Building Interactive LLM-persona

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1 INTRODUCTION

As described by Cooper et al. [2], personas are composite archetypes created from user behavior patterns identified during research, serving as critical tools for ideating and validating design concepts used by product designers, development teams, as well as stakeholders. Traditional personas typically include a narrative and a photo. The narrative incorporate important research findings along with some fictional situations [2]. The final persona product is typically a concise written narrative accompanied by a photo. However, this static format relies on designers and development teams to empathize and role-play during the design phase. In addition, Matthews el al. also noted that traditional personas are often abstract and impersonal, limiting their effectiveness in the design and decision-making phases [3, 13]. Creating interactive personas offers promising opportunities to provide real-time feedback based on user data and context throughout the design, development, and decision-making process.

Persona creation has traditionally relied on qualitative methods such as interviews, observations, and survey data of actual and potential users. More recent methods use large datasets, including statistical analysis of customer data [15], clickstreams [28], and social media data [9]. However, these approaches often do not address sensitive user groups where empirical data is restricted due to practical and ethical reasons, and large datasets are not readily available. In addition, in the data-driven persona creation process, designers make their best efforts to use available data, but the data sources might not always be trustworthy [18]. Quality control on smaller datasets could be more promising.

Research has shown that Large Language Models (LLMs) can generate believable synthetic Human-Computer Interaction (HCI) research data to represent user experiences [7]. This finding presents a potential opportunity for LLMs to fill the data gap where empirical data is restricted and large datasets are not available. Traditional and data-driven methods of persona creation often fall short for sensitive groups due to the lack of available data. This research aims to explore the use of LLMs to generate proxy personas for sensitive groups using limited data from online forums, creating interactive personas that represent, engage, and empower sensitive user groups.

Understanding the inherent biases and stereotypes in LLMs, this research will also explore methods to detect, monitor, and correct these biases during the persona creation process. Additionally, co-created personas have been used as

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a technique with users who have diverse needs or health conditions to empower users [16] and produce authentic personas [6, 27]. This paper will explore engaging subject experts or users in the persona development process to enhance authenticity and accuracy in order to avoid stereotypes and biases.

Previous studies have explored the generation of personas using LLMs through prompts [23] and the creation of synthetic research data [7]. However, limited research has investigated using LLMs to expand available data for persona creation, particularly for sensitive user groups. Furthermore, while many studies have highlighted the presence of stereotypes and biases in LLM-generated content, there is insufficient research on how to detect and correct these biases during the persona creation process. In addition, recent studies have studied and evaluated interactive persona systems [10, 11, 19, 21], but there are limited studies on interactive personas that maintain live interaction, engagement, and communication throughout the design process.

This research aims to address the following questions regarding employing LLMs in interactive persona creation:

- RQ1: How can LLMs be utilized to create interactive personas for sensitive user groups when large datasets are not available?
- RQ2: What methods can be used to detect, monitor, and correct stereotypes and biases in LLM-generated personas?
- RQ3: How can subject experts or users be engaged in the persona creation process to ensure authenticity and validation?
- RQ4: How do LLM-generated personas compare to traditional personas in terms of accuracy, inclusiveness, and usability?
- RQ5: What metrics and methodologies can be used to evaluate the quality and effectiveness of interactive LLM-based personas?

The goal of this project is to develop interactive LLM-personas specifically tailored for sensitive user groups. Utilizing LLMs to expand limited user data and create data-driven interactive personas. The project also aims to develop interactive personas to facilitate continuous engagement, communication, and feedback through HCD phases. Stereotypes and biases should be detected, monitored, and corrected in the LLM-persona creation process.

2 LITERATURE REVIEW

2.1 Personas

Persona, as described by Cooper et al. [2], are composite archetypes created from user behavior patterns identified during research. They serve as powerful tools for understanding and communicating about user goals and behaviors in specific contexts. Persona helps to engage the empatyh of the design and development team around the user uesrs' goasl. Personas shall be developed with rigor and sophistication, avoiding stereotypes and ensuring they accurately represent a meaningful cross section of users. In addition to traditional persona, which mainly relies on interviews and ethnography, there are several approaches for designing personas in recent years, including data-driven methods, co-created personas, collaboration personas, and LLMs and AI-generated personas.

2.1.1 Data-driven Personas. Data-driven personas rely on large dataset including statistical analysis of customer data [15], clickstreams [28], and social media data [9]. Researches have found data-driven personas creation to be efficient, cost effective, scalable, and reflective of actual user behavior [15, 28]. In addition, researchers also used real-time online user data to develop data-driven personas to keep them up-to-date [9]. Researchers have also been evaluating the biases

in data-driven personas. Researchers have conducted with auto-generated data-driven personas to explore how to reduce biases in them and the optimal number of personas [20, 21]. The findings of the research suggest that generating more personas results in a better representation of diverse demographic groups, with the optimal number for significant diversity gains being around 40 personas.

2.1.2 Co-created Personas. Co-created personas and co-design involve users or subject experts in the persona creation process to address people with diverse needs [16], children [27], and people with disabilities [6]. Neate et al, explored co-created personas with users who have diverse needs and findings showed that co-created personas empowered users within a more accessible design process.

2.1.3 Collaboration Personas. Collaboration personas focus on designing tools for group interactions, emphasizing collective goals and individual roles within the group [5, 8, 14].

2.1.4 LLMs and AI-Generated Personas. With the rapid development of LLMs, LLMs and AI-generated personas has been studied recently as a new approach in persona creation. Existing researches have shown LLMs models can generate personas with proper prompts[23]. Studies have demonstrated that LLMs like GPT-3 can generate human-like responses [25], highlighting their potential for creating empathetic personas.

Recent research has shown the potential of LLMs in generating believable and relatable personas. For example, auto-generated personas have been developed to enhance user-centered design practices among university students, using GPT-4, DALL-E 2, and knowledge graphs [29]. The proposed system auto process survey data, auto-generated 2D avatars with options for automatic or customized entity generation. The results showed that auto-generated personas system has significant improvements in efficiency, satisfaction, accuracy, and diversity compared to traditional methods. The auto-generated persona process also showed no significant difference in collaboration and creativity.

LLMs can generate consistent, believable, relatable, and informative personas with relatively low amounts of stereotyping, although biases related to age, occupation, and geographic representation can still persist [23]. There were 450 personas generated using GPT-4 with prompts specifying different genders (male, female, one with specifying gender) and addiction types (alcohol, opioids, social media, online shopping, gambling). The team also implemented two-stage prompting with a list of "skeletal" persona and then a full persona description to avoid repetitive personas in generation process.

LLMs and AI-generated personas have shown the potential of being a powerful and efficient way to create believable, relatable, and data-driven personas. At the same time, researchers have shown inherent stereotype and biases in LLMs generated personas. Therefore careful attention must be paid to addressing biases and ensuring the authenticity of these personas through iterative validation and engagement with real users and subject experts.

2.2 Interactive Personas

According to Matthews et al. research [13], personas are mainly being used for communication, but not for design. Practitioners found personas to be abstract, impersonal, misleading and distracting. Traditional persona usually includes a persona narrative and persona photos. In decision making process, personas are mostly used as role-playing mechanisms "for the designers to "put on" a persona and determine the successes and failures of the product for that persona" [4]. In 2017, Vandenberghe proposed an idea of interactive persona inspired by chatbots, which uses machine learning to simulate user behavior and provide an interface for designers to interact with rich user data throughout the design process [26]. Vandenberghe also suggested that the interactive persona has the opportunities to address some

practical and ethical challenges of involving real-human-users. The proposed interactive persona can provide access to rich user data 24/7 which makes the design interaction efficient, easy and widely accessible. However, the interactive persona was only proposed as an idea and there was no implementations or design to it.

In addition to the chatbot inspired persona, there are few more researchers who explored interactive persona or interactive persona systems including experiential persona [12], interactive persona systems [19, 21, 22]. Experiential explored personas consists of a carefully curated, staged collection of artifacts, as an alternative to 2D persona. Automatic persona generation system developed by Salminen el al, uses large-scale online social media and other online analytics data to create data-driven personas. However, the automatic persona generation system focused on the interactivity during the persona generation process and the final personas are presented in a persona profile format and does not provide additional integration with designers during design phases.

2.3 LLMs and Challenges related to Stereotypes and Biases

Large Language Models (LLMs) have shown potential in generating believable, relatable, and informative personas. However, inherent biases and stereotypes persist in LLM-generated personas and synthetic information. For example, Salminen el al. evaluated 450 personas generated using CPT-4 and have revealed bias in LLMs-generated personas, particularly related to age, occupation, and pain points, as well as a strong bias towards personas from the United States [23]. Based on the observation of the research, researchers suggested to verify the LLM-generated personas using diversity and bias analysis techniques, as well as subject-matter experts to establish external validity. Prompt design would also be able to address and affect some of the issues in diversity, bias, or quality of the persona [23].

In addition, Agnew et al. evaluated the use of AI instead of human participants in psychological science, user research, and AI development, outlining several practical and intrinsic challenges [1]. They noted that modern language models are not yet ready to simulate human cognition and decision-making. LLMs are typically trained once and are not frequently updated to reflect changing social norms. They stated, "Modern LLMs struggle to model the wide range of opinions held across human communities, especially minority perspectives. User and psychology research rely on a variety of non-linguistic indicators (reaction time, facial expressions, and even pupil dilation) to study and understand human cognition and behavior" [1]. The research calls for a careful evaluation of AI-generated insights and the inclusion of human participants to ensure genuine understanding and empowerment.

There are inherent biases and stereotypes shown in LLMs-generated contents due to the data they are trained on. Research also indicated that LLM-powered conversational search led to more biased information querying compared to conventional search and an opinionated LLM reinforcing user views exacerbate the bias [24]. Therefore, when using LLMs in data and persona creation, it is crucial to implement methods to detect, monitor, and correct stereotypes and biases inherent in the training datasets.

2.4 Human-centered Design (HCD) Phases and Use of Persona Tool in Those Phases

Human-centered design (HCD) is an approach that prioritizes human needs, capabilities, and behaviors in the design process [17]. The HCD process typically involves phases such as empathize, define, ideate, prototype, test, and implement. Personas are critical in the early phases of HCD, particularly in creating empathy and defining problem statements. Interactive personas can support idea generation during the ideation phase and provide valuable feedback during testing, especially when involving sensitive user groups is impractical.

Interactive personas can enhance the HCD process by offering real-time updates and engaging features that allow designers to interact with user data dynamically. This interaction helps maintain a user-centered focus throughout the design process, ensuring that the final product aligns with user needs and preferences.

2.5 Persona Evaluation

3 METHODOLOGY

4 STUDY PROCEDURE

5 SYSTEM DESIGN FRAMEWORK

6 CONCLUSION

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