

AI-based Personalized UX Design

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Abstract:

Personalized User Experience (UX) research has been studied and practiced for many years. However, UX supported by Artificial Intelligence (AI) technology is still relatively new to many users in the field of technical communication. In computer science, AI is regarded as machine intelligence that utilizes algorithms. Specifically, AI aims to learn from large amounts of data across different users, enabling it to make decisions for personalized UX design by building a trainable function with user data as input. This paper embarks on our exploration of AI-supported UX with an ambitious aim: to inspire individuals in technical communication to utilize AI technology in UX design, facilitate their understanding of the basic methods of AI in personalized UX design, and ultimately promote the application of AI in this area. The research also discusses the limitations of AI in personalized UX design.

Keywords:

User Experience, Artificial Intelligence, Personalized, Design

1. Introduction

Nowadays, users are not satisfied merely with a smooth user flow, colorful animations, and an aesthetically pleasing user interface. They demand a more personalized user experience (UX) for products, systems, or services. Only when they feel a sense of personal and individual communication will they show their loyalty and choose one product or service over others. Effortless UX designs strive to obtain personalized behavioral information to enhance customer engagement effectively. Among the emerging trends, the possibilities of artificial intelligence (AI) and machine learning in personalized UX design stand out as particularly popular. Many organizations prefer to make the UX of their products or services more personalized through AI technology. In 2019, a survey on the use of AI in businesses conducted by Narrative Science and the National Business Research Institute revealed that about two-thirds of companies had adopted AI technology, a figure that had doubled since 2016. With the adoption of AI, UX is set to undergo significant transformation, resulting in increased user satisfaction, personalized experiences, and positive user behavior. AI leverages data collection by the system to tailor products, systems, or services to the individual needs of users. Evidently, AI helps to personalize UX, making it more individualized and approachable.

Exploring deeper into what AI can do for UX reveals its potential to generate an advanced system of personalization. With the increasing scale of UX data, AI has become a promising technique to extract knowledge from this data and aid in designing personalized UX. AI is a wide-ranging branch of computer science focused on building intelligent machines capable of performing tasks that typically require human intelligence [2]. The most widely used AI technique is deep learning, which is based on cognitive neuroscience and utilizes multiple layers to progressively extract higher-level features from the original input. This is a major motivation behind developing deep structure learning frameworks, as they can capture more complex abstractions. For example, lower layers may identify edges, while higher layers can identify concepts related to human beings, such as digits, letters, or faces in image processing. For years, designing truly personalized experiences has inevitably faced the realities of system limitations. However, with an abundance of user information, hyper-contextual and hyper-personalized experiences can finally be designed.

A personalized UX design benefits both users and developers. It allows users the freedom to create a platform tailored to their own needs, while also helping developers cater to a diverse user base. This research proposes methods for personalizing user experience through AI in an academic setting. This paper first reviews personalized UX and the application of AI in personalized UX, then analyzes the major steps of AI-based personalized UX design, and finally discusses the limitations affecting AI application in the personalization of UX design. The goal of this research is to inspire professionals in technical communication to utilize AI technology in UX, help them learn the basic steps of AI in personalized UX design, and ultimately put AI theory into practice in this field.

2. Literature Review

2.1. Personalized UX

The concept of personalization is the provision of personally relevant content, products, and services based on users' unique characteristics and requirements [9]. Users pay more attention to the identity, value, and experience of developing a personalized product than the product itself [10]. Personalized functions of UX are increasingly favored by users because they "treat different users differently" and reduce the cognitive burden on users.

UX is defined as "a person's perceptions and responses that result from the use and/or anticipated use of a product, system, or service" according to ISO 9241-110:2010. This formal definition of UX is relevant to a variety of concepts, such as affective, functional, aesthetic, emotional, hedonic, and experiential aspects of person-product interaction, as highlighted by some renowned scholars [3, 7, 8]. Among them, Hassenzahl's interpretation of UX is highly regarded [2]: it is generally seen as inherently dynamic, given the continuously changing internal and external states of a person and different situations during and after the interaction with a product or service. Obviously, the personalization of UX transitions from visible, stable perceptions and responses to the invisible, dynamic internal and emotional states. Therefore, making UX personalized is crucial to the rapid development of user experience.

2.2. AI in Personalized UX

Artificial Intelligence (AI) is a prominent technology used in various industries of UX, including automobile, healthcare, education, transportation, and more. AI and UX share the same end objective: to interpret human behavior and anticipate what users will do next. Several studies have explored AI in UX. For instance, Gomes and Preto discuss AI and interaction design for a positive emotional UX [6]. Oh et al. design a prototype that allows users and the AI agent to draw pictures collaboratively to enhance the user experience [11]. Chen et al. analyze AI-based technology of self-service in public service delivery in terms of UX and influencing factors [5]. Gu et al. study attractive routes to improve personalized trip recommendations with the help of AI [12]. Additionally, Bernardo et al. design and evaluate the usability of AI for rapid prototyping music technology [4].

Although AI has significant advantages in UX personalization, it has not been widely discussed in this area. AI utilizes data collection from specific users to design personalized UX, resulting in more personal experiences and greater user satisfaction. There are three major AI techniques in UX: unsupervised learning, supervised learning, and reinforcement learning. However, the key issue in designing a good AI model is collecting high-quality training data. Unfortunately, not all collected data are equal. The inherent assumptions and context related to datasets are often neglected, highlighting the need to design personalized UX via AI.

There are specific explorations, such as personalized chatbots. Følstad and Brandtzæg believe that chatbots are rarely set up in a way that makes each interaction personalized, often implemented in a “one-size-fits-all” approach [1]. Similarly, Chaves and Gerosa show that dissatisfaction with chatbots is often due to their generic nature [5]. They also note multiple benefits of personalized chatbots but acknowledge the challenges in achieving this. Ghandeharioun et al. (2019) emphasize the importance of chatbots having personality and emotional understanding to enhance user experiences. Skjuve and Brandzaeg discuss the communicational competencies chatbots need for a positive user experience, yet there is a research gap regarding actual design guidelines beyond technical aspects.

3. AI-based Personalized UX Design

AI is a powerful technology for creating user-centric products by personalizing individual experiences, which enhances tasks like recommendations, search results, notifications, and ads. Netflix provides a notable example of this (as shown in Figure 1).

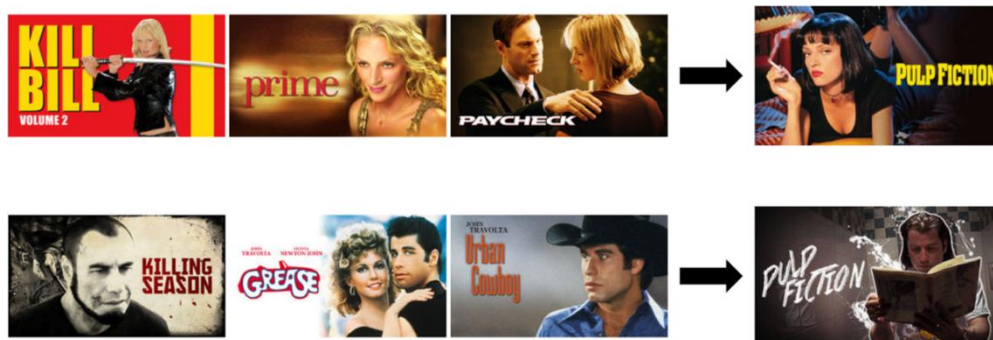


Figure 1. Different artworks of Pulp Fiction are reported based on user's preference for cast members.

Netflix aims to build a personalized recommendation system that effectively presents the right titles to each member at the right time. Not everyone sees the same artwork when browsing Netflix; instead, the artwork is tailored based on users' preferences and behaviors. For instance, a user who has watched many movies with Uma Thurman would see Uma on the cover art for "Pulp Fiction." In contrast, a user who has watched many movies with John Travolta would see John on the cover. This is an example of personalized UX.

3.1. Collect User Information

Collected user information is frequently used to provide various individual or personalized experiences. This data enables the creation of unique interactions that closely align with users' interests and needs, whether by gathering user preferences directly or analyzing past experiences to predict relevance. In today's digital world, users encounter orchestrated content controlled by marketers and algorithms that determine which products or services they are shown. Organizations often encourage users to build profiles on websites or apps, starting with basic registration details such as name, age, behavior, and interests. However, transparency and consent are crucial when collecting user data in this manner.

AI-based personalization offers significant advantages in user data collection. By utilizing algorithms, AI creates profiles of potential customers based on factors like demographics, geolocation, behavior, and device usage. Machine learning, a key component of AI, employs algorithms, filters, and analytics to predict user preferences for brands, categories, topics, colors, prices, and more. There are two types of algorithms used: basic algorithms that do not rely on personal data, and advanced algorithms that do rely on personal data. Once information is collected, AI-based personalization tailors every interaction a customer has with a brand. For example, Google tracks users' upcoming travel plans, appointments, and other events stored on their devices, notifying them before scheduled times.

3.2. Enable User Engagement

User data collection is crucial for personalized UX design, but its value hinges on active user participation. Once users are acquired, engagement becomes paramount. Engagement measures how actively users interact with a website or app. Increased engagement leads to more active users and greater user data collection. Here are four strategies to encourage user engagement and facilitate personalized content creation from data collection:

Firstly, a streamlined and efficient onboarding process encourages more users to participate. Complex UX processes can deter users, so reducing account creation steps and offering various registration options is advisable. Providing feature education during onboarding helps users understand functionality through action.

Secondly, UX messages aligned with users' needs and preferences encourage continued product use. These messages might include alerts about application issues, payment failures, or updates. Segmenting audiences and designing personalized content ensures relevance and value in the information users receive.

Thirdly, offering incentivization programs, such as rewards or loyalty programs, capitalizes on user engagement. These programs not only encourage product use but also foster a sense of importance and belonging to the brand.

Lastly, fostering two-way communication is crucial. This approach makes users feel appreciated and helps organizations gather feedback, resolve issues, and gradually enhance product functionality. Responsiveness to user inquiries builds trust, encourages positive reviews, and cultivates long-term brand loyalty.

In summary, actively engaging users through streamlined processes, personalized messaging, incentivization, and responsive communication fosters a robust user experience and supports effective personalized UX design.

3.3. Personalize the Content

Content personalization is a strategy that leverages visitor data to deliver relevant content based on audience interests and motivations, as described by the Content Marketing Institute. This approach serves as a user experience shortcut, efficiently connecting audiences with the information they need and enhancing the likelihood of converting leads. It's recognized as a crucial aspect in AI-based personalization of UX design, valued by decision-makers and quality-control professionals alike. Content personalization becomes particularly impactful when users can directly manipulate data to adapt content to their preferences. Once user data is collected and their needs and interests are understood, profiles can be personalized accordingly. This includes addressing users by name, presenting content aligned with their interests, and recommending similar content based on their behavior. Streamlining forms to auto-fill with user-provided information further enhances this personalized approach.

Spotify provides a compelling example of effective content personalization through Big Data, AI, and Machine Learning. With over 207 million active users globally, Spotify processes more than 100 billion data points daily from its desktop and mobile platforms. This data fuels algorithms and machine learning models that curate personalized user experiences, such as the widely acclaimed Discover Weekly playlist. This playlist leverages data insights to recommend music tailored to individual tastes, reaching 40 million listeners in its first year alone.

3.4. AI model

AI, particularly neural networks, operates in a manner akin to the neurons in the human brain. Neural networks are a widely used AI model, and understanding their specific architectures involves viewing each "neuron" within the network as a node (as shown in Figure 2). Each node functions as a mathematical unit that processes data or hidden representations. In a neural network, layers consist of multiple nodes, creating a hierarchical structure with multiple layers.

Each node, or perceptron, takes inputs and computes a weighted sum, akin to multiple linear regression. This computed signal is then passed through an activation function, typically nonlinear, which introduces complexity and allows the network to model nonlinear relationships in data. This process of weighted sums and activations across layers enables neural networks to learn and represent complex patterns and relationships in data, making them powerful tools in AI and machine learning. AI algorithms are commonly categorized into three main sub-categories based on their applications and data availability.

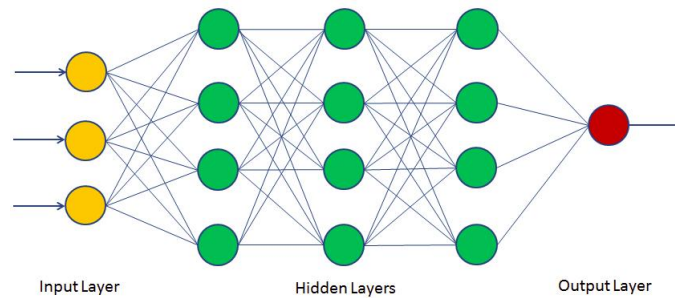


Figure 2. User data will be used as the input and personalized user experience design will be the output through the deep neural network (AI model).

Supervised learning algorithms make predictions based on correctly labeled data, where each example in the dataset is accompanied by a label or output. This labeled data allows the algorithm to learn a mapping from inputs to outputs. For example, in the case of photos with relevant tags or houses with characteristics and prices, supervised learning can predict tags for new photos or estimate the price of a new house based on its features. If the output to predict is a list of labels or values, it's called classification. If the output is a numerical value, it's called regression. Supervised learning involves fitting a model (like a line in simple cases or more complex models in others) to the labeled data to generalize patterns and make predictions on new, unseen data.

Unsupervised learning algorithms explore unlabeled data, where there are no predefined labels or outputs. Instead, the algorithm identifies patterns or structures in the data. For example, on e-commerce sites, unsupervised learning can identify related items or recommend products to customers based on their browsing or purchasing behavior, without explicitly knowing what the meaningful outputs (like product categories or preferences) might be. If the algorithm identifies groups of similar items, it's called clustering. If it discovers associations or rules within the data, such as people who buy product A also tend to buy product B, it's called association.

Reinforcement learning differs from supervised and unsupervised learning in that it doesn't rely on a pre-existing dataset. Instead, an agent learns to make decisions through trial-and-error interactions with a dynamic environment. The agent receives feedback in the form of rewards or penalties based on its actions. The goal of reinforcement learning is for the agent to learn the optimal behavior that maximizes cumulative reward over time. For example, in games like Mario or strategic games like Go and Dota, reinforcement learning algorithms can learn to play by maximizing rewards (such as collecting coins) and minimizing penalties (such as losing points or lives).

4. Conclusions

AI indeed enhances personalized UX in ways that surpass traditional technologies and marketing strategies. It facilitates deeper and more personalized interactions between brands and users, leveraging valuable insights and automating routine tasks that free up human resources for more creative and strategic endeavors. Despite concerns about AI replacing human jobs, it's unlikely that professions requiring high levels of innovation, creativity, and experience will disappear anytime soon. AI excels at automating repetitive tasks and processing vast amounts of data, tasks that are often time-consuming but less creative. This capability allows professionals to focus more on the creative and enjoyable aspects of their work, fostering innovation and higher-

level problem-solving. For example, an Oxford University study suggested that a significant portion of jobs in the US could potentially be automated by 2033. However, rather than displacing humans, AI is more likely to augment their capabilities by handling mundane tasks, thereby enabling professionals to concentrate on areas where human judgment, intuition, and creativity are indispensable. In essence, the role of AI in the workforce is about complementing human skills and capabilities, not replacing them. By integrating AI into workflows, organizations can optimize efficiency, enhance user experiences, and empower employees to engage in more fulfilling and impactful aspects of their roles.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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