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Editorial

Special Issue on Human–Computer Interactions 2.0

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Abstract: Human–computer interaction (HCI) research involves the design and use of computer technology, focusing in particular on the **interfaces** between people (**users**) and computers. HCI researchers observe the ways in which humans interact with computers and design technologies that allow them to interact in novel ways. As HCI evolves into HCI 2.0, user experiences and feedback become ever more relevant. This Special Issue, "Human Computer Interactions 2.0", presents 11 excellent papers about topics related to human–computer interactions. It aims to provide a broad international forum for world researchers, engineers and professionals in human–computer interaction research for the discussion and exchange of various scientific, technical and management discoveries across the world.

1. Introduction

Human–computer interaction (HCI) involves research on the design and use of computer technology, particularly focusing on the interfaces between people (users) and computers. HCI researchers look at the novel ways in which humans interact with computers and the design technologies that allow them to do so. HCI research encompasses the design, evaluation and implementation of interactive computing and computer-based systems for the benefit of human use. Yet, while driven by recent technological advances and the increasing transformation of computing devices into radically new future forms of interaction, HCI is a field in need of significant innovation and breakthroughs. For example, an understanding of user experience (UX) is integral to the development and success of digital systems that deliver appropriate user experiences in different contexts; as HCI evolves into HCI 2.0, user experiences and feedback become ever more relevant.

In addition, the fourth IEEE Eurasia Conference on IOT, Communication and Engineering 2022 (IEEE ECICE 2022, http://ecice2022.iikii.org/) was held in Yunlin, Taiwan, on 28–30 October 2022, providing a communication platform for the scientific exchange of IOT and advanced manufacturing research among scholars. The booming economic development in Asia, driven by the leading manufacturing industries, with production ranging from automobiles, machinery, computers, communication devices, consumer products and flat panel displays to semiconductor and micro/nano areas, has stimulated significant interest among universities, research institutions and numerous industrial corporations. This conference aims to provide a broad international forum for world researchers, engineers and professionals in IOT and manufacturing fields for the discussion and exchange of various scientific, technical and management discoveries across the world. There were 164 papers presented in IEEE ECICE 2022 conference. This Special Issue, "Human Computer Interactions 2.0", presents excellent papers from 164 papers presented in IEEE ECICE 2022 and other high-quality papers considering human–computer interactions. The main goal of this Special Issue is to provide a broad international forum for world researchers, engineers and professionals in human–computer interactions topics for the discussion and exchange of various scientific, technical and management discoveries across the world.

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2. The Topics of the Special Issue "Human Computer Interactions 2.0"

This Special Issue showcases 11 excellent papers on topics related to human–computer interactions.

Cerqueira et al. wrote the article "Glove Prototype for Feature Extraction Applied to Learning by Demonstration Purposes" [1]. This paper presents a sensorial glove prototype capable of acquiring hand motion and estimating its pose. The presented solution features twelve inertial measurement units (IMUs) to track hand orientation. The sensors are attached to a glove to decrease the project cost. The system also focuses on sensor fusion algorithms for the IMUs and further implementations, presenting a thealgebraic quaternion algorithm (AQUA), used because of its modularity and intuitive implementation. An adaptation of a human hand model is proposed, explaining its advantages and its limitations.

Wu et al. present "MinerGuard: A Solution to Detect Browser-Based Cryptocurrency Mining through Machine Learning" [2]. This paper proposes a solution, called MinerGuard, to detect mining pages. MinerGuard was designed based on the observation that mining JavaScript code consumes a lot of CPU resources because it needs to execute plenty of computation. MinerGuard does not need to update data used for detection frequently. On the contrary, blacklist-based or feature-based solutions must update their blocklists frequently. The experimental results show that MinerGuard is more accurate than blacklist-based or feature-based solutions in mining page detection. MinerGuard's detection rate for mining pages is 96%, but that of MinerBlock, a blacklist-based solution, is 42.85%. Moreover, MinerGuard can detect 0-day mining pages and scripts, but the blacklist-based and feature-based solutions cannot.

Wang et al. present the paper "Requesting Help Module Interface Design on Key Partial Video with Action and Augmented Reality for Children with Autism Spectrum Disorder" [3]. This research focused on three child participants with ASD and language disorders. The goal was to strengthen the effectiveness of their requesting help and to organize their oral expression, to use requesting help modules, to remove static key images, and to use augmented reality (AR) combined with the dynamic video clips in key partial video with action (KPV). This study developed request-assistance training in conjunction with an auto organizational menu (AOM), multiple case studies and withdrawal designs, training-response methods, and a comparison of outcomes. The proposed AR sentence intervention effectively increased the children's desire to communicate with others and the accuracy rate of their help requests and increased their level of communication.

Hsu et al. present "WPFD: Active User-Side Detection of Evil Twins" [4]. This study succeeded in developing a user-side detection system that can successfully identify the presence of an evil twin. The packet forwarding behavior generated by the evil twin and the TCP/IP (Transmission Control Protocol/Internet Protocol) protocol are both used by the WPFD. It can identify evil twins without a hitch when the authors utilize accessible Wi-Fi settings in public spaces or IoT smart homes with unencrypted WLANs (Wireless Local Area Network). However, neither additional data nor a wireless network administrator's assistance is needed. The authors compare our work to various publications on popular Rogue Access Points (APs) or IoT (Internet of Things) smart homes. The WPFD does not require any extra setup to install on the host of any end user. According to experimental findings, the WPFD true positive and true negative rates are 100% even when the Received Signal Strength Index (RSSI) is 45%.

Tsai et al. present the paper "Using Convolutional Neural Networks in the Development of a Water Pipe Leakage and Location Identification System" [5]. This study intended to apply artificial intelligence (AI) deep learning to develop a water pipe leakage and location identification system. This research established an intelligent sound-assisted water leak identification system, developed and used a localized AI water leak diagnostic instrument to capture on-site dynamic audio, and integrated Internet of Things (IoT) technology to simultaneously identify and locate the leakage. The actual excavation verification results show that the accuracy of the convolutional neural network (CNN) after training is greater

than 95%, and the average absolute error calculated between the output data and the input data of the encoder is 0.1021, confirming that the system has high reliability and can reduce the cost of excavation by 26%.

Peng et al. wrote the article "Data Imbalance Immunity Bone Age Assessment System Using Independent Autoencoders" [6]. In this paper, a data imbalance immunity bone age assessment (DIIBAA) system is proposed. It consists of two branches, the first branch consists of a CNN-based autoencoder and a CNN-based scoring network. This branch builds three autoencoders for the bone age data of toddlers, puberty, and post-puberty stages. Since the three types of autoencoders do not interfere with each other, there is no data imbalance problem in the first branch. After that, the outputs of the three autoencoders are input into the scoring network, and the autoencoder that produces the image with the highest score is regarded as the final prediction result. In the experiments, imbalanced training data with a positive and negative sample ratio of 1:2 are used, which has been alleviated compared to the original highly imbalanced data. In addition, since the scoring network converts the classification problem into an image quality scoring problem, it does not use the classification features of the image. Therefore, in the second branch, the authors also add the classification features to the DIIBAA system. At this time, DIIBAA considers both image quality features and classification features. Finally, the DenseNet169-based autoencoders are employed in the experiments, and the obtained evaluation accuracies are improved compared to the baseline network.

Liu et al. present "A Robust Countermeasures for Poisoning Attacks on Deep Neural Networks of Computer Interaction Systems" [7]. In this paper, the authors focus on poisoning attacks and analyze three poisoning attacks on DNNs. They develop a countermeasure for poisoning attacks, Data Washing, an algorithm based on a denoising autoencoder. It can effectively alleviate the damages inflicted upon datasets caused by poisoning attacks. Furthermore, the authors also propose the Integrated Detection Algorithm (IDA) to detect various types of attacks. In our experiments, for Paralysis Attacks, Data Washing shows a significant improvement (0.5384) over accuracy increment and can help IDA detect those attacks, while for Target Attacks, Data Washing makes it so that the false positive rate is reduced to just 1% and IDA can have a high accuracy detection rate of greater than 99%.

Wang et al. present "Machine Learning Prediction of Turning Precision Using Optimized XGBoost Model" [8]. This study proposes a machine learning approach for optimizing turning parameters in such a way as to maximize the turning precision. The Taguchi method is first employed to optimize the turning parameters, and the experimental results are then used to train three machine learning models to predict the turning precision for any given values of the input parameters. The model that shows the best prediction performance (XGBoost) is further improved through the use of a synthetic minority over-sampling technique for regression with Gaussian noise (SMOGN) and four different optimization algorithms, including center particle swarm optimization (CPSO). Finally, the performances of the various models were evaluated and compared using the leave-one-out cross-validation technique. The experimental results show that the XGBoost model, combined with SMOGN and CPSO, exhibits the best performance and is a useful tool for predicting the machining error of turning. This method can also reduce the cost of obtaining the optimized turning parameters corresponding with the predicted machining error.

Wu et al. present the paper "Application of Virtual Reality Method in Aircraft Maintenance Service—Taking Dornier 228 as an Exam" [9]. In this study, an aircraft maintenance virtual reality (AMVR) system was developed. For a Dornier-228 aircraft, a walk-around visual inspection of its fuel system was designed and tested in a virtual environment. For the system, CATIA V5 and Unity 3D software were used for designing the 3D model of the aircraft and developing the visual environment, respectively. With the software, the visual environment of the aircraft hangar was created for the system. The developed system was tested by students to validate the effectiveness of using the AMVR system in training. The students acknowledged that the system was beneficial to their learning, which proved

that the developed system is highly effective for training students to improve aircraft maintenance skills.

Lee et al. present "Hardware Development and Safety Control Strategy Design for a Mobile Rehabilitation Robot" [10]. This study presents a prototype and a safety controller for a mobile rehabilitation robot (MRR). The prototype integrates an autonomous mobile bodyweight support system (AMBSS) with a lower-limb exoskeleton system (LES) to simultaneously achieve natural over-ground gait training and motion relearning. Human-centered rehabilitation robots must guarantee the safety of patients in the presence of significant tracking errors. It is difficult for traditional stiff controllers to ensure safety and excellent tracking accuracy concurrently because they cannot explicitly guarantee smooth, safe, and overdamped motions without overshoot. This paper integrated a linear extended state observer (LESO) into proxy-based sliding mode control (ILESO-PSMC) to overcome this problem. The LESO was used to observe the system's unknown states and total disturbance simultaneously, ensuring that the "proxy" tracks the reference target accurately and avoids the unsafe control of the MRR. Based on the Lyapunov theorem to prove the closed-loop system stability, the proposed safety control strategy has three advantages: (1) it provides an accurate and safe control without worsening tracking performance during regular operation, (2) it guarantees safe recoveries and overdamped properties after abnormal events, and (3) it does not need to identify the system model and measure unknown system states as well as external disturbance, which is quite difficult for human–robot interaction (HRI) systems. The results demonstrate the feasibility of the proposed ILESO-PSMC for MRR. The experimental comparison also indicates a better safety performance for the ILESO-PSMC than for the conventional proportional–integral–derivative (PID) control.

Leite et al. present "Visual Management and Gamification: An Innovation for Disseminating Information about Production to Construction Professionals" [11]. The purpose of this paper was to evaluate a gamified model for disseminating production information in the construction industry using visual management. This is a qualitative exploratory study that employed the Design Science methodology and the Design Science Research method. The model was designed, developed, and evaluated by 35 people, including 10 off-site users who focused on usability, user experience, and model promotability, 15 engineers, and 10 workers who considered user experience and promotability. Employees and managers thought the model was excellent, while outside users thought it was good. Furthermore, the evaluators made suggestions for improvements. The authors conclude that the proposed model improves production information dissemination in construction by considering the target audience's digital inclusion and knowledge diffusion within work teams.

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