# LITERATURE SEARCH/REVIEW

# CIS4011-N RESEARCH METHODS 2021

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## 1. INTRODUCTION AND TOPIC OUTLINE

FinTech also known as financial technology is a new financial industry that applies technology to improve financial services. The industry was driven by the progress in e-finance for financial companies after the global financial crisis in 2009. This development the integration of internet technology, artificial intelligence (AI) and big analytic data.

One of the current uses of AI in FinTech is analysing a client risk profile – an example of which is peer to peer lending approval which is the basis of this literature review. The current implementation of black box machine learning models provide little access to understanding how variables are combined to make its predictions. As such, black box AI has proved unsuitable in regulated financial services because both designers and users have little access to understanding how variables contribute to the predictions made. In addition, there may also be possible biases that are inherited by the algorithms from human prejudices embedded in the training data [1].

Black box AI models challenges the need for transparency in automated decision making. In a presentation by the European Commission High Level Expert Group on AI on their Ethics Guidelines for Trustworthy AI in April 2019, AI systems and their decisions should be explained in a manner that is adapted to the relevant stakeholder [2]. AI systems should develop mechanisms for auditability, assessment of algorithms, data and design processes to promote accountability of the decisions being produced, thus allowing AI developers and their relevant stakeholders to validate their decision rationale.

## 2. RESEARCH QUESTION

What are the other alternative artificial intelligence applications that can be utilised in FinTech-related automated decision making in place of black-box models?

## 3. DATABASE SEARCH

In order to acquire the best evidence and discussion of the question posed, I searched for multiple queries across several journal website and iterating through until I have obtained a sufficient collection of academic papers to be used as reference for the research required for my dissertation.

I carried out several broad searches – one for the ethical guidelines, another for present models implemented and another for current experimental alternatives.

### 3.1 *Discovery Database*

| No. | Question | Keywords | Filters | Results | Notes |
|---|---|---|---|---|---|
| 1 | What are the existing articles written about Explainable AI in FinTech? | Explainable AI in Fintech | None | 93 | There are too many articles that are not peer reviewed that also include newspapers article |
| 2 | What current peer reviewed work has been published on Explainable AI in FinTech? | Explainable AI in Fintech | Year: 2016 – 2021<br>Include: Peer Reviewed<br>Exclude: Newspapers Article | 9 | Reviewable list of journal articles have been found |

### 3.2 *IEEE Xplore*

| No. | Question | Keywords | Filters | Results | Notes |
|---|---|---|---|---|---|
| 1 | What has been published on Explainable AI? | Explainable AI | None | 264 | There were too many resulting journals across a very broad range of topics |
| 2 | What has been published on Explainable AI in the last 5 years? | Explainable AI | Year: 2016 - 2021 | 263 | The resulting journals need to include only those relating to the FinTech industry |
| 3 | What has been published about Explainable AI relating to the FinTech industry? | Explainable AI | Year: 2016 – 2021<br>Topics excluded: Medical computing, health care, medical image processing, diseases | 199 | It was difficult to find information relating to the industry I am exploring. |
| 4 | What conference papers have been published regarding Explainable AI? | Explainable AI | Year: 2016 – 2021<br>Published Material: Conferences only | 157 | There were 4 relevant conference papers |

| | | | | | |
|---|---|---|---|---|---|
| | | | Topics excluded: Medical computing, health care, medical image processing, diseases | | |
| 5 | What journals have been published regarding Explainable AI? | Explainable AI | Year: 2016 – 2021<br>Published Material: Journals Only<br>Topics excluded: Medical computing, health care, medical image processing, diseases | 32 | There were 2 relevant journals that can be utilised |

3.3 *Science Direct*

| No. | Question | Keywords | Filters | Results | Notes |
|---|---|---|---|---|---|
| 1 | What are the existing publications regarding Explainable AI? | Explainable AI | None | 414 | There is a broad range of results that may need to be manually filtered for the industry I am focussed on |
| 2 | What are the existing publications regarding Explainable AI? | Explainable AI | Years: 2018 - 2021 | 386 | There is a large portion of the materials published between 2020 and 2021. There were none between 2016 and 2017. |
| 3 | What are existing peer-reviewed material regarding Explainable AI in FinTech? | Explainable AI | Years: 2018 – 2021<br>Article Type: Review articles, research articles, Case reports | 300 | The results were looked through manually. There was 1 research article relevant to the topic and industry I am exploring |
| 4 | What are existing peer-reviewed material regarding Explainable AI in FinTech? | Explainable AI | Years: 2018 – 2021<br>Article Type: Review articles, research articles, Case reports<br>Subject area: Business, Management and Accounting | 28 | The updated filter for the subject area did not produce the publication from the previous search. However, a suitable number of relevant articles have been obtained across the last two searches. |

3.4 *ACM Digital Library*

| No. | Question | Keywords | Filters | Results | Notes |
|---|---|---|---|---|---|
| 1 | What are existing material relating to Explainable AI? | Explainable AI | None | 268,987 | There is a very broad range of results. |
| 2 | What are existing material relating to Explainable AI in FinTech? | Explainable AI in FinTech | None | 269,064 | The results need to be filtered by relevant publishing years. |
| 3 | What are existing material relating to Explainable AI in FinTech? | Explainable AI in FinTech | Publication Date: Last 5 years | 81,725 | The results are still too broad. |
| 4 | What are existing journals relating to Explainable AI in FinTech? | Explainable AI in FinTech | Publication Date: Last 5 years<br>Publications: Journals | 13,122 | The results are to be filtered for research articles and media format. |
| 5 | What are existing journals relating to Explainable AI in FinTech? | Explainable AI in FinTech | Publication Date: Last 5 years<br>Publications: Journals<br>Content Type: Research Articles<br>Media format: PDF | 11,560 | The range of results are still too broad and need to be more topic specific. |
| 6 | What are existing journals relating to Explainable AI in FinTech? | Explainable AI in FinTech AND FinTech | Publication Date: Last 5 years<br>Publications: Journals<br>Content Type: Research Articles<br>Media format: PDF | 14 | The results were not relevant enough. |
| 7 | What are existing publications relating to lending in Explainable AI? | Explainable AI AND Lending | Publication Date: Last 5 years<br>Publications: Journals<br>Content Type: Research Articles<br>Media format: PDF | 563 | There were too many results and I was not able to refine any further. |

## 4. LITERATURE EVALUATION

As the Artificial Intelligence industry is constantly evolving, it was key in ensuring the information collected in this literature review was recently published and its applications are up to date. Almost all of the searches had a date range criteria applied so only the most recent publications were collected from the databases. However, it was also necessary to refer to several older publications for the basis of the current methodologies referred to in the literature obtained from the databases. For a publication to be considered shortlisted, it must relate to Explainable Artificial Intelligence, the FinTech industry and also lending platforms where possible.

## 5. INCLUSION AND EXCLUSION PROCESS

| | **Research Paper Title** | **Include / Exclude** | **Reasoning** |
|---|---|---|---|
| 1 | A Type-2 Fuzzy Logic Approach to Explainable AI for regulatory compliance, fair customer outcomes and market stability in the Global Financial Sector | Include | Relevant methodology that can be used with regards to the research question. |
| 2 | From Machine Learning to Explainable AI | Include | Relevant to the exploration of Explainable Artificial Intelligence |
| 3 | Predicting Liquidity Ratio of Mutual Funds via Ensemble Learning | Exclude | This paper is not relevant to the research topic. |
| 4 | Build confidence and acceptance of AI-based decision support systems – Explainable and liable AI | Include | Research is relevant to exploring Explainable Artificial intelligence. |
| 5 | Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI) | Include | Study will be useful to understanding the use of Explainable Artificial Intelligence in place of black-box models. |
| 6 | Factual and Counterfactual Explanations for Black Box Decision Making | Include | Paper is useful for the defending the research question. |
| 7 | Explaining black-box classifiers using *post-hoc* explanations-by-example: The effect of explanations and error-rates in XAI user studies | Exclude | The paper is not specific to the research topic. |
| 8 | Artificial intelligence in business: State of the art and future research agenda | Exclude | It is too broad in relation to the research question. |
| 9 | Applications of Artificial Intelligence in commercial banks – A research agenda for behavioural finance | Exclude | Not relevant to the research question. |
| 10 | The effects of explainability and causability on perception, trust and, acceptance: Implications for explainable AI | Include | Appropriate to expanding the research question. |
| 11 | An explainable AI decision-support-system to automate loan underwriting | Include | The research is relevant to the research question. |
| 12 | Shapley-Lorenz eXplainable Artificial Intelligence | Include | This is appropriate to defending an explainable artificial intelligence system. |

| | | | |
|---|---|---|---|
| 13 | Model of Sustainable Development Based on FinTech in Financial and Banking Industry: A Mixed-Method Research | Include | Relevant to the main theme of the research question. |
| 14 | Explainability and Fairness in Machine Learning: Improve Fair End-to-end Lending for Kiva | Include | Relevant as a point of reference of an alternative to a black-box model. |
| 15 | Explainable AI in Fintech Risk Management | Include | Related to the research question and proposes a proven solution. |
| 16 | A Systematic Analysis on FinTech and Its Applications | Exclude | The area of application has already been identified – this paper is not relevant. |
| 17 | Examination of the Factors Contributing to Financial Technology Adoption in Indonesia using Technology Acceptance Model: Case Study of Peer to Peer Lending Service Platform | Exclude | The paper is specific to adoption in Indonesia. And the area of discussion is not relevant to the research question. |
| 18 | A Perfect Storm: Social Media News, Psychological Biases, and AI | Exclude | It is not specific to the research question. |
| 19 | Addressing Regulatory Requirements on Explanations for Automated Decisions with Provenance – A Case Study | Include | Useful as a reference to regulation of automated decision making. |
| 20 | A Survey on Trajectory Data Management, Analytics, and Learning | Exclude | Too broad with respect to the research question. |
| 21 | Bridging the Gap Between Ethics and Practice: Guidelines for Reliable, Safe, and Trustworthy Human-centered AI systems | Include | Relevant to the research topic. |
| 22 | Responsible data management | Exclude | This paper is not relevant to the research topic. |
| 23 | Data Protection in AI Services: A Survey | Exclude | Does not relate to the research question. |
| 24 | Robust Ordinal Regression: User Credit Grading with Triplet Loss – Based Sampling | Include | Useful as reference for an alternative to black-box models. |

***Total included = 14***
***Total excluded = 10***

## 6. CONCLUSION AND LIMITATIONS

The literature review was quite successful as I was able to obtain a wide range of sources across all the databases used. The literature was included only if it met the specified requirements that I outlined before the search. Numerous individual searches were carried out that used a range of filters and keywords. Some had to be updated or improved to obtain more specialised results.

I found that Explainable Artificial Intelligence has been widely used across a number of industries but its application to the FinTech industry is still growing. One survey found on the topic by Adadi and Berrada (2018) explains that Explainable Artificial Intelligence relates more to the initiatives and efforts carried out in response to AI transparency and trust concerns rather than to a formal technical concept. I found this useful in expanding my research question into exploring the ethical aspects of artificial intelligence applications within the FinTech industry.

Several publications found had provided an extensive list of citations that I was able to use to expand my search. I considered them a high quality source and used it as an author search to identify other potential publications on the similar topic. This was very useful as I was able to delve further into my research question.

The ACM Digital Library was a challenge to work with. Searches still produced a large number of results despite having filtered them further by their publishing date and using specific keywords relating to the set criteria. I was unable to filter the search results to anything less than 500 results. I resorted to manually reading through results so as to not miss out on potentially useful publications.

I also faced the initial challenge of learning to utilise Boolean expressions to specify my searches but I was able to master it after several searches.

The overall literature search assisted in building my ideas for the research topic. I began with the initial intention of exploring an alternative artificial intelligence application for decision making systems (e.g. lending platforms). However my literature search expanded my ideas to also explore and incorporate the ethical aspects of those artificial intelligence applications. This will allow me to contribute further to the FinTech industry as I will attempt to build trust and transparency in automated decision making amongst both providers and consumers.

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