AI-BASED FRAUD DETECTION IN BSKY

About HSTP

The Health Systems Transformation Platform (HSTP) is a non-profit organisation incorporated in May 2018 under Section 8 of the Companies Act, 2013. It was established as a Health Systems Design Centre in 2017 by the founding donors Tata Trusts and the Bill and Melinda Gates Foundation (BMGF). The vision is to conduct impactful health systems research for evidence-based policy reforms. The organisation strives to be an autonomous institution committed to this cause.

The HSTP has actively collaborated with the Biju Swasthya Kalyan Yojana (BSKY) in Odisha since November 2018, contributing significantly to the advancements in public health insurance. As a result of this partnership, evidence-based program improvements, knowledge generation, and comprehensive training for both clinical and program staff have been achieved.

About Wadhwani AI

Wadhwani AI, a non-profit organisation dedicated to applied AI, is committed to improving people's lives and livelihoods through implementing AI/ML technology. With a multidisciplinary team of 200 professionals based in Delhi, Mumbai, and Bengaluru, the organisation manages over 30 AI projects in areas such as education, healthcare, and agriculture, including several deployed at the national level. Wadhwani AI has been appointed the official AI partner for various Government of India Ministries and State Departments. The organisation has developed various public health solutions, such as the Clinical Decision Support System (CDSS) deployed on the eSanjeevani portal and the Cough for TB app created in collaboration with the Central TB Division (CTD).

In collaboration with the National Health Authority (NHA), Wadhwani AI has created an Intelligent Document Processing (IDP) solution to streamline claim adjudication for Ayushman Bharat Pradhan Mantri - Jan Arogya Yojana (AB PM-JAY) by extracting pertinent information from medical documents. Their cutting-edge technology is currently able to process lab reports and discharge summaries. They are working with esteemed partners from IIT-B and IIT-D to expand this capability to other types of investigation reports and medical documents. Their partnership with the PM-JAY vertical of NHA has gained valuable insight into the public health protection scheme ecosystem, enabling them to identify and address its unique challenges. This positions them well to tackle claim adjudication and fraud detection for the BSKY.

The HSTP has partnered with Wadhwani AI to develop an AI-based claim fraud detection and adjudication solution for the BSKY.

Fraud in Public Health Schemes

Public Health Protection Schemes are crucial in ensuring access to essential healthcare services for vulnerable sections of the population. However, fraud is a prevalent issue within these

programs. From minor identity theft to more significant false claims and overbilling by healthcare providers, these attempts to defraud the system ultimately deprive those who genuinely need medical care. Furthermore, these fraudulent activities burden the already limited resources allocated for healthcare services, exacerbating the healthcare disparities prevalent in society.

Prevalent fraud in public health protection schemes erodes the citizens' trust, deterring them from utilising the services offered. This leads to delayed medical treatment and ultimately compromises public health outcomes. Additionally, financial losses resulting from fraud reduce the availability of essential resources, including medical personnel, equipment, and medications. The resulting inequality perpetuates a cycle of ill health and poverty by depriving the most vulnerable populations of their rightful access to healthcare. Therefore, addressing and preventing fraud within public health protection schemes is imperative to ensure the equitable delivery of healthcare services to all.

AI/ML for Fraud Detection

AI/ML solutions significantly enhance the detection of fraudulent activities through a variety of efficient and accurate methods:

Sl. No.	*Type of Fraud Detection*	*AI / ML Capability*	*Data Required*
1.	**Anomaly Detection**	Analyse patterns in large volumes of data and identify deviations from the norm to flag potentially fraudulent activities such as unusually high billing, excessive claims or suspicious patient-provider relationships.	Historical claims data, patient demographics, provider information, and geospatial data.
2.	**Map Risk Factors**	Graph patterns in previously confirmed fraud cases to identify risk factors to predict potential fraud, aiding proactive investigation and prevention.	Historically confirmed fraudulent claims data, patient demographics, provider information, and geospatial data.
3.	**Hospital, Region, and User Profiling**	Build profiles of healthcare providers, regions, and user groups to derive the trustworthiness score for individual groups.	Historical claims data, patient demographics, provider information, and geospatial data.
4.	**Fraud Triggers**	Based on the patterns identified (anomalies, risk factors, profiles, etc.), create real-time triggers to identify potentially fraudulent cases, activities, medical documents, or bills.	
5.	**Automated Decision Support**	Assign priority and likelihood ratings to potential fraud cases, providing recommendations to investigators so they can focus on high-risk cases and work more efficiently.	
6.	**Image Analytics**	Analyse images of X-rays and other scans to determine whether they support the diagnosis claimed, match pictures of the beneficiary with treatment images submitted, etc.	Scan images and reports, patient images, procedure images, and details of diagnosis/procedure.

AI/ML solutions have the potential to detect potential fraud cases in real-time and continuously improve their ability to identify emerging fraud patterns through machine learning. However, the quality and variety of data available heavily influence these capabilities, and additional efforts may be necessary, such as data preprocessing based on the quality or class of the medical

document, its template and source, and language. These capabilities can be integrated into existing digital platforms or applications for a more comprehensive fraud detection system. AI-enabled analytics and business rules provide granular insights into fraudulent triggers and reasons for their occurrence. For instance, an Intelligent Document Processing (IDP) and Optical Character Recognition (OCR) capability could be added to extract information from medical documents submitted with claims, and further capabilities such as document de-duplication and facial recognition can also be implemented to enhance the fraud detection capability of the system.

Appendix

The following section highlights the AI/ML capabilities available for Discharge Summaries, and Lab reports with performance metrics at par with state-of-the-art models.

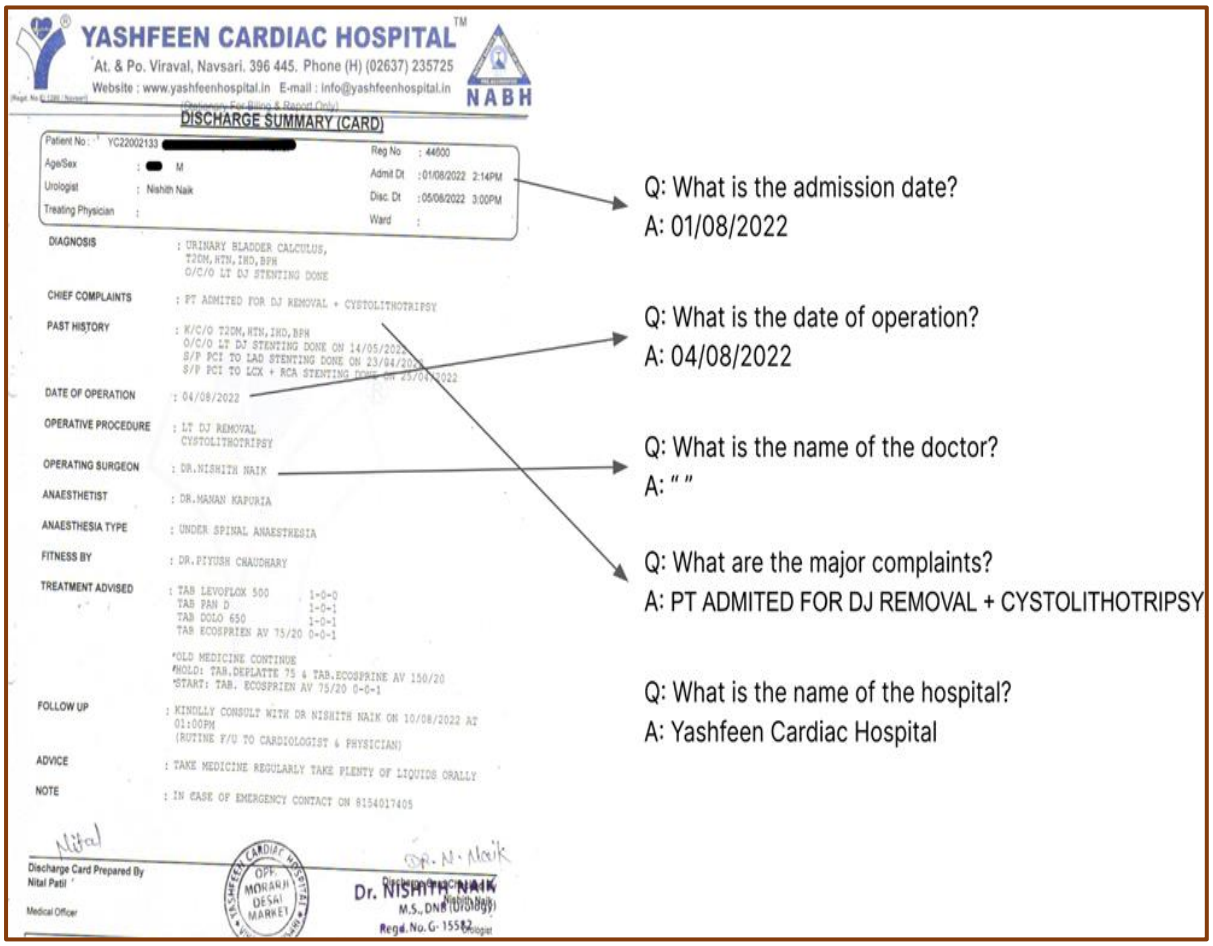

Image 1: Output generated for Discharge Summary using Visual QnA Model

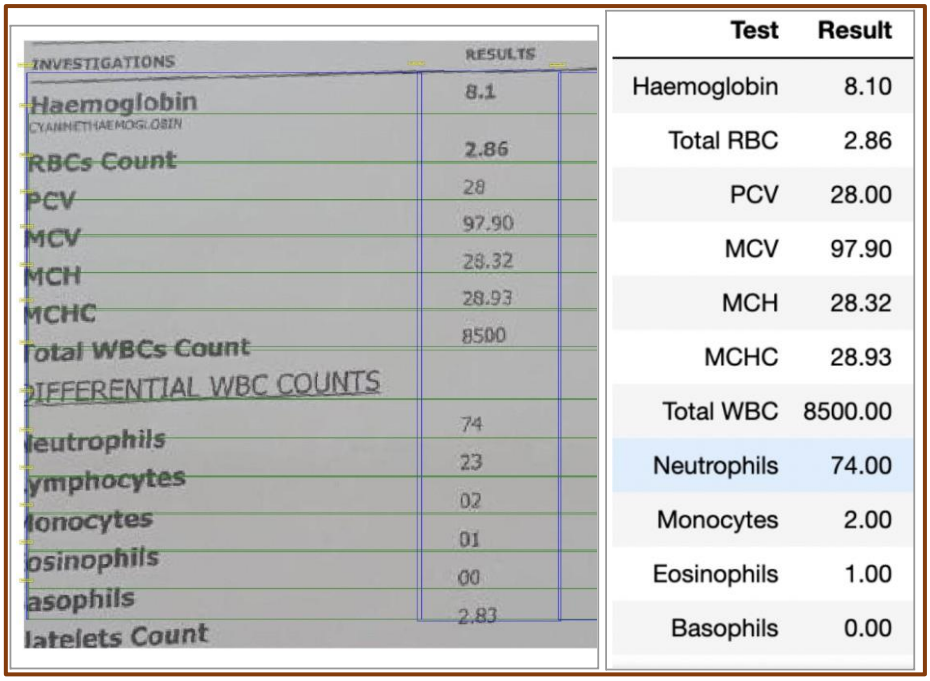

Image 2: Output generated for Lab Reports using Table Extraction Model

Note: ***Since medical documents contain PII and PHI data, a live demo of the solution is a preferred modality for sharing the capabilities of the solution.***

ML Workflow

1. Around N% of claims requests tend to be fraud (find value of N). This is a small but sizable minority.

2. Assuming BSKY does not have an extensive database of fraudulent claims, the ML problem is essentially a cold-start problem and, hence, must look to unsupervised ML techniques.

3. Initially leverage the VQA model and table extraction algorithm developed for the NHA project to pull out features for each claims request such as medical test values, patient details such as gender, age, healthcare provider details, location, etc. Then, the dataset provided by the BSKY team could be supplemented with geospatial datasets freely available from Google and Facebook. These GIS datasets have information such as healthcare accessibility, road connectivity, relative wealth index, population density, etc, for different geographical regions in India. Other Wadhwani AI projects, such as Active Case Finding for vulnerable TB population groups, already use these datasets and hence know how to access and use them.

4. Unsupervised clustering techniques such as DBScan, Isolation Forest, and Kmeans commonly detect outlier clusters on the features identified in step 3. These techniques and perhaps a few more could be used to do a cluster analysis/outlier detection on the claims data to flag potentially fraudulent claims.

5. Each unsupervised clustering technique can generate a candidate label (fraud or genuine) for each claim. The principles from data programming are used to combine these multiple potential labels into a single strong label for each claim.

6. The output of our unsupervised methods will be sent to the BSKY team for follow-up. The BSKY team will provide feedback on whether the flagged claims were fraudulent or not.

7. This feedback will be incorporated into the modelling pipeline to generate annotated datasets. In other words, datasets with ground truth are available.

8. This will allow pivoting from unsupervised techniques to actual supervised machine-learning techniques to identify fraudulent claims. For this, techniques such as Support Vector Machines, Logistic Regression, and Graph Neural Networks could be tried. Different models can be trained on the annotated data feedback provided by the BSKY team. The prediction of the different supervised models will be used to detect fraudulent claims in the next deployment cycle.

9. Again, feedback will be provided by the BSKY team on the prediction model to increase the annotated dataset and improve model performance. Wadhwani AI has collaborated with Prof. Milind Tambe, who works on AI for social good at Harvard and has expertise on how to best incorporate feedback received from deployment in the field into ML models.

10. Over time, a profile is built for hospitals and health care providers who send higher rates of fraudulent claims.