

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA19130 - Fintech and Artificial Intelligence in Finance - Towards a transparent financial industry (FinAI)

Applicant name: Ioana Florina Coita

Details of the STSM

Title: **Leveraging AI Tools for Fraud Prevention and Early Warning on Crowdfunding and P2P Platforms**

Start and end date: 06/04/2024 to 14/04/2024

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

This research relates to deliverable no. 7 from COST Action 19130 entitled "Leveraging AI Tools for Fraud Prevention and Early Warning on Crowdfunding and P2P Platforms". The purpose of this research is to evaluate the effectiveness of AI tools in detecting and preventing fraud within crowdfunding and peer-to-peer (P2P) lending platforms.

During this STSM I worked together with the following researchers: Jana Peliova (SK), Martin Alexa (SK), Juraj Valek (SK), Codruta Mare (RO), Stefana Belbe (RO), Serhan Aydin (TR), Marcos Machado (NL), Wouter van Heeswijk (NL), Andreas Gregoriades (CY), Christos Themistocleous (CY), Christina Ortiz (ES), Ramona Rupeika (LT), Karsten Wenzlaff (DE). Hanna Kristin Skaftadottir (IS) and the whole list is available [here](#).

Me, Jana, Christina, Hanna, Ramona, Stefana, Karsten, Martin started working on the literature review and a draft is [here](#). We established that a definition of fraud should be made according to the model described in this [paper](#) (Cumming et al., 2023). We will follow the Trust Triangle (Dupont & Karpoff, 2019).

Based on the previous hypothesis, we changed the perspective focusing more on fraudulent behaviour as defined by the paper mentioned. Dupont and Karpoff (2019) underscore the critical nature and delicate balance of trust in economic exchanges. They present a framework comprising three mechanisms designed to install discipline, discourage opportunistic behavior, and cultivate adequate trust. As previously noted, the three pillars of the "Trust Triangle" are: (1) first-party enforcement (personal ethics, integrity, culture); (2) related-party enforcement (market

¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

forces and reputational capital); and (3) third-party enforcement (laws, regulations, regulators). Legal enforcement by government agencies within the crowdfunding market has been relatively weak, and regulators have limited capacity for enforcement. Consequently, the integrity of project creators and the enforcement by platforms are crucial in establishing backers' trust. This is particularly significant as platform revenue is directly tied to the amounts raised (typically a fixed percentage), and any excess funds go to the creators.

We collected new data sets: (<https://webrobots.io/kickstarter-datasets/>, <https://webrobots.io/indiegogo-dataset/>, <https://p2pmarketdata.com/articles/universes/market-reports/>, <https://www.p2p-banking.com/>) along with what we already had collected through our Action.

We started modelling the data:

- Together with Serhan and Gocke and me did exploratory data analysis and looked for common features in the following datasets. Results show some correlations between certain features but for the moment neither point our directly towards fraud. We still need to get more data, as the one that we have is transactional. We are looking to find text data from campaigns to correlate with transactional data from individual plaforms.
- Along with Andreas and Christos applied some topic analysis to text data from kikstarter data and found certain common features that lead to the success or failure of a project.
- Together with Stefana, Marcos and Wouter are working on indigogo data looking for common features that could be related to fraudulent behaviour. For the moment results are interesting and point towards combining transactional and text data.

Given the context of the “Trust Triangle” and its importance in crowdfunding, as mentioned earlier, we have taken specific steps in our research methodology to address these concerns.

We have prepared and processed the data. To train and test the model, we explored a variety of approaches, including regression, decision trees, random forests, support vector machines (SVM), and Kernel Principal Component Analysis (KPCA). We utilized feature selection methods like Recursive Feature Elimination (RFE). To further enhance accuracy, we employed ensemble techniques such as Random Forest or Gradient Boosting. Additionally, we explored the use of neural networks to forecast the target variable and evaluated their performance using our data. We applied cross-validation techniques to validate the models.

Moreover, we utilized unsupervised learning strategies, such as K-means clustering, hierarchical clustering, or KPCA, to identify patterns and clusters in our dataset. To understand and explain the predictions made by our machine learning models, we utilized explainable AI techniques like KPCA to elucidate nonlinear grouping of responses.

We conducted Exploratory Data Analysis (EDA) to understand the distributions of features, the relationship between features and fraud scores, and any patterns suggesting the use of hidden or sensitive features. We implemented AI models using the known features to predict fraud scores and compared the models' performance with the platform's outcomes to identify the presence of hidden features or human interventions. We used profit metrics and fraud detection rates to evaluate the effectiveness of current thresholds, experimenting with adjustments to identify potential improvements in profit scoring.

For this study, we combined qualitative and quantitative techniques to conduct experiments on collected data, involving pre-processing, analysis, and predictive modelling. We also examined the models for the use of sensitive features and evaluated bias using fairness metrics.

These steps align with our focus on establishing trust in the crowdfunding environment, especially given the lack of strong legal enforcement and the critical role of platform enforcement and creator integrity.

We have a first draft of the paper here. We split the work into teams, there is the literature review team, the data and methodology team and the review team. We are working simultaneously so that the results from the literature are feed into the AI models to obtain the results. We will present preliminary results to the following COST events: Brussels 14-15.05.24, Bucharest 17.05.24, Istanbul 20-21.05.24, Twente 10-14.05.24, Gran Canaria 18-19.07.24.

We estimate to send a preliminary manuscript to SSRN by end of June.

References:

Cumming, D., Hornuf, L., Karami, M. et al. Disentangling Crowdfunding from Fraudfunding. *J Bus Ethics* 182, 1103–1128 (2023). <https://doi.org/10.1007/s10551-021-04942-w>.

Dupont, Q., & Karpoff, J. M. (2019). The trust triangle: Laws, reputation, and culture in Empirical finance research. *Journal of Business Ethics*, 163, 217–238.

(max. 500 words)

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Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

The Short-Term Scientific Mission (STSM) conducted as part of COST Action CA19130, "Leveraging AI Tools for Fraud Prevention and Early Warning on Crowdfunding and P2P Platforms," aimed to assess the efficacy of AI tools in identifying and mitigating fraudulent activities within crowdfunding and peer-to-peer (P2P) lending platforms. The STSM activities were executed in alignment with the Action's objectives, particularly focusing on revealing fraudulent behaviors and fostering collaboration among researchers.

The STSM involved collaboration with multiple researchers across various disciplines, including literature review, data analysis, and methodology development. The initial phase focused on defining fraud according to established models and frameworks, such as those proposed by Cumming et al. (2023) and the Trust Triangle framework by Dupont and Karpoff (2019). This phase set the foundation for subsequent research endeavors.

New datasets were collected from diverse sources, including Kickstarter, Indiegogo, and P2P lending platforms, supplemented by existing data obtained through the COST Action. The research team embarked on data modeling activities, exploring correlations and patterns within the datasets to identify potential indicators of fraudulent behavior. Initial exploratory data analysis revealed certain correlations but did not directly pinpoint fraud-related features, necessitating further data acquisition, particularly textual data from crowdfunding campaigns.

Several modeling approaches were employed, ranging from traditional regression techniques to advanced machine learning algorithms, including decision trees, random forests, support vector machines (SVM), and neural networks. Ensemble techniques and feature selection methods were utilized to enhance model accuracy and interpretability. Unsupervised learning methods, such as clustering, were also employed to uncover hidden patterns within the data.

Exploratory Data Analysis (EDA) was conducted to understand feature distributions and their relationship with fraud scores. The models' predictions were evaluated against platform outcomes to assess their effectiveness in fraud detection. Explainable AI techniques were employed to elucidate the models' decision-making processes and identify potential biases.

The STSM goal was to prepare a preliminary manuscript, which underwent collaborative review and refinement. The research findings and methodologies were disseminated and will be at various COST events and through publications in high-quality journals. Planned follow-up activities include continued collaboration, further research dissemination, and manuscript submissions.

Overall, the STSM successfully contributed to the objectives and deliverables of COST Action CA19130, particularly in revealing fraudulent behavior, fostering collaboration among researchers, and disseminating research

findings. The proposed follow-up activities aim to build upon the STSM's outcomes and further advance knowledge in the field of fraud prevention in crowdfunding and P2P lending platforms.

Our research endeavors contribute to the achievement of several MoU objectives and deliverables of COST action CA19130. In particular:

1. Objective no. 1 focusing on revealing fraudulent behaviour;
2. Objective no. 8 bringing researchers together to collaborate and disseminate results, objective no. 14 maximizing job opportunities and;
3. Objective no. 6 improving gender equality;

This application also contributed to deliverables of the Action, including deliverable no. 7 " Leveraging AI Tools for Fraud Prevention and Early Warning on Crowdfunding and P2P Platforms" and deliverable no. 14" Key software (codes, packages) and will be committed to COST Github account and extended the existing data repository.

Preliminary results were disseminated in Cluj COST event from 24th to 25th April 2024 and while research advances, they will be presented to next events like the one in Brussels, Bucharest, Istanbul from 20th to 21st of May and Gran Canaria event from 18th to 19th of July. Also, results will be presented through Vasile Strat`s COST Action podcast and by writing a minimum of one discussion paper to be published in an open science repository and also in a high-quality journal.

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Ioana Florina Coita

