**University of Waterloo**

Faculty of Mathematics

**Artificial Intelligence and It’s Impact in Banking**

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**Memorandum of Submittal**

To: Arup Saha, Manager

From: Jason Zhen

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RE: Work Report: Artificial Intelligence and It’s Impact in Banking

The enclosed report, “Artificial Intelligence and It’s Impact in Banking” was prepared for my 3B work term. This is the fourth work report of four that is required by the co-operative education program at the University of Waterloo.

Our team was dedicated to developing proof-of-concept ideas and implementing them. My role in the company was an android developer. The duties required of my role included implementing proof-of-concept ideas, many of which involved the use of artificial intelligence, namely optical character recognition, and working on defects.

The purpose of this report is to explain to readers what artificial intelligence is, explain the various services a bank provides, and discuss how artificial intelligence can be used to solve these problems more efficiently.

I understand and acknowledge that this report will be evaluated by you as well as the faculty of Mathematics at the University of Waterloo. This report is an original work created by me, with no assistance, for academic credit only for this work term.

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**Executive Summary**

This report will discuss the how artificial intelligence affects the various processes involved in banking today. There are many problems that can be solved with artificial intelligence that are either extremely difficult or impossible to solve through either a rule-based or algorithmic approach.

The purpose of this report is to show how artificial intelligence can be used to solve a variety of problems in the banking industry. For example, the amount of call centers can be reduced by having artificial intelligence mimic a conversation. One such library that can be used to do this is Google’s own “Dialog Flow”.

Other problems that can be solved include mobile cheque depositing, scanning bills, improving banking security, etc. However, artificial intelligence isn’t always perfect and there are still times where a human is needed to make a decision. Also, artificial intelligence can be expensive to implement, and a traditional rules-based approach can also solve the problem just fine.

**1.0 Introduction**

Many problems are either impossible or extremely difficult to solve using a traditional algorithmic or rules-based approach. For example, consider the problem of recognizing characters. There are multiple fonts out there, some with serif and others without serif, yet humans are quite capable of recognizing characters regardless of the font.

A naïve approach would be to try and map certain patterns of pixel arrangements to each character. It’s not feasible to do this. There are hundreds of fonts to choose from so each character would require hundreds of mappings. This doesn’t even consider the problem of recognizing handwritten characters of which there could be an infinite amount of small variation for each character.

Artificial intelligence solves this by taking inspiration from how human brains work, through neurons. Artificial neurons are created using mathematics that can generalize that a ‘2’ looks like a ‘2’ and a ‘3’ looks like a ‘3’.

The actual process of teaching this algorithm how to distinguish characters is out of scope for this work report. In short, there are a bunch of neurons that take in pixel data. The algorithm is fed multiple images of multiple characters and it adjusts the equations in each neuron until it gets more and more correct. Over the course of thousands of images, the algorithm is able to generalize when a ‘2’ is a ‘2’.

**1.1 Banking Services**

There are many different categories of artificial intelligence. Artificial intelligence can be used to do optical character recognition, described earlier. Artificial intelligence can also be used to do anomaly detection. The algorithm in this case, takes a set of data and checks to see if there are outliers. This can be very useful in the field of computer security since viruses cause computers to behave extraordinary.

Banks provide a lot of different services to us. They allow customers to deposit cheques, pay bills, foreign exchange etc. This report is going to discuss how artificial intelligence can be used to improve the efficiency of these services. For example, optical character recognition can be used to deposit cheques. Simply take a picture of the cheque and the algorithm will be able to read the individual characters such as the amount being deposited and the name of the person who sent the money.

Figure Image of a Customer using Mobile Cheque Deposit From https://www.facebook.com/rbc/photos/a.319716438040249/1084337524911466/?type=1&theater

Optical character recognition can be used to make paying bills easier for the customer. The same idea applies, the algorithm is able to recognize the amount due and determine the name of the company. How this is done specifically, is proprietary information.

Artificial intelligence can simulate dialog between customers and the bank. When a customer needs to talk to an agent to solve a problem, such as when a customer needs to cancel a transaction on their credit card. In these cookie cutter type problems, the solution is often very similar for each instance and can be easily automated. For more nuanced problems, a human would be required, however.

Lastly, anomaly detection can be used to provide anti-fraud for banks. A variety of data points can be used such as time of day the account was accessed, geographic location, and others such that suspicious activity can be detected. Once again, the way this is implemented is proprietary information and cannot be explained in detail for this report.

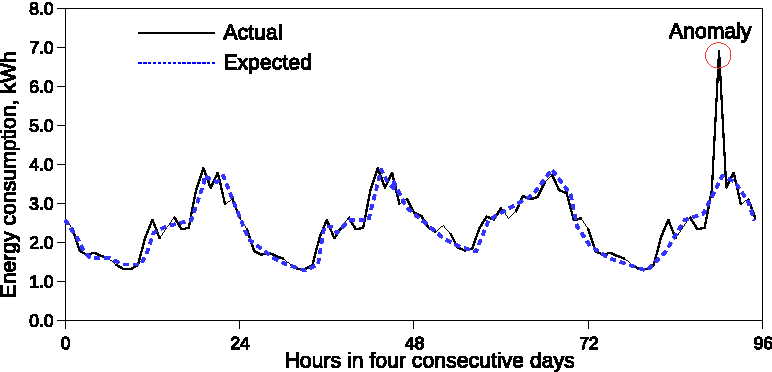


Figure Image Showing How Anomaly Detection Works From https://deepai.org/machine-learning-glossary-and-terms/anomaly-detection

**2.0 Analysis**

The main advantage of artificial intelligence is the main problem with human workers. Humans are slow and prone to error. They also cost much more per hour than the electricity costs of an algorithm running on a server. So, the main draw of artificial intelligence, is its ability to reduce the number of human workers and have either the same level of productivity or, in some cases, a higher level of productivity than before. Many of these problems solved by artificial intelligence also provide a lot of convenience for customers.

The usage of optical character recognition reduces the need for customers to physically walk into a bank to pay bills or deposit cheques. This also reduces the demand for physical tellers since a large number of people will simply use the mobile cheque deposit. There are still cases that mobile cheque deposit won’t solve. The elderly, for example, is a demographic less inclined to replace physical human interaction with an algorithmic one. Similarly, there are people who don’t trust the idea of sending their cheques and bill information online. The optical character recognition is also not perfect either, sometimes extra unnecessary characters could be read that change the amount being deposited or sent. The solution is to have the customer still manually enter the amount information or manually verify the information and still have humans double check deposits where the algorithm wasn’t very confident.

There are a lot of phone or text conversations that have the same flow when a customer is talking to a customer service agent. Problems like reversing a credit card transaction, opening a chequing account, are common problems customer service agents try to resolve. This too, can be automated. Artificial intelligence can mimic human dialog, a good example of this is Google’s Dialog Flow. Dialog Flow’s artificial intelligence is trained of lots of data that Google collects in order for it to determine how best to respond to a customer’s query. This can be used to heavily reduce the load on call centers since problems can be resolved online over text or through voice recognition which is another form of artificial intelligence. Not having to pay as many employees in a call center saves a lot of money for the bank. Like optical character recognition, however, there will be cases where the customer’s problem is too nuanced for Dialog Flow to handle. In this case, a human operator will have to take over. This will not completely replace customer service agents but will reduce the amount needed.

Anomaly detection can be used to improve security in banking. This will also inadvertently reduce the need for customer service agents. If customers’ online banking accounts are safer from attackers, then there will be less queries to customer service agents about account breaches. To reiterate, anomaly detection works by detecting outliers in the data given. The algorithm is trained on the customer’s normal usage based on usage characteristics like time spent logged into the account, geographic location, money transferred in a single transaction, etc. Once the algorithm has learned how the customer normally uses the online banking service, it can detect anomalous, malicious activity. There are cases, however, where anomalous usage is not necessarily malicious usage, for example, the customer goes on vacation. Then the geographic location will be different. In these cases, there needs to be a way for the customer to manually override the anomaly detection. In these cases, human intervention is required.

Lastly, this report has talked a lot about reducing the number of jobs, but artificial intelligence can create jobs as well. Artificial intelligence requires a lot of data analysis to work properly. Data analysts and data scientists will be in higher demand to implement and train these algorithms. Data collection will become a massive industry where companies will be able to sell data to other companies.

**3.0 Conclusions**

Artificial intelligence will affect many customer facing jobs. Banks will not require as many customer service agents or bank tellers to function. Yet, most of these jobs will not be completely replaced since the algorithms are still fallible in ways that humans aren’t. It is very reliant on the data it is trained on, so if the data is lacking values for some specific subset of a problem, then it won’t work properly. An example of this is if the data the mobile cheque depositing algorithm is trained on is lacking data from cheques of type A. Then it will be very confused when reading cheques of type A.

Besides saving the bank money, artificial intelligence improves convenience for customers. All major banks need to offer these services now or they cannot compete in the market. It’s very enticing to use a bank that offers mobile cheque deposit, mobile bill-pay and others over one that doesn’t.

Artificial intelligence also creates a lot of demand for data scientists and software developers who know how to implement these algorithms.

**4.0 Recommendations**

Although artificial intelligence can solve many problems in the banking industry, it is naïve to think that it can replace humans entirely. It is recommended that humans oversee these algorithms in cases where it is not confident in its solution. For example, should Dialog Flow be unable to solve a customer’s problem the customer should be forwarded to a real customer service agent who will better able to assist. For mobile bill pay and mobile cheque deposit, customers should be able to manually verify that the amounts and company selected by the algorithm are correct. There shouldn’t be a human on the banking side for every cheque deposit or bill payment. This would defeat the entire purpose of having artificial intelligence. Some pictures taken by a customer are harder to read than others, i.e. if the lighting conditions are bad. In those cases, a human on the bank’s side should verify the output.

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