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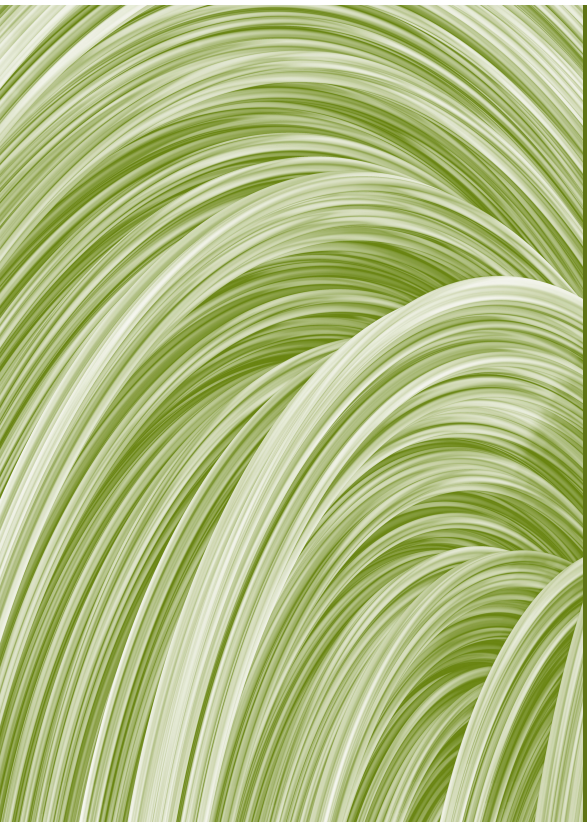
Electronic Multimedia



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Section Information

The Section “Electronic Multimedia” reports on electronic multimedia technology, tools, and applications of electronic multimedia, including but not limited to circuits, networking, signal processing, systems, software, and systems integration.

Section Editor-in-Chief
Prof. Dr. Stefanos Kollias

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Selected Papers

Utilization of Immersive Virtual Reality as an Interactive Method of Assignment Presentation

Authors: Martin Krajčovič, Marián Matys,Gabriela Gabajová and Dávid Komačka

Abstract: Virtual reality is a technology with many possible uses and ways to improve various processes, including the presentation of results. This paper deals with the utilization of virtual reality as a tool for assignment presentation. During the classes of manufacturing and assembly systems design, the conventional form of presentation was replaced with immersive virtual reality, where the students would present their work while wearing the virtual reality headset and walking around the 3D model of their design. The main goal was to test whether this approach had a positive impact on the students' motivation and engagement in the presentation creation and presenting itself. To test this approach, a small case study took place at the Department of Industrial Engineering, Faculty of Mechanical Engineering at the University of Žilina. In conclusion, the overall responses to this experiment were positive; the majority of the students felt more comfortable while presenting and more motivated to put more effort into their preparation. Wearing a virtual reality headset caused the students not to have to directly face the audience, giving them more confidence while presenting. Additionally, the novelty of the virtual reality technology made the students more engaged in showing their work. There is a plan to integrate the virtual reality presentation as the stable part of this assignment.

https://doi.org/10.3390/electronics13081430

A 5K Efficient Low-Light Enhancement Model by Estimating Increment between Dark Image and Transmission Map Based on Local Maximum Color Value Prior

Authors: Qikang Deng, Dongwon Choo, Hyochul Ji and Dohoon Lee

Abstract: Low-light enhancement (LLE) has seen significant advancements over decades, leading to substantial improvements in image quality that even surpass ground truth. However, these advancements have come with a downside as the models grew in size and complexity, losing their lightweight and real-time capabilities crucial for applications like surveillance, autonomous driving, smartphones, and unmanned aerial vehicles (UAVs). To address this challenge, we propose an exceptionally lightweight model with just around 5K parameters, which is capable of delivering high-quality LLE results. Our method focuses on estimating the incremental changes from dark images to transmission maps based on the low maximum color value prior, and we introduce a novel three-channel transmission map to capture more details and information compared to the traditional one-channel transmission map. This innovative design allows for more effective matching of incremental estimation results, enabling distinct transmission adjustments to be applied to the R, G, and B channels of the image.

https://doi.org/10.3390/electronics13101814

SlowR50-SA: A Self-Attention Enhanced Dynamic Facial Expression Recognition Model for Tactile Internet Applications

Authors: Nikolay Neshov, Nicole Christoff, Teodora Sechkova, Krasimir Tonchev and Agata Manolova

Abstract: Emotion recognition from facial expressions is a challenging task due to the subtle and nuanced nature of facial expressions. Within the framework of Tactile Internet (TI), the integration of this technology has the capacity to completely transform real-time user interactions, by delivering customized emotional input. The influence of this technology is far-reaching, as it may be used in immersive virtual reality interactions and remote tele-care applications to identify emotional states in patients. In this paper, a novel emotion recognition algorithm is presented that integrates a Self-Attention (SA) module into the SlowR50 backbone (SlowR50-SA). The experiments on the DFEW and FERV39K datasets demonstrate that the proposed model achieves good performance in terms of both Unweighted Average Recall (UAR) and Weighted Average Recall (WAR) metrics, achieving a UAR (WAR) of 57.09% (69.87%) on the DFEW dataset, and UAR (WAR) of 39.48% (49.34%) on the FERV39K dataset. Notably, SlowR50-SA operates with only eight frames of input at low temporal resolution, highlighting its efficiency. Furthermore, the algorithm has the potential to be integrated into Tactile Internet applications, where it can be used to enhance the user experience by providing real-time emotion feedback. SlowR50-SA can also be used to enhance virtual reality experiences by providing personalized haptic feedback based on the user's emotional state. It can also be used in remote tele-care applications to detect signs of stress, anxiety, or depression in patients.

https://doi.org/10.3390/electronics13091606

Low-Cost Training of Image-to-Image Diffusion Models with Incremental Learning and Task/Domain Adaptation

Authors: Hector Antona, Beatriz Otero and Ruben Tous

Abstract: Diffusion models specialized in image-to-image translation tasks, like inpainting and colorization, have outperformed the state of the art, yet their computational requirements are exceptionally demanding. This study analyzes different strategies to train image-to-image diffusion models in a low-resource setting. The studied strategies include incremental learning and task/domain transfer learning. First, a base model for human face inpainting is trained from scratch with an incremental learning strategy. The resulting model achieves an FID score almost equivalent to that of its batch learning equivalent while significantly reducing the training time. Second, the base model is fine-tuned to perform a different task, image colorization, and, in a different domain, landscape images. The resulting colorization models showcase exceptional performances with a minimal number of training epochs. We examine the impact of different configurations and provide insights into the ability of image-to-image diffusion models for transfer learning across tasks and domains.

https://doi.org/10.3390/electronics13040722

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Guest Editors: Cheonshik Kim and Raylin Tso
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