

BFSI- OCR OF BANK STATEMENTS

Milestone 4 Report



PREPARED BY:
Jasneet Arora

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1. Introduction

The BFSI (Banking, Financial Services, and Insurance) OCR (Optical Character Recognition) project aims to develop a comprehensive system to automate the extraction, visualization, and analysis of financial document data. Utilizing the meta-llama/Llama-3.2-11B-Vision-Instruct-Turbo model, the system processes bank statements, salary slips, and other financial records, ensuring accuracy and efficiency. Through integrated modules for data acquisition, quality control, OCR processing, and visualization, the project delivers a streamlined solution, culminating in a unified, user-friendly interface.

2. Objectives

Milestone 4 focuses on creating a unified system that integrates functionalities developed earlier into a seamless workflow. The goal is to enhance user experience by enabling manual and cloud-based image uploads through a Streamlit interface, implementing the Meta Llama OCR pipeline for text extraction, and providing dynamic data visualization with Plotly alongside querying capabilities using the Meta Llama model for interactive financial document analysis.

3. Methodology

The methodology for Milestone 4 integrates existing functionalities into a cohesive system. A Streamlit interface supports both manual image uploads and cloud-based retrieval via Cloudinary. The meta-llama/Llama-3.2-11B-Vision-Instruct-Turb model powers OCR processing, extracting data from financial documents with high accuracy. Visualization uses Plotly to create interactive graphs, while querying capabilities leverage the Meta Llama model for context-aware insights. This ensures an efficient, user-friendly workflow for financial data analysis.

4. Technical Implementation

4.1 Unified Streamlit Interface

The Streamlit interface serves as the central user interaction platform, offering:

- **Manual Uploads:** Users can upload images directly via a drag-and-drop interface.
- **Cloud-Based Retrieval:** Images stored in Cloudinary can be fetched using the Cloudinary API, providing flexibility for large-scale usage.

4.2 OCR Pipeline Integration

The OCR processing pipeline integrates:

- **Image Preprocessing:** Encoding images in Base64 format for compatibility with the Meta Llama model.
- **Data Extraction:** The meta-llama/Llama-3.2-11B-Vision-Instruct-Turbo model extracts key financial data, with custom prompts designed to capture structured information from complex document layouts.

- **Data Cleaning:** Pandas is used to organize extracted data, removing extraneous symbols and formatting issues using regular expressions.

4.3 Visualization and Insights

- **Dynamic Visualizations:** Interactive bar and pie charts created using Plotly enable users to analyse extracted data effectively.
- **Query Feature:** Users can ask document-specific questions through a chatbot interface, powered by the meta-llama/Llama-3.2-11B-Vision-Instruct-Turbo model, which provides context-sensitive answers.

4.4 File Management

Temporary files are managed efficiently using Python's tempfile and os libraries, ensuring seamless processing and system stability.

5. Results and Deliverables

5.1 Results

The integrated system successfully combines functionalities for:

- **Image Management:** Uploading and retrieving images from multiple sources.
- **Data Extraction:** Accurate text extraction and data organization for financial documents.
- **User Interaction:** Real-time data visualization and querying capabilities, enhancing user experience.

5.2 Deliverables

- **Streamlit Interface:** A unified interface supporting manual image uploads, cloud-based retrieval, data visualization, and document querying.
- **OCR Processing:** Fully functional OCR pipeline using the meta-llama/Llama-3.2-11B-Vision-Instruct-Turbo model.
- **Data Visualization:** Dynamic and interactive tools powered by Plotly.
- **Querying Features:** AI-driven interface for deeper insights into document content.

6. Dashboard Snapshots

6.1 Example 1: Profit and Loss Statement

6.1.1 Updated Images Using Cloudinary

Financial Document Analyzer

Select Document Type

Profit and Loss Sta...

Select Data Source

Fetch from Cloudinary

Upload Files

Select Graph Type

Pie Chart

Clear All Data

Profit and Loss Statement Analysis

Number of Images to fetch

15

Fetch Images

PROFIT & LOSS STATEMENT

For Self Employed

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

PROFIT & LOSS STATEMENT

For Self Employed

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

PROFIT & LOSS STATEMENT

For Self Employed

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

Forecasted Profit and Loss Statement

Analysis for the first year of operation including when appropriate, with cost of goods sold, gross profit and net income.

FORECASTED PROFIT AND LOSS STATEMENT

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

Simple Profit and Loss Statement (P&L)

(in millions)

2021A

Revenue: [Revenue]

Gross Profit: [Gross Profit]

Less: COGS: [COGS]

Gross Profit: [Gross Profit]

Less: SG&A: [SG&A]

EBIT: [EBIT]

Less: Interest Expense: [Interest Expense]

EBT: [EBT]

Less: Taxes: [Taxes]

Net Income: [Net Income]

PROFIT & LOSS STATEMENT

For Self Employed

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

QUARTERLY PROFIT & LOSS STATEMENT

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

Forecasted Profit and Loss Statement

Analysis for the first year of operation including when appropriate, with cost of goods sold, gross profit and net income.

FORECASTED PROFIT AND LOSS STATEMENT

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

QUARTERLY PROFIT & LOSS STATEMENT

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

RENTAL PROPERTY

PROFIT AND LOSS STATEMENT

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

PROFIT & LOSS STATEMENT

For Self Employed

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

Net Income: [Net Income]

ACME Corporation

PROFIT & LOSS STATEMENT

Company Name: [Name]

Period: [Period]

Revenue: [Revenue]

Expenses: [Expenses]

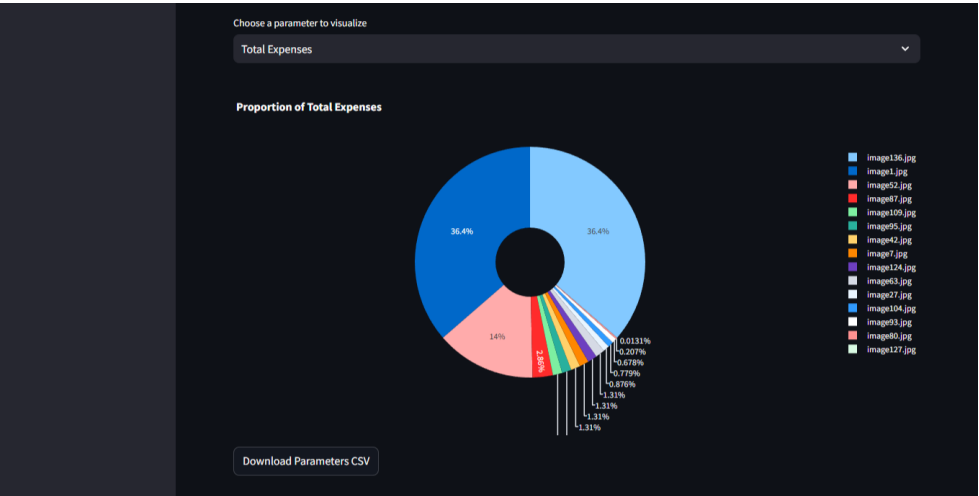
Net Income: [Net Income]

6.1.2 Parameter Extraction

Extracted Parameters

	Parameter	Value	Document
0	Total Revenue	100,000	image109.jpg
1	Total Expenses	75,000	image109.jpg
2	Gross Profit	25,000	image109.jpg
3	Net Profit	20,000	image109.jpg
4	Operating Expenses	5,000	image109.jpg
5	Total Revenue	100,000	image95.jpg
6	Total Expenses	75,000	image95.jpg
7	Gross Profit	25,000	image95.jpg
8	Net Profit	20,000	image95.jpg
9	Operating Expenses	5,000	image95.jpg

6.1.3 Visualization: Pie Chart



6.1.4 Ask a Question About the Document

Ask a Question About the Document

Select Image to Query

Document 5

Enter your question about the document:

How do I increase the gross profit?

To increase the gross profit, you can consider the following strategies:

1. Reduce COGS (Cost of Goods Sold): Lowering the cost of producing or purchasing your products can directly contribute to an increase in gross profit. This could involve negotiating better prices with suppliers, streamlining production processes, or implementing cost-saving measures.

2. Increase Selling Price: If possible, consider raising the selling price of your products without compromising their quality or value. This will directly increase revenue and, if COGS remains constant, lead to a higher gross profit margin.

3. Improve Efficiency: Enhancing operational efficiency can help reduce waste, minimize errors, and optimize resource utilization. This can lead to a decrease in COGS and an increase in gross profit.

4. Invest in Product Development: Developing new products or improving existing ones can increase their value and potentially command higher prices. This can contribute to an increase in gross profit if the cost of development is managed effectively.

5. Optimize Inventory Management: Managing inventory levels effectively can help reduce holding costs and minimize waste. This can contribute to a decrease in COGS and an increase in gross profit.

6. Implement Lean Manufacturing: Implementing lean manufacturing principles can help eliminate waste and improve efficiency in production. This can lead to a decrease in COGS and an increase in gross profit.

7. Reduce Waste: Identifying and eliminating unnecessary waste in production can help reduce COGS and increase gross profit.

8. Invest in Technology: Investing in technology can help streamline processes, reduce errors, and improve efficiency. This can lead to a decrease in COGS and an increase in gross profit.

9. Develop Strategic Partnerships: Forming strategic partnerships with suppliers or other businesses can help reduce costs and improve efficiency. This can contribute to a decrease in COGS and an increase in gross profit.

10. Focus on Quality Control: Ensuring high-quality products can help command higher prices and reduce returns or defects. This can contribute to an increase in gross profit if the cost of quality control is managed effectively.

By implementing these strategies, you can potentially increase your gross profit and improve your overall financial performance.

6.2 Example 2: Bank Statement

6.2.1 Updated Images Using Cloudinary

Financial Document Analyzer

Select Document Type

Bank Statement

Select Data Source

Fetch from Cloudinary

Upload Files

Select Graph Type

Bar Chart

Clear All Data

Bank Statement Analysis

Number of images to fetch

7

Fetch Images

image65.jpg

image7.jpg

image146.jpg

image25.jpg

image89.jpg

image32.jpg

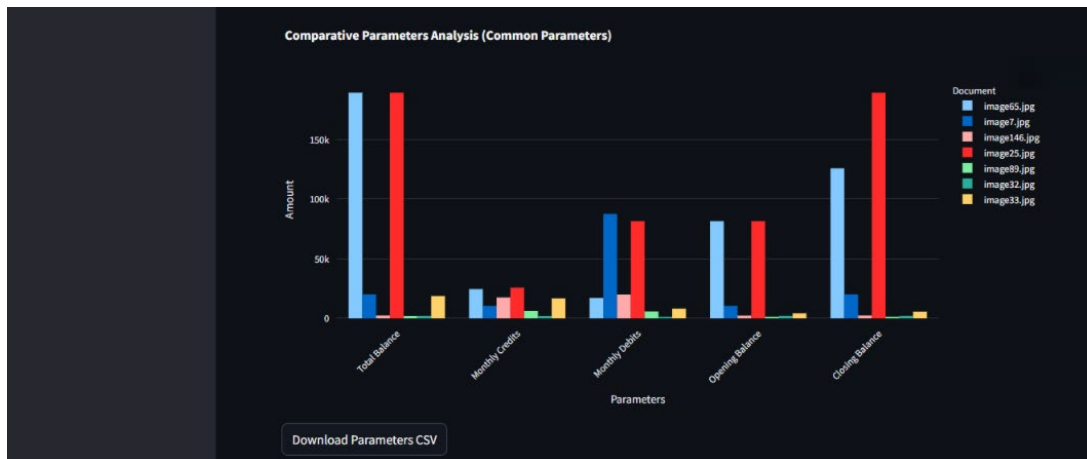
image33.jpg

Manage app

6.2.2 Parameter Extraction

Extracted Parameters			
	Parameter	Value	Document
0	Total Balance	189,296.31	image65.jpg
1	Monthly Credits	24,610	image65.jpg
2	Monthly Debits	17,120	image65.jpg
3	Opening Balance	81,607.4	image65.jpg
4	Closing Balance	125,883.63	image65.jpg
5	Total Balance	20,144.38	image7.jpg
6	Monthly Credits	10,487.68	image7.jpg
7	Monthly Debits	87,684.11	image7.jpg
8	Opening Balance	10,487.68	image7.jpg
9	Closing Balance	20,144.38	image7.jpg

6.2.3 Visualization: Bar Chart



6.2.4 Ask a Question About the Document

Select Image to Query

Document 4

Enter your question about the document:

Give me a complete analysis of the document in 10 points.

The document provided is a bank statement from Chase Bank, dated July 1, 2008, through July 31, 2008. The statement includes the following information:

- **Account Information:** The statement includes the account number, primary account number, and customer service information.
- **Checking Summary:** The statement provides a summary of the checking account, including the beginning balance, deposits and additions, checks paid, other withdrawals, fees and charges, and the ending balance.
- **Deposits and Additions:** The statement lists the deposits and additions made to the account during the period, including the date, description, and amount of each deposit.
- **Total Deposits and Additions:** The statement provides the total deposits and additions made to the account during the period.
- **Customer Service Information:** The statement includes customer service information, such as the website, service center, hearing impaired, and international calls.
- **Account Type:** The statement indicates that the account is a primary account.
- **Account Balance:** The statement provides the account balance at the beginning and end of the period.
- **Transaction History:** The statement includes a transaction history, which lists all transactions made to the account during the period.
- **Security Features:** The statement includes security features, such as a barcode and a signature line.
- **Disclaimer:** The statement includes a disclaimer that states that the bank is not responsible for any errors or omissions in the statement.

Overall, the document provides a comprehensive overview of the customer's checking account activity during the specified period. It includes all necessary information, such as account details, transaction history, and security features, to ensure that the customer has a clear understanding of their account activity.

7. Challenges and Solutions

7.1 Integration Challenges

- **Challenge:** Harmonizing functionalities like Cloudinary integration, OCR processing, and data visualization without compromising performance.
- **Solution:** Modular architecture ensured seamless integration, while extensive testing verified system reliability.

7.2 API Reliability

- **Challenge:** Occasional connectivity and retrieval issues with the Cloudinary API.
- **Solution:** Implemented robust error-handling mechanisms, including retries and fallback operations.

8. Next Steps

Future enhancements will focus on:

- Deploying the system in a production environment for real-time financial document analysis.
- Optimizing performance to handle various document formats and larger datasets.
- Incorporating additional features such as multi-language support and automated report generation.

9. Appendices

Appendix A: Technical Architecture

- **Frontend:** Streamlit for user interaction, including image uploads and retrieval.
- **PDF/Image Processing:** PyMuPDF (fitz) for extracting content from PDFs and Pillow for handling image formats.
- **Data Processing:** Pandas for organizing and manipulating extracted data with regular expressions for cleaning.
- **Visualization:** Plotly for dynamic bar and pie charts.
- **AI Integration:** Together API for document analysis and parameter extraction.
- **Cloud Integration:** Cloudinary API for scalable image storage and retrieval.
- **System Advancements:** Enhanced querying with the Meta Llama model and real-time visualization for dynamic data insights.

Appendix B: Technical Specifications

- **Software:**
 - Streamlit: Framework for interactive web applications.
 - PyMuPDF: Extracting content from PDFs.
 - Pandas: Data manipulation and organization.
 - Plotly: Generating interactive visualizations (bar, pie charts).
 - Pillow: Processing and converting image formats.
 - Cloudinary API: Scalable image retrieval and storage.
 - Together API: AI-powered text extraction and analysis.
- **Hardware Requirements:**
 - RAM: Minimum 8GB.
 - CPU: 2.5 GHz or higher.

- Storage: 50GB available space for file handling and processing.
- **Operating System:** Windows, macOS, or Linux.
- **Web Browser:** Chrome or Firefox recommended for Streamlit interface.

Appendix C: Hardware and Software Requirements

- **Hardware:**
 - Minimum RAM: 8GB.
 - CPU: Intel Core i5 or equivalent.
 - Storage: 50GB available space.
- **Software:**
 - Operating System: Windows, macOS, or Linux.
 - Python 3.8+ and libraries like Streamlit, PyMuPDF, Pillow, Pandas, Plotly, Together API.
 - Browser for UI interaction: Chrome or Firefox recommended.