Git / GitHub
- **Deployment:** Docker (for containerization)

DATASET

- **Semester 7:** No custom dataset is required. The project will leverage the zero-shot capabilities of the pre-trained Gemini API. Testing will be conducted using a small, manually collected set of 20-30 sample prescription images.
- **Semester 8:** A custom dataset of 150-200 anonymized handwritten prescription images will be collected and annotated using Label Studio to train our own model.

IMPLEMENTATION



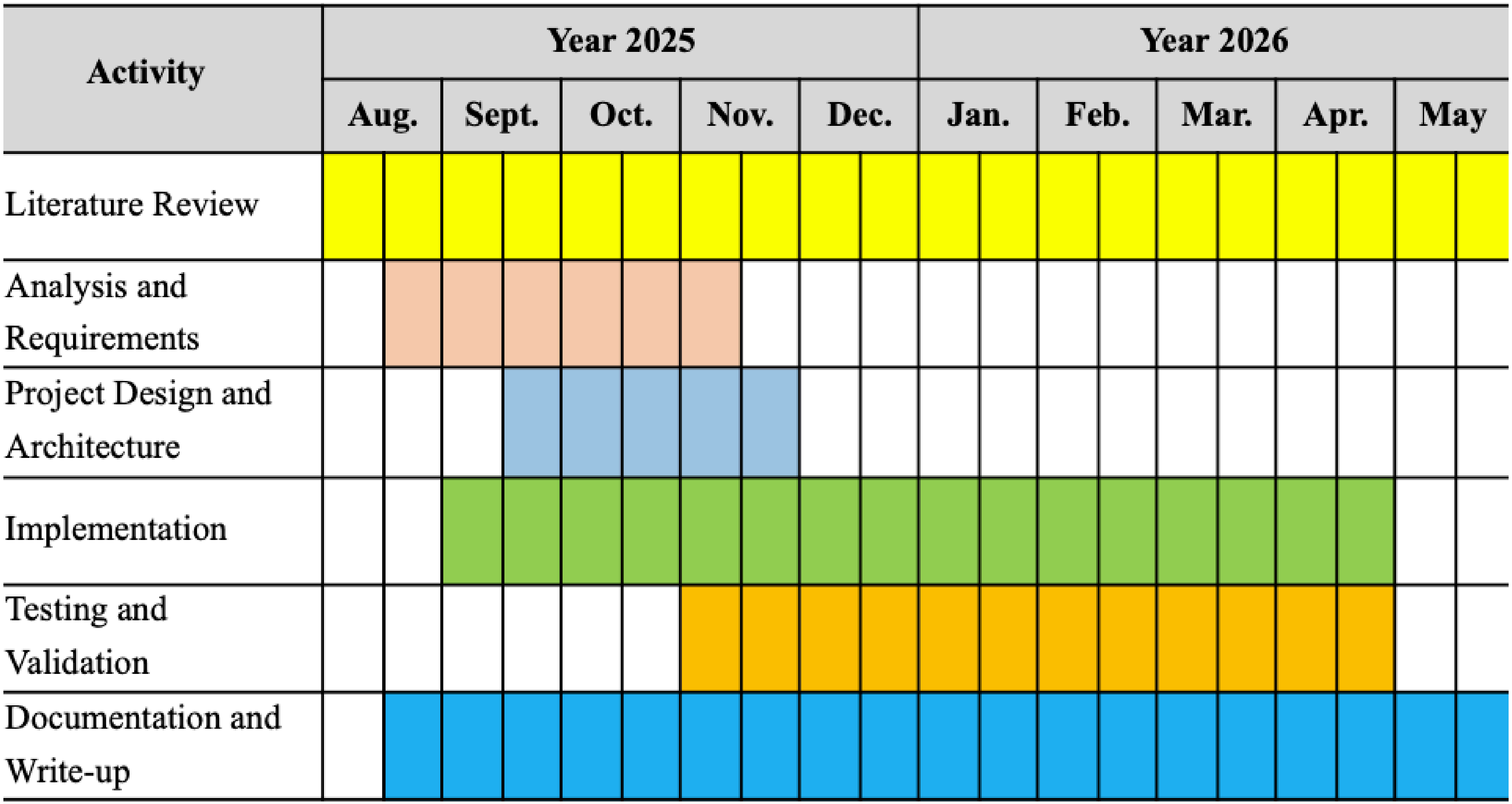
RESULTS

LEARNINGS

WORK PLAN TILL END-TERM EVALUATION

- **October:**
  - Finalize and rigorously test the Gemini API prompt.
  - Complete the development of all FastAPI backend endpoints.
  - Design and implement the Firebase database schema.
- **November:**
  - Develop all primary Flutter screens (Home, Camera, History, Details).
  - Integrate the Flutter app with the FastAPI backend (image upload and data fetching).
- **December:**
  - Conduct end-to-end testing of the complete application.
  - Implement the medication reminder feature using Firebase Cloud Messaging.
  - Prepare the final project report and presentation.

GANTT CHART


Activity
Year 2025
Year 2026
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
Literature Review
Analysis and Requirements
Project Design and Architecture
Implementation
Testing and Validation
Documentation and Write-up

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GitHub Repository URL: https://github.com/SONISOMYA/digimeds					
Team Member	Roll No.	Work Done (provide complete details)	Work Contribution (%)	Lines of Code (if any)	Lab Attendance (%)
1.	221030329	• Created the GitHub repository and established the initial project structure. • Began development of the Flutter application's foundational structure • Objectives, and Literature Review(ppt)			
2.	221030282	• Experimented with OpenCV for basic image preprocessing tasks. • Prepared the first draft of project presentation (PPT). • Set up development environment . • Explored relevant research papers for background study.			
3.	221030238	• Contributed to literature review and research paper study. • Helped in project design and data flow planning. • Assisted in preparing documentation and presentation material.			
4.	221030227	• Contributed to literature review and research paper study. • Helped in diary writing. • Helped in documentation and presentation making.			

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No. of Meetings with Supervisor:			
Week No.	Duration	Remarks (**as mentioned in the weekly log**)	Incorporated (Yes/No)
1.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
2.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
3.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
4.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
5.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	

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Week No.	Duration	Remarks (**as mentioned in the weekly log**)	Incorporated (Yes/No)
6.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
7.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
8.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
9.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	
10.	dd/mm/2025 to dd/mm/2025	• Remark 1 • Remark 2 • Remark 3	

REFERENCES (1/3)

- [1] J. A. Austin, "The effect of digitisation on the safe management of anticoagulants," in Proc. AIDH Summit / UQ Report(2022.)
- [2] S. Bedi, Y. Liu, L. Orr-Ewing, et al., "Testing and evaluation of health care applications of large language models: a systematic review," JAMA, 2025.
- [3] W. Peng, Y. Feng, C. Yao, et al., "Evaluating AI in medicine: a comparative analysis of expert and ChatGPT responses to colorectal cancer questions," Sci. Rep, 2024.
- [4] H. Ullah, M. Tanveer, and A. Jan, "Enhancing Handwritten Prescription Recognition with AI-Driven OCR," J. Comput. Biomed. Inform., 2025.
- [5] S. S. de Almeida, R. S. Fontes, L. P. C. Alves, et al., "Artificial intelligence in healthcare text processing: a review applied to named entity recognition," Front. Artif. Intell., 2025.
- [6] L. J. Fajardo et al., "Doctor's Cursive Handwriting Recognition System Using Deep Learning," in Proc. IEEE 11th Int. Conf. Humanoid, Nanotechnology, Inf. Technol., Commun. Control, Environ., Manag. (HNICEM), 2019, pp. 1-6.
- [7] P. G. et al., "Doctor's Handwritten Prescription Recognition System In Multi-Language Using Deep Learning," Research Paper, 2021.
- [8] P. P. Roy et al., "Keyword spotting in doctor's handwriting on medical prescriptions," Expert Syst. Appl., vol. 76, pp. 113-128, 2017.

REFERENCES (2/3)

- [9] P. S. Dhande and R. Kharat, “Character Recognition for Cursive English Handwriting to Recognize Medicine Name from Doctor's Prescription,” in Proc. Third Int. Conf. Comput., Commun., Control Autom. (ICCUBEA), 2017, pp. 1-5.
- [10] C. Tao, M. Filannino, and Ö. Uzuner, “Prescription extraction using CRFs and word embeddings,” J. Biomed. Inform., vol. 72, pp. 60-66, 2017.
- [11] M. Sharma, T. Vatsal, S. Merugu, and A. Rajan, “Automated Digitization of Unstructured Medical Prescriptions,” in Proc. 61st Annu. Meet. ACL — Ind. Track, 2023, pp. 972-983.
- [12] T. Mankash et al., “MIRAGE: Multimodal Identification and Recognition of Annotations in Indian General Prescriptions,” 2024.
- [13] U. Ali et al., “Leveraging Deep Learning with Multi-Head Attention for Accurate Extraction of Medicine from Handwritten Prescriptions,” 2024.
- [14] A. Datta et al., “Preserving medical information from doctor's prescription using weak supervision,” Comput. Biol. Med., vol. 183, 2025.
- [15] N. Nayak et al., “Medical Prescription Recognition Using Machine Learning,” Int. Res. J. Mod. Eng. Technol. Sci., vol. 5, no. 4, pp. 2458-2463, 2023.

REFERENCES (3/3)

- [16] P. Thetbanthad et al., “Application of Generative Artificial Intelligence Models for Accurate Prescription Label Identification and Information Retrieval for the Elderly in Northern East of Thailand,” J. Imaging, vol. 11, no. 1, 2025.
- [17] H. Ullah et al., “Enhancing Handwritten Prescription Recognition with AI-Driven OCR,” J. Comput. Biomed. Inform., 2025.
- [18] Y.-Y. Ou et al., “AI Prescription Recognition System,” in Proc. IEEE 9th Int. Conf. Appl. Sci. Eng. Technol., 2021.
- [19] E. Hassan et al., “Medical Prescription Recognition using Machine Learning,” in Proc. IEEE 11th Ann. Comput. Commun. Workshop Conf. (CCWC), 2021, pp. 0973-0979.
- [20] A. Maiti et al., “Improved RNN-based System for Deciphering Doctors’ Handwritten Prescriptions,” Am. J. Adv. Comput., vol. 3, no. 2, 2021.

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Thanks.