



A study of the influence of news reports and other contextual open-source information on the consumer behavior of bank card users

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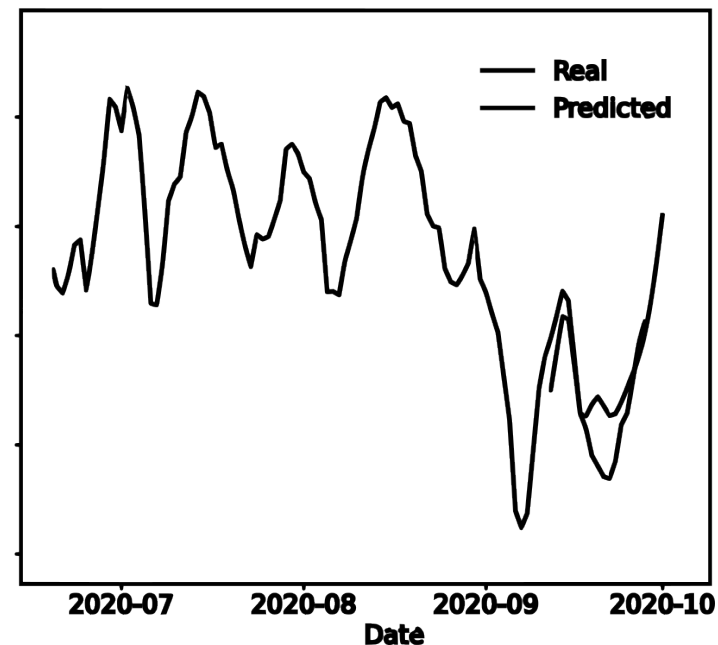
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NEWS

Causality?

TRANSACTIONS

PREDICTIONS



TOPIC ANALYSIS

LDA

NMF

JASen

Top2vec

BERTopic

FORECASTING

ARX

RF

BRNN

(S)ARIMAX

QRF

RCNN

VARX

SVR

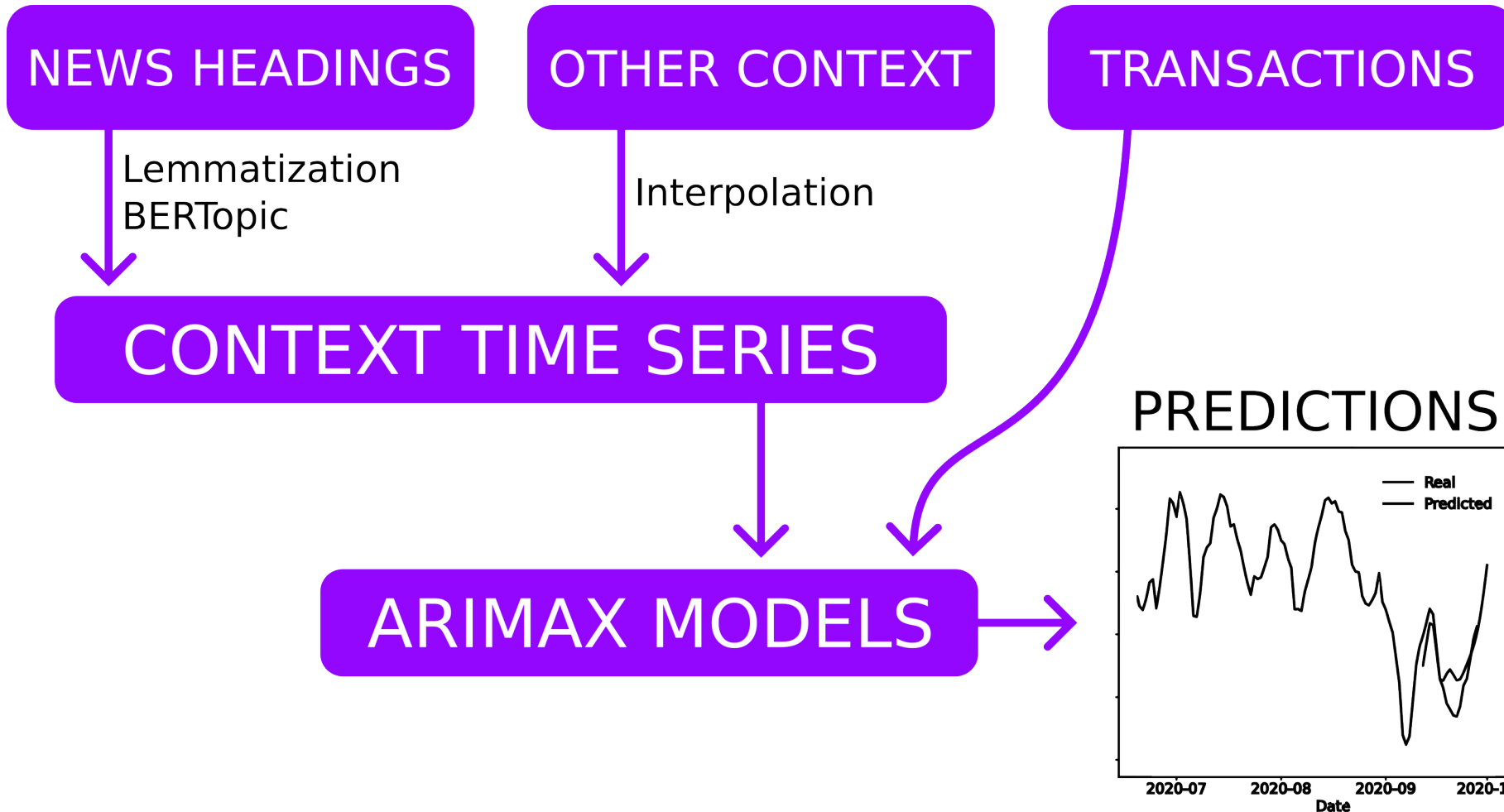
LSTM

NARX

kNN

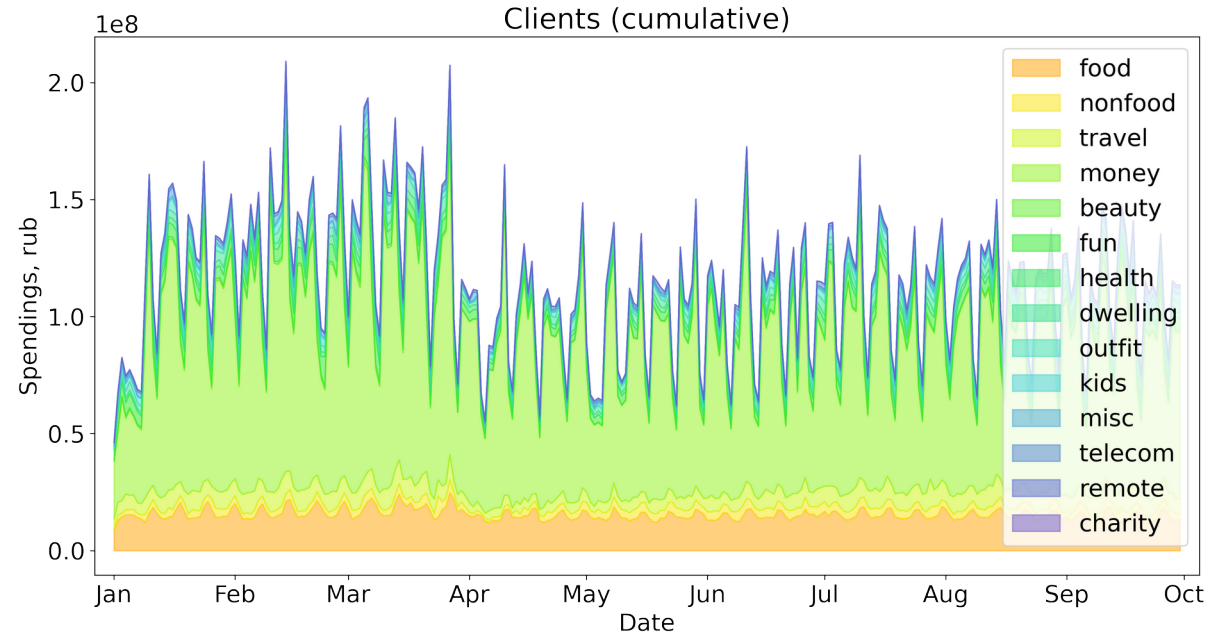
LR/PCA

Plan of the experiment

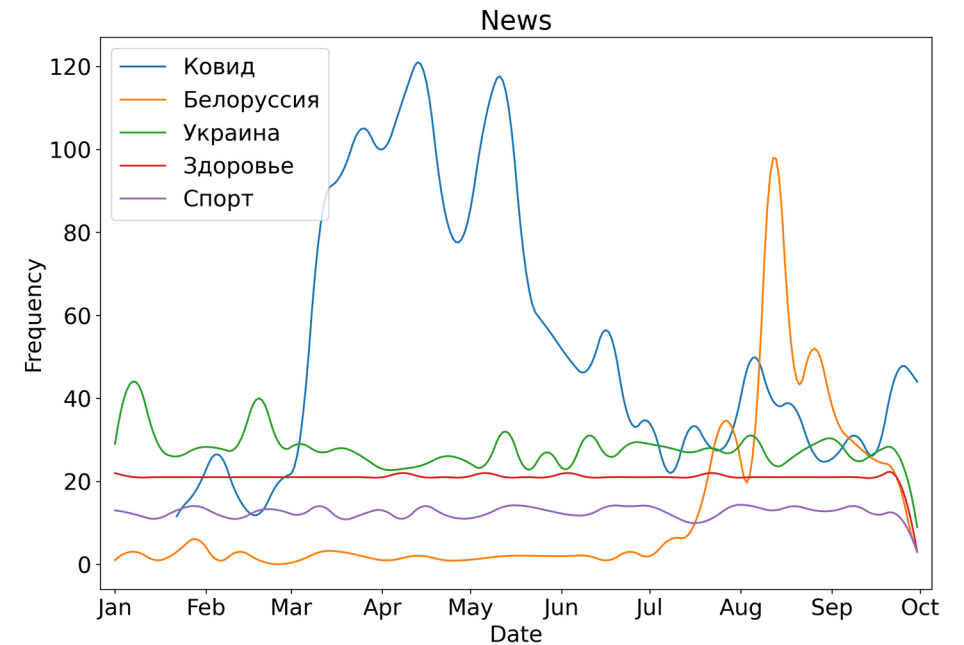


Data overview

Synthetic transactions

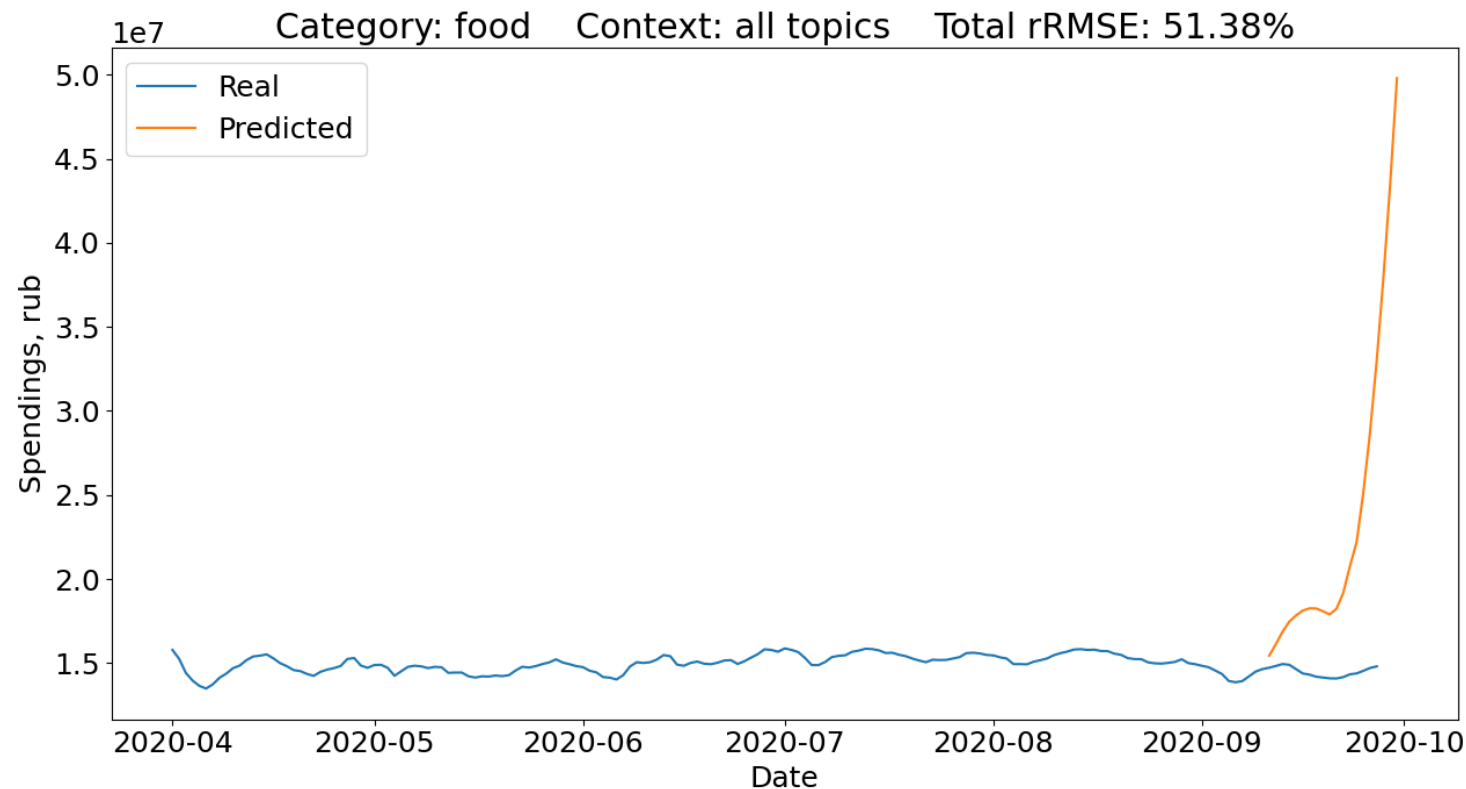


News after topic analysis



Additionally, **20** macroeconomical and epidemiological **time series** were added to the context.

ARIMAX using the whole context

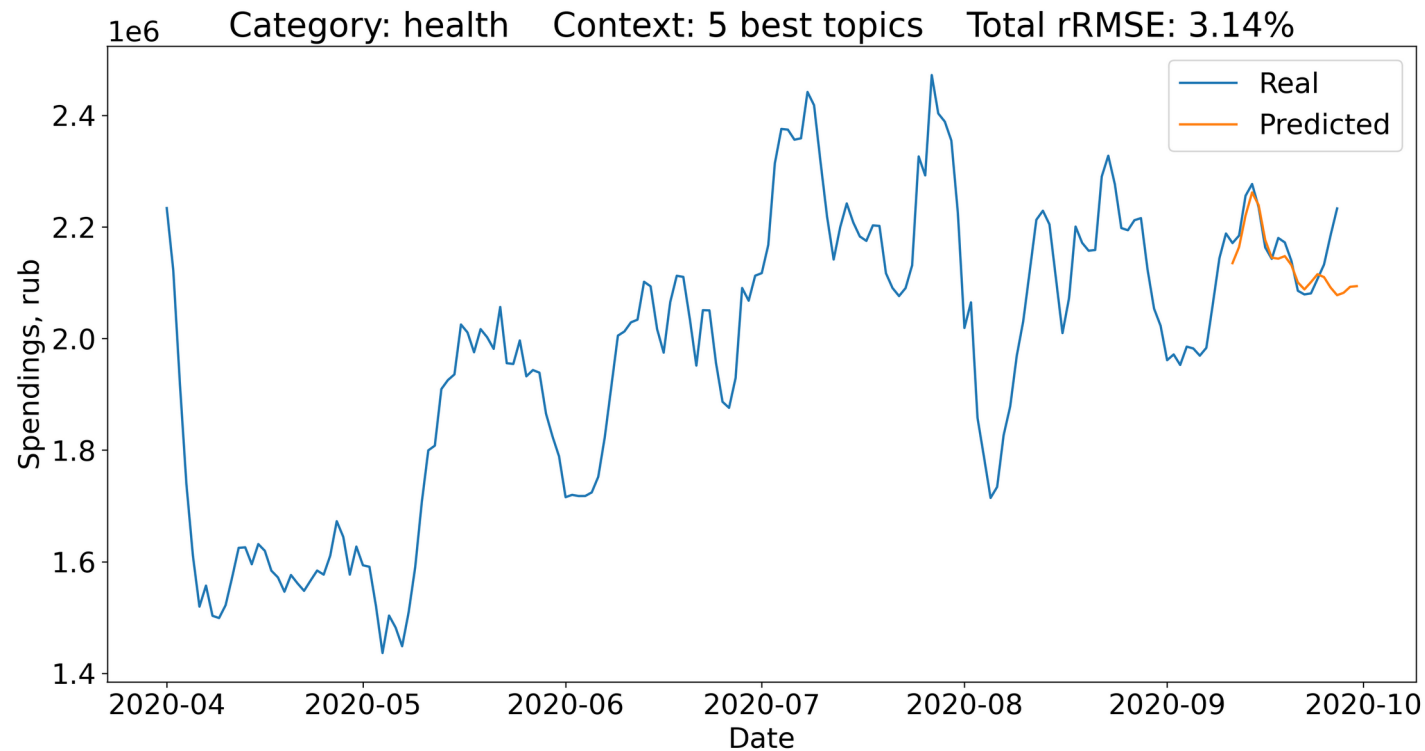


Error metrics are averaged across 10 runs with different prediction dates.

*ARIMAX consumption forecast using the whole context is of low quality. **Selection of exogenous variables is required.***

ARIMAX predictions for the best categories

Health - 3.14%



5 best topics, used for the model:

- Real estate affordability, Russia
- Real estate affordability, SPb
- COVID news
- GDP
- COVID-19 in Russia, new cases

ARIMAX prediction enhancement via adding exogenous variables

Kids - 29.96 → 7.13%



Category: kids Context: 10-23% rRMSE
Total rRMSE: from 28.96% to 7.13%



Added variables:

- Consumer price index
- Consumer price index, food
- Consumer price index, services

First two topics are negatively correlated with consumption with zero day lag.

Consumption and context cross-correlation



	food	travel	beauty	fun	health	kids
Unemployment	113, -0.81	22, 0.94	42, 0.95	26, 0.86	1, 0.83	0, 0.74
Covid-19 in Russia, total deaths	95, -0.80	0, 0.89	0, 0.95	0, 0.87	0, 0.73	0, 0.69
Key interest rate	103, 0.82	18, -0.95	36, -0.95	26, -0.88	0, -0.83	0, -0.73
COVID news	97, 0.81	21, -0.93	22, -0.91	18, -0.85	0, -0.81	0, -0.74
Travel news	94, -0.76	122, -0.66	84, 0.56	35, 0.54	35, 0.51	71, 0.65
Investment news	39, 0.61	117, 0.45	72, 0.61	116, 0.59	117, 0.65	93, -0.42
GDP, billions rub	83, -0.81	0, 0.82	0, 0.91	0, 0.83	0, 0.69	0, 0.66

Lag in days and Pearson cross-correlation

Findings & conclusion

Findings:

- Mining and processing methods as well as ARIMAX models were implemented in Python3.
- Some consumption categories show dependency on context such as news. The best predictions are achieved when context is carefully selected.
- Time-lagged cross-correlation can be used to confirm or refuse causal hypotheses.

Conclusion:

- The Individual task was fully completed, although further research is needed.



I/ITMO

**Thank you for
attention!**