Report on **Master Thesis**

Institute of Economic Studies, Faculty of Social Sciences, Charles University

Student:	**Bc. Jan Sinčák**
Advisor:	**doc. PhDr. Jozef Baruník, Ph.D.**
Title of the thesis:	**Machine Learning Methods in Payment Card Fraud Detection**

OVERALL ASSESSMENT *(provided in English, Czech, or Slovak):*

Short summary
The thesis focuses on the problem of detection of fraudulent card transactions. Autor presents current trends in card fraud and describes extensively common types of frauds with methods of card fraud detection. In the empirical part, the performance of four ML models to detect card fraud is tested. Jan also tests whether ensemble machine learning methods are superior to standard models in fraud detection. Finally, he compares the machine learning models with the traditional rule-based card fraud detection systems and discusses the potential use of the ML approach in a real-world application. The results of the thesis show that machine learning models are an interesting and potentially important substitute for traditional fraud detection systems.

Contribution
The thesis brings a substantial contribution as it uses modern ML methods to detect card frauds. Results show that this approach can be potentially beneficial. Important is the comparison to a Czech bank's rule-based fraud detection system. Even though the ML approach is not superior now, it can be important for future applications.

Methods
The methods used in the thesis are based on the machine learning methods. All used methods (Logistic regression, neural network, random forest, and extreme gradient boosting) are described and correctly used. The author carefully works with the data. He correctly stresses the importance of data preparation. As the frauds are very rare (0.1%), the dataset for modeling needs to be balanced to synthetically increase number of frauds (19%).

Literature
Jan shows that he knows recent and relevant literature in the field of machine learning. He uses all sources correctly. Furthermore, the literature review is on a very high level.

Manuscript form
The manuscript has a standard form with a clear and logical structure. Important machine learning techniques are clearly and fully exposed. It is also reader-friendly. Furthermore, the presentation, as well as a description of the results, is excellent.

Overall evaluation and suggested questions for the discussion during the defense

To conclude, Jan presents an excellent master thesis. The presentation and discussion of results are perfect. The results of the Urkund analysis do not indicate significant text similarity with other available sources. In my view, the thesis fulfils the requirements for a master thesis at IES, Faculty of Social Sciences, Charles University. I fully recommend the thesis for defense, suggesting grade A.

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SUMMARY OF POINTS AWARDED *(for details, see below):*

CATEGORY		**POINTS**
Contribution	*(max. 30 points)*	30
Methods	*(max. 30 points)*	30
Literature	*(max. 20 points)*	20
Manuscript Form	*(max. 20 points)*	20
TOTAL POINTS	*(max. 100 points)*	**100**
GRADE	**(A – B – C – D – E – F)**	**A**

NAME OF THE REFEREE: Mgr. Lukáš Vácha, PhD.

DATE OF EVALUATION: 13.6.2023

Digitálně podepsáno (13.6.2023)
Lukáš Vácha

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Referee Signature