



REVA
UNIVERSITY

Bengaluru, India

Established as per the section 2(f) of the UGC Act, 1956,
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REVA Academy for Corporate Excellence (RACE)

Sentiment Analysis on Credit Cards using Online Reviews

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Date: 27-August- 2022

MBA in Business Analytics

Capstone Project Presentation
Year: II

race.reva.edu.in



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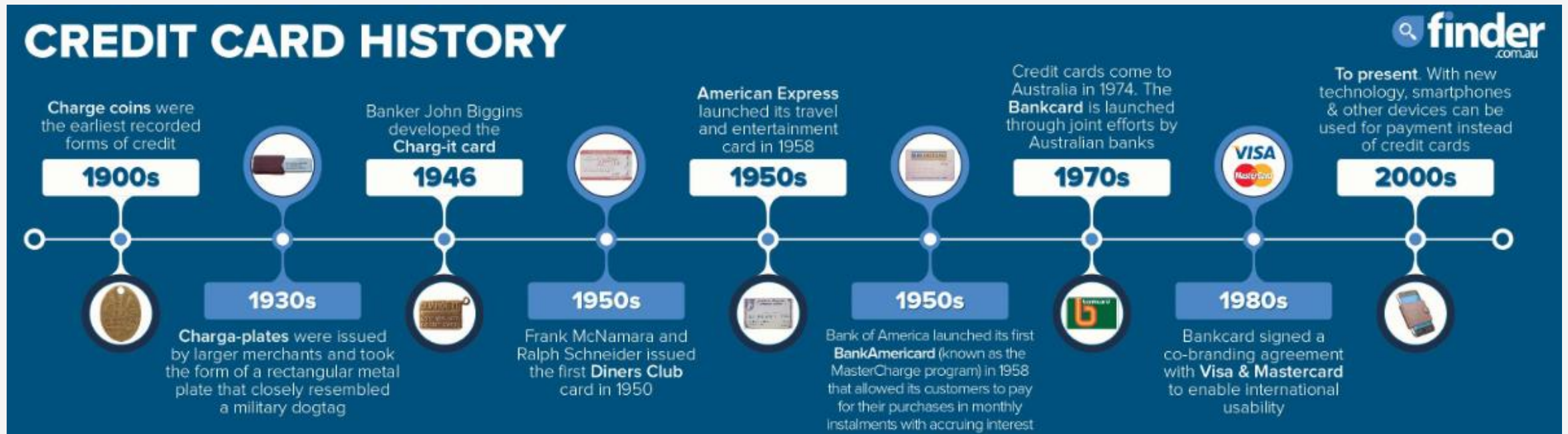
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References | Publications | Plagiarism Score

- History of credit cards starts in 1887, with the idea of using a card to make purchases
 - novel Looking Backward, written by Edward Bellamy.
- First used in the 1920s in the U.S, as an alternative to many other forms of merchant credit, intended to sell gasoline to the growing number of drivers on the road.
- By 1921, Western Union also started to issue charge cards to regular customers.





Introduction

TO EARN POINTS AND MILES FOR TRAVEL

CREDIT CARDS
WE USE FOR
ONLINE
SHOPPING

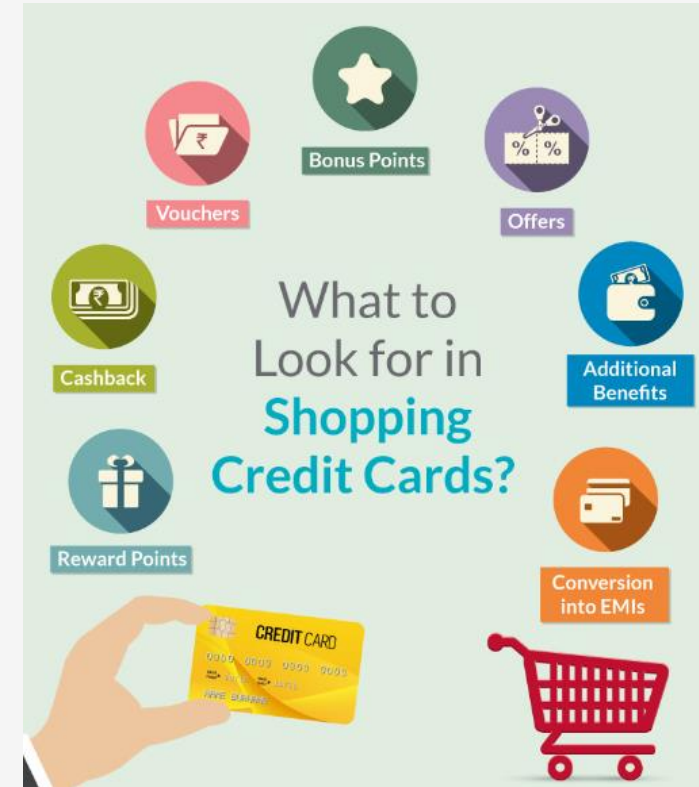


Shopping:

- Concept of converting the high purchase amount into low-cost EMIs has revolutionized.
- Discounts on credit cards get extended on movie tickets.
- Online shopping Discounts.
- Waivers at petrol/diesel pumps across the country.

Traveling:

- Without carrying Money.
- At Airport or railway station a unique experience, complimentary lounge access, priority check-in.
- Comprehensive travel insurance coverage.



Literature Review

Paper Title	Authors	Journal	Objective
Determining banking service attributes from online reviews: text mining and sentiment analysis	Divya Mittal Shiv Ratan Agrawal	International Journal of Bank Marketing	Using text mining and sentiment analysis to identify core banking service attributes and customer sentiment in online user-generated reviews. And study customer satisfaction based on the identified predictors.
Best Offer Recommendation Service	Kiran Gajanan Javkar Siddharth Hasmukh Vora Amit Someshwarrao Rodge Joy Bose Hitesh Sharma	International Conference on Advances in Computing , Communications and Informatics	Determine the best set of coupons or offers available given a user profile and payment mechanism such as a credit card which enables the service to recommend the best deals to the user.
Assessment of service quality using text mining – evidence from private sector banks in India	Somnath Chakrabarti Deepak Trehan	International Journal of Bank Marketing	To analyse user reviews to better understand the correlation between RATER dimension sentiment scores as independent variables and user overall rating (customer satisfaction) grouping in “good” and “bad” as dependent variables through the development of the authors’ own logistic regression model using lexicon-based sentiment analysis.
Recommendation system in E-commerce websites: A Graph Based Approach	Shakila Shaikh Dr. Sheetal Rathi	IEEE 7th International Advance Computing Conference	The Paper is regarding the lack of semantic factors in recommendation systems and describes the different recommendation techniques that are being employed in the current e-commerce website.

Problem Statement

Aim to develop a data pipeline to store data in a datastore and perform Text Analytics on Credit Card using Online reviews.

“Text analytics and sentiment analysis are performed on the reviews and tweets collected from websites and Twitter to develop tableau dashboards – which help to visualize the sentiments of users on using different credit cards based on credit card category, develop a recommendation system for recommending the cards based on card categories and develop a simple chatbot which suggests best suitable credit cards “

Project Objectives

Three major objectives of this study:

- Tableau dashboard on sentiment analysis of credit card usage on transactional category and four cities of India.
- A recommendation system to recommend similar credit cards based on the credit card categories.
- Simple Chat Bot, which suggests the best suitable credit card based on the user's questions.

Project Methodology

CRISP-DM Framework - Cross-Industry Standard Process for Data Mining

Business Understanding: Focus on understanding the project objectives and requirements from a business perspective, then converting this knowledge into a analytics objectives and a preliminary plan to achieve the objectives.

Data Understanding: Starts with an initial data collection and proceeds with activities in order to get familiar with the data, to identify data quality problems, discover first insights into the data, or to detect interesting patterns to form hypotheses.

Data Preparation: Covers all activities to construct the final dataset from the initial raw data. Data preparation tasks are likely to be performed multiple times and not in any prescribed order. Tasks include record and variable selection as well as transformation and cleaning of data for modelling.

Modeling: Various modeling techniques are selected and applied, and their parameters are set to optimal values. Some techniques have specific requirements regarding the form of data. Therefore, stepping back to the data preparation phase is often necessary

Evaluation: Thoroughly evaluate the model and review the steps executed to be certain it properly achieves the business objectives. At the end of this phase, a decision on the use of the analytics results should be reached.

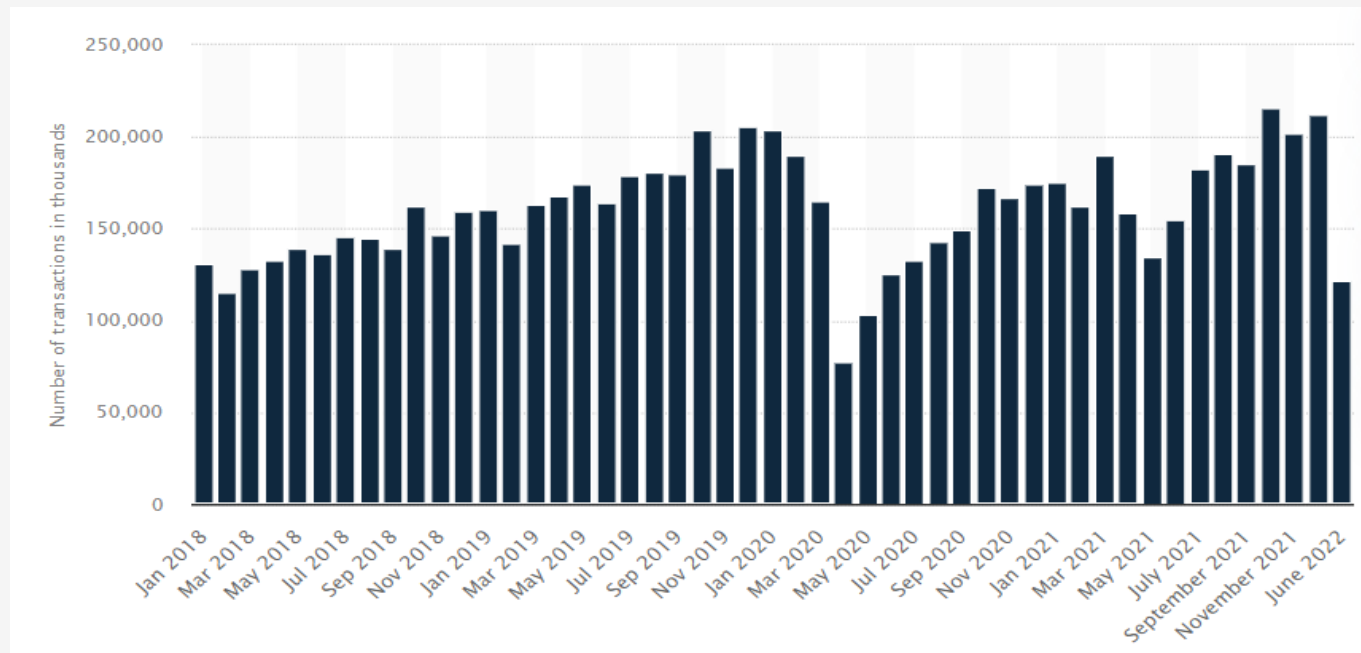
Deployment: Once the model is created and tested and evaluated on the Test and Validation data. The model undergoes different real-time evaluations and testing and after the approval process, the code is pushed to the PROD/Live data



Business Understanding

With the help of emerging technologies,

- Fintech firms are attracted by the need to improve the financial services already offered by various institutions.
- Credit card plays an important role in the current transactional world.
- Credit card holders are switching from credit seekers to regular users of it, mainly due to transactional medium.



Credit Wise

No of Cards (million) (*MAY 2019)

2018-2019*	48.9
2017-2018	37.4
2016-2017	29.8
2015-2016	24.5

Amount transacted (₹lakh cr)

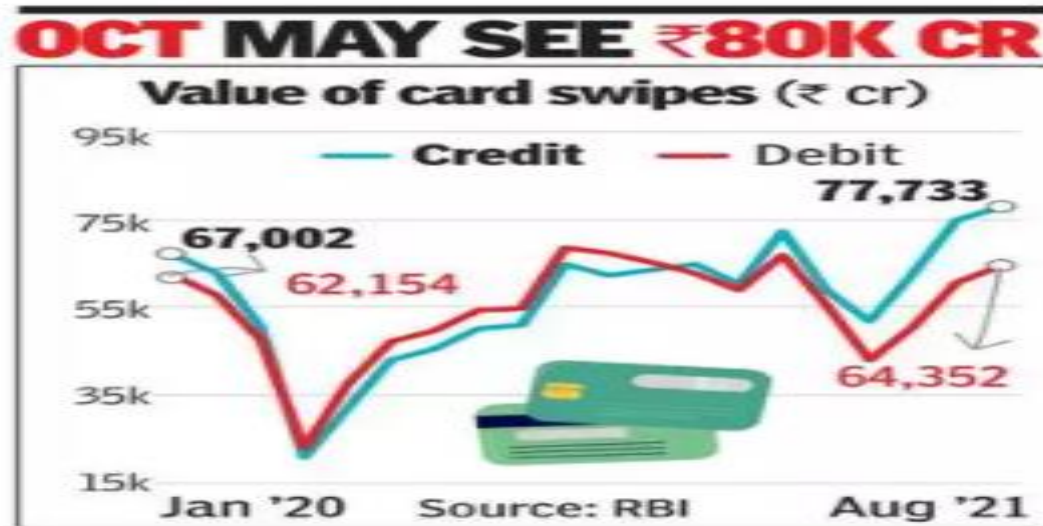
2018-2019*	6.07
2017-2018	4.6
2016-2017	3.3
2015-2016	2.4

No of transactions (billion)

2018-2019*	1.7
2017-2018	1.4
2016-2017	1.09
2015-2016	0.8

Business Understanding

“Credit card spending hit Rs 2 Lakh crore high in 2021. Spending on credit cards had taken a severe hit during the first 9 months of the pandemic between March 2020 to December 2020. Spending on debit cards outstripped credit for this period. October has begun with a bang with the reopening of malls and online sales.”



Credit card e-spends beat swipes by 76%

In A First, RBI Shares Separate Data For Online, Offline Use Of Plastic, Debit Cards Top In Stores

Mayur.Shetty@timesgroup.com

Mumbai: Credit card spending online by Indians outstrips the value of in-store swipes by 76%. Data released by the RBI shows that Indians predominantly use their credit cards online for payments, while debit cards are more used for physical stores. The RBI data provides for the first time a break-up of online versus in-store payments, which explains the regulator's concerns over risks involved in online usage.

According to the data for March 2022, 7.3 crore credit cardholders spent Rs 68,327 crore online as against the Rs 38,773 crore used for making payments in stores using card-swipe machines. In terms of the number of transactions, there is not much difference with 11.1 crore offline credit card transactions versus 11 crore online transactions.

Debit cards, however, tell a slightly different story. The 91.7 crore debit cards active in India were used for 20.8 crore transactions in stores and for 11.9 crore transactions online. This means that roughly one in five debit cards were used for payments in stores and

little more than one in 10 were used for online payments. In terms of the value of transactions, Rs 40,831 crore was spent in stores, while Rs 22,687 crore was spent online.

Data on credit and debit cards released by the RBI for the month of March 2022 shows that banks increased their card base by 6.2 crores to 7.3 crores in 12 months. The 1.1 crore addition resulted in

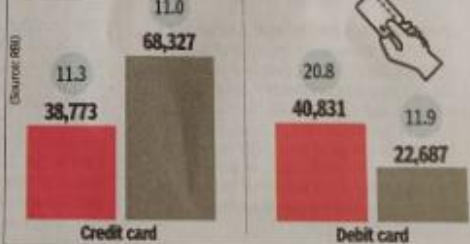
16% growth to 1.37 crores. Axis Bank grew its card base 26% to 90 lakh cards.

In terms of card additions, HDFC Bank, the largest player, ranked fourth due to an RBI ban on adding new customers for nearly eight months. This resulted in the card base growing only 10% to 1.65 crore. Kotak Mahindra was the fastest-growing among the top five by adding

DECODING MODE OF PAYMENT

Value of transactions in March (₹ cr)

■ PoS machine (physical stores) ■ No. of transactions (in cr)



an 18% growth in the card base. The highest addition came from ICICI Bank, which grew its card base by 22.5% to 1.3 crore cards. In terms of absolute growth, State Bank of India came in second adding 19

7.8 lakh cards and taking its card base to 31.9 lakh — an increase of 32.6%. IDFC Bank, which launched its differential card product, managed to add 5.6 lakh cards, taking its base to nearly 8 lakh cards.

paisabazaar.com

bankbazaar
Credit To You

Best Website for Checking Credit Score

★★★★★

Credit Report

My colleague in the office had suggested checking Paisabazaar's website for personal finance products. Where I found the option to 'Check Credit Score for Free'. I am extremely impressed with the service.



Siddharth Sharma
Posted on: Sep 24, 2021

Great Website for Checking Credit Score

★★★★★

Credit Report

I really liked your website. I have been planning to apply for a home loan for a long time so I downloaded my credit score and used the free tools to check my eligibility and the EMIs that I would have to pay on my loan.



Roopali
Posted on: Sep 23, 2021

Had a Good Experience

★★★★★

Credit Report

I wanted to apply for a credit card and someone at my office had told me to check my credit score before applying for it. A score above 750 is considered to be a good score for availing credit card. I checked my credit score from Paisabazaar.com and it was 780. Amazing service.



Megha
Posted on: Sep 23, 2021

Web scrapped data from the websites and then transformed it into .csv files using the tool Octoparse.

Title	View	View1	shortprofile	shortprofile2
Good card with travel benefits	HDFC Bank Credit Card	I got a travel-specific HDFC credit card in 2019. I	Mrityunjay Abhivyakti Posted on: Jun 2, 2021	Mrityunjay Abhivyakti
Good benefits but less rewards	State Bank of India Credit Card	I have been using SBI Credit Card since 2019. I lik	Mangesh Kumar Posted on: Jun 2, 2021	Mangesh Kumar
Exciting perks and benefits	ICICI Bank Credit Card	One thing is for sure that Paisabazaar has quality	Ojasvini Posted on: Jun 2, 2021	Ojasvini
HDFC Moneyback Credit Card	HDFC Bank Credit Card	This was my first credit card and I still have it wit	Rahul Kumar Arya Posted on: May 25, 2021	Rahul Kumar Arya

Data Understanding



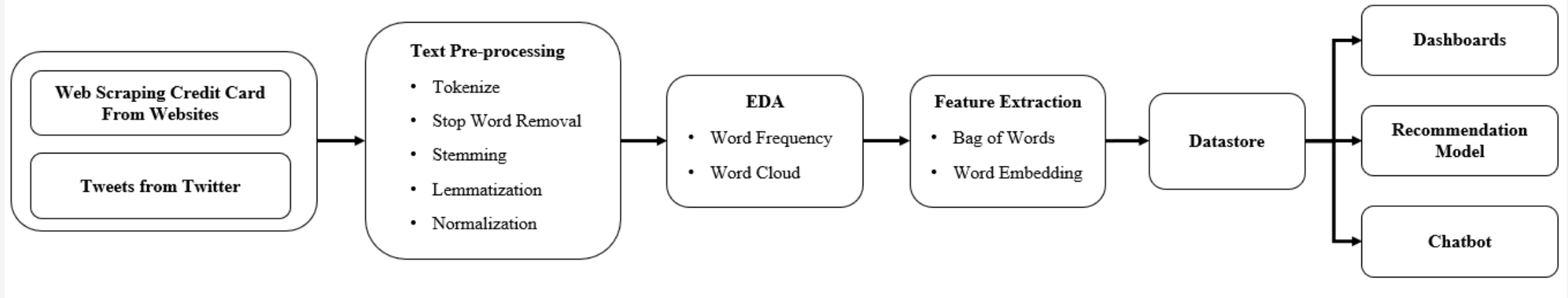
Bank Card Details	Geo Code	Product	Region
icici Credit Card	Bangalore - 12.97,77.59,150mi	icici	Bangalore
Axis Credit Card	Mumbai - 19.07,72.87,150mi	Axis	Mumbai
SBI Credit Card	Delhi - 28.70,77.10,150mi	SBI	Delhi
hdfc Credit Card	Kolkata - 22.57,88.36,150mi	hdfc	Kolkata

tweets from Twitter API using R programming. Tweets are acquired using different parameters.

tttext	date	isretweet	retweetcount	favoritecount	score	product	region	country	duplicate
OnePlus 9RT in stock	19-01-2022 02:04	FALSE	0	0	0	SBI	Delhi	India	FALSE
@AxisBankSupport i haven't applied for Flipkart	19-01-2022 02:44	FALSE	0	0	0	Axis	Delhi	India	FALSE
@HDFC_Bank My loan application and credit ca	19-01-2022 03:34	FALSE	0	0	0	hdfc	Delhi	India	FALSE
Hey @AxisBank , i didn't received my credit car	19-01-2022 03:53	FALSE	0	1	-1	Axis	Delhi	India	FALSE
@TechnoFino									
Bro I find a term in my hdfc millinea credit card statement.									
1 RP Premium LTF.									
What is this mean?									
Is m	19-01-2022 04:03	FALSE	0	0	0	hdfc	Delhi	India	FALSE
@HDFC_Bank why have you been charging me	19-01-2022 04:24	FALSE	0	0	0	hdfc	Bangalore	India	FALSE

Data Preparation

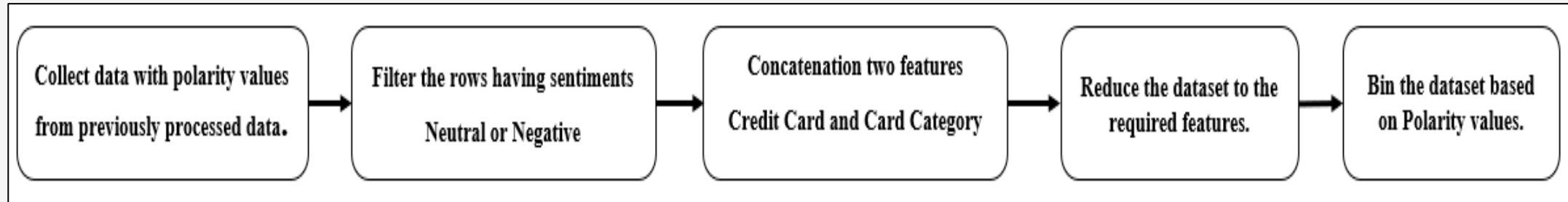
Data pipeline to perform pre-processing of data and for storing data in datastore



Data from the datastore is further pre-processed

- Develop dashboards
- Credit card recommendation system
- Simple Credit card Chatbot

Data Preparation steps for Recommendation Engine.



	userid	credit_card_category	polarity_bin
0	0	HDFC Bank Credit Card - reward	2
1	1	State Bank of India Credit Card - shopping	3
2	2	ICICI Bank Credit Card - general	3
3	3	HDFC Bank Credit Card - reward	2
4	4	American Express Credit Card - reward	4

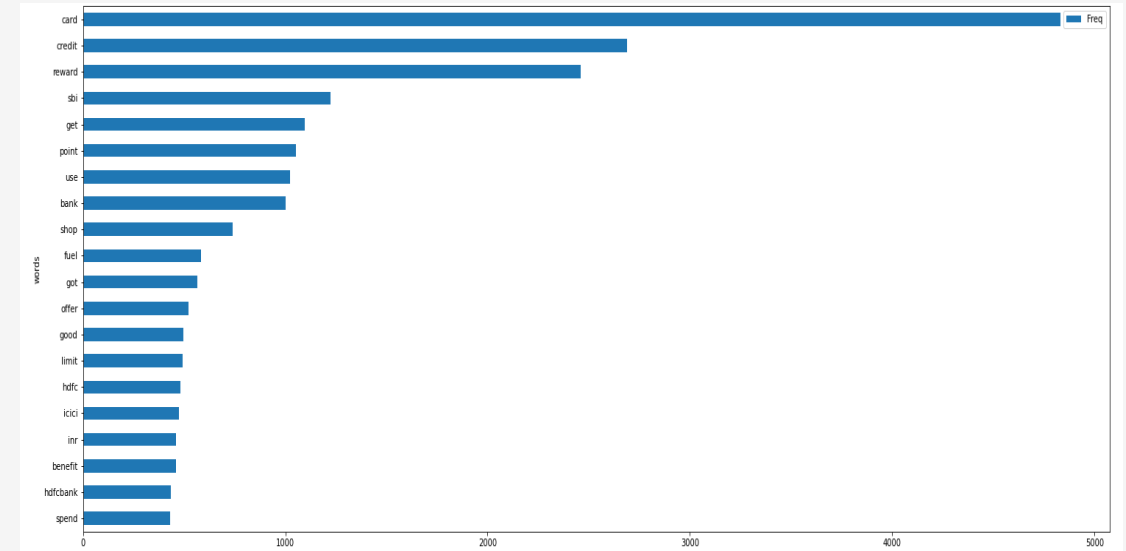
Data Preparation for Simple Chat-Bot

```
{
  "intents": [
    {
      "tag": "greeting",
      "patterns": ["Hi there", "How are you", "Is anyone there?", "Hey", "Hola", "Hello", "Good day"],
      "responses": ["Hello - I am Credit Card Bot, How Can I help you?"],
      "context": [""]
    },
    {
      "tag": "goodbye",
      "patterns": ["Bye", "See you later", "Goodbye", "Nice chatting to you, bye", "Till next time"],
      "responses": ["See you!", "Have a nice day", "Bye! Come back again soon."],
      "context": [""]
    },
    {
      "tag": "thanks",
      "patterns": ["Thanks", "Thank you", "That's helpful", "Awesome, thanks", "Thanks for helping me"],
      "responses": ["Happy to help!", "Any time!", "My pleasure"],
      "context": [""]
    },
    {
      "tag": "noanswer",
      "patterns": [" "],
      "responses": ["Sorry, can't understand you", "Please give me more info", "Not sure I understand"],
      "context": [""]
    },
    {
      "tag": "card",
      "patterns": ["Credit Card", "I want Credit Card", "Card"],
      "responses": ["Please type the approx montly spend income 10000 or 20000 or 30000 or 40000."],
      "context": [""]
    },
    {
      "tag": "category",
      "patterns": ["10000", "20000", "30000", "40000"],
      "responses": ["Choose Credit Card category to like to spend Fuel, Shopping, Reward, Cashback, Lifestyle, Travel"],
      "context": [""]
    }
  ]
}
```


Descriptive Analytics



Word Cloud

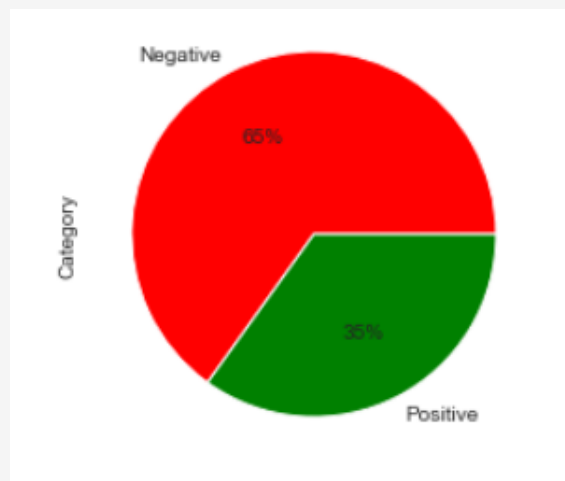


Word Frequency

Top 5 commonly used words

- card
- credit
- reward
- sbi
- get

```
[('card', 4832),  
( 'credit', 2690),  
( 'reward', 2459),  
( 'sbi', 1225),  
( 'get', 1097),  
( 'point', 1053),  
( 'use', 1023),  
( 'bank', 1000),  
( 'shop', 741),  
( 'fuel', 583),  
( 'got', 564),  
( 'offer', 520),  
( 'good', 496),  
( 'limit', 493),  
( 'hdfc', 480),  
( 'icici', 473),  
( 'inr', 461),  
( 'benefit', 459),  
( 'hdfcbank', 435),  
( 'spend', 429)]
```



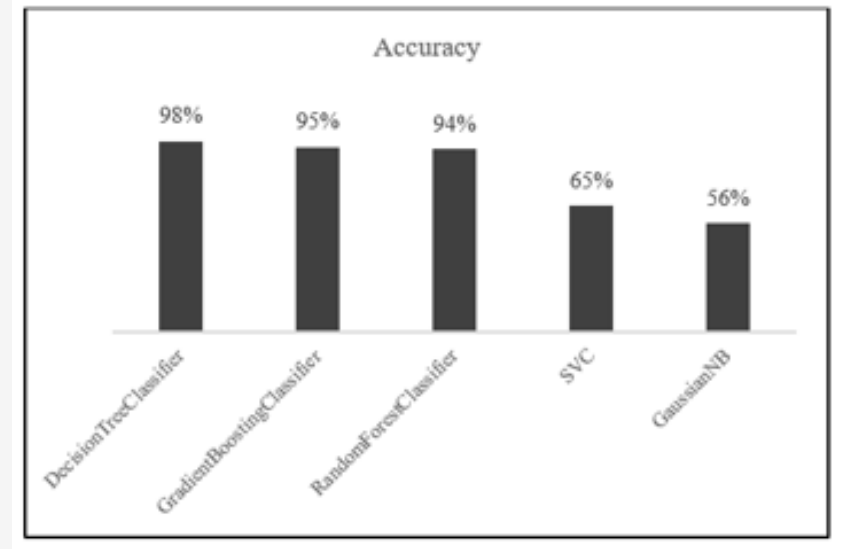
Classification Model Approach
Text Blob Polarity
Fine Tuning with BERT
Word Embedding TF-IDF Vectorizer
Lexicon Vocabulary
VADER Sentiment

Dataset has 1796 positive text which is 36% and 3348 negative text which is 65% of the extracted data.

Model Evaluation

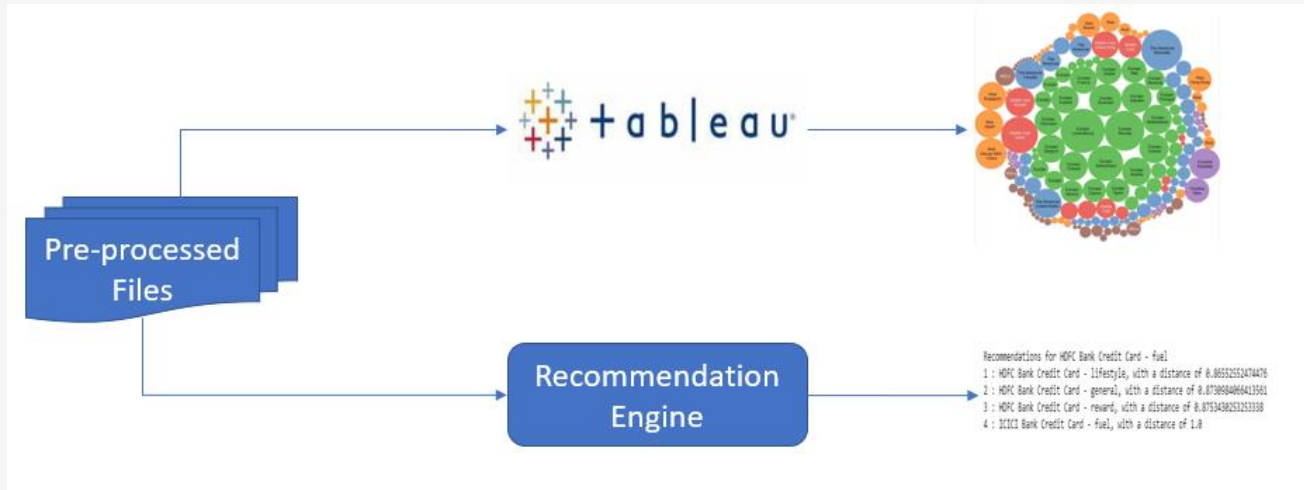
S.N.	Approach	Accuracy	Classifier with Best Result
1.	Text Blob Polarity	98%	Decision Tree Classifier
2.	Fine Tuning with BERT	97%	Transfer Learning
3.	Word Embedding TF-IDF Vectorizer	94%	Gradient Boosting Classifier
4.	Lexicon Vocabulary	93%	Gradient Boosting Classifier
5.	VADER Sentiment	90%	Random Forest Classifier

Text Blob Polarity with Decision Tree Classifier has given the highest accuracy of 98% for the analysis.



Comparison of Accuracies of Text Blob Polarity Model

Model Deployment

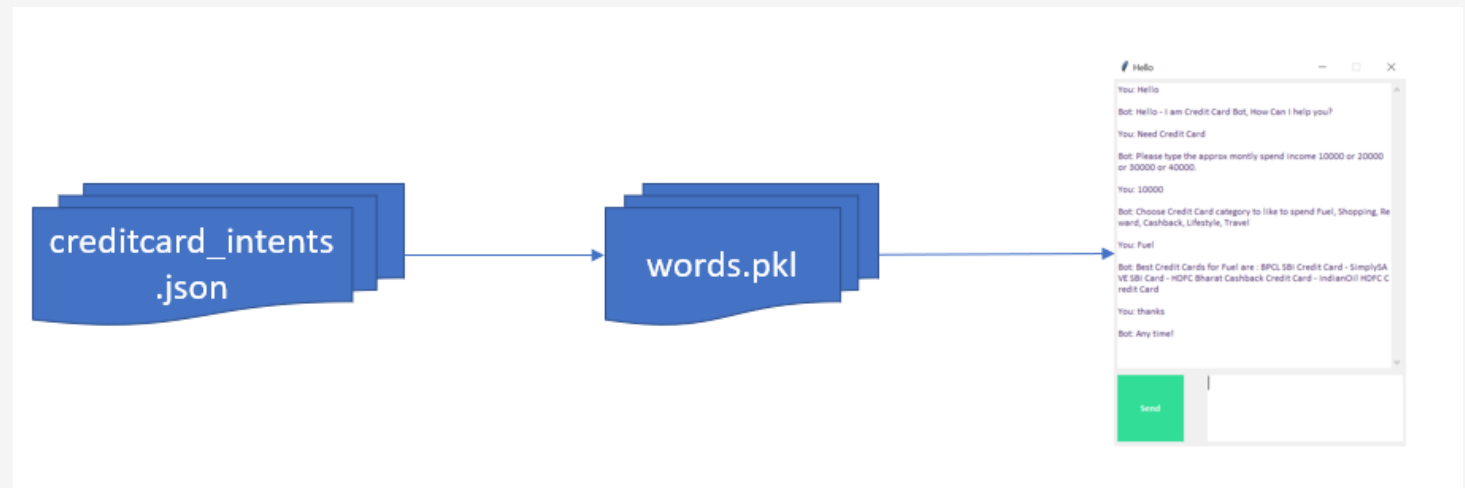


Deployment Model for

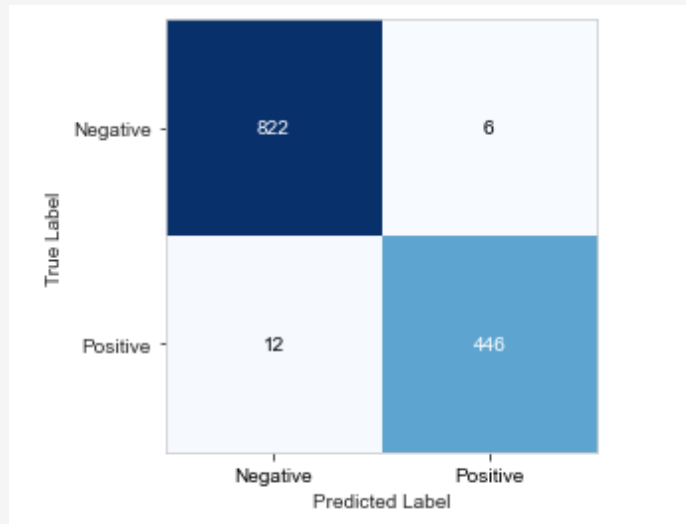
- Tableau Dashboard
- Recommendation System

Deployment Model for

- Simple Chatbot



Results and Insights



Decision Tree Confusion Matrix – Text Blob

Confusion Matrix: Model was able to identify 446 positives and 822 negatives correctly 6 false negatives and 12 false positives.

Precision value for both positive and negative classifiers is 0.98.

Recall value for positive values is 0.96 and for negative values is 0.97.

Recommendations for State Bank of India Credit Card - general

- 1 : American Express Credit Card - shopping, with a distance of 0.8786329908905898
- 2 : American Express Credit Card - reward, with a distance of 0.9510487013222725
- 3 : American Express Credit Card - general, with a distance of 0.978669514978249
- 4 : ICICI Bank Credit Card - general, with a distance of 1.0

Recommendation for general credit card

You: Hello

Bot: Hello - I am Credit Card Bot, How Can I help you?

You: Need Credit Card

Bot: Please type the approx montly spend income 10000 or 20000 or 30000 or 40000.

You: 10000

Bot: Choose Credit Card category to like to spend Fuel, Shopping, Reward, Cashback, Lifestyle, Travel

You: Fuel

Bot: Best Credit Cards for Fuel are : BPCL SBI Credit Card - SimplySAFE SBI Card - HDFC Bharat Cashback Credit Card - IndianOil HDFC Credit Card

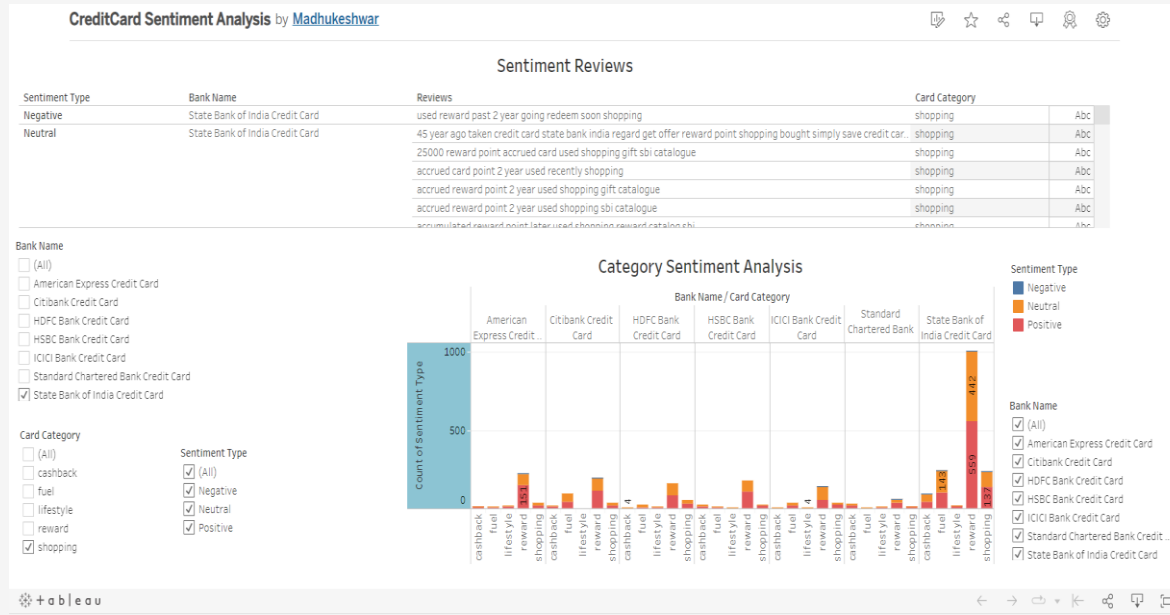
You: thanks

Bot: Any time!

Credit card Chat Bot Responses

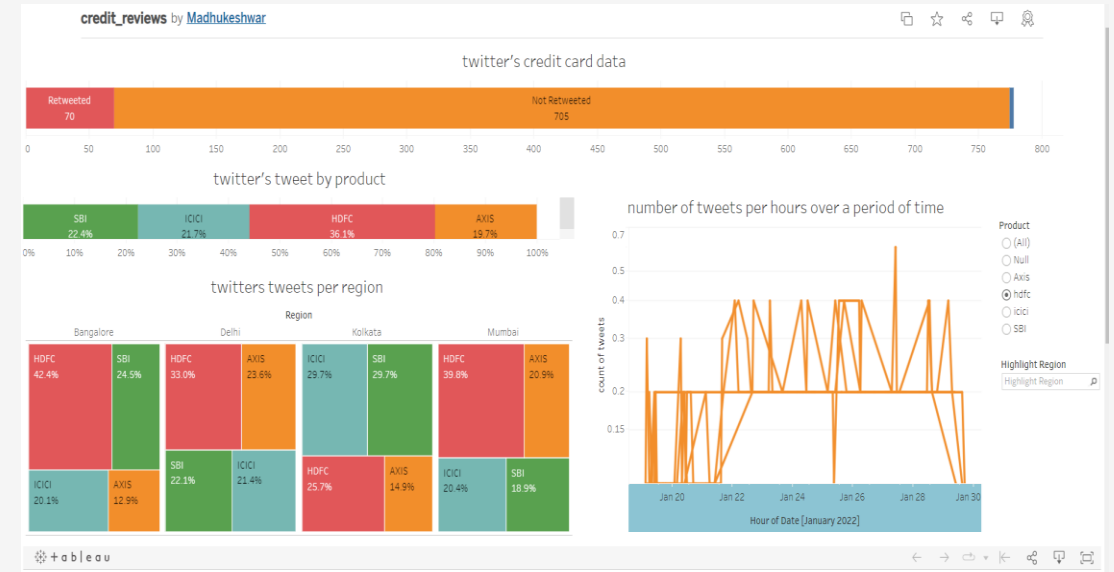


Results and Insights



- SBI credit card transactions are high and Standard Chartered Bank is Low.
- Credit cards are mainly used for remedying the rewards offered by Banks.
- Cards used for the Lifestyle and Cashback category minimal.
- Cards used for fuel usage are moderate.

DEMO



- HDFC Credit Cards are used more for transactions followed by SBI Credit Cards.
- SBI Credit Cards are used more in the region Bangalore and Kolkata.
- ICICI Credit Cards are used in the Kolkata region followed by SBI Credit Cards.
- Axis Credit Cards are used more in Delhi and Mumbai Region.

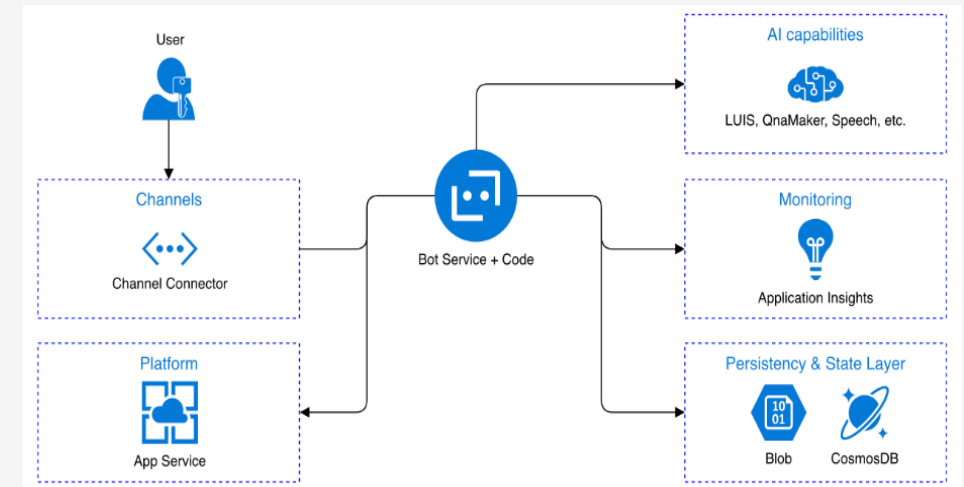
Conclusion and Future Work

Data collected from websites and Twitter, underwent data wrangling, EDA, and sentiment analysis using various machine learning techniques. A dashboard, recommendation system, and simple QA ChatBot was developed.

- Currently, the data collection, data wrangling, dashboards, and machine learning models are not automated.



Data Factory: Hybrid data integration



Bot Architecture on Azure

GitHub Link:
<https://github.com/kyasanur/Sentiment-Analysis-on-Credit-Cards-using-Online-Reviews>

Sentiment Analysis on Credit Cards using Online Reviews

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