E.T.-RNN: Applying Deep Learning to Credit Loan Applications

Dmitrii Babaev
dmitri.babaev@gmail.com
Sberbank AI Lab

Maxim Savchenko
savvvan@gmail.com
Sberbank AI Lab

Alexander Tuzhilin
atuzhili@stern.nyu.edu
New York University

Dmitrii Umerenkov
d.umerenkov@gmail.com
Sberbank AI Lab

Problem formulation

- Credit scoring require extensive feature engineering and deep domain knowledge.
- Hard to make reliable scoring decisions regarding persons without significant credit history.
- Existing bank credit scoring models do not use the raw transactional data available about the customer.

Transactional Data

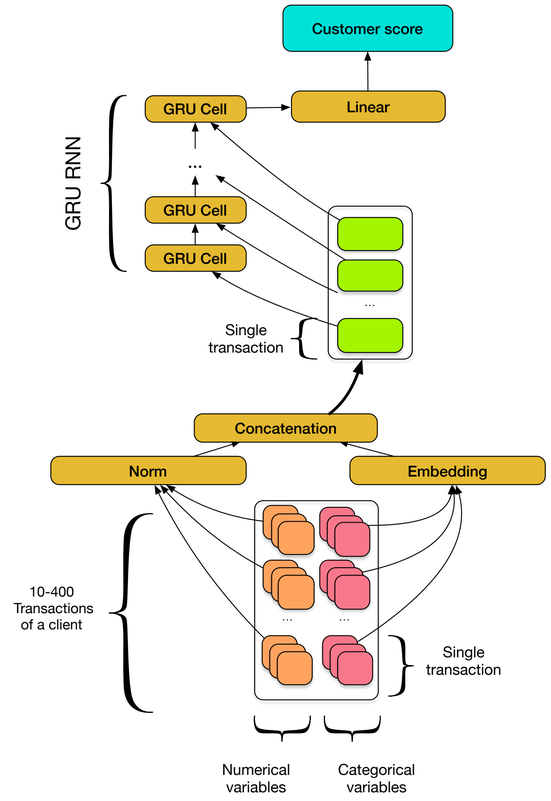
Amount	230	5	40
Currency	EUR	USD	USD
Country	France	US	US
Time	16:40	20:15	9:30
Date	Jun 21	Jun 21	Jun 22
Merchant type	Restaurant	Transportation	Household Appliance
Card type	Visa Classic	Visa Gold	Visa Gold
Issuing branch	90/10735	90/10735	90/017779
N opened credit cards	1	1	1
N opened debit cards	1	1	1

- 740 thousand clients
- 200 million transactions
- Target - default on consumer loan during a year

Embedding-Transactional (E.T.) RNN

- RNN on transaction embeddings
- Performance measure - ROC AUC (Gini)
- Margin ranking loss
- Average of 6 models ensemble

Model architecture

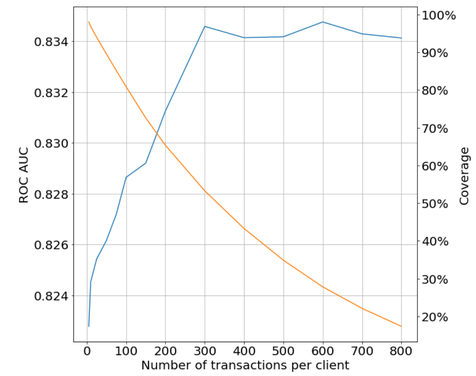


Baselines and results

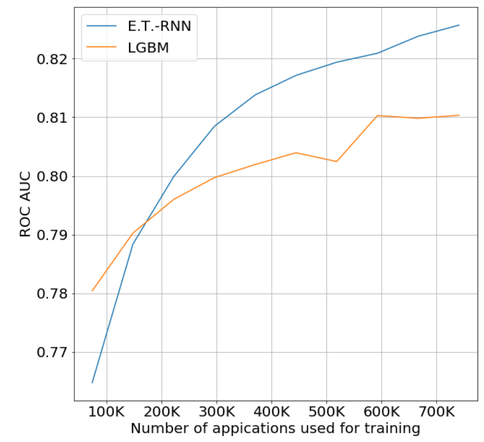
- Scoring improves until ~ 350 transactions/ client
- More than 50% of clients have more than 350 transactions for our dataset
- For clients with at least 25 transactions (about 95% of clients), we reach 82.5 ROC-AUC
- It takes 17 minutes to score 1 million customers on an Tesla P100 GPU. The inference time scales linearly.

	ROC AUC	N Features
Logistic regression	0.78	~400
LGBM	0.81	~7000
E.T.-RNN	0.83	12

Classification quality vs number of transactions



E.T.-RNN has steeper learning curve than LGBM.



Business applications and advantages

- Can make credit loan decisions in nearly real-time.
- Even a person without any credit history can be reliably accessed for credit-worthiness using his or her transactional history.
- A fair approach to credit scoring as it does not rely on personal or demographic information of an individual
- Information in the transactional data is exceptionally hard to forge
- No need for feature design