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MediTrust: AI-Based Verification System for Detecting Fraudulent Medical Fund Requests and Ensuring Donor Confidence

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***Abstract*—** Medical Fund refers to financial assistance provided to individuals or families to cover medical treatments, surgeries, or emergencies. However, the increasing prevalence of fraudulent medical fund requests has become a critical challenge, with scammers fabricating treatment documents or bills to deceitfully solicit donations. Existing verification methods are often manual or semi-automated, requiring human intervention to validate submitted documents. These approaches are time-consuming, error-prone, and struggle to detect sophisticated fraudulent attempts, leading to donor skepticism and reduced contributions. To address these issues, this project introduces an AI-powered Medical Fund Verification System that automates the detection and validation of submitted bills. The system first employs CRAFT (Character Region Awareness for Text Detection) to accurately identify text regions in uploaded medical documents, even in complex layouts. Extracted text regions are then processed using Donut (Document Understanding Transformer), a deep learning–based OCR model that converts document images into structured text, capturing critical details such as patient name, hospital information, and treatment costs. Finally, the Fuzzy Matching Algorithm cross-verifies the extracted information against a trusted hospital database to identify discrepancies and detect potential fraud. By combining advanced text detection, transformer-based recognition, and intelligent pattern matching, this system ensures accurate and timely verification of medical fund requests, safeguarding donor contributions, enhancing transparency, and restoring trust in medical crowdfunding platforms.

Keywords-- Medical Fund Verification, Fraud Detection, Artificial Intelligence, Deep Learning, Document Analysis, Fuzzy Matching, Medical Crowdfunding.

I. INTRODUCTION

Medical fundraising has become an important way for individuals raise money for treatments, surgeries, and healthcare expenses through online platforms and community support. With the growth of digital crowdfunding, people can easily share their medical needs and receive financial help from donors across the world.

However, this rapid growth has also led to a rise in **fraudulent medical fund requests**, where scammers create fake bills, manipulate documents, or provide false information to collect money dishonestly. Existing verification methods are mostly manual or rule-based, which are time-consuming, inefficient, and unable to detect advanced fraud techniques**.**

To address this issue, the project introduces **MediTrust**, an AI-based medical fund verification system. It uses advanced technologies like deep learning and intelligent algorithms to automatically analyze medical documents, extract important information, and verify their authenticity. By combining text detection, document understanding, and pattern matching, the system can accurately identify genuine and fraudulent requests.

The goal of this system is to **enhance transparency, improve trust among donors, reduce fraud, and ensure that financial support reaches only deserving patients** in a timely manner.

II. LITERATURE REVIEW

Medical fraud detection has become an important research area due to the rapid growth of digital healthcare systems and online crowdfunding platforms. Several studies have explored the use of **machine learning and artificial intelligence (AI)** techniques to identify fraudulent activities in healthcare and financial domains .

Early fraud detection systems were primarily based on **rule-based and manual verification methods**. However, these approaches were limited in handling large-scale data and failed to detect complex fraud patterns. With the advancement of technology, researchers began applying **machine learning techniques** such as decision trees, support vector machines, and logistic regression to identify suspicious patterns in healthcare claims and transaction.

Recent studies highlight that **3%–10% of healthcare expenditure is lost due to fraud**, emphasizing the need for advanced detection systems . Machine learning approaches are broadly categorized into:

- **Supervised learning** (trained using labeled fraud data)
- **Unsupervised learning** (detects anomalies without labels)
- **Hybrid models** (combine multiple techniques for better accuracy)

With further advancements, **deep learning and AI-based approaches** have gained popularity. These models can analyze large and complex datasets, recognize hidden patterns, and detect sophisticated fraud schemes. Techniques such as neural networks, natural language processing (NLP), and graph-based models are widely used for identifying fraudulent activities in healthcare systems .

In addition, AI has been successfully applied in detecting various types of healthcare fraud, including:

- False billing and insurance claims
- Identity fraud
- Manipulated medical documents
- Network-based fraud involving multiple entities

Despite these advancements, several challenges remain:

- **Imbalanced datasets** (few fraud cases compared to genuine cases)
- **Lack of labeled data** for training models
- **Model interpretability issues** (black-box nature of AI)
- **Data privacy and security concerns**

Recent research suggests that combining multiple AI techniques and improving explainability can enhance fraud detection performance. Hybrid models and real-time detection systems are considered promising directions for future development.

III. RESEARCH GAP

Although significant progress has been made in healthcare fraud detection using machine learning and AI, several limitations still exist in current systems, especially in the context of **medical crowdfunding platforms**.

Identified Gaps

1. **Lack of Automated Document Verification**
   Most existing systems rely on manual or semi-automated verification, which is slow and inefficient. There is a lack of fully automated solutions that can process and validate medical documents in real time.
2. **Limited Focus on Document-Based Fraud**
   Many research works focus on structured data such as insurance claims, but **fraud in medical fundraising often involves unstructured documents** like bills and reports, which are not effectively handled by traditional systems.
3. **Inefficient Handling of Complex Document Layouts**
   Conventional OCR tools struggle with **multi-format, handwritten, or complex medical documents**, leading to inaccurate data extraction and weak fraud detection.
4. **Absence of Integrated End-to-End Systems**
   Existing approaches often address only one part of the problem (e.g., detection or classification), but lack a **complete pipeline** that includes document processing, verification, classification, and user interaction.
5. **Poor Detection of Sophisticated Fraud**
   Rule-based and basic machine learning models cannot detect **subtle manipulations**, such as slight changes in billing amounts, fake hospital names, or altered patient details.
6. **Limited Real-Time Verification**
   Many systems are not designed for **real-time processing**, causing delays in fund approval and affecting patients in urgent need.
7. **Low Transparency and Donor Trust**
   Current platforms do not provide sufficient verification transparency, leading to **reduced confidence among donors**.

IV. PROPOSED SYSTEM /METHODOLOGY

The proposed system, project, is an AI-based medical fund verification platform designed to automatically analyze medical documents, detect fraudulent requests, and ensure transparency in medical crowdfunding platforms. It leverages advanced AI techniques to streamline the verification process, reduce human error, and protect donor contributions while ensuring timely support for genuine patients.

- Intelligent Document Analysis

This module focuses on extracting accurate and reliable information from medical documents. The CRAFT (Character Region Awareness for Text Detection) algorithm identifies text regions in uploaded medical bills, receipts, and discharge summaries, even in complex layouts. These detected regions are then processed by the Donut (Document Understanding Transformer) model, which extracts structured data such as patient details, hospital information, treatment type, and cost breakdown. By understanding both the content and layout of documents, this module ensures high accuracy in text recognition and information extraction.

- **AI-Based Verification and Fraud Detection**

Once structured data is extracted, the system applies a Fuzzy Matching algorithm to compare the information against verified hospital records. This allows the system to detect discrepancies, mismatched details, or manipulated entries, thereby identifying potentially fraudulent fund requests. Unlike traditional verification methods, MediTrust can handle variations in spelling, formatting differences, and complex billing structures, ensuring reliable and automated fraud detection.

V. SYSTEM ARCHITECTURE AND WORKFLOW

The MediTrust system follows a multi-layer architecture that integrates users, web application, AI modules, and database.

1**. User Layer**

Includes three types of users:

Patient (Fund Requester) – uploads medical documents and creates fund requests

- Donor – views verified requests and donates
- Admin – monitors, verifies, and approves/rejects requests

2. Web Application Layer

- Built using Flask (backend) and HTML/CSS/Bootstrap (frontend)
- Handles:

User registration & login

Document upload

Request management

Communication between modules

3. AI-Based Fraud Detection Layer (Core Layer)
The system uses MySQL as its database management system to ensure efficient and secure data storage. It stores all essential information required for the functioning of the platform, including user details, medical fund requests, hospital records, verification results, and transaction data. This centralized database enables quick retrieval, proper management of records, and supports the smooth execution of verification, tracking, and donation processes within the system.

4. Supporting Modules
Fund Verification Module – final decision making
Payment Processing Module – secure donations
Notification System – alerts users about status updates

System Architecture

System Workflow

The workflow shows how the system processes a request step-by-step:

Step 1: User Registration & Login

Patients, donors, and admins create accounts and log in

Step 2: Fund Request Submission

Patient enters details and uploads medical documents (bills, reports)

Step 3: Preprocessing

Uploaded documents are cleaned and enhanced for better accuracy

Step 4: Text Detection (CRAFT)

System identifies text regions in the document **Step 5:** Text Extraction (Donut)

Extracts key details:

Patient name

Hospital name

Treatment

Cost

Step 6: Data Verification (Fuzzy Matching)

Extracted data is compared with hospital database

Similarity score is calculated

Step 7: Fraud Classification

Based on score:

High → Genuine

Medium → Suspicious

Low → Fraudulent

Step 8: Admin Review

Admin checks flagged/suspicious requests and approves or rejects

Step 9: Fundraising & Donation

Only verified requests are shown to donors

Donors make secure payments

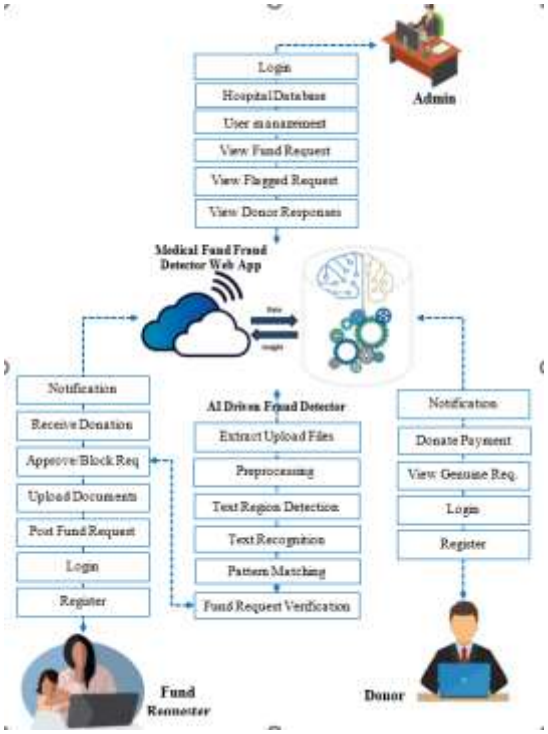
Step 10: Notification

System sends updates to:

Patients (status)

Donors (payment confirmation)

Admin (alerts)



VI. ALGORITHMS AND MODELS USED

The Medi Trust system uses a combination of deep learning models and intelligent algorithms to detect fraudulent medical fund requests accurately and efficiently.

1.Preprocessing Algorithm:

Before analysis, uploaded medical documents are enhanced using image processing techniques

Noise removal

Contrast enhancement

Resizing and grayscale conversion

Purpose: Improves image quality for accurate text detection and extraction.

2. CRAFT (Character Region Awareness for Text Detection)

CRAFT is a deep learning-based model used to detect text regions in images.

Key Features:

Detects individual characters instead of full words

Handles complex layouts, curved text, and multi-column bills

Generates:

- Region scores (text areas)
- Affinity scores (links between characters)

Purpose: Precisely identifies text areas in medical documents.

3. Donut (Document Understanding Transformer)

Donut is a transformer-based deep learning model used for document understanding.

Key Features:

Converts document images into structured text data

Understands layout and context

Extracts key information such as:

Patient name

Hospital name

Treatment details

Total cost

Purpose: Extracts meaningful and structured information from documents.

4. Fuzzy Matching Algorithm

Fuzzy matching is used to compare extracted data with records in the hospital database.

Key Features:
Allows approximate matching instead of exact matching
Handles spelling variations and formatting differences
Uses similarity metrics like:
Levenshtein distance
Token matching

Purpose: Detects inconsistencies or mismatches in data to identify fraud.

5. Fraud Classification Algorithm

This algorithm classifies fund requests based on similarity

scores.
Classification Criteria:
Score ≥ 85 → Genuine
Score 65–84 → Suspicious
Score < 65 → Fraudulent

Purpose: Automatically determines the authenticity of requests.

6. Image Processing (OpenCV)
Used for preprocessing and enhancing document images.
Functions:
Image filtering
Edge detection
Noise reduction
Purpose: Improves input quality for AI models.

7. Deep Learning Frameworks

PyTorch / TensorFlow

Used to implement and run AI models like CRAFT and Donut

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Enable high-performance computation and scalability

VII. RESULTS AND DISCUSSION

The proposed AI-based medical fund verification system was implemented and evaluated using medical documents such as hospital bills, treatment records, and supporting datasets. The system successfully automated the entire verification process, from document analysis to final fraud classification..

A. Document Processing::

The CRAFT-based text detection accurately identified text regions in complex medical documents, ensuring reliable extraction even from multi-column and unstructured formats.

B. Data Extraction:

The Donut (Document Understanding Transformer) model effectively converted document images into structured data, capturing key details such as patient name, hospital information, treatment type, and cost.

C. Data Verification:

The Fuzzy Matching algorithm successfully compared extracted data with hospital database records, identifying mismatches and inconsistencies even in cases of spelling variations or formatting differences.

D. Fraud Detection System:

The AI-driven verification process accurately classified fund requests into genuine, suspicious, or fraudulent categories based on similarity scores and predefined thresholds.

E. System Integration:

The integration of preprocessing, text detection, extraction, and verification modules ensured smooth data flow and efficient end-to-end automation of the fraud detection process.

F. Performance Evaluation:

The system demonstrated high accuracy in detecting fraudulent requests while reducing manual effort and processing time. It efficiently handled multiple requests and maintained consistent performance.

G. Comparative Discussion:

The results indicate that the proposed system significantly improves transparency, reliability, and efficiency in medical crowdfunding platforms. By integrating multiple AI techniques, the system provides a comprehensive and automated solution for fraud detection..

Compared to traditional recruitment methods, the system:

- Reduces manual effort and verification time
- Minimizes human errors and bias
- Improves accuracy in fraud detection
- Ensures faster and consistent verification process

Limitations and Observations

Despite the effectiveness of the proposed AI-based medical fu verification system, certain limitations were observed duri implementation and testing

1. **Image Quality Sensitivity:**
   The performance of document processing may vary depending on the quality of uploaded medical documents. Poor lighting, low resolution, blurred images, or scanned copies can affect text detection and extraction accuracy.

2. **OCR and Extraction Limitations:**
   Although the Donut model performs well, it may face challenges with **handwritten text, complex tables, or heavily formatted documents**, leading to partial or inaccurate data extraction.

3. **Data Dependency:**
   The accuracy of the system depends on the quality and completeness of the **hospital database and training datasets**, which may limit performance in real-world scenarios with unseen data.

4. **Model Constraints:**
   Pre-trained models such as CRAFT and Donut may require **fine-tuning for specific document formats or regional hospital bill structures** to achieve optimal results.

5. **System Integration Challenges:**
   Integrating multiple AI modules (preprocessing, detection, extraction, and verification) increases

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system complexity and may introduce **processing delays** in real-time verification.

6. **Edge Case Errors:**
Minor issues were observed during testing, such as large file upload failures, slight delays in notifications, and inconsistencies in logging certain system activities.

driven interviews, and multimodal analysis. It improves accuracy, reduces bias, and enhances efficiency compared to traditional methods. Despite minor limitations related to data quality and environmental factors, the system demonstrates strong performance and scalability, making it a reliable solution for modern recruitment.

VIII. PERFORMANCE EVALUATION

The performance of the proposed AI-based medical fund verification system was evaluated based on **accuracy, efficiency, and reliability** across its core modules. The CRAFT-based text detection demonstrated high accuracy in identifying text regions from complex medical documents, while the Donut model effectively extracted structured information such as patient details, hospital information, and treatment costs..

The Fuzzy Matching algorithm provided reliable verification by accurately comparing extracted data with hospital database records and identifying inconsistencies. The fraud classification module successfully categorized requests into genuine, suspicious, and fraudulent with consistent results.

The overall system showed significant improvements in processing speed and reduced dependency on manual verification. It efficiently handled multiple requests, maintained data integrity, and ensured secure transaction processing. By automating the verification workflow, the system minimized human errors, improved transparency, and enhanced donor confidence. Overall, the system demonstrated strong performance, scalability, and reliability in detecting fraudulent medical fund requests.

IX. CONCLUSION

The proposed AI-based medical fund verification system provides an efficient and automated solution for detecting fraudulent medical fund requests in crowdfunding platforms. By integrating advanced AI techniques such as CRAFT for text detection, Donut for document understanding, and Fuzzy Matching for data verification, the system significantly reduces manual effort, minimizes errors, and improves the accuracy of fraud detection.

The system enables reliable analysis of medical documents by extracting and verifying critical information, ensuring that only genuine requests are approved. It enhances transparency, strengthens donor confidence, and ensures that funds are allocated to deserving patients in a timely manner. Compared to traditional verification methods, the system demonstrates improved efficiency, consistency, and scalability.

Overall, MediTrust offers a robust and practical framework for intelligent medical fund verification, with strong potential for real-world deployment in secure and transparent medical crowdfunding platforms.

X. FUTURE WORK

The proposed system can be further enhanced by incorporating advanced features to improve scalability, accuracy, and usability. Future work includes integrating **blockchain technology** to ensure secure and tamper-proof storage of medical records and transactions. The system can be extended with a **mobile application** to provide easy access for patients, donors, and administrators.

Additionally, integration with **government healthcare systems and insurance databases** can improve verification accuracy through real-time validation of medical records. The use of more advanced AI models can further enhance document understanding and fraud detection capabilities.

Cloud-based deployment can also be implemented to support large-scale usage and real-time processing. Improvements in security mechanisms, such as advanced encryption and access control, can further protect sensitive user and financial data.

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