



Applications of Machine Learning at CIBC

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INTRO

Advanced Analytics

Data Science & AI Research
Solution & Insights

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OUTLINE

Retail Account Opening Fraud Detection
ATM Cash Demand Forecasting
Representational Learning and Topic Analysis

Fraud Detection

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Retail Account Opening Fraud Detection

CIBC receives millions of retail account applications on a yearly basis

Applications are made across a number of products (chequing, saving, lending) and are received from a variety of channels (online, telephone banking, in-branch)

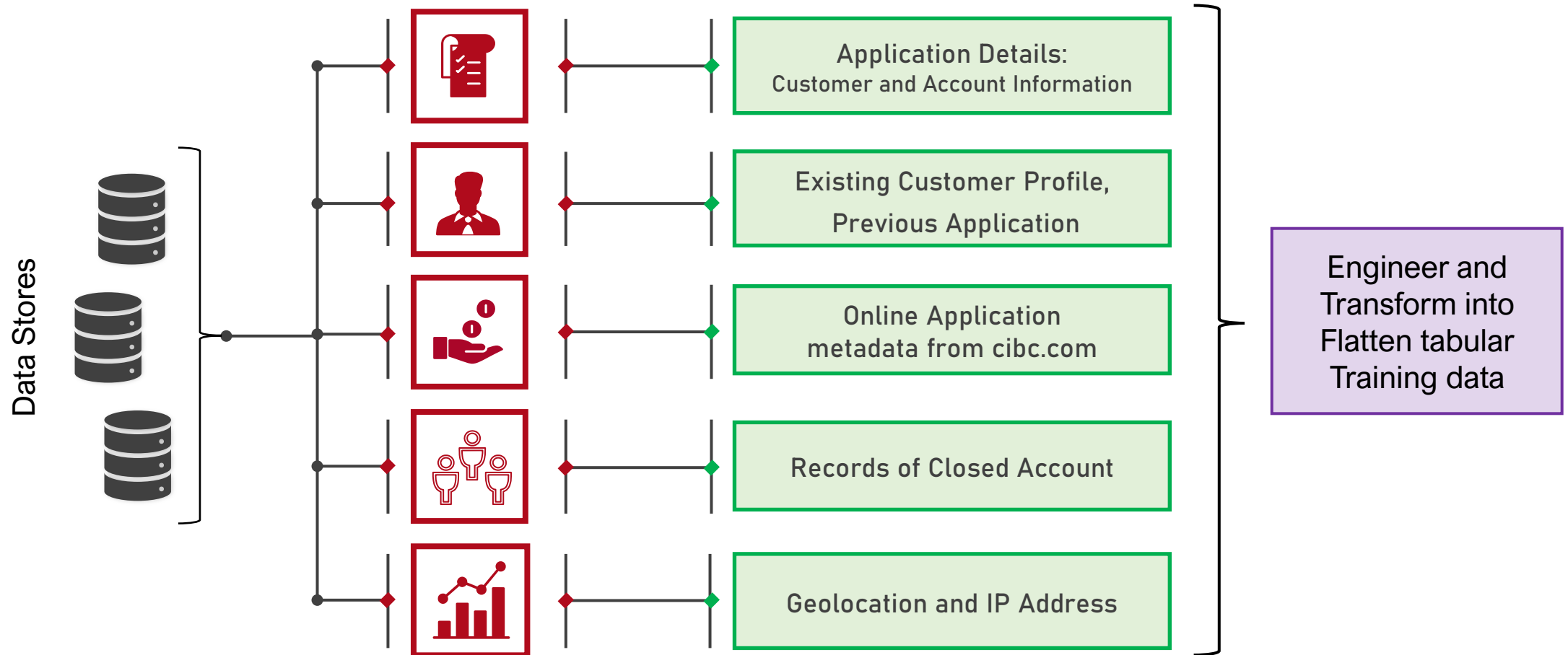
A portion of these applications are created by fraudsters

<1% account applications turn out to be fraudulent, examples:

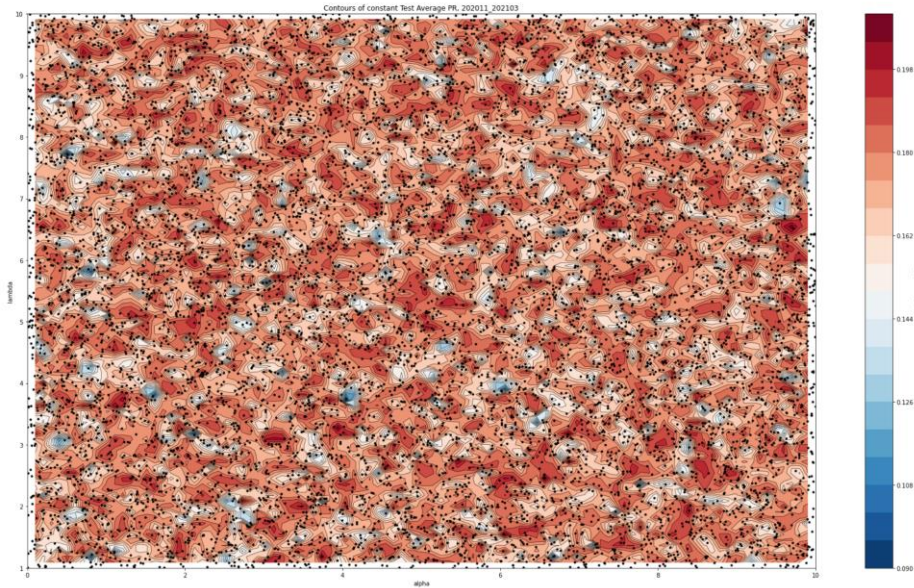
- Synthetic accounts (Identities were either completely or partially fabricated)
- Compromised IDs (Personal information are taken over)

Retail Account Opening Fraud Detection

By integrating disparate pieces of the application profile into a single view we can apply machine learning techniques at scale to discriminate suspicious applications



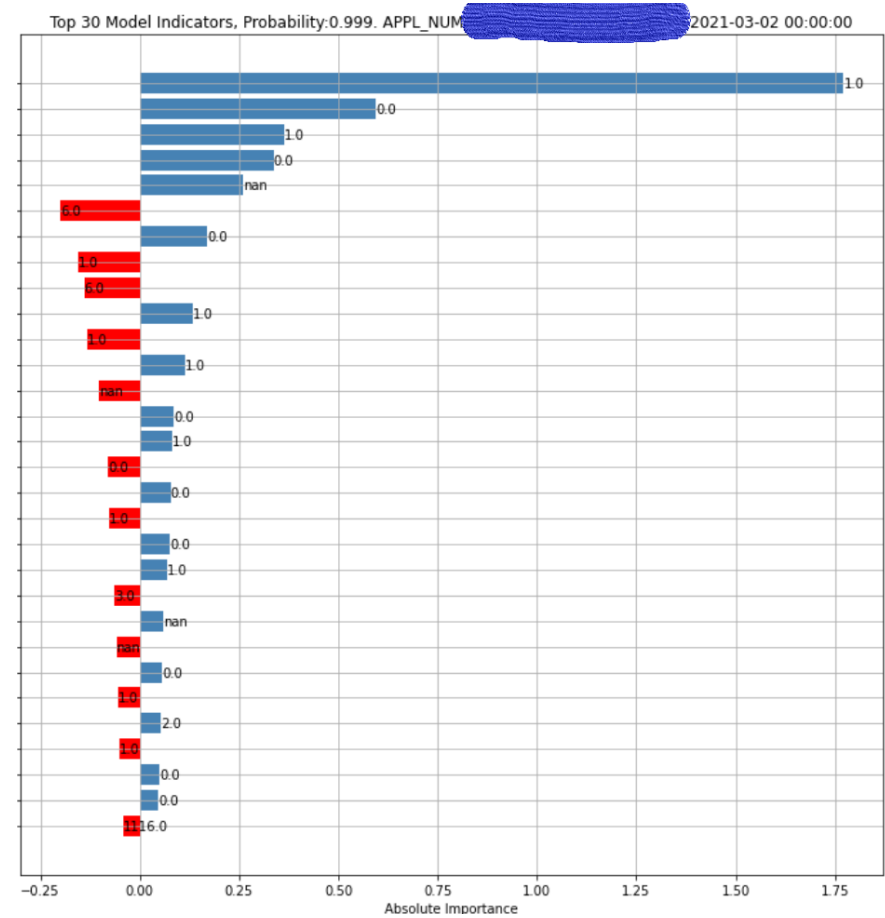
Retail Account Opening Fraud Detection



We take a supervised learning approach of predicting current application suspicion based on a sliding window of historical data. Our model has ~10,000 features and >~1,000,000 rows of learning examples.

We take advantage of GPUs to efficiently sample the hyperparameter space over a large number of randomly chosen hyperparameters

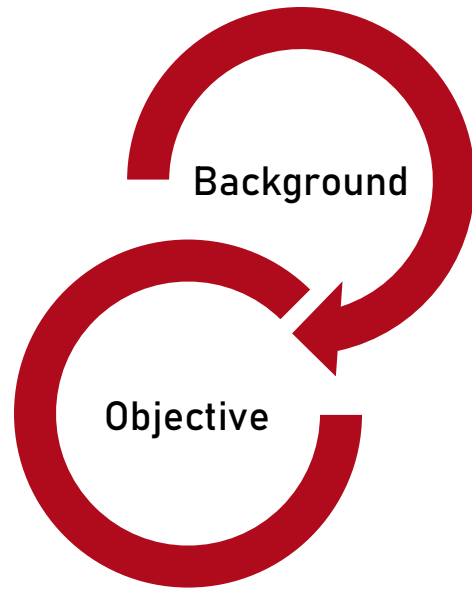
We use Shapely values to provide model interpretability, which is critical in applications of Machine Learning where customer transparency matters.



ATM Cash Demand

Lux Liu
Sr. Data Scientist

ATM Cash Demand Forecast

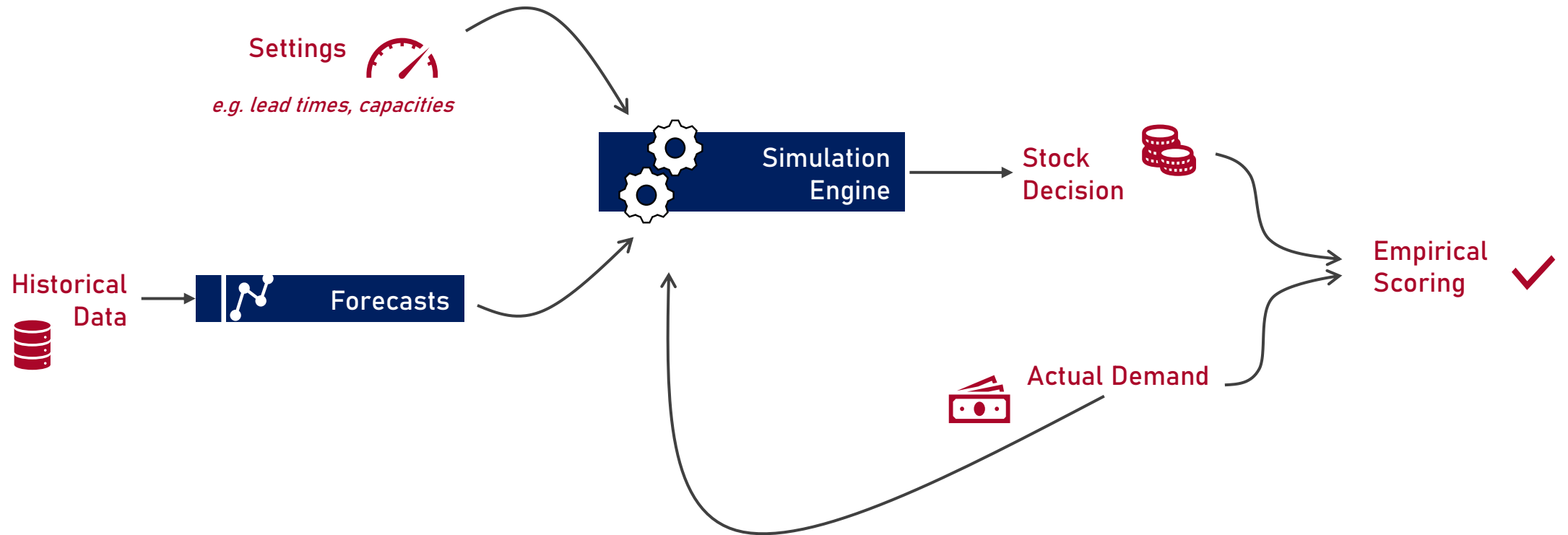


Business needs to develop advanced algorithms to improve ATM cash managements.

- Prevent client inconvenience due to cash outages
- Save time and money in trips to reload ATMs
- Lower the financial cost to maintain too much cash in the ATMs
- Make profit by mobilizing idle cash

- To accurately predict cash demand at the denomination level for cross-Canada ATMs
- To reduce the cost of keeping money in machines
- To reduce the cost of inconveniencing clients

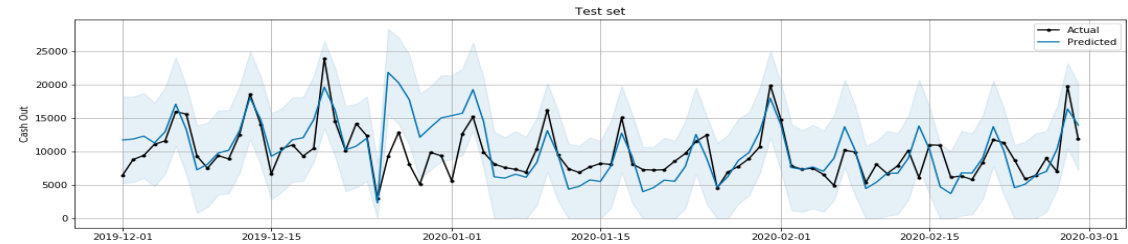
Predict & Optimize with Rolling Forecasts



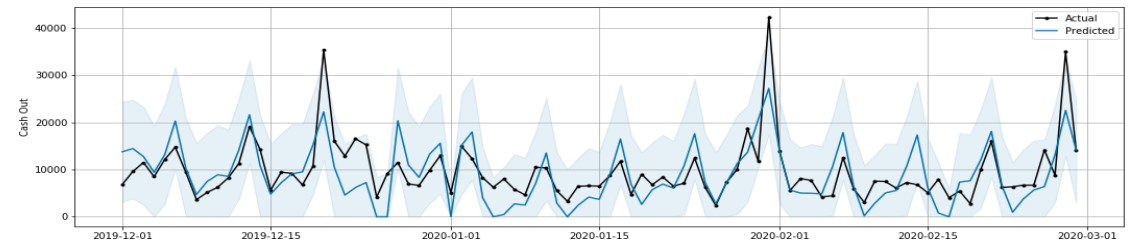
Takeaways

- Forecasts are improved in comparing with the native system
 - (metric: weighted Mean absolute percentage error (WMAPE))
- Optimization provides a tool to optimize the trade-off between the risk of ATM cash outages and the cost of holding excess cash in ATMs. The simulated back-tests show potential cost savings in terms of number of cash reloads and cash usage.

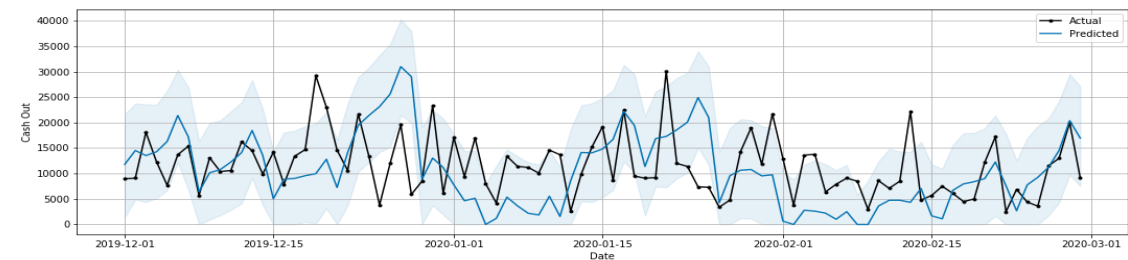
Twenties



Fifties



Hundreds

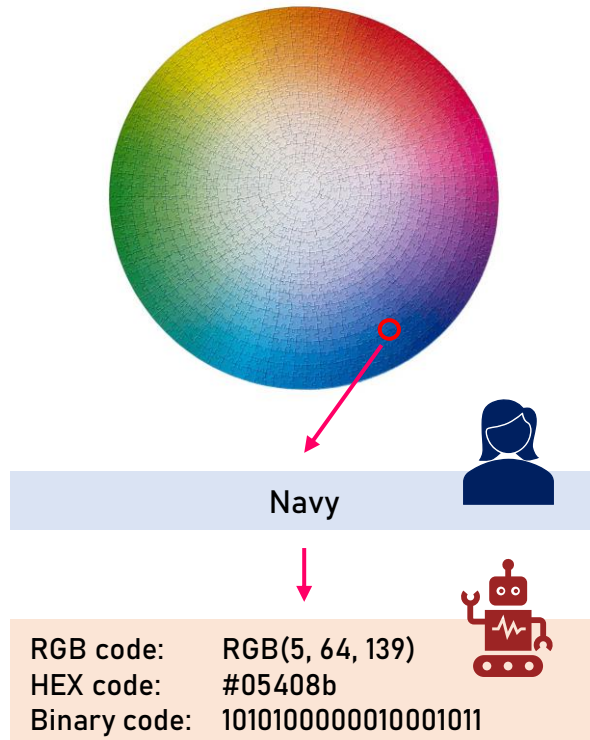


Topic Analysis

Ali Pesaraghader
Sr. Research Scientist

Skipgram Word Representation for Mapping Chat Transcripts to Intents - [1]

How Machine Understands Color...?



Can we do something similar for words and even texts?

YES!

- How?
- We can train **natural language processing (NLP)** algorithms to map words/terms to **vectors** of decimals (aka **embeddings** or **term representations**)
- Machine then can understand a piece of text based on those vectors
- Skipgram, or Word2Vec, is one of those algorithms
- Word2Vec also pushes related terms to different regions of representation/latent space

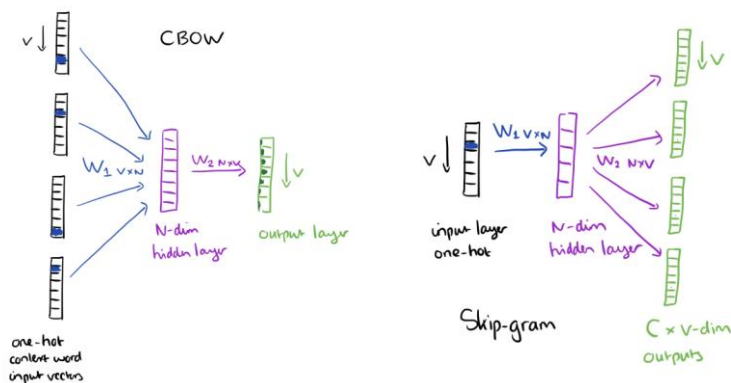
Representational Learning and Topic Analysis

Skipgram Word Representation for Mapping Chat Transcripts to Intents - [2]

Problem:

Mapping a chat transcript to 11 pre-defined intents namely **Request money, Send money, Cancel an e-transfer, Add someone to send money to, Make a payment, Show my scheduled payments, Cancel a scheduled bill payment, Show me my bills, Add a new bill to pay, Activate a credit card, View my Aventura rewards benefits (insurance)**

- Remove non-ascii characters and clean text
- Tag punctuations, links, postal codes, etc.
- Remove stop-words and lemmatize
- Find bigrams and trigrams using vector space models (e.g., TF-IDF)
- Mask bigrams and trigrams in transcripts and intents utterances
- Create Skipgram word embeddings using FB's fastText
- Measure Cosine similarity between a transcript and intents embeddings



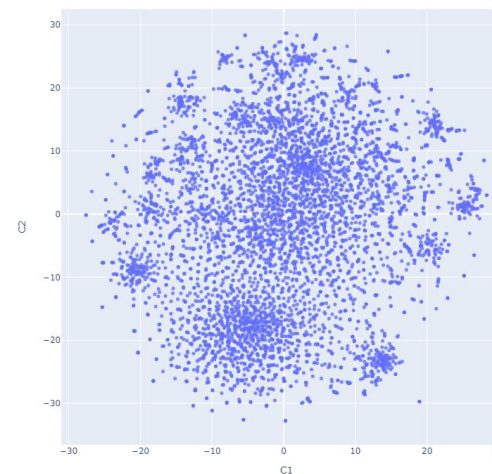
The amazing power of word vectors:
<https://blog.acolyer.org/2016/04/21/the-amazing-power-of-word-vectors/>

I am applying for CIBC investor edge (just opened a TFSA), in the application process, it asks for my bank account number (original holder). Do I type in my chequing account number or my CIBC TFSA account number? Hi *****! Hope you re doing well :) My name is ***** , thanks for chatting with me! Likewise! I m not entirely sure which one you would put there; I d actually recommend chatting with my colleagues at Investor s Edge. They have a chat service and will be able to help with the application <https://www.investorsedge.cibc.com/en/contact-us.html> Okay, can I ask a different question (and am I allowed to disclose how much money I have in the question)? Sure, go ahead! And yes, this is a secured chat :) great, so I opened the TFSA and contributed 20,000 from my savings account. The account was active within 24 hours, and the TFSA says there is 20,000 in the account, but my savings still has the original 27,000. Will the money in the savings account change? Yes it will! It just take a business day for the funds to move over, but you ll see the change soon Okay thank you for the help! No worries! Was that everything for now *****? Yes, thanks for the help! Have a good day! Have a good day yourself ***** , and thanks for banking with CIBC! Stay safe out there You too!



[boc] apply [3grm1] open tfsa [mos] application process [mos] ask [2grm10] number original holder [eos] type [2grm18] number cibc [2grm24] number [eq] ***** [eos] [hsm] ***** [mos] [eos] likewise [eos] entirely [mos] actually recommend colleague [2grm4] [eos] service application [lnk] [mos] ask different question allow disclose money question [eq] [mos] ahead [eos] [mos] secure [hsm] [mos] open tfsa contribute [num] [mos] [num] [2grm8] [eos] [2grm252] [num] hour [mos] tfsa say [num] [mos] [num] account [mos] saving original [num] [mos] [num] money [2grm8] change [eq] [eos] business fund move [mos] change soon [eos] worry [eos] ***** [eq] [mos] [eos] [eos] ***** [mos] [2grm9] [eos] stay safe [eos] [eoc]

t-SNE visualization



The selected intent is: Cancel an e-transfer

hello how are you I sent a e transfer to a wrong account Hi My name is Thank you so much for your patience and sorry for the wait! **no problem If the eTransfer was not sent to an account with Autodeposit, you should still be able to cancel the eTransfer.** However, there is a cancellation fee of 3. 50 it was autodeposit its the wrong one Do you know the person who it was accidentally sent to? my father which he is saying the account no longer working i tried putting it in a nother account somehow the email i guesswent to the old account I see. Let me take a look and see what s going on. ok thank you please I see that there was 100 sent to enzolog icloud. com yes that s the one It looks like it was **successfully deposited into the account where that email is registered for eTransfer Autodeposit.** hes said he has no account anymore Since it was successfully sent, it cannot be cancelled or retrieved and the recipient would have to send it back to you. he doesn t have the account anymore In that case, your dad would need to reach out to his bank and figure out why they still accepted it for him. **you cant stop iy No, an eTransfer cannot be stopped once it has been deposited.** can u tell what bank it went to Since the eTransfer was successfully deposited, it would be safe to assume that they still have an active account registered for that email for Autodeposit. I m so sorry but I m not able to see that information. ok thank you

Representational Learning and Topic Analysis

Skipgram Word Representation for Mapping Chat Transcripts to Intents - [3]

DE
MO

Client Interaction - Intent Mining

Chat ID	Transcript
xxxxxx	Hi I want to withdraw my money from mutual funds Hello ***** my name is ***** Thank you for using Liv...
xxxxxx	Can I please cancel the automatic payments to my Visa Aventura card? We have refinanced our mortgage ...
xxxxxx	Hello, I issued a cheque and I wonder if I can do stop payment on it? Do if the recipient tries to cash it, the ...
xxxxxx	hello Hello ***** my name is ***** Thank you for using Live Chat. I will be assisting with your inquiry to...
xxxxxx	Hi Hello ***** My name is ***** How may I provide you with excellent service today? I try to set up a re...
xxxxxx	Hello, my name is **** Thank you for using Live Chat. I will be assisting with your inquiry today. It looks lik...
xxxxxx	Can I get the money released? I deposited a cheque yesterday and I need it for my mortgage payment tod...
xxxxxx	hello how are you I sent a e transfer to a wrong account Hi *****! My name is ***** Thank you so much f...
xxxxxx	Hello, I need to do a stop Payment. I paid the wrong bill this morning on online banking Mar 23, 2020 INTE...
xxxxxx	Hello ***** my name is ***** Thank you for using Simplii Live Chat. I will be assisting with your inquiry to...
xxxxxx	Hi there my debit card no has recently been locked I need to reset it in order to activate my new card Hi



Intent: Chat No.:

Select an intent to see its corresponding results for the selected chat. Chat Index or Number.

Highlighted Top Scored Sentences for chat: xxxxxx

hello how are you I sent a e transfer to a wrong account Hi ***** My name is ***** Thank you so much for your patience and sorry for the wait. **no problem if the eTransfer was not sent to an account with Autodeposit, you should still be able to cancel the eTransfer.** However, there is a cancellation fee of [NUMBER] it was autodeposit its the wrong one Do you know the person who it was accidentally sent to. my father which he is saying the account no longer working i tried putting it in a nother account somehow the email i guesswent to the old account I see. Let me take a look and see what s going on. ok thank you please I see that there was [NUMBER] sent to enzolog

Intent	Score
Cancel an etransfer	0.902
Send money	0.864
Add someone to send money to	0.848
Cancel a scheduled bill payment	0.842
Request money	0.831
Show my scheduled payments	0.774
Show me my bills	0.771
Make a payment	0.767
Add a new bill to pay	0.758
Activate a credit card	0.745
View my aventura rewards benefits (insurance)	0.707



Q&A