

**School of Computer Science and Statistics**

**Individual Assessment Submission Form**

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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 Aoife Hayes Date 31/03/24

Description of use of Chatbots/Generative AI tools:

**AI-Driven Personalization in Ecommerce**

**Description of Application**

This report will discuss how the AI-driven digital engagement technique of personalisation is applied within the realm of ecommerce. The advent of AI in climate where online retail is evolving every day has raised the bar for personalisation in ecommerce. AI has revolutionised the manner in which businesses engage with consumers by enabling the creation of tailored, immersive shopping experiences that were previously unattainable.

Data lies at the core of AI-driven personalisation. The amalgamation of consumer and product data fuels AI engines. Without this foundational component, the true potential of AI-driven personalisation may not be realised. Real-time consumer data offers a plethora of insights into consumer behaviours, preferences and purchasing trends. Every click, page visit, purchase, and even cart abandonment feed AI algorithms with crucial information, facilitating the creation of highly customised experiences that meet the unique preferences of every consumer. Product data introduces another layer of complexity. A comprehensive product database is comprised of elements such as product specifications, photos, reviews and ratings. AI algorithms meticulously examine this data to discern product characteristics and how they relate to consumer preferences, resulting in more accurate and pertinent recommendations.

Generative AI pushes the boundaries of personalization further by going beyond the mere analysis of consumer and product data. By actively creating fresh content, generative AI transforms the consumer experience (Brenninkmeijer, 2024). Examples of AI-driven personalisation in ecommerce include customised recommendations, marketing campaigns, predictive analysis, and support in the form of chatbots/virtual assistance.

Recommendation engines powered by AI contribute to higher upsell revenues by monitoring consumer behaviour in real time and providing smarter, individualised product recommendations (Mileva, 2023). Studies reveal that when contemplating their first purchase from a brand, 67% of initial customers regard product recommendations as a critical factor influencing their decision to buy (Brenninkmeijer, 2024). In markets marked by fierce competition and numerous distractions, product recommendations can be transformative. They lead to higher upsell revenues by not only fostering loyalty among returning consumer buts also conveying a sense of value and understanding to first-time visitors from the brand (Seekmeai, 2023).

AI also empowers enterprises to deliver targeted marketing messages, promotions, and discounts to the appropriate customers at the opportune moments. More effective advertising reduces marketing spend and increases revenue (Mileva, 2023). It also enhances conversion rates whilst mitigating the likelihood of overwhelming consumers with irrelevant content, hence refining the overall consumer experience (Seekmeai, 2023).

AI also has the capacity to predict forthcoming consumer behaviours and trends, which helps ecommerce enterprises in forecasting demand. This gives companies adequate time to align inventories and refine pricing strategies accordingly. Operational efficiency and consumer satisfactions improves as a result (Mileva, 2023).

Chatbots powered by AI transcend robotic, scripted replies by employing various techniques such Natural Language Processing (NLP) and sentiment analysis to increase the quality of support to consumers (Mileva, 2023). These virtual assistants provide instant, round-the-clock service making consumers feel supported always. Aside from addressing queries, resolving queries, and providing guidance, these chatbots also assimilate knowledge from each interaction to furnish increasingly precise responses over time (Seekmeai, 2023). Human agents are freed up and mundane issues are solved quickly and efficiently. According to Juniper Research, chatbots saved businesses approximately 2.5 billion hours and $8 billion in 2022 (Cummings, 2023).

**Identification of Stakeholder Roles Involved in the Application and its Governance**

In the domain of AI-powered personalization in e-commerce, various stakeholders hold pivotal positions in the development, utilization, and regulation of applications. An overview of these stakeholders and the roles they fulfil are outlined below.

AI-driven personalisation systems are often developed by ecommerce companies (retailers), either through internal development or partnerships with technology partners, to enhance the consumer experience and drive sales. For example, the collaboration between The Estee Lauder Companies Inc. (ELC) with Google Cloud represented a ground-breaking advancement in ecommerce personalisation. ELC offers real-time consumer sentiment analysis by incorporating generative AI, proactively resolving complaints, and improving the digital brand experience. The Retail Search and Recommendations Artificial Intelligence solutions from Google Cloud enhance customised retail experiences on ELC's websites, guaranteeing smooth customer journeys. Using Google's PaLM 2 language model, ELC can perform extensive sentiment analysis and customise plans for more than 20 high-end cosmetics companies. Utilising Google Cloud's Vertex AI platform to integrate AI-powered apps simplifies processes, lowers expenses, and increases output (Sitiatarfa, 2024). Ecommerce is also in charge of establishing rules and regulations for the moral application of AI to personalisation, guaranteeing observance of data privacy, and monitoring the correct operation of the systems. This also involves being transparent with consumers by educating them about AI usage in chatbots, personalization, and product recommendations (Hakeemat, 2023).

Data scientists and AI engineers create and implement various AI models for personalisation, such as collaborative filtering and deep learning. They work to continuously ameliorate the accuracy and efficacy of personalisation by fine-tuning algorithms based on user behaviour and feedback (Yang et al., 2019). Shopee is an ecommerce platform that also employs a team of data scientists and AI engineers who are dedicated to improving the brand experience using advanced engagement tools. According to estimates from Bolt, the Shopee Beauty Cam, an augmented reality makeup try-on tool, has increased conversions for beauty businesses by up to three times. This supports research indicating that 75% of consumers are prepared to spend extra for tailored online shopping experiences, underscoring the potency of Shopee's strategy (Sitiatarfa, 2024).

Of course, consumers engage with AI-driven personalisation features such as customised recommendations, marketing campaigns, predictive analysis, and support in the form of chatbots/virtual assistance that are specifically catered to them based on their behaviour patterns and interest. For example, the implementation of Tongyi Qianwen on Taobao and Tmall ushered in a fresh era of customer engagement, marked by the debut of Ali Xiaomi, a chatbot offering personalized responses through natural language understanding (Sitiatarfa, 2024). Through their interactions with tailored experiences, customers offer feedback that shapes industry standards around data protection and user permission as well as the development of AI algorithms (Liu et al., 2021).

Other stakeholders that take on external oversight roles include regulatory bodies and government agencies, as well as third-party auditors and ethical AI consultants. For example, the European AI office established in February 2024 within the Commission, oversees the enforcement and implementation of the AI Act in member states. Its goal is to foster an atmosphere where AI technologies respect human rights, dignity, and confidence while encouraging cooperation, creativity, and research among stakeholders (European Commission, 2024). Element AI is an ethical AI consulting firm that is committed to responsible AI development. The company leverages AI for societal good and promotes equitable progress through its active involvement in AI for Good initiatives (Kueny, 2023).

**Identification of Ethical Risks**

AI personalisation in e-commerce presents an array of moral dilemmas that may impact several different parties. An explanation of these risks and what they mean for stakeholder groups are described below.

Optimal AI functionality requires large volumes of customer data, which often raises privacy concerns. To profile and personalise users to increase click-through rates, advertisers and data collecting companies seek to obtain as much information as possible about consumers (Apostolov, 2019). Despite the many benefits consumers experience from AI-driven personalisation in ecommerce, studies also find that even those who are in favour of AI-powered personalisation, are also apprehensive about disclosing such personal information (Zhu and Chang, 2016). Data including browsing history, purchase behaviour and demographic information may be collected without users' explicit consent. For example, although some users regularly remove their cookies to restrict the amount of private information that websites can use, data collectors still use methods like stealth browser-based tracking, which expose personal information to advertisers even when cookies are removed (Nill and Aalberts, 2014). Even if data is collected with the users' permission, there is still a fine line between personalisation and intrusion. Of course, this risk of privacy breach because of AI personalisation in ecommerce directly affects consumers. The relationship between consumers and an ecommerce company would inevitably be compromised if consumers perceive their privacy as violated or their sensitive information exploited by third parties. These breaches may severely undermine consumer trust, leading to reduced loyalty and ultimately, a decrease in revenue for the business. In addition to experiencing decreased revenue, companies may face a huge bashing to their public reputation in light of a privacy breach scandal. For example, in 2018, Facebook encountered a significant crisis following the revelation that a political consultancy business had improperly obtained the personal information of millions of users. This episode brought to light the significance of moral data practices and the requirement for more stringent laws to safeguard user privacy (FasterCapital, n.d.).

The impartiality of personalization algorithms hinges on the fairness of the data they utilize. Therefore, if AI algorithms are trained on inadequate datasets, biases may seep into them and lead to prejudice against particular client demographics, potentially seriously damaging a company's reputation. If biases are present in the training set, these algorithms could reinforce and amplify discriminating results. For example, if an algorithm for recommending jobs shows prejudice against groups of people, it may worsen already-existing disparities in the labour market (FasterCapital, n.d.). In 2020, Twitter's image cropping algorithm demonstrated a preference for white faces over black ones in picture previews. This bias was starkly apparent as the algorithm cropped images to prominently display white faces (Marketing, 2023). Moreover, in 2018, Amazon also faced huge criticism when it was discovered that its AI-powered hiring tool was biased against female applicants. The algorithm was trained on historical resumes, most of which came from male applicants, leading to a gender bias in the recommendations (FasterCapital, n.d.). The development of filter bubbles as a result of AI-driven personalisation may play a role in further perpetuating bias. The term "filter bubble" describes the process of continually limiting a user's material through excessive personalisation to the point where they only see the same content. If people are overly reliant on online ecommerce websites, and remain ignorant to the underlying filtering mechanisms used, they risk losing arguably the greatest benefit of being an internet user - autonomy (Bozdag and Timmermans, 2011).

Manipulative marketing strategies have existed for years the in the world of ecommerce. However, these strategies coupled with a collection of large volumes of data for AI algorithmic systems have dramatically increased firms' capabilities to influence consumer choices and behaviour. The use of AI with alongside clever design tactics, predatory advertising, and pervasive price discrimination may lead consumers to make inferior purchasing choices that ultimately serve the financial interests of the firm (Petropoulos, 2022). Through continual optimization for engagement metrics, algorithms have the potential to exploit psychological weaknesses, directing users towards addictive content or behaviours. For instance, the incessant flow of personalized content, notifications, and recommendations on numerous e-commerce social media platforms can foster addictive consumer behaviour and exacerbate mental health issues by encouraging excessive screen time (FasterCapital, n.d.).

The extent of the risks highlighted above and how they affect various stakeholders is contingent upon the degree to which an individual ecommerce company relies on AI for personalization on their platforms. For example, in terms of privacy concerns, a company with minimal reliance on AI personalization may receive a few nonthreatening queries surrounding data collection. However, for those heavily dependent on AI, the stakes are considerably higher, as they may face significant legal repercussions and profound breaches of consumer trust. These threats are likely to materialise given the growing use of AI in e-commerce unless businesses put strong mitigation measures in place. Nevertheless, commercial pressures may encourage some businesses to put financial gain ahead of ethical considerations. Striking a healthy balance between AI utilization and human interaction poses as a challenge for many ecommerce companies, yet it should not be overlooked as it has knock on effects on other stakeholders involved, such as consumers (Curator, n.d.).

**Discussions of Mitigation Measures for Risk**

In order to address the ethical risks outlined above, the following mitigation measures may be implemented.

In order to address the pressing privacy concerns surrounding with the vast amounts of user data required for machine learning, responsible data handling is imperative. Businesses must secure explicit user consent to process data, adhere to strict data protection regulations and ensure robust security measures are in place to safeguard sensitive information. Effective personalisation may still be achieved when data is anonymized to protect user privacy (FasterCapital, n.d.). Establishing a commitment to data privacy guarantees both legal compliance and the preservation of customer trust. It is also important that ecommerce companies foster a sense of transparency regarding their use of AI in personalisation. This involves openly communicating the extent of AI integration, data handling practices and security measures employed. Building confidence can be aided by offering easily reachable customer service and transparent channels for resolving AI-related problems. The relationship between consumers and e-commerce firms is strengthened when the latter displays that it is committed to ethical AI practices (Seekmeai, 2023).

According to a study carried out by Dr. Varsha P.S. at Presidency University concluded there two ways of reducing bias in AI algorithmic systems. Firstly AI itself may be used to detect and reduce the effect of human bias. Secondly, enhancing AI systems' ability to use data to generate and implement models may be effective in avoiding the creation of bias and or perpetuating various prejudices held by people and society. In order to implement either of these approaches successfully, firms should recognise the scenarios where AI can rectify bias, as well as those where AI may exacerbate bias. This necessitates the establishment of stringent policies and techniques to detect and mitigate bias in AI systems (Varsha, 2023). This may involve the careful curation of training datasets, regular auditing of algorithms for bias and the use of strategies such as adversarial testing. The ProPublica investigation into biased recidivism prediction algorithms emphasize the importance of addressing bias in machine learning (FasterCapital, n.d.).

Navigating ethics of AI-driven personalisation in ecommerce requires extreme caution on the part of both marketers and AI engineers. Marketing experts must be conscious of the power they possess and use it wisely, ensuring that AI is being used to improve the shopping experience rather than prey on consumer weaknesses (Seekmeai, 2023). Of course, the goal of personalisation is to improve consumer experiences, however it is crucial to honour user choices and allow individuals authority over their customised paths, so their autonomy is not removed. Users may be empowered, and the acceptance of personalised recommendations can be guaranteed by giving them the choice to accept or reject personalised experiences, letting them alter their preferences, and offering clear settings to control personalisation. By providing choices to opt-in or opt-out of personalised experiences, it is possible to empower users and receive their approval of personalised recommendations. People feel more in control over their online experiences if they can modify their preferences and adjust clear settings to govern personalisation. This cultivates sense of freedom and confidence in their shopping experience (FasterCapital, n.d.).

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