# **Hyper personalization in Banking: a Comprehensive Report**

# **Introduction:**

Hyper-personalization in banking is transforming the financial sector by offering tailored experiences based on customer preferences, behaviors, and financial standing. By leveraging advanced AI models like GPT-4o, banks can analyze vast amounts of customer data to provide highly relevant product recommendations. This report outlines how GPT-4o can be trained on customer data to enhance personalized banking recommendations based on profile attributes such as credit score, liabilities, and market exposure.

# **Approach:**

Analyze customer details and recommend 3-5 banking products from a provided list that best match the customer's profile, needs, and preferences. The product recommendation will be influencedcustomer sentimental Analysis. We will store these customer details in SQL lite data base. Use Collaborative filtering and Content filtering machine learning algorithms to recommends the products and services.

# **Model Selected:**

GPT 4.0 was model used for Recommendation, some of the key considerations for

Contextual Understanding: Transformer models understand the context of words in a sentence, leading to better semantic matching.

Transfer Learning: Pre-trained models can be fine-tuned on specific tasks with limited data, leveraging knowledge from large-scale pre-training.

Scalability: Transformer models can handle large datasets and complex language structures efficiently.

# **TrainingFine Tuning Capabilities:**

RAG based approach was used to fine training and fine tuning the model

We have Prepared synthetic data for personal banking and commercial banking customers with the help of GPT models and used that datasets for training and the models, some of the parameters include the following

# **Key Components:**

#### ****1. Data Collection & Preprocessing****

**To achieve accurate recommendations, the AI model requires structured customer data, which includes:**

* **Demographic Information:** Age, income level, location, occupation.
* **Financial History:** Transaction history, spending patterns, investment behaviors.
* **Credit Score Analysis:** Risk assessment based on credit history.
* **Liabilities & Market Exposure:** Outstanding loans, mortgages, and other financial obligations.
* **Social Media & Sentiment Data:** Extracting customer opinions and preferences through sentiment analysis.

#### ****2. Training the GPT-4o Model****

**To enable GPT-4o to generate highly relevant banking product recommendations, the following steps are taken:**

##### **a. Data Ingestion & Fine-Tuning**

* Preprocess and structure customer data into a training dataset.
* Use a **Retrieval-Augmented Generation (RAG)** approach to allow GPT-4o to access real-time customer data during interactions.
* Fine-tune GPT-4o using synthetic and historical banking data to enhance its predictive capabilities.

##### **b. Feature Engineering**

* Identify key variables that influence financial decisions.
* Generate embeddings for customer data to match with relevant banking products.
* Develop a ranking mechanism to prioritize recommendations based on customer needs and financial health.

##### **c. Model Optimization**

* Utilize **Collaborative Filtering** and **Content-Based Filtering** to refine product suggestions.
* Leverage **FAAIS Vector Database AI Similarity Search** to enhance accuracy in finding similar customer profiles and their preferred banking products.
* Implement reinforcement learning to continuously improve the model based on customer feedback and engagement.

# **Corporate Customer Data:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Customer ID | Industry | Financial Needs | Preferences | Revenue (in dollars) | No. of Employees |
| CUST001 | Manufacturing | Working capital, Equipment loan | Digital banking | 50,000,000 | 500 |
| CUST002 | Retail | Inventory financing, POS system | Branch banking | 10,000,000 | 120 |
| CUST003 | Healthcare | Expansion loan, Payroll services | Online services | 25,000,000 | 250 |
| CUST004 | Technology | Venture funding, Cloud services | API integration | 100,000,000 | 800 |
| CUST005 | Construction | Project financing, Insurance | Relationship mgr | 75,000,000 | 600 |
| CUST006 | Logistics | Fleet financing, Cash management | Mobile banking | 30,000,000 | 300 |
| CUST007 | Hospitality | Property loan, Card payments | Personalized svc | 40,000,000 | 450 |
| CUST008 | Education | Infrastructure loan, Payment gateway | Online services | 15,000,000 | 200 |
| CUST009 | Energy | Equipment leasing, Risk management | Digital banking | 90,000,000 | 700 |
| CUST010 | Automotive | Supplier payments, Trade finance | API integration | 60,000,000 | 550 |

# **Transaction History:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Customer ID | Product ID | Transaction Type | Category | Amount (In Dollars) | Purchase Date | Payment Mode |
| CUST001 | P001 | Purchase | Equipment | 15,000 | 2024-03-01 | Bank Transfer |
| CUST001 | P011 | Payment | Loan EMI | 3,000 | 2024-03-05 | Direct Debit |
| CUST001 | P012 | Subscription | Software License | 2,000 | 2024-03-10 | Credit Card |
| CUST001 | P013 | Purchase | Office Supplies | 1,500 | 2024-03-15 | Bank Transfer |
| CUST003 | P003 | Payment | Loan EMI | 2,500 | 2024-03-03 | Direct Debit |
| CUST003 | P014 | Purchase | Medical Equipment | 25,000 | 2024-03-07 | Wire Transfer |
| CUST003 | P015 | Subscription | Healthcare Software | 5,000 | 2024-03-12 | Credit Card |
| CUST005 | P005 | Purchase | Insurance | 8,500 | 2024-03-05 | Bank Transfer |
| CUST005 | P016 | Payment | Construction Loan | 30,000 | 2024-03-08 | ACH Transfer |
| CUST005 | P017 | Purchase | Machinery | 45,000 | 2024-03-14 | Wire Transfer |
| CUST002 | P002 | Purchase | Inventory | 5,000 | 2024-03-02 | Credit Card |
| CUST004 | P004 | Subscription | Cloud Services | 1,200 | 2024-03-04 | Credit Card |
| CUST006 | P006 | Payment | Fleet Lease | 4,000 | 2024-03-06 | ACH Transfer |
| CUST007 | P007 | Purchase | Property | 50,000 | 2024-03-07 | Wire Transfer |
| CUST008 | P008 | Subscription | Online Services | 900 | 2024-03-08 | Credit Card |
| CUST009 | P009 | Payment | Equipment Lease | 10,000 | 2024-03-09 | Direct Debit |
| CUST010 | P010 | Purchase | Raw Materials | 20,000 | 2024-03-10 | Bank Transfer |

# **Social Media Sentiment Data:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Customer ID | Post ID | Platform | Content | Timestamp | Sentiment Score | Intent |
| CUST005 | POST100 | LinkedIn | Great customer service experience! Highly recommend. | 2024-03-01 00:00:00 | 0.9 | Praise |
| CUST003 | POST101 | Facebook | Had some issues with the payment gateway, took a while to resolve. | 2024-03-02 00:00:00 | -0.5 | Complaint |
| CUST003 | POST102 | Twitter | Loving the new app update, much faster and smoother! | 2024-03-03 00:00:00 | 0.8 | Feedback |
| CUST001 | POST103 | Twitter | Disappointed with the loan approval process, took too long. | 2024-03-04 00:00:00 | -0.7 | Complaint |
| CUST005 | POST104 | Facebook | Fantastic banking solutions for small businesses. | 2024-03-05 00:00:00 | 0.85 | Praise |
| CUST009 | POST105 | Facebook | Security issues need to be addressed, had a scare last week. | 2024-03-06 00:00:00 | -0.6 | Security Concern |
| CUST007 | POST106 | Instagram | Great rewards program, really enjoying the cashback benefits! | 2024-03-07 00:00:00 | 0.95 | Praise |
| CUST010 | POST107 | Twitter | Customer support is not responsive, need better service. | 2024-03-08 00:00:00 | -0.4 | Complaint |
| CUST007 | POST108 | Twitter | The website needs an update, it's quite slow on mobile. | 2024-03-09 00:00:00 | -0.3 | Feedback |
| CUST001 | POST109 | LinkedIn | Investment options are excellent, very satisfied with the returns. | 2024-03-10 00:00:00 | 0.7 | Praise |
| CUST007 | POST110 | Instagram | The mobile banking app crashed multiple times today! | 2024-03-11 00:00:00 | -0.8 | Complaint |
| CUST009 | POST111 | LinkedIn | Loyal customer for years, and still happy with the service. | 2024-03-12 00:00:00 | 0.9 | Praise |
| CUST006 | POST112 | Twitter | They resolved my issue quickly, kudos to the support team! | 2024-03-13 00:00:00 | 0.6 | Praise |
| CUST004 | POST113 | Twitter | Poor transparency in transaction fees, not happy with hidden charges. | 2024-03-14 00:00:00 | -0.2 | Complaint |
| CUST001 | POST114 | Instagram | Easy loan application process, seamless experience. | 2024-03-15 00:00:00 | 0.8 | Praise |

Then we have conducted human evaluations to assess the coherence, relevance, and factual accuracy of the generated responses.

# **Recommendation Approach:**

**Sentiment Analysis:**

Analyze customer sentiments from their interactions or feedback to understand their preferences and needs.

**Collaborative Filtering:**

Use collaborative filtering to recommend products based on similarities between customers. This can be done using user-item interaction matrices.

**Content-Based Filtering:**

Use content-based filtering to recommend products based on the features of the products and the preferences of the customer.

**Hybrid Recommendation:**

Combine the results from collaborative filtering and content-based filtering to provide a more robust recommendation.

**FAAIS Vector Database AI Similarity Search:**

An open-source library developed by Facebook AI Research for efficient similarity search and clustering of dense vectors. Supports a variety of indexing methods and similarity metrics. This database was used to search the recommendations from banking products.

# **Implementation Challenges & Solutions:**

|  |  |
| --- | --- |
| **Challenges** | **Solutions** |
| Data Privacy & Security | Implementing encryption and secure storage mechanisms. |
| Model Bias & Fairness | Using diverse datasets to prevent discriminatory recommendations. |
| Real-Time Adaptability | Continuous training and updating of models with fresh data. |
| Integration with Legacy Systems | Developing APIs to ensure smooth integration with existing banking infrastructure. |

# **Future of Hyper-Personalization in Banking:**

**With advancements in AI, hyper-personalization will continue to evolve, offering:**

* **Real-time financial advisory services.**
* **Predictive analytics for proactive customer engagement.**
* **Integration with blockchain for secure financial transactions.**
* **AI-driven fraud detection and risk mitigation.**

# **Conclusion:**

By leveraging GPT-4o and advanced machine learning techniques, banks can create a truly personalized customer experience. Training AI models with customer data, analyzing financial patterns, and using recommendation algorithms ensure that each customer receives tailored banking solutions that enhance satisfaction, retention, and financial well-being.