



Locking in Trends: A RAG-Based Approach to Secure Consumer Predictions



Lorena C. Madeline G. ,Connor G. , Rashia H. , Munpreet K. , Zaina K. , Sofia M. , Sarah M. ,Yana N. , Julia P. , Alex P. , Skyler P.,
Bader R. , Jordana T. , Valerie T.

PROJECT BACKGROUND

dormakaba creates access and security solutions in residential and commercial spaces. Using the company's data, we delegated tasks through the following teams of: Artificial Intelligence (AI) , Machine Learning (ML), and Software Engineering (SWE) to clean and display clear results of invoices, patterns, locations, and findings.

OBJECTIVE

This project develops a machine learning model that helps dormakaba to better:

- Identify at-risk credit customers
- Match unapplied cash receipts to the correct customer and invoice
- Streamline customer data management to improve financial accuracy
- Support better strategic decisions across the organization

CENTRAL QUESTIONS

- Can we utilize the data we were given to optimize customer trends?
- How can we train a Machine Learning model on payment and invoice data?
- How can we best predict a customer's likelihood to pay on time?

METHODS AND DATA

Figure 1.1



Data Given:

- Customer Locations (International and Domestic)
- Current Customer Payments
- Past Customer Invoices

Fall 2024 : Using Python techniques, we organized the data set we were given by sorting each entry by hotel chain, handling null values

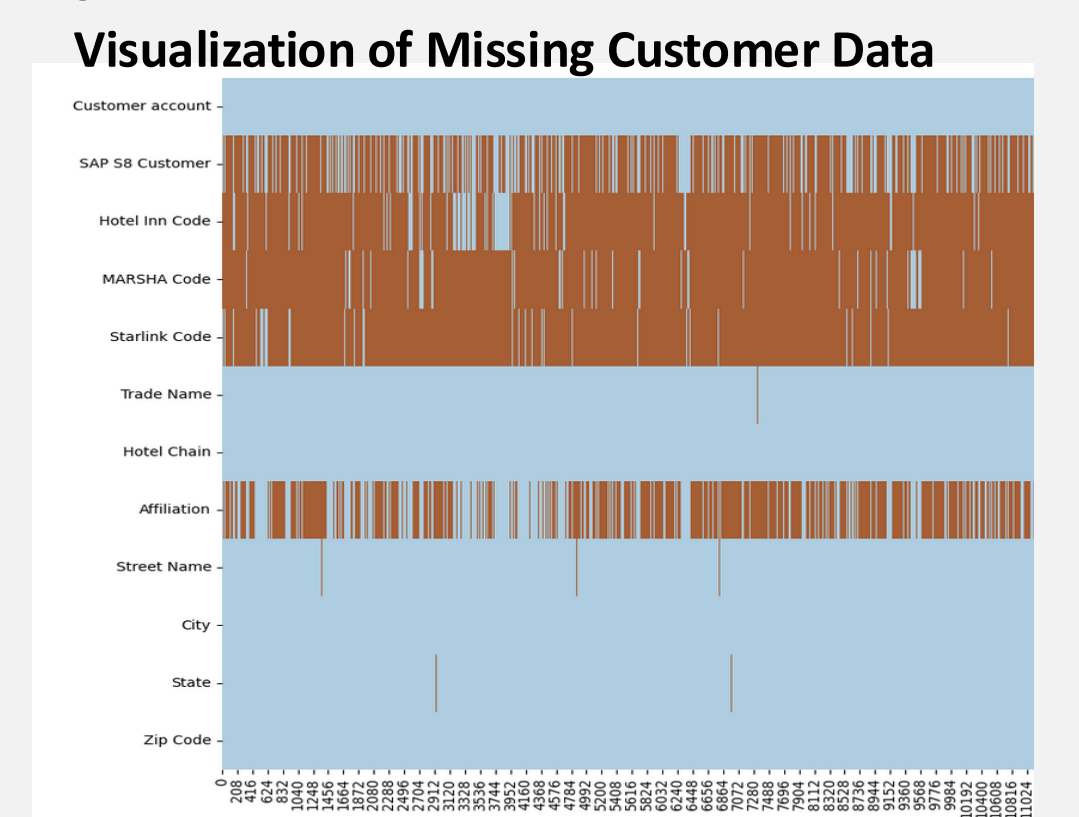
Spring 2025: Received the AR dataset to predict customer payment behavior based on their past payment history.

- Machine Learning team cleaned the given data, correctly handled null values, and created regression and linear models and sent results to Artificial Intelligence team
- Artificial Intelligence team then created a RAG model that utilized the Machine Learning team's findings using open-source software sent their results to the Software Engineering team
- Software engineering team created a user-friendly interface that allows a user to interact with the AI model created by the AI team

DATA EXPLORATION

In our data cleaning process, we used the functions we've worked on previously to transform raw data into a clear and usable format.

Figure 1.2



Orange = Missing

Figure 1.4

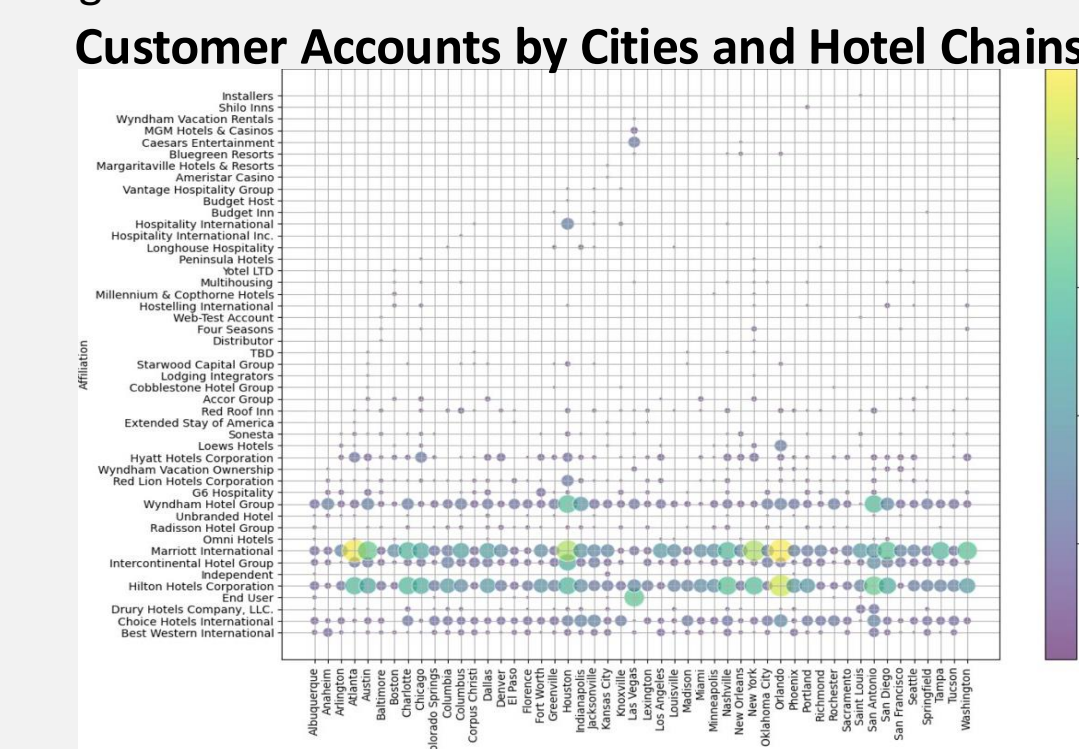


Figure 1.3

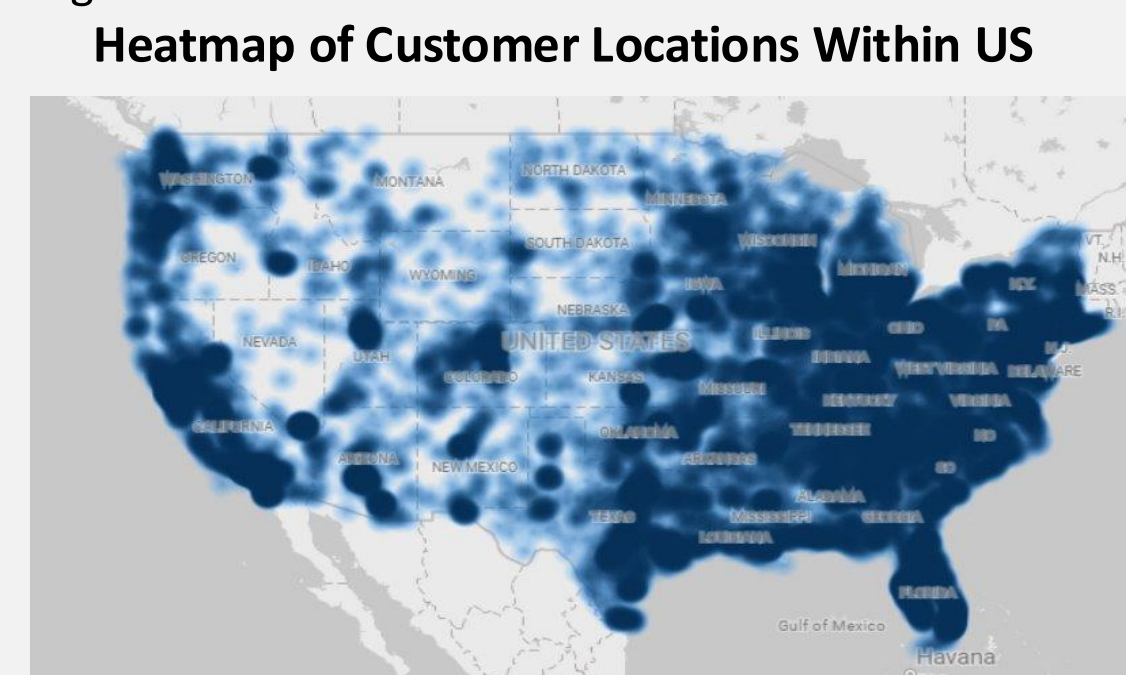


Figure 1.5



Figure 1.6

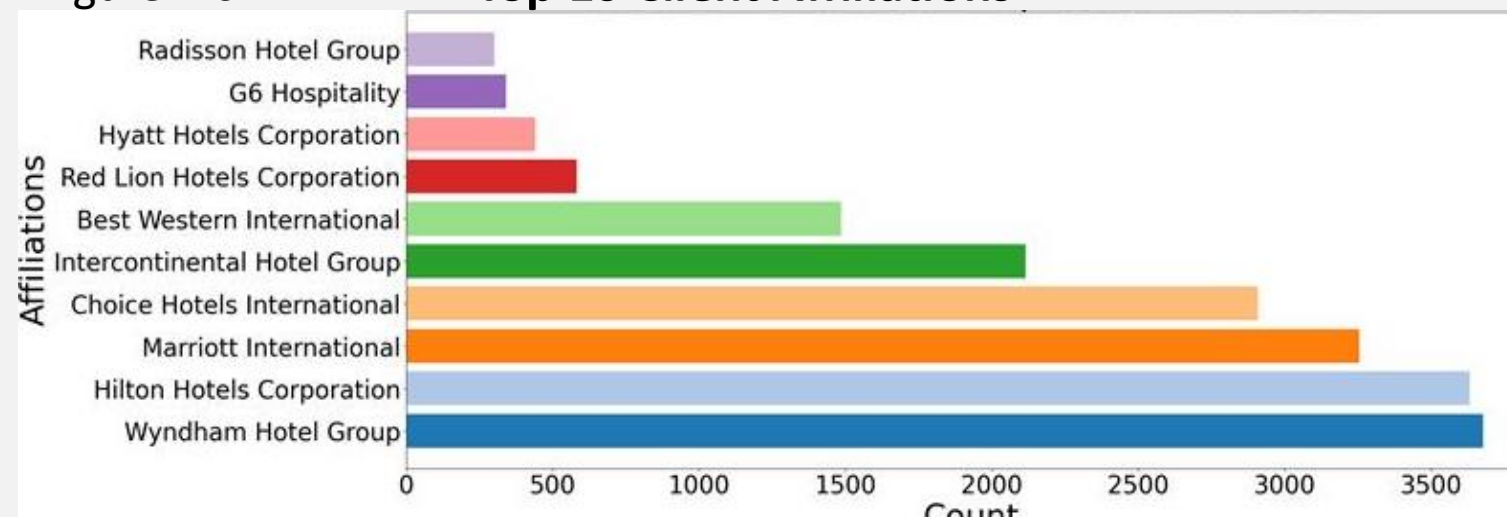
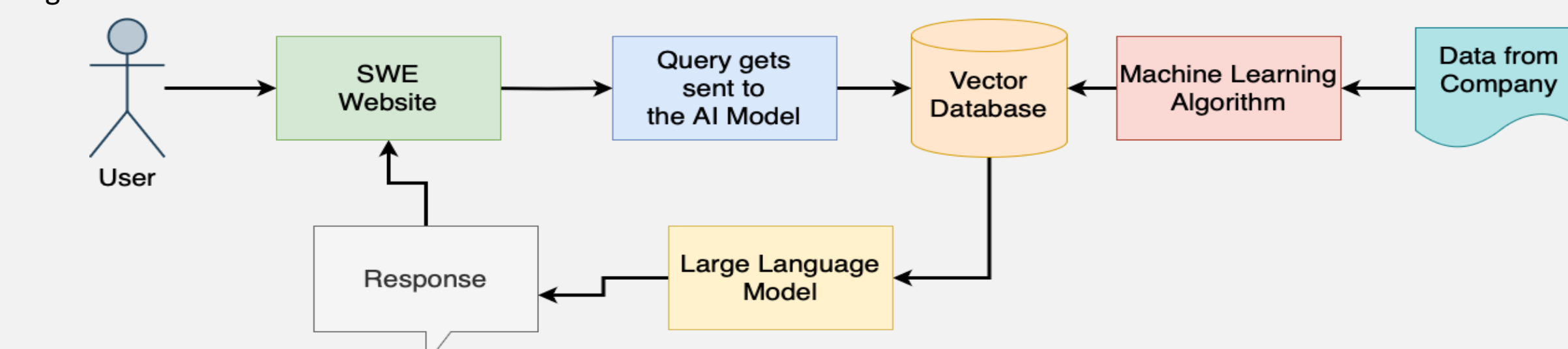


Figure 1.7

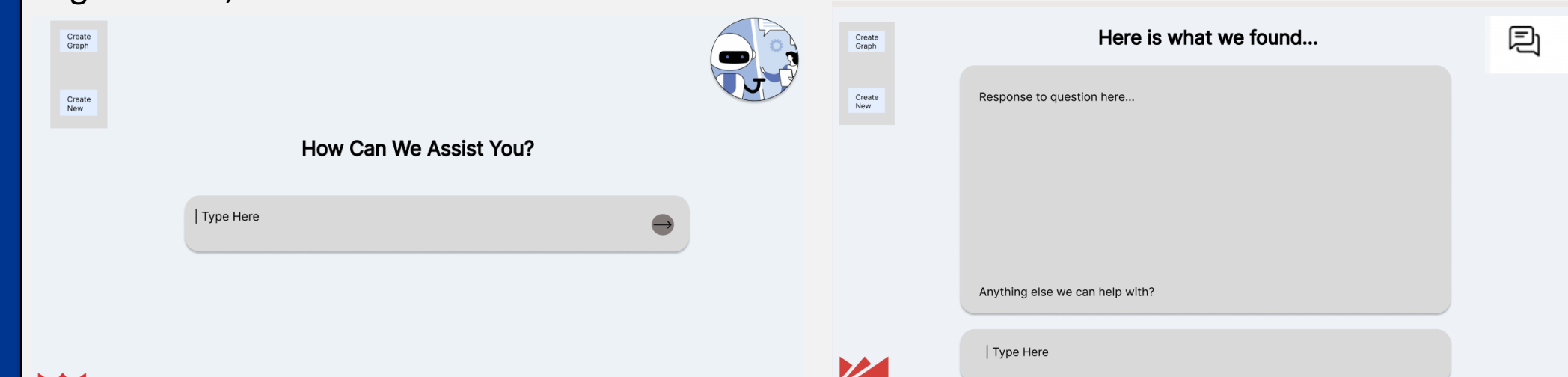


Using data manipulation skills from the first semester, we transformed our new dataset into a machine learning pipeline that powers our AI model. The results of this process are then displayed on the website developed by the SWE team, enabling users to interact with the model's insights in real time.

RESULTS AND FINDINGS

Used a combination of HTML, CSS and JavaScript to create a page that would allow users to access the most updated data. Users can enter prompts about the data into an AI chatbot to predict the payment history of past customers.

Figures 1.8a, 1.8b



Utilized Accounts Receivable (AR) data to analyze customer payment patterns by comparing actual payments to expected amounts. Regression and linear modeling was used to analyze data and create visuals.

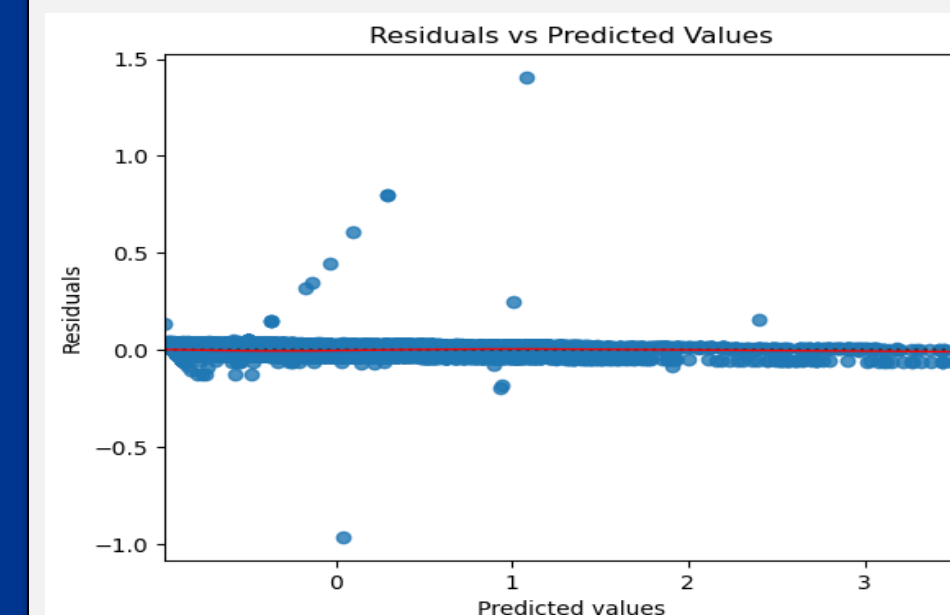


Figure 1.9

Figure 1.9 visually represents the predictive capability of the regression model. The model has R^2 score of 0.99, the RMSE is roughly 30 days.



Figure 1.10

Figure 1.10 represents the average Bleu Score our rag model achieved using a T5 model to comply with the company's privacy policy; then used natural language processing (NLP) to understand user questions and generate relevant and accurate responses.

FUTURE GOALS

AI: We would like to be able to more accurately predict customer's future behavior using various ML models and techniques (i.e. What payment terms do customers in Chain X receive?)

ML: Creating linear regression and multiple regression machine learning models to predict trends based on costumer and client behavior

SWE: Design an AI chatbot for the full-stack application and working on creating a functioning landing page that includes graph generation.

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