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**School of Computer Science and Statistics**

**Individual Assessment Submission Form**

| **Course Title** | **TEP Engaging in a Digital World** |
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| **Module Title** | **TEP 00062** |
| **Lecturer(s)** | **Prof Dave Lewis, Prof Vincent Wade** |
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**Assignment Submission Declaration:**

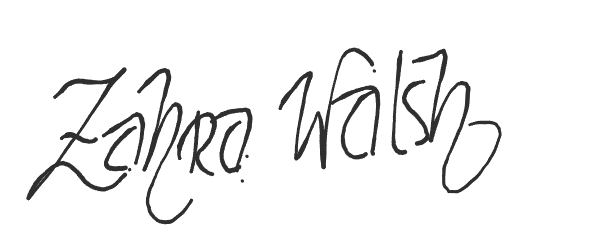
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**I declare that this assignment, together with any supporting artefact is offered for assessment as our original and unaided work, except in so far as any advice and/or assistance from any other named person in preparing it and any reference material used are duly and appropriately acknowledged.**

**Any use of Chatbots/Generative AI tools in researching the materials research for this report is fully described at the end of the report. I confirm that no text produced by such tools has been directly used in the report.**

**Signed**

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**Date 27/3/24**

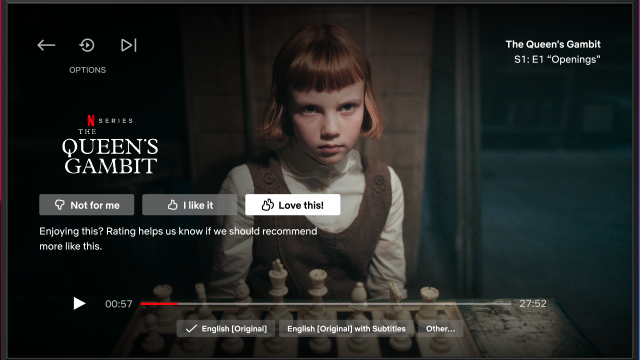
**Description of use of Chatbots/Generative AI tools:**

**N/A**

1. **Description of Application**

The application selected for this assignment is Netflix. Netflix is an online, ad free streaming platform where users pay a subscription fee to access a wide collection of movies, shows, documentaries and more, as well as exclusive content that is only available on Netflix called ‘Netflix Originals’. Users can access this content both online and offline.

Machine learning algorithms, which fall under the umbrella of AI, are used to tailor recommendations for its users. There are 2 main forms of data that Netflix collects from its user; implicit data and explicit data (Plummer, 2017). Explicit data is the data that the users directly share, such as clicking the ‘thumbs up button’ if they liked what they just watched (see Fig. 1). This data is then used to recommend content similar to the one the user just liked, however these recommendations are not just based on the genre, it is also based on the actors that star in it, and where the movie is set (Spangler, 2022). Netflix’s employees tag such factors (genre, actors present, the setting etc) in all of their content and compile this data to group this content into categories (Spangler, 2022). Netflix then collects implicit data from its users which consists of behavioural data. Implicit data includes watch time by users, for example if a user stopped watching a movie after 10 minutes and then never finished watching it, this would suggest they did not enjoy this movie and would not watch movies similar to it. Netflix then combines both implicit and explicit data, and its ML algorithms have the tools needed to form recommendations tailored to each user (Netflix Research, n.d.). These ML algorithms find behavioural similarities between users, Todd Yellin, Netflix’s Vice President, describes users with similar tastes as ‘Taste Communities’, where users that make up a certain ‘Taste Community’ are recommended similar content (Spangler, 2022). This customised user experience by AI enhances users digital engagement as it makes finding new content easier than ever before. When a user has a good experience with Netflix’s recommendations, it is likely they will return to watch more recommended content, thus continuing user engagement with the application. The more content watched, the more accurate the recommendations become, and the user's experience and engagement will continue to benefit from Netflixs ML algorithms.



***Figure 1.*** *Image depicts a screenshot of the Netflix app. The user has 3 options; (i) to thumbs down the show meaning this content is ‘not for me’, (ii) to thumbs up the show, meaning they like this content, or (iii) to two thumbs up the show, meaning they love it. This is an example of explicit data that the user provides.*

*Image source: Netflix.*

Another way in which AI is utilised within the application is through the production of multiple thumbnails for the one movie/show. Certain thumbnails are selected over others to increase click through rates (CTR) from users. Rather than just using a movie /shows original cover art, Netflix generates multiple thumbnails for the content on its platform. Out of the multiple thumbnails produced, specific thumbnails are selected over others based on what an individual user is most likely to click. This digital engagement feature improves CTR as it entices users to watch content that they may have already scrolled past due to its previous thumbnail. The thumbnail is generated by Aesthetic Visual Analysis(AVA), where thousands of frames are scanned for certain factors such as the brightness of the frame, the skin tones of the people within the frame presented and the overall quality of the image (Yu, 2019). Two main factors considered when determining what thumbnail include the theme of the thumbnail and who is displayed in the thumbnail. One example illustrated by Yu is the various thumbnails used for the series ‘Riverdale. For users that are avid thriller enthusiasts, a moody and thriller-esque thumbnail is presented, however for users that enjoy the romance genre more than thrillers, such users are presented with a light hearted, brighter image that includes pastel colours which contribute to the romantic aesthetic the thumbnail presents (See Fig. 2), (Yu, 2019). Riverdale does include both genres of thriller and romance, so having 2 different thumbnails to optimise CTR for different users interests is a clever tactic to increase user engagement. Netflix has recently implemented a type of ML called ‘contextualisation bandits’ which allows the application to change thumbnails that a user sees on a daily basis (Roth, 2020). Contextualisation bandits save time as thumbnails can be adjusted by using real time data from the user, whereas previous ML produces thumbnails based on data collected over a longer period of time. The use of multiple, customised thumbnails saves Netflix money, as users are encouraged to watch shows they previously would not have given second thought to, meaning Netflix does not have to licence more content for its platform. Contextualisation bandits cleverly utilises the content Netflix already has, and simply moulds it to meet the needs of multiple ‘taste communities’.

Therefore, the use of ML allows Netflix to form customised thumbnails and content recommendations which improves overall user satisfaction and engagement, and saves the application money in the long run.



***Figure 2.*** *The left image depicts a light hearted, romantic thumbnail for the series ‘Riverdale’. The right image depicts a moodier, thriller-like thumbnail for the same series. This is an example of two thumbnails that can be presented to a user to increase CTR.*

*Image source: (Yu 2019)*

1. **Identification of Stakeholder Roles involved in the application and its governance**

One stakeholder includes Netflix inc., which employs approximately 13,000 people, therefore the company itself is a central stakeholder to the application (Cuofano, 2024). Netflix inc. is responsible for the running of the platform and providing users with the streaming service. The application’s success is a result of the work that the employees within the company put into the application. Roles that the Netflix inc. is responsible for include; the sourcing and provision of content for user’s, generating revenue for the application by charging user’s a subscription fee for its service, constantly improving the application by implementing AI and improved algorithms to provide the user with the best possible experience, thus outcompeting other streaming services. Netflix inc. is responsible for increasing user digital engagement, therefore constant innovations such as the implementation of new ML like ‘contextualisation bandits’ is implemented to achieve this goal. Netflix inc. is also responsible for collecting and analysing user data, and using this data in a way to improve the application itself without breaching the privacy of the user. As well as licensing content for the platform, Netflix inc. is also responsible for in-house productions of content for the application, this content is called ‘Netflix Originals’ where Netflix owns 100% of the production and distribution rights (Robinson, 2018). Regarding governance, Netflix’s board of directors oversees the applications governance and makes decisions to ensure that Netflix inc. complies with current regulatory requirements.

The users of the platform are called subscribers as they pay a subscription fee for this streaming service, therefore subscribers are another stakeholder. Netflix has approximately 260 million subscribers (Shewale, 2024). The role of this stakeholder is to generate revenue for the company, as well as to provide implicit and explicit data for Netflix to then use appropriately to improve the user experience and to improve the application itself. Therefore subscribers govern how and what data Netflix can analyse. The subscribers benefit from this platform service as they can stream content both online and offline, as well as watch ad free content and have access to Netflix Original content which is not available on any other streaming site.

Another stakeholder includes the companies whose content is featured on Netflix. This content is licensed by Netflix and is therefore different from Netflix Originals. The role of such content providers is to provide content that will entice Netflix users and improve CTR and viewership. If content providers stopped licensing their content, Netflix’s platform would crumble as ¾ of their platform consists of licensed content (Welk, 2023). Content providers benefit from Netflix licensing their content as they receive large sums of money for doing so. Netflix also provides them with a new platform for their content to be streamed on and enables their content to reach new audiences. Content providers govern how the licensed content is used and the duration of its usage on Netflix’s platform.

Regulatory bodies conclude the list of stakeholders for this application. The main role of regulatory bodies, such as the European Data Protection Board, is to ensure Netflix complies with current regulations like General Data Protection Regulation (GDPR) which is enforced in countries within the European Union. Regulatory bodies therefore ensure that a user's personal data is protected (European Parliament & Council of the European Union, 2018). Regulatory bodies also regulate and therefore govern the content that is available on Netflix.

**Identification of Ethical Risks**

1. **Risk to human rights**

**Netflix company**

Data security risks: Netflix could be subjected to legal difficulties if they do not keep their user’s data protected.

Severity of data security risk: High severity risk as it could cost Netflix a lot of money if they are taken to court over legal issues regarding user privacy violations.

Likelihood of data security risk: Medium likelihood of this risk, Netflix has disclosed that it does not sell user data and that any information collected about a user can be requested by the user to see and/or to be deleted (Netflix inc, no date), however the use of IP addresses to crack down on password sharing increases the likelihood of this risk.

Risk to just and favourable work: Just and favourable work is at risk if Netflix licences content that was made under exploitative conditions.

Severity of this risk: High severity risk as it violates worker’s conditions and would support exploitative labour.

Likelihood of this risk: Medium likelihood risk as Netflix is under constant pressure to licence more content, and therefore thorough background checks may not be completed of working conditions in the studio.

**Subscribers**

Legal risks: if a user’s privacy is violated by Netflix, the user may face legal action with Netflix.

Severity of this risk: Low severity risk as it would cost a user a lot of money to pursue legal action against Netflix.

Likelihood of this risk: Low likelihood risk as users agree to what data they are okay with sharing when they create a Netflix account.

Risk to just and favourable work: users could unknowingly support exploitative labour through their subscription fee as this revenue could go towards content produced in exploitative conditions.

Severity of this risk: Low severity risk as it is Netflix’s responsibility to acquire content that has been fairly produced.

Likelihood of this risk: Medium likelihood risk as Netflix is under constant pressure to licence more content, and therefore thorough background checks may not be completed of working conditions in the studio.

**Regulatory bodies**

Legal risk: Regulatory bodies could bring Netflix to court for violating user privacy or through providing content which breaks laws of a certain country where the platform is streamed, as content is regulated differently in every country.

Severity of this risk: High severity risk as Netflix could face fines.

Likelihood of this risk: Medium likelihood risk, as it depends on who the regulatory authority is in the country where Netflix is being streamed, as it differs from country to country.

1. **Risk to labour practices**

**Netflix company**

Labour displacement risk: As more AI is implemented into the application, it could result in less workers needed, and therefore employees being laid off.

Severity of this risk: High severity risk as it would lead to worker dissatisfaction and leave workers without a job which reflects poorly on the company and affects the economy.

Likelihood of this risk: High likelihood risk as many ‘tech’ companies such as Twitter, have laid off thousands of workers, as the application requires less staff to achieve the same productivity (Toh & Liu, 2023).

Deskilling of work risk: Translators being replaced by machine translators, which translate content on Netflix into various languages.

Severity of this risk: High severity risk as it would lead to worker dissatisfaction and leave workers without a job which reflects poorly on the company and affects the economy.

Likelihood of this risk: High likelihood risk as Netflix has already implemented machine translation (MT) within the application.

**Subscribers**

Labour displacement risk: If workers are laid off due to increased AI implementation, subscribers could be impacted negatively as they could feel less satisfied if customer support is handled by AI rather than a human.

Severity of this risk: Medium severity risk as subscribers may end their subscription with Netflix and use another streaming service platform if they feel unsatisfied with the streaming platform.

Likelihood of this risk: Medium likelihood risk as AI customer support systems are becoming the norm for many websites and applications.

Deskilling of work risk: As MT is replacing human translators, this could result in subtitles being poorly translated.

Severity of this risk: High risk, as Netflix could lose subscribers due to poorly translated content, and subscribers may use a different streaming service if left feeling unsatisfied.

Likelihood of this risk: Low risk as MT is becoming more precise at translating.

**Regulatory bodies**

Labour displacement and deskilling of work risk: If workers lose their jobs due to AI implementation or due to implications of deskilling, regulatory bodies may have to assess how Netflix has laid off these workers and if it has complied with current labour laws.

1. **Risk to the environment**

**Netflix company**

Carbon emission risks: Netflix generated 1.5 million metric tons of carbon in 2021 (Netflix inc., 2021). Its carbon footprint is a result of data storage centres, production and streaming of content all consuming large amounts of energy, thus generating high carbon footprints. The increased use of AI within the application further increases Netflix’s carbon footprint as it requires a lot of energy (Coleman, 2023).

Severity of this risk: High severity risk as this contributes to the increasing global average temperatures (Lindsey, 2023).

Likelihood of this risk: Medium likelihood risk as Netflix inc. has currently promised to invest in carbon offsetting through nature based solutions and half their emissions by 2030, however the idea of carbon offsetting means companies like Netflix can continue emitting carbon without having to actually reduce the emissions (Netflix Sustainability, 2021).

**Subscribers**

Carbon emission risks: streaming content on Netflix causes carbon emissions. Streaming 1 hour of content results in approximately 100g of carbon emissions (Stewart, 2021).

Severity of this risk: Even though streaming content on Netflix produces carbon emissions which in turn causes global warming, in comparison to other anthropogenic activities, these emissions are relatively small. Therefore the severity of this risk is low.

Likelihood of this risk: High risk as this is the main activity of subscribers on this platform. They use this service to stream content.

**Regulatory bodies**

Carbon emission risks: Regulatory bodies use data centres to store data collected from their research.

Severity of this risk: Low risk as it does cause carbon emissions however other anthropogenic activities result in more carbon emissions, therefore the severity is relatively low in comparison.

Likelihood of this risk: high as this activity does produce carbon emissions.

1. **Risk to fair operating procedures**

**Netflix company**

Risk of misusing licensed content: This risk could occur if Netflix inc. does not adhere to the licensing terms of agreement regarding content from third parties. An example of this would be Netflix keeping a movie on its platform longer than the licensing period that was agreed.

Severity of this risk: is high as it would cause Netflix to face fines or legal action.

Likelihood of this risk: is low as misusing licensed content would cost Netflix inc. a lot of money, hence Netflix has a legal team to ensure that the company complies with agreements with third parties (Netflix Jobs, no date).

**Subscribers**

Risk of misusing licensed content: Netflix subscribers could misuse licence content by breaking Netflix’s terms of use by recording and/ or sharing licensed content on the platform to third parties who do not have a Netflix subscription.

Severity of this risk: is high as it can cause Netflix a lot of legal damage and reputational damage if the application’s subscribers can easily misuse its licensed content.

Likelihood of this risk: is high as both Netflix original shows and licensed content can be found on illegal streaming sites, meaning this content was misused and illegally distributed.

**Regulatory bodies**

Risk of misusing licensed content: Netflix could misuse licensed content by inappropriately rating the content, for example allowing age restricted content be made available for children to watch. This situation would involve regulatory bodies that are responsible for content standards stepping in and addressing this misuse of licensed content.

Severity of this risk: High severity risk as Netflix could face large fines or legal action by misusing licensed content.

Likelihood of this risk: Low likelihood of this risk as Netflix adheres to regulation guidelines depending on which country the platform is being streamed in. Netflix also has a parental controls feature that blocks inappropriate content from being viewed on Netflix kids accounts.

1. **Risk to consumer issues**

**Netflix company**

Risk of misleading information to consumers: Netflix has been in controversy recently due to their apparently biassed algorithms that perpetuate stereotypes and mislead users. For example, in the article, ‘Uncovering Bias in Programming’, Tindal illustrates an example of algorithm bias as results for films with all African American casts come up as other movie suggestions when the name Whoopi Goldberg is typed into the search bar (Tindal, 2023). This is misleading as the user was searching for Whoopi Goldberg films, and not for films that are predominantly African American casts. Another example of misleading information is the production of thumbnails with African Americans actors depicted, despite the very small role they play in the movie. Here we see Netflix using people of colour in thumbnails to increase CTR for people who watch movies with predominantly people of colour in it. This is not only misleading, but it also treats one set of users differently from another set of users, as one set receives a thumbnail that accurately reflects the movie whereas the set receives a misleading thumbnail that poorly reflects the movie just to increase CTR’s (Yu, 2019).

Severity of this risk: High severity is associated with this risk as Netflix could face reputational damage and backlash from its subscribers that were misled.

Likelihood of this risk: The likelihood is high as thumbnails and content recommendations on this platform can change for users on a daily basis, meaning there are more opportunities for users to be misled.

**Subscribers**

Risk of misleading information to consumers: Users can feel frustrated if the thumbnail of the movie they selected inaccurately represented the movie. This leaves the user unsatisfied with the streaming service.

Severity of this risk: High severity risk as Netflix could lose its subscribers if they were left unsatisfied with inaccurate recommendation systems and thumbnails. This ultimately results in decreased user engagement and revenue loss if subscribers cancel their subscriptions

Likelihood of this risk: Medium likelihood associated with this risk as Netflix’s algorithms are occasionally inaccurate or biassed, with algorithms constantly being improved, the likelihood of this risk will decrease over time.

**Regulatory bodies**

Risk of misleading information to consumers: If complaints are made by consumers to regulatory bodies, regulatory bodies may intervene and force Netflix to employ fair and accurate content recommendations and thumbnails.

Severity of this risk: Low severity is associated with this risk as Netflix can promptly address a complaint made by a subscriber by quickly changing the content’s thumbnail or where the content is recommended. Thus this issue can be easily resolved.

Likelihood of this risk: Medium likelihood associated with this risk as algorithms are prone to unintentional bias (Heilweil, 2020).

1. **Risk to community involvement and development**

**Netflix company**

Risk of AI on local employment: The increased use of AI within Netflix could lead to increased layoffs which contribute to local unemployment.

Severity of this risk: High severity as layoffs negatively impact communities. For example; increased unemployment (due to layoffs) results in a strain on consumer spending in local communities thus affecting local economic stability.

Likelihood of this risk: High likelihood of this risk as trends suggest more tech companies layoff staff due to AI implementation (Confino, 2024).

**Subscribers**

Risk of local health: With the various digital engagement methods successfully employed by Netflix to increase user engagement, this encourages sedentary behaviour as subscribers are encouraged to stream more and more content.

Severity of this risk: There is a high severity of this risk on local community wellbeing as subscribers become less active, and subjected to the consequences of sedentary behaviour such as an increased risk of obesity (Rosiek et al., 2015).

Likelihood of this risk: The likelihood of this risk is high as improved recommendation systems encourage and enable users to stream content seamlessly.

**Regulatory bodies**

Risks of AI on local wellbeing: If layoffs occur due to AI implementation, community well being could be negatively impacted if many locals were employed by Netflix, hence regulatory bodies may enforce stricter regulations regarding the societal impacts of AI implementation.

Severity of this risk: Severity of this risk is high as layoffs can result in local economic instability and poor mental health amongst those laid off. It can also result in financial insecurity and stress for those laid off.

Likelihood of this risk: The likelihood of this risk is high due to trends in AI implementation resulting in layoffs in the tech industry (Confino, 2024).

**Discussion of Mitigations Measures for Risk**

Data security is one of the more harmful risks that the stakeholders of Netflix face. User data is at risk of being breached through various means, for example; there is a risk of user data being leaked if Netflix uses third party services to analyse user data, weak authentication could result in a users account being easily accessed by unauthorised personnel, thus leading to a users data being subject to exposure. Data could also be breached unintentionally by Netflix employees as a result of human error. For example during the production of a Netflix Original show, data on set could be leaked by a worker who posts a behind the scenes photo that contains sensitive information.

Netflix inc. is a stakeholder that has the power to incorporate stronger measures regarding data security. More specifically Netflix’s IT department and Chief Information Security Officer (CISO) currently being Vitaly Gudanets would be directly involved in minimising the risk of user data being breached or misused. An increased number of audits is both a technical and organisational control that is needed to help identify weaker spots in Netflix’s data storage and security system, and would prevent underlying issues from prevailing for a long period of time.

An increased number of audits would also be a preventative measure against cyberattacks as hackers take advantage of ‘weak points’ within a security system. Netflix currently does not use Two Factor Authentication (2FA), meaning its subscribers' data and accounts are subject to hackers (James & Quinlan , 2024). In house technical controls are needed to target this risk, specifically; Netflix’s IT department and CISO should employ 2FA as a preventative measure to mitigate the risk of hackers accessing subscribers accounts and data.

Netflix aims to crack down on password sharing between users that do not live together by obtaining and analysing IP addresses of the devices used to log into the shared account (Hector, 2024). This raises concern for users, as an IP address is sensitive information and once it is stored it becomes susceptible to unauthorised access. Data encryption is one measure that should be taken if Netflix opts to store a user's IP address as this mitigates the risk of a user's data being leaked.

Another stakeholder that Netflix inc. interacts with, includes various regulatory bodies. Such interactions involve third party organisational controls to ensure that Netflix complies with current data regulations such as GDPR.

Finally, regarding data protection during the production of content, Netflix could employ more preventative measures such as mandatory educational programmes about data protection. Educational programmes further educate employees on data protection and enable them to successfully adhere to current data regulations. Such measures would mitigate the risk of employees leaking sensitive information unintentionally. This would be an example of an organisational control achieving this mitigation measure.

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