

Bank offered rate based on Artificial Intelligence

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Abstract— *The rise of event streaming in financial services is growing like crazy. Continuous real-time data integration and AI processing are mandatory for many use cases. Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.*

Keywords— *Artificial Intelligence, Lendo, Swedbank*

I. INTRODUCTION

As the hype around AI has accelerated, vendors have been scrambling to promote how their products and services use AI. Often what they refer to as AI is simply one component of AI, such as machine learning. AI requires a foundation of specialized hardware and software for writing and training machine learning algorithms. No one programming language is synonymous with AI, but a few, including Python, R and Java, are popular.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. In this way, a chatbot that is fed examples of text chats can learn to produce lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples.

AI programming focuses on three cognitive skills: learning, reasoning and self-correction. This aspect of AI programming focuses on acquiring data and creating rules for how to turn the data into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task. AI in banking is maturing, bringing the potential for higher-complexity solutions that generate positive ROI across business segments. Adoption of AI solutions in banking has become more mainstream: A majority of financial services companies say they've implemented the technology in business domains like risk

management (56%) and revenue generation through new products and processes (52%), per the Cambridge Centre for Alternative Finance and the World Economic Forum. As AI gains popularity in banking, financial institutions (FIs) are building on their existing solutions to solve increasingly complex challenges.

Most banks (80%) are highly aware of the potential benefits presented by AI and machine learning, per an OpenText survey of financial services professionals. In fact, many banks are planning to deploy solutions enabled by AI: 75% of respondents at banks with over \$100 billion in assets say they're currently implementing AI strategies, compared with 46% at banks with less than \$100 billion in assets, per a UBS Evidence Lab report seen by Insider Intelligence. Certain AI use cases have already gained prominence across banks' operations, with chatbots in the front office and anti-payments fraud in the middle office the most mature.

Artificial Intelligence (AI) has been around for a long time. AI was first conceptualized in 1955 as a branch of Computer Science and focused on the science of making "intelligent machines" machines that could mimic the cognitive abilities of the human mind, such as learning and problem-solving. AI is expected to have a disruptive effect on most industry sectors, many-fold compared to what the internet did over the last couple of decades. Organizations and governments around the world are diverting billions of dollars to fund research and pilot programs of applications

of AI in solving real-world problems that current technology is not capable of addressing.

Artificial Intelligence enables banks to manage record-level high-speed data to receive valuable insights. Moreover, features such as digital payments, AI bots, and biometric fraud detection systems further lead to high-quality services for a broader customer base. Artificial Intelligence comprises a broad set of technologies, including, but are not limited to, Machine Learning, Natural Language Processing, Expert Systems, Vision, Speech, Planning, Robotics, etc.

The adoption of AI in different enterprises has increased due to the COVID-19 pandemic. Since the pandemic hit the world, the potential value of AI has grown significantly. The focus of AI adoption is restricted to improving the efficiency of operations or the effectiveness of operations. However, AI is becoming increasingly important as organizations automate their day-to-day operations and understand the COVID-19 affected datasets. It can be leveraged to improve the stakeholder experience as well.

The following are 5 applications of Artificial Intelligence in banking:

Chatbots deliver a very high ROI in cost savings, making them one of the most commonly used applications of AI across industries. Chatbots can effectively tackle most commonly accessed tasks, such as balance inquiry, accessing mini statements, fund transfers, etc. This helps reduce the load from other channels such as contact centres, internet banking, etc.

Automated advice is one of the most controversial topics in the financial services space. A robo-advisor attempts to understand a customer's financial health by analyzing data shared by them, as well as their financial history. Based on this analysis and goals set by the client, the robo-advisor will be able to give appropriate investment recommendations in a particular product class, even as specific as a specific product or equity.

One of AI's most common use cases includes general-purpose semantic and natural language applications and broadly applied predictive analytics. AI can detect specific patterns and correlations in the data, which legacy technology could not previously detect. These patterns could indicate untapped sales opportunities, cross-sell opportunities, or even metrics around operational data, leading to a direct revenue impact.

AI can significantly improve the effectiveness of cybersecurity systems by leveraging data from previous threats and learning the patterns and indicators that might seem unrelated to predict and prevent attacks. In addition

to preventing external threats, AI can also monitor internal threats or breaches and suggest corrective actions, resulting in the prevention of data theft or abuse.

AI is instrumental in helping alternate lenders determine the creditworthiness of clients by analyzing data from a wide range of traditional and non-traditional data sources. This helps lenders develop innovative lending systems backed by a robust credit scoring model, even for those individuals or entities with limited credit history. Notable companies include Affirm .

1.1 OBJECTIVE

Designing a prototype system which simulates a real time banking environment, which can respond and perform loan approval functionality via Event Based Microservice Architecture and Artificial Intelligence depict sample Digital transformation that's recently going on in IT industry. Event based Banking System is a real time online banking which should be able to perform all banking functionalities via internet without the need of customer to come to a physical bank.

- The primary goal is to create a prototype of real type loan approval system
- The framework provides a general banking application which can be used by customer to borrow loan for any purpose tagged to any organization something similar to Klarna in Sweden.
- To immediately to credit check and inform customer , whether he is eligible to get the loan amount or not and to give Banks to get the potential customers easily.

1.2 SCOPE

BORAI can be useful for all banks including private banks as well as public banking sectors including all countries . More than end customers or users , BORAI is useful for Banks to get their potential customers which they might lose due to very minute differences in Loan interest rate offered.

Scope is only to determine offer rate per customer , and does not include Artificial Intelligence application on determining fraud card users or any other banking business scenarios. Here we are use AI only to determine , which Interest rates can be lesser but not to find out who is fraud and who is not.

We are going to do it based on AWS AI technologies available in the market like AWS Sage Maker .

II. LITERATURE SURVEY

Less than a decade after helping the Allied forces win World War II by breaking the Nazi encryption

machine Enigma, mathematician Alan Turing changed history a second time with a simple question: "Can machines think?"

Turing's 1950 paper "Computing Machinery and Intelligence" and its subsequent Turing Test established the fundamental goal and vision of AI.

At its core, AI is the branch of computer science that aims to answer Turing's question in the affirmative. It is the endeavor to replicate or simulate human intelligence in machines. The expansive goal of AI has given rise to many questions and debates. So much so that no singular definition of the field is universally accepted.

► DBS Bank: AI-Driven Transaction Surveillance

Since the passage of the Bank Secrecy Act, also known as the Currency and Foreign Transactions Reporting Act, in the US in 1970, banks around the world have been held accountable by governments for preventing money laundering, suspicious cross-border flows of large amounts of money, and other types of financial crime.

DBS Bank, the largest bank in Singapore and in Southeast Asia, has long had a focus on anti-money laundering (AML) and financial crime detection and prevention.

► Design of bank service products based on AI digital human technology

Based on the "AI digital human service" technology, this paper focuses on the design of the bank network of "AI digital human service", and tries to carry out the design practice from the aspects of man-machine, interaction mode and use mode.

► Assessing a Voice-Based Conversational AI prototype for Banking Application

This paper aims to assess a Conversational AI for a banking application in terms of usability, attractiveness, and intuitiveness. For this purpose, two different prototype versions were developed with varying dialog design and visual backgrounds.

The experiment was conducted by letting 40 participants interact with the prototype versions, exploiting the Wizard-of-Oz (WoZ) paradigm, and administering three questionnaires to measure their perception of the Conversational AI prototype.

► Redefining Banking and Financial Industry through the application of Computational Intelligence;

In recent times, AI and machine learning are perceived to be the most valuable enabler to achieve competitive advantage by enhancing the decision making capabilities and transforming the banking industry.

This paper will highlight the applications of AI and evaluate its utility in different functional areas of financial industry focusing primarily on automation of banking operations and customer engagement. It concludes with an analysis of how banking and financial organizations frame their environment and effectively use computational intelligence to improve their business.

► What Banking and Phone Data Tell us about the Socioeconomic Groups and Their Consumption Patterns?

This paper makes use of a large dataset of anonymized banking transactions and phone calls to classify individuals into socioeconomic groups (SEGs) and social networks, determine their consumption patterns, and compare the latter with equivalent information available from household surveys.

The results obtained demonstrate that classification into SEGs by aggregated bank income provides a robust breakdown of the population that is validated by a social network analysis of the phone data.

► Trust in Banking Management System using Firebase in Python using AI;

The Banking Management System (BMS) is windows based Trusted GUI application which can be used to store the data of bank account holders into a trusted real time database in Firebase which could be later used to fetch the details of account by any system using internet.

The Scope of BMS is to help the banks to allow their account holders or users to gain access onto their particular account from sitting at home itself using internet. Making their data accessible to them online. This helps the users to make their data safe in database and also leads to built trust among the banks and their customers.

► Digital Banking Transformation: Application of Artificial Intelligence and Big Data Analytics for Leveraging Customer Experience in the Indonesia Banking Sector;

This study explores the application of AI and BDA in banking for leveraging customer experience. This study used literature review and interviews to gather the data. We interview more than some persons in Indonesia banking industry to get the insight on the implementation of AI and BDA in Indonesia.

The paper reveals best practices of the global banking and Indonesian banking, in the implementation of AI & BDA. The contributions of this study are proposed enterprise architecture and recommended digital innovation in AI and BDA that enables banking institutions to leverage customer experiences.

- The Integration of AI on Workforce Performance for a South African Banking Institution

The ultimate purpose is to improve the workforce's performance in the South African banking institution and ensure successful adaptation to artificial intelligence. Descriptive statistics have been adopted with the use of frequency distribution tables to analyze and present the information on the variables of interest.

It is essential for the banking institution to adopt and integrate artificial intelligence with workforces because the next frontier for shared services may be far more interesting, incorporating greater computing power so that the differences between human perception and intelligent automation become indistinct.

- The Human Touch: Practical and Ethical Implications of Putting AI and Robotics to Work for Patients

We live in a time when science fiction can quickly become science fact. Within a generation, the Internet has matured from a technological marvel to a utility, and mobile telephones have redefined how we communicate.

Health care, as an industry, is quick to embrace technology, so it is no surprise that the application of programmable robotic systems that can carry out actions automatically and artificial intelligence (AI), e.g., machines that learn, solve problems, and respond to their environment, is being keenly explored.

- Toward Scalable Artificial Intelligence in Finance;

The goal is to support finance practitioners navigate the plethora of AI options more effectively and accelerate data monetization. While ML techniques in data analytics and forecasting apply to many scenarios, this paper focuses on selected competences in Banking, Financial Markets and Chief Finance Officer (CFO) operations.

The architecture and method introduced in this paper is a first step toward a service practice. We harvest from our work carried out in banks, asset management firms and CFO lines-of-business as well as R&D experiences in new finance technologies for over one decade.

III. EXISTING SYSTEM

A software requirements specification (SRS) is a document that captures complete description about how the system is expected to perform. It is usually signed off at the end of requirements engineering phase.

Requirement analysis is significant and essential activity after elicitation. We analyze, refine, and scrutinize the gathered requirements to make consistent and

unambiguous requirements. This activity reviews all requirements and may provide a graphical view of the entire system. After the completion of the analysis, it is expected that the understandability of the project may improve significantly. Here, we may also use the interaction with the customer to clarify points of confusion and to understand which requirements are more important than others.

Some projects are developed for the general market. In such cases, the prototype should be shown to some representative sample of the population of potential purchasers. Even though a person who tries out a prototype may not buy the final system, but their feedback may allow us to make the product more attractive to others. The prototype should be built quickly and at a relatively low cost. Hence it will always have limitations and would not be acceptable in the final system. This is an optional activity.

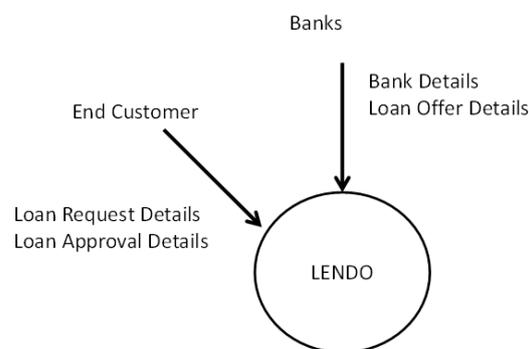


Fig 1 Context Diagram

In Existing System , All Private banks and Public banks of Sweden are subscribed to their service. As soon as a customer registers with required details like

- 1) Name
- 2) Personal Number (Similar to Aadhar card number)
- 3) Loan Required
- 4) Salary
- 5) Property Details

Lendo Application , sends the application to all banking customers and once Bank responds , it sends the quotation to Customers with certain time. Whichever option , Customer likes , customer chooses and then approves from his end .Once customer approves , the bank does the hard search of all criteria before lending the loan . **Lendo** is a leader in the field of debt crowdfunding for Small and Medium Enterprises (SMEs). **Lendo** offers investing opportunities in SME financing in Saudi Arabia. Investors get attractive short-term and Sharia-compliant returns, while SMEs obtain instant cash flow. Lendo is a

marketplace for loans. This includes, among many things, a place for consumers to compare consumer loans, car loans, credit cards, business loans and mortgages. Lendo was founded in Sweden in 2007, when few players offered price comparison for consumer loans without affecting customers' credit scores.

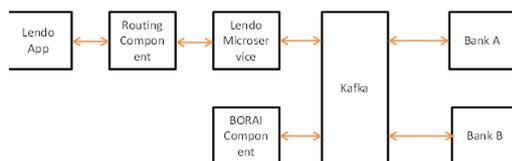
In Existing system , the application does not have intelligence to guide banks with offer percentage based on Market strategy. With minute offer rate differences , certain banks lose customer by considering only Business strategy .Hence in proposed system , we are going to make the application intelligent . We are going to guide the banks to finalize the offer rate based on Marketing strategy as well as Business Strategy by repetitive data.In Next screen , we are going to guide COOP bank to offer 5.09 % instead of 5.90 % .This 5.09 % comes out of the calculation done by business logic based on Business Strategy and Market Strategy which will be explained in next review.

Lendo Application will have the front end of registration form , where customers can register the loan request via, API routing component , once the form is registered the routing takes it to Lending Microservice , which process the loan request and send the details to Banks via event based Architecture .

The current application has a problem where different banks offer different rate but with minute differences .

- Say Example Bank 1 offers ar 5.1 % and Bank 2 offers at 6.1 % , though for Bank 2 even 5.0 % would be beneficial based on business strategy . So During this situation if we bring in our solution , to make Bank 2 intelligent and offer 5.0 % , then Bank 2 would win the loan contract with the customer.
- So in one line , our problem statement would be , To determine offer rate per customer , to have high probability of getting acceptance .

IV. PROPOSED SYSTEM



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Once the Banks receive the requests, they process the customer information and then different loan offers are given to the customers via the App.

Very minute differences are thrown so that it is easily identified by banks . Say for example Coop bank have a higher offer rate than forex bank , but given an Artificial Intelligence, Coop can go for a lesser percentage at later point of time.

V. MODULES

We are planning to implement using 5 modules ,

Module 1 – Lendo Application – With Application Form

Module 2 – Lendo Microservice (Kafka Producer)

Module 3 – Integration Microservice (Producer and Consumer Libraries)

Module 4 – Bank Services (Kafka Consumer)

Module 5 – BORAI Microservice

MODULE 1 – LENDO APPLICATION FORM

This is the first form that the end customer needs to fill to apply loan, this form would request for salary information , loan request , duration information . Based on the collection of these details, it will be sent to multiple banks at the same time to get different offer rates.

MODULE 3 - INTEGRATION LAYER

The architecture leverages distributed processing and fault-tolerance with fast failover, no-downtime, rolling deployments, and the ability to reprocess events, so you can recalculate output when your code changes. Integration and Stream Processing are still key functionality but can be realized in real time natively instead of using additional ETL, ESB or Stream Processing tools.

The screenshot shows the Lendo website interface for comparing personal loans. At the top, there's a navigation bar with 'Lendo' logo, 'Menu', 'Collect loan', 'Submit inquiry', a phone number '0771-15 15', and a 'Sign in' button. Below the navigation, the main heading is 'Loans without collateral - personal loans up to 600 000 SEK'. A sub-heading reads: 'Apply for a personal loan through Lendo and compare up to 40 loan offers from our partner banks and financial institutions. By comparing loan offers you can save money by assuring you choose the lowest possible interest rate and monthly cost based on your prerequisites.' There are four green checkmarks listing benefits: 'Apply in 2 minutes', 'Application is free of charge - non-committal', '1 application - up to 40 loan offers', and 'Sweden's largest loan comparison site'. Below this, it says 'Apply and compare loan offers today!' and 'What do our customers think?' with a Trustpilot logo. The main content area has a 'Select loan amount' slider set to 300,000 kr and a 'Select loan term' dropdown set to 1 year. An 'Approximate cost' box shows 'SEK 2,838 /month'. A question asks 'Do you have loans that you want to consolidate?' with 'And' and 'No' options. A large blue button says 'Start the application'. Below this is a table of loan offers:

Bank	Loan Amount	Term	Interest Rate	Monthly Cost	BankID
Lån & Spar Bank	300 000 kr	12 år	5.37 %	3 054 kr ANNUITET	✓ BankID
FRISK BANK	400 000 kr	12 år	6.03 %	3 758 kr RAK	✓ BankID
COOP Medlems Bank	350 000 kr	12 år	6.09 %	3 414 kr ANNUITET	✓ BankID
Santander	350 000 kr	12 år	6.65 %	3 488 kr ANNUITET	✓ BankID
ICA Banken	500 000 kr	12 år	6.75 %	5 047 kr ANNUITET	✓ BankID
marginale	350 000 kr	12 år	6.94 %	3 520 kr ANNUITET	✓ BankID

A concrete example architecture shows how to build a complete streaming platform leveraging the widely-adopted open-source framework Apache Kafka to build a mission-critical, scalable, highly performant streaming platform. Messaging, integration, and stream processing are all built on top of the same strong foundation of Kafka; deployed on-premise, in the cloud, or in hybrid environments. In addition, the open source Confluent projects, based on top of Apache Kafka, add additional features like a Schema Registry, additional clients for programming languages like Go or C, or many pre-built connectors for various technologies.

MODULE 4 – BANK SERVICES

Let's start at the beginning. What, exactly, is a credit check? When most lenders and other authorities check your credit, they're looking at that three-digit FICO score mentioned above — the one that ranges from 300 (poor) to 850 (exceptional). They will likely also receive your entire credit report, which is a lengthy, detailed document listing all your open accounts, their statuses, and several years of your historical behavior around loans and credit, among other items. By historical behavior, we mean things like whether you pay your bills on time or late, how much debt you've managed, and whether any debts have been put in for collection.

Incidentally, when your credit is checked, it can be either a soft or hard credit inquiry. The former are inquiries that don't impact your precious credit score. But the latter can wind up lowering your score because these "hard pulls," as

they are sometimes known, can indicate that you are shopping around for more credit, which can make you look like a risky prospect.

But back to our question about whether a bank will initiate a credit check...the answer is: not exactly. They don't typically check your credit score. Instead, they use their own kind of financial background check system. It's called ChexSystems — and it's a reporting agency similar to but distinct from the ones that record and report your credit score.

MODULE 5 BORAI MICROSERVICE

Our world is moving at a fast pace. Though banks originally built their foundations to be run solely by humans, the time has come for artificial intelligence in the banking industry. In 2020, the global AI banking market was valued at \$3.88 billion, and it is projected to reach \$64.03 billion by the end of the decade, with a compound annual growth rate of 32.6%. However, when it comes to implementing even the best strategies, the application of artificial intelligence in the banking industry is susceptible to weak core tech and poor data backbones.

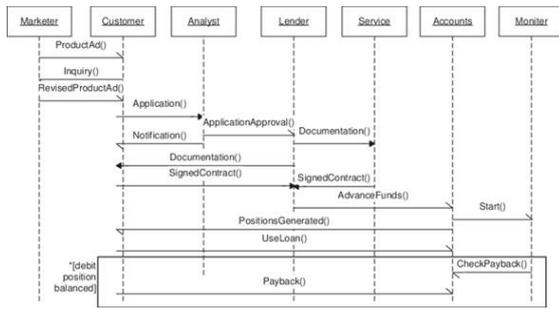
By my count, there were 20,000 new banking regulatory requirements created in 2015 alone. Chances are your business won't find a one-size-fits-all solution to dealing with this. The next-best option is to be nimble. You need to be able to break down the business process into small chunks. By doing so, you can come up with digital strategies that work with new and existing regulations.

AI can take you a long way in this process, but you must know how to harness its power. Take originating home loans, for instance. This can be an important, sometimes tedious, process for the loan seeker and bank. With an AI solution, loan origination can happen quicker and be more beneficial to both parties.

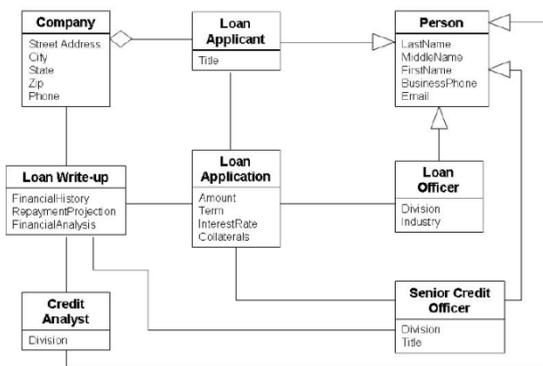
As the world of banking moves toward AI, it is integral to note that the crucial working element for AI is data. The trick to using that data is to understand how to leverage it best for your business' value. Data with no direction won't lead to progress, nor will it lead to the proper deployment of your AI. That is one of the top reasons it is so challenging to implement AI in banks — there has to be a plan.

Even if you come up with a poor strategy, those mistakes can be course-corrected over time. It takes some time and effort, but it is doable. If you home in on how customer information can be used, you can utilize AI for banking services in a way that is scalable and actionable. Once you understand how to use the data you collect, you can develop technical solutions that work with each other,

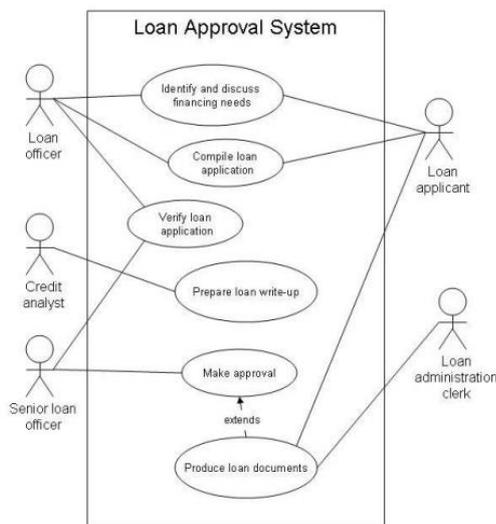
identify specific needs, and build data pipelines that will lead you down the road to AI.



Sequence Diagram



Class Diagram



Use Case Diagram

VI. CONCLUSION

Lendo application induced Artificial intelligence to banks, so that they can identify potential customers for them without losing their business. Existing Lendo application has some issues to Bank, where they lose potential customer with minute differences in the offer rate they provide but once this Artificial intelligence is introduced, they will be able to

use without losing potential customers.

VII. FUTURE ENHANCEMENT

All banks can take this idea and become a Digital bank, avoiding waiting time and physical spaces. The traditional integrated banking model is under tremendous stress. In its place, a diverse digital banking ecosystem of bank and non-bank players is emerging. Succeeding in a digital banking ecosystem will require a new set of capabilities, which are more common in other industries than in today's vertically integrated corporate banking market. Banks will need to develop the "muscles" by adopting new technologies like Apache Kafka to compete in the new landscape.

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