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MODULE TITLE: Cloud AI
Code: COS7054-B
Level M
Academic Year: 2022/23 Semester 1

Coursework 1

Artificial Intelligence for credit card fraud detection
Group coursework

Aim

1- Highlight the important techniques, cloud infrastructure and services, and AI methodologies that are employed in fraud detection while at the same time focusing on the existing literature.
2- To produce a piece of analysis along with an AI demonstration on possible improvements to financial fraud detection and write a research report on cloud AI capabilities when implemented on the financial fraud dataset.

Problem statement

Combat fraud with state-of-the-art technology.

Credit card fraud is a major challenge for many businesses, causing substantial and growing financial losses every year.
According to the UK-2022 annual fraud report[1]:

- Unauthorised financial fraud losses across payment cards, remote banking and cheques totalled £730.4 million in 2021.
- Banks and card companies prevented £1.4 billion in unauthorised fraud in 2021.
- UK Finance members reported 195,996 incidents of Authorised Push Payment (APP) scams in 2021 with gross losses of £583.2 million.

Detecting fraud patterns in payment card transactions is a challenging problem. With the ever-growing amount of data generated by payment card transactions, it has become impossible for a human analyst to detect fraudulent patterns in transaction datasets, often characterized by a large number of samples, many dimensions, and online updates. As a result, the design of payment card fraud detection techniques has increasingly focused in the last decade on approaches based on machine learning (ML) techniques that automate the process of identifying fraudulent patterns from large volumes of data[2].

[1] https://www.ukfinance.org.uk/system/files/2022-06/Annual%20Fraud%20Report%202022_FINAL_.pdf
[2] https://fraud-detection-handbook.github.io/fraud-detection-handbook/Foreword.html

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For this coursework, the requirement is to produce a document (2000 words) on a piece of research you have undertaken to describe the cloud AI framework and method for credit card fraud detection.
The aim is to investigate the problem of credit card fraud detection and the role AI and cloud services can play in fraud prevention, analysis, and detection. In doing so, you are expected to perform the following tasks:

- Investigate public credit card fraud detection dataset and have a basic understanding of their significance and meaning. Datasets and case study is listed in canvas under the learning materials.
  https://bradford.instructure.com/courses/18236/modules/items/371685
  Original dataset https://www.kaggle.com/datasets/mlg-ulb/creditcardfraud
- You can use any other credit card fraud detection for this study to support your case study.
- Highlight aspects of credit card fraud detection that AI can improve using these data sets.
- Propose a cloud AI system or framework that can be implemented for credit card fraud detection.
- Evaluate computing and cloud infrastructure using relevant tools, technologies and programming tools.
- Describe and critically assess AI services (including security aspects_ on the Cloud, showing the spectrum of Cloud computing capabilities used to deploy them.
- Discuss your findings, making recommendations for further investigation and improved implementation.
- Write a 2000 words report to present your work and findings.

Useful Reading and resources
Check canvas resources under the learning materials
https://bradford.instructure.com/courses/18236/modules

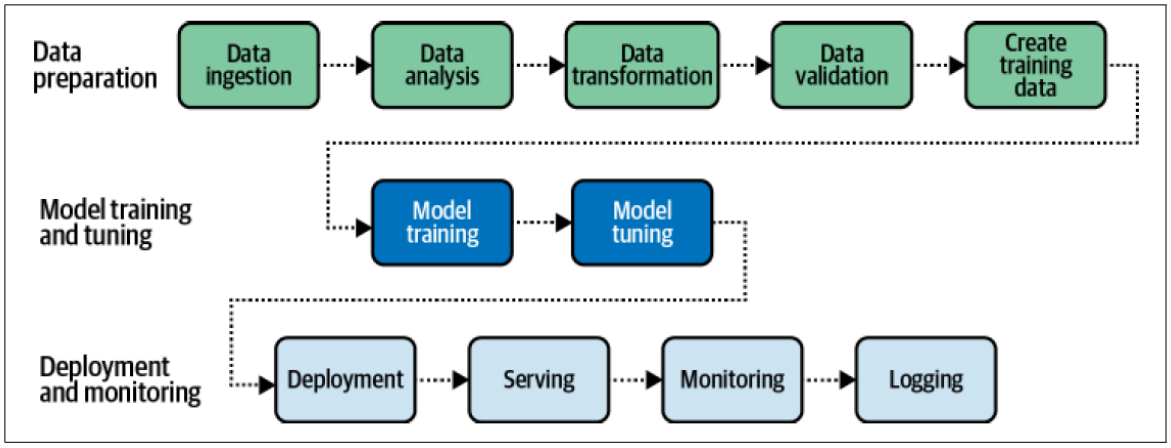
Recommended website
https://bradford.instructure.com/courses/18236/pages/recommended-websites?module_item_id=371981

Reading list
https://bradford.instructure.com/courses/18236/external_tools/63

Effort required

The coursework is worth 50% of the module marks. You are expected to demonstrate good effort in exploring the background of this problem, understanding the datasets, processing the data, developing a meaningful AI framework showing implementing of some basic aspects of cloud AI infrastructure, and writing up your report. The coursework is worth 50% of the marks for this 20-credit module. A 20-credit module is nominally 200 hours of your time, some of which is spent in lectures, labs and private study. You should expect to be spending around 70 hours on this coursework.

The development of cloud AI and machine learning system goes through different phases, as discussed in our lectures and labs.
The AI life Cycle is shown below as a quick reminder.
It will be best if you consider these phases in your report when demonstrating the design and development of the Cloud AI system or framework. You need to describe the goals and objectives of your AI system, the feasibility of selected data, different users and their requirements, the basic design of it, deployment concepts and challenges. You are encouraged to implement (not mandatory) one of these phases in a programming language (Python, Matlab, Java, etc.).



Ref: https://www.oreilly.com/library/view/data-science-on/9781492079385/

Deadline for submission of report
Week 7 (to be confirmed)
Late submissions (without acceptable extenuating circumstances) will receive a mark of zero.

Your report will contain the following sections:

- Title (one line) and authors.
- Abstract (one paragraph 5-10 lines): the review should start with a summary paragraph that describes briefly the addressed topic, problem and main challenges, and your critical evidence and review outcome.
- Introduction
- Problem Description
- Project Motivation and Objective
- Research challenges
- Write Report Structure.
- Literature Review
    - Related Work -> this is general overview of your research problem.
    - Technical Review -> cloud AI frameworks.
    - Algorithms or Methods -> previous algorithms done for credit card fraud detection.
    - Evaluation -> Overview of the weaknesses and strengths of different techniques for credit card fraud detection (Could be a comparison table).
- Data with Initial Analysis.

- Data Description
- Data Preparation -> describe your data preprocessing pipeline.
  That may include:
  - Data Association.
  - Data Cleaning.
  - Feature Engineering.
  - Initial Analysis and exploration.
  - Data Characteristics or features.
  - Trend Analysis.
  - Class Distribution.
  - Clustering analysis.
- Critical analysis - >Describe and critically assess AI services on the Cloud and understanding the spectrum of Cloud computing capabilities used to deploy them.
  - You can include flowchart explaining your framework.
  - Reflection, legal, and ethical aspects of your cloud AI method or framework.
- Conclusion.
- Bibliography and Citations.

You may find also useful the following directions and suggestions:

- What difficulties did you find regarding reproduction of the main research paper work? Provide reflections focused on technical, interpretational and functional issues.
- Discuss the results of the case studies and any interesting observations by comparing them with other published work (use journal papers, conference proceedings, books and online resources available preferably via the University's Library resources). What did you observe?
- What conclusions could you deduce/induce from each result?
- Which analysis techniques were most helpful to evaluate, explore, or model?
- How did authors compare techniques?
- What techniques/activities could you see more used next (in future follow-up work) to continue this work?

Context and Submission Description

This is a group coursework.

Coursework electronic submission comprises one report addressing the research problem, submitted in.pdf format; the file will have suggestive file name preferably linked to the question they are related to (e.g. CW1-[UoBnumber1_FL1- UoBnumber2_FL2- UoBnumber3_FL3].pdf, where [UoBnumber] is replaced with your student id number, and FL is replaced with your first and last name. It should be submitted using Canvas following instructions made available on the VLE. The report may also contain relevant appendices with technical details and evidence of practical work, including own code shared in Google Colab, GitHub or OneDrive. The coursework report for this assessment should be submitted via Canvas as a single pdf document.

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Marking Scheme:

Criteria	>80%	70-80%	60-70%	50-60%	40-50%	<40%
Presentation of the report (25%)	Fully adheres to student guidelines. Minor spelling and grammatical errors. Excellent use of appropriate and scientific language. Excellent structure and organisation. Excellent readability.	Fully adheres to student guidelines. Lack of spelling and grammatical errors. Very good use of appropriate language. Excellent structure and organisation.	Mainly adheres to student guidelines. Few spelling and grammatical errors. Good use of appropriate language. Well-structured with logical organisation	Some adherence to student guidelines. Some spelling and grammatical errors. Inconsistent use of appropriate language. Organisation and progression evident.	Little adherence to student guidelines. Many spelling and grammatical errors. Minimal use of appropriate language. Inadequate attention to structure and organization.	Does not adhere to student guidelines. Major deficiencies in spelling and grammar. Lack of appropriate language. A disorganised report with lack of evident structure.
Description and achievement (25%)	Novel or innovative solution to research problem. Exceptional amount of high quality work. Comprehensive testing	Problem is meaningful, innovative challenging and complex. Problem explicitly stated with precise explanation of all research objectives. Fully tested (or in	A relevant and original topic which is effectively translated into project aims and objectives which are clearly stated. Well tested system or prototype (or in theoretical	Appropriate problem area chosen. Objectives outlines with the main areas of investigation identified. Some evidence of adequate testing (or in theoretical	Limited investigation of the problem area poorly defined. Objectives vague or insufficient. Very limited testing (or in theoretical submissions –	Simple or unoriginal solution to the problem showing lack of imagination (relies on title to direct project). No or inadequate testing (or in theoretical submissions – no

	completed, critically reviewed and results incorporated into product.	theoretical submissions – excellent analysis and recommendations).	submissions – good analysis and recommendations).	submissions – Some analysis and recommendations).	Very limited analysis and recommendations). .	analysis and recommendations)
The demonstration and Comparative Evaluation (25%)	Signs of professionally developed AI concepts, excellent understanding of user requirements, excellent specifications and system requirements. Specification effectively interpreted with signs of original thinking and/or research. Ability to fully answer all questions with evidence of	Fully developed cloud AI concepts, fully-developed user requirement , fully developed specification and System requirement. Evidence of excellent understanding of AI-development process and applications. Ability to fully answer all questions with evidence of excellent understanding	Evidence of developed AI concepts, developed user requirements, developed specifications and System requirements. Good understanding of the AI-development process and applications. Ability to answer some of the questions with good evidence of understanding.	Partial in-depth development of AI concepts, Partial in-depth developed user requirements, Partial in-depth developed specifications and System requirements. Evidence of a fair understanding of the AI-development process and applications. Ability to answer most questions with evidence of understanding. A fair interpretation of the research problem.	Limited development of AI concepts, limited developed user requirements, limited developed specifications and System requirements. Evidence of a limited understanding of the AI-development process and applications. Ability to answer dew questions with limited understanding. Limited interpretation of	No or very limited development of AI concepts, no or very limited developed user requirements, no or very limited developed specifications and System. Inability to answer most of the questions.

	excellent understanding.				the research problem.	
Quality of work and understanding (25%)	Research findings break new ground.	Wide range of material. Excellent evidence of critical evaluation and original thinking. Substantial number of appropriate references. Evaluation and recommendations fully and appropriately reviewed and presented. Excellent link to implementation. Research findings fully consider broader issues.	Focus on key areas using relevant sources. Evidence of critical evaluation. Wide range of references with a varied bibliography. Clear evaluation & recommendations identifying key issues. Clear link to implementation. Research findings apparent with some consideration of broader issues.	Adequate information survey with some evidence of critical evaluation. Appropriate range of references. Good bibliography. Evaluation and recommendations identify some key issues. Link to implementation apparent. Research findings lack consideration of broader issues.	Limited sources of information used. Limited range of references. Limited bibliography. Limited evaluation and recommendations and limited ability to show the link to implementation. Lacking clarification of research findings.	Review of existing literature not evident. No references provided with limited or omitted bibliography. No evaluation or recommendations and inability to show the link to implementation. Conclusions do not link to research findings.

Feedback

Feedback will be given via an assignment feedback sheet. Marks will be returned within 2 weeks of submission.

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You should make yourself aware of the plagiarism policies of the University.