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Web Application for Interpretation of Doctor's Handwritten Prescription and Suggesting the best Price Offer over Various e-Commerce Websites using AI

Tanmesh Joshi[1], Saumen Das[1], Sankalp Ghosh[1], Chirag Jha[1], Dr. Vinayak D. Shinde[2]

[1]Department of Computer Engineering, Shree L.R Tiwari College of Engineering, Mumbai, Maharashtra, India

[2]Assistant Professor, Department of Computer Engineering, Shree L.R Tiwari College of Engineering, Mumbai, Maharashtra, India

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ABSTRACT

Patient record-keeping is crucial for accurate diagnoses and treatment. In India, due to time constraints, most doctors manually write prescriptions, making it challenging for pharmacists to read them correctly. This increases the risk of dispensing the wrong medicine, which can have serious and even fatal consequences for patients. To address this problem, this research proposes an online handwritten medical prescription recognition system that allows users to scan prescriptions and compare prices across different websites. OCR techniques are used to recognize medicine names in handwritten prescriptions, while NLP techniques such as Cosine Similarity are employed to overcome the issue of misinterpretation. The review study focuses on Named Entity Recognition and Relation Extraction, which help identify named entities and extract relations between entities. Most state-of-the-art techniques are offline and computationally expensive, highlighting the need for understanding the deep-learning processes used in the proposed system. The system stores various features such as medicine names, uploaded images, user details, and search history to improve recognition accuracy. Additionally, new features are proposed to enhance accuracy further. Uses a local dataset from a pharmacy shop and past prescription records from local doctors.

Keywords: OCR, NLP, Cosine Similarity, NER, Word2vec, Amazon Textract, Google Cloud Vision.

I. INTRODUCTION

A major boost in the pharmaceutical E-commerce sector happened due to the large number of people buying smartphones in the last few years. There are over 1.2 million doctors registered in the Indian Medical Council across south Asian countries, most of which use handwritten prescriptions rather than printed ones. While ordering through any E-commerce website. We have to know certain details about medicine. But a large set of people cannot order online just because they have prescriptions and are unable to read the doctor's writing. We wanted to solve this problem and wanted to figure out if such a system can exist which can automatically scan prescriptions and accurately provide medicines.

A doctor's prescription is a written or electronic order from a licensed healthcare provider that authorizes a patient to receive a medication or treatment. The prescription typically includes the patient's name, the medication name, dosage instructions, the route of administration, and the provider's signature. The purpose of a prescription is to ensure that patients receive the correct medication or treatment and are aware of the potential risks and benefits associated with it. Additionally, a prescription helps to prevent drug abuse and ensures that patients receive appropriate medical care. [1] Existing research suggests that the effects of OCR error vary by the analytical toolset. [2] Existing deep neurally inspired architectures as the numerical methods for solving their respective differential equations. The present work aims to provide a model that can accurately predict medicine prescribed by doctors in prescription. The method that has been used to create a model can detect those medicines which are present in the database. As the database grows the model will able to prescribe or detect more accurately.

Web app: Website used as an application on mobile devices. E-commerce for medicines: e-commerce includes buying and selling medical devices and drugs and offers advantages such as convenience, lower prices & discounts, a wide range of products, replacement and refund policies, reviews and feedback, and quality certifications.

OCR (Optical Character Recognition) is a process of extracting text from images or scanned documents. It is a popular technique used in various applications, such as digitizing printed documents, recognizing license plates, and detecting text in natural scenes. Deep learning has revolutionized OCR by enabling the development of more accurate and efficient OCR models. Deep learning models use Convolutional Neural Networks (CNNs) to extract features from input images and Recurrent Neural Networks (RNNs) to perform sequence recognition on the extracted features.

II. LITERATURE

Several related works are done in the field of AI-based Web applications for Interpretation of Doctor's handwritten prescriptions and suggesting the best price offer over various e-commerce websites:

Thomas Hegghammer's [1] proposes the impact of OCR errors depends on the analytical toolset being used. Topic models are found to be less affected by OCR errors, with an acceptable minimum OCR accuracy of 80%. However, classification models are more sensitive to errors, and the results obtained have been inconsistent. The most significant challenges have been observed in NLP tasks that require keen attention to detail, such as named entity recognition and part-of-speech tagging.

Chirag I. Patel, Dileep Labana, Sharnil Pandya, Kirti Modi, Hemant Ghayvat, and Muhammad Awais [2] have proposed that the use of deep neurally inspired architectures and memory-efficient implementations has made it possible to stabilize large models while reducing computational costs compared to their original versions. This technique has helped in the numerical solutions of differential equations by making it easier to handle the complex and large models that arise in such problems. The use of deep neural networks and efficient memory implementations has made it possible to solve these differential equations more accurately and efficiently, thus enabling researchers to better understand and model complex systems. The approach has been successful in reducing computational costs and enabling the modelling of complex systems that were previously too difficult to analyze.

H. Hosseini, B. Xiao, and R. Poovendran [3] proposed a method of attack in which they added a sufficient amount of noise to an image, causing the API to generate different outputs for the same image, while a human observer would perceive the original content. The study demonstrated the successful execution of this attack on various image types, including natural images, images containing faces, and images containing text. This type of attack is known as an adversarial attack, where an attacker intentionally manipulates the input data to deceive machine learning algorithms. The ability to conduct such attacks can have significant consequences in fields such as security, privacy, and fraud detection, as it can cause the AI systems to produce incorrect or misleading results. The study highlights the need for developing robust defense mechanisms against such attacks in the field of computer vision.

Xianyong Yi, Rongge Zheng, Aoyu Wang, Hao Qin, and Yufeng Chen [4] suggest that the Word2Vec algorithm, which processes natural language by calculating the cosine similarity, can be significantly improved by utilizing High-Performance Computing (HPC) to parallelize the algorithm. The authors note that the exponential growth of information in the training corpus text makes the serial implementation of the original Word2Vec algorithm a bottleneck with low processing efficiency. Therefore, parallelizing the Word2Vec algorithm using HPC can significantly enhance the training efficiency of corpus texts. This approach can help overcome the challenge of low processing efficiency, which is a significant issue when dealing with large datasets in natural language processing.

III.METHODOLOGY

Mediscan is a web-based application that allows users to upload their prescriptions and receive medication-related information in a convenient manner. Once the user reaches the Mediscan website, they have the option to either sign up or log in. After logging in, they are directed to the homepage where they can upload an image of their prescription. The prescription image is then stored in a database and sent to Amazon Textract and Google Vision for processing. After the processing is complete, the extracted prescriptions are converted into text form, which is then used for web-scraping data from three different websites: Tata1Mg, Truemeds, and Amazon. in. The web-scraped data is presented to the user in a list format. The Mediscan system is equipped with various Machine Learning models, including OCR, an anchoring mechanism, NER, and a cosine similarity checker, to ensure accurate and efficient prescription processing. This system streamlines the process of obtaining medication-related information and eliminates the need for users to manually search for the necessary information.

After logging into our system, users can upload prescriptions to our website, which are then stored in both an SQL database and an AWS S3 bucket. Our system uses Amazon Simple Queue Service to check the availability of the Textract service. If Textract is available, the prescription is sent to the service via a lambda function, which converts the image into a textual format and returns a JSON response. Since the JSON response may contain spelling errors, we use a probabilistic model to correct them.

We use Amazon Textract and Google Vision to extract text from images. However, OCR engines may extract incorrect spellings. To identify and correct these errors, we use word similarity checkers like word2vec and cosine similarity. We create a database of incorrect spellings and map them to their correct counterparts. The word2vec and cosine similarity techniques use high-dimensional vectors to represent words in semantic space and learn from co-occurrence patterns in a large corpus of text. These techniques help us to ensure the accuracy of the extracted text.

We used word2vec and cosine similarity to identify appropriate responses. These are neural network-based techniques that generate word embeddings, and high-dimensional vectors that represent words in a semantic space. Word2Vec and cosine similarity learn a distributed representation of words based on their co-occurrence patterns in a large corpus of text, leading to a better understanding of which responses are suitable.

We designed a user-friendly interface with Figma and ensured it met our target audience's standards. We used Material UI, a frontend component library by Google, to convert the designs into real web components. The result is a comfortable and intuitive user interface that is easy to navigate.

For word similarity checking, the word2vec framework is used for mapping wrong words to the right word using Natural Language Processing (NLP). Word2Vec provides an efficient way of capturing the semantic and syntactic relationships between words, which can be used for various natural languages processing tasks such as text classification, sentiment analysis, and machine translation. The technique involves two main approaches: the Continuous Bag of Words (CBOW) and the Skip-gram model.
Before computing cosine similarity, the text needs to be pre-processed. This includes removing stop words, punctuation, and other non-essential words. Each document or text is represented as a vector in a high-dimensional space. The vectorization process converts the text into a numerical representation that can be used for calculating similarity. After vectorizing the text, cosine similarity can be calculated between two documents using the formula mentioned earlier.

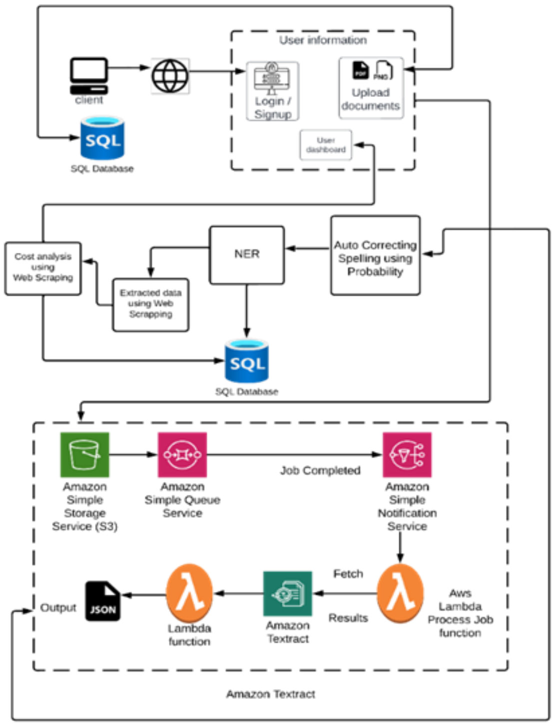

Figure 1. Architecture Diagram of Mediscan

IV. IMPLEMENTATION

A. Text Extraction model

The initial step involved coding the process of uploading an image and obtaining its text output. The process entails storing the prescription image in an SQL database and an AWS S3 bucket. Amazon Simple Queue Service then checks if the Textract service is available. If the Textract service is available, the lambda function takes the prescription and sends it to Textract for conversion into a textual format, which is returned as a JSON file. However, since this JSON file can have multiple spelling errors, it is necessary to correct them using a probabilistic model. Before using any probabilistic model, the accuracy of the extracted text was very low, approximately.

B. Spelling correction model

After the completion of the first phase, the development moved on to the next phase, which involved creating a probabilistic model to correct the spelling errors in the extracted text from the prescription image. They decided to use the cosine similarity and Jaccard similarity models for this task. Using these models, they created a database where all the misspelled words were listed, and they were mapped to their correct spellings. This way, when the extracted text had spelling errors, the model would compare the incorrect word with the database and suggest the correct spelling. This step greatly improved the accuracy of the extracted text, making it more reliable for further processing.

C. Cosine Similarity

Cosine similarity is a metric used to measure the similarity between two data objects, regardless of their size. The metric is commonly used in Natural Language Processing (NLP) to determine the similarity between two sentences. In this method, each sentence is represented as a vector, and the cosine similarity measures the cosine of the angle between the two vectors. The formula for cosine similarity between two vectors A and B can be expressed as:

cosine_similarity = (A.B) / (||A|| ||B||)

where:

A.B represents the dot product of vectors A and B

||A|| represents the magnitude of vector A

||B|| represents the magnitude of vector B

In other words, the cosine similarity is the cosine of the angle between the two vectors A and B. It measures the similarity between two vectors in a multi-dimensional space, where each dimension represents a different feature or attribute. The value of cosine similarity ranges between -1 and 1, where -1 indicates complete dissimilarity, 0 indicates no correlation, and 1 indicates complete similarity.

The cosine similarity is beneficial because even if the two similar data objects are far apart by the Euclidean distance because of their size, they could still have a smaller angle between them. Smaller the angle, the higher the similarity.

When plotted on a multi-dimensional space, the cosine similarity captures the data objects' orientation (angle), not magnitude.

D. Jaccard Similarity

The Jaccard similarity is a widely used statistical measure in various fields, including data mining, text analytics, and information retrieval. It helps in determining the similarity between two sets of data based on the proportion of shared elements relative to the total number of distinct elements in both sets. The Jaccard similarity coefficient is calculated as the ratio of the size of the intersection of the two sets to the size of the union of the two sets. It ranges from 0 to 1, where 0 indicates no similarity, and 1 indicates complete similarity. To calculate the Jaccard similarity between sets A and B, the intersection and union of the sets are determined. The intersection refers to the set of elements that are present in both sets, while the union is the set of all distinct elements from both sets. By calculating the Jaccard similarity, one can gauge the similarity and diversity of sample sets accurately. It can be represented as a percentage ranging from 0% to 100%, where a higher percentage indicates a higher degree of similarity between the sets.

E. Web Scraping

Web scraping is the automated process of extracting data and information from websites using bots or software. It involves extracting the underlying HTML code of a webpage and collecting the data stored in its database. This enables the scraper to replicate the website content elsewhere and extract thousands or even millions of data sets in a shorter amount of time compared to manual data collection. To begin web scraping, a request is made to a website and the entire content of the webpage is made available as plain text. The content is then parsed using a library that represents the parsing logic for the text. In this case, the html5lib library is used to parse the text content to HTML DOM-based representation. The beautifulsoup4 library takes the parsed content and the parsing library as input parameters. It allows the user to navigate and search for elements from the parsed HTML nodes, extract data from the HTML nodes, and search for required nodes from the HTML structure. In the context of medicine spelling extraction, after the right spelling is extracted from Amazon Textract and cosine similarity checker, a Python program can be used to scrape all the offers related to that medicine from various websites. The extracted data can then be displayed on a website dashboard.

V. RESULTS

In this research paper, the Mediscan-Web application has been introduced, which is designed to interpret doctors' handwritten prescriptions and suggest the best price offers available on various e-commerce websites. This application uses AI technology to extract the names of the medicines from the uploaded prescriptions and search for their prices and offers on three different websites: 1Mg, Truemeds, and Amazon. The accuracy of the system has been evaluated on a training dataset of 1,000 medicines and found to be 80%. This application can greatly assist both doctors and patients in finding the best prices for medicines and in ensuring that the right medicines are prescribed and purchased.

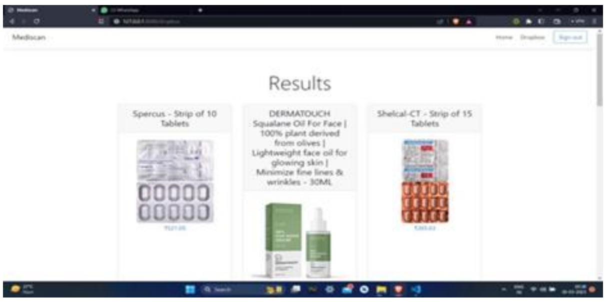

Figure 2. Result

VI.CONCLUSION

This research aimed to develop an offer recommendation system using machine learning and web scraping techniques. The system was designed to detect medicines from prescriptions uploaded on websites and compare prices from various e-commerce websites. Additionally, Mediscan provided users with a platform to keep their medical records secure and easily accessible.

Although the system achieved 80% accuracy over 1,000 medicine training datasets, it is not always 100% accurate. Therefore, further research is needed to evaluate its performance in a real-world setting and improve its accuracy. This research demonstrates the potential of advanced machine learning techniques to create efficient prescription detection and offer a recommendation system.

VII. REFERENCES

[1] T. Hegghammer, “OCR with Tesseract, Amazon Textract, and Google Document AI: a benchmarking experiment,” Journal of Computational Social Science, vol. 5, no. May 2022, pp. 861-882, 2022.

[2] C. I. Patel, D. Labana, S. Pandya, K. Modi, H. Ghayvat and M. Awais, “Histogram of Oriented Gradient-Based Fusion of Features for Human Action Recognition in Action Video Sequences,” MDPI, vol. 20, no. 24, 2020

[3] Z. NASAR, S. W. JAFFRY and M. K. MALIK, “Named Entity Recognition and Relation Extraction:,” Research Gate, p. 39, 2021.

[4] E. UZUN, “A Novel Web Scraping Approach Using the Additional Information Obtained From Web Pages,” IEEE Access, vol. 8, pp. 61726 - 61740, 2020.

[5] W. Yang and K. Orkphol, “Word Sense Disambiguation Using Cosine Similarity Collaborates with Word2vec and WordNet,” MDPI, vol. 11, no. 5, 2019

[6] J. Zhang, F. Wang, F. Ma and G. Song, “Text Similarity Calculation Method Based on Optimized Cosine Distance,” 2022 International Conference on Electronics and Devices, Computational Science (ICEDCS), pp. 37-39, 2023

[7] X. Yi, R. Zheng, A. Wang, H. Qin and Y. Chen, "Design and implementation of Word2Vec parallel algorithm based on HPC," 2017 Chinese Automation Congress (CAC), Jinan, China, pp. 585-590, 2017A

[8] D. M. Thomas and S. Mathur, "Data Analysis by Web Scraping using Python," 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA) , pp. 450-454, 2019.

[9] H. Hosseini, B. Xiao and R. Poovendran, "Google's Cloud Vision API is Not Robust to Noise," 2017 16th IEEE International Conference on Machine Learning and Applications (ICMLA) , pp. 101-105, 2017.

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