Department of Electrical, Electronic and Computer Engineering

Department of Electrical, Electronic and Computer Engineering	Key words	human(touchless) interface, embedded systems, deep learning image processing, control system, autonomous driving, service robot

Doctor of Engineering / Professor

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Education

Department of Control Engineering, Faculty of Engineering Science, Osaka University
Graduate school of System Engineering, Wakayama University

Professional Background

Advanced Technology R&D Center, Mitsubishi Electric Corporation

Consultations, Lectures, and Collaborative Research Themes

Research and development of sensors and systems using artificial intelligence-related technologies such as deep learning

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Main research themes and their characteristics

「Rapid Prototyping of Embedded Systems Implementing Deep Learning」

To realize systems applying deep learning, a process involving creating a network model, collecting training data, training the model, and evaluating the results is necessary. Particularly, improving performance relies heavily on the quality of the training data. Once training is completed, embedding the trained network into microcontrollers or computer programs enables the implementation of desired functionalities. Research is being conducted on implementation and embedding techniques to efficiently develop such systems that utilize deep learning.

For instance, when capturing images of people using smartphone or digital cameras, it has become common for the camera to recognize individuals and display their facial contours. Furthermore, by leveraging deep learning, it's possible not only to recognize facial contours but also to detect the positions and movements of facial organs such as eyes and mouth. Technologies that recognize joints in the body and estimate skeletons from images are expected to be applied in various fields, including healthcare, welfare, sports, and the preservation of traditional craftsmanship.

As an application example of such technologies, research is being conducted on "touchless interfaces." While deep learning is already being used in technologies that recognize hand and joint positions to estimate skeletons from images, further deep learning can realize new "touchless interfaces."

Figure 1 illustrates an example of "aerial handwriting input" where hand positions and their trajectories are learned to recognize characters drawn in the air. Present-day smartphones mainly rely on touch panel input, with flick input being utilized. In the future, wearable smart glasses may become mainstream, and at that time, an application like "aerial grip input" demonstrated in Figure 2, where buttons displayed in the air through the glasses are manipulated by gripping, could be considered.

Additionally, as an example of supporting communication with people with disabilities, Figure 3 demonstrates "American Sign Language recognition."

Please note that demo videos for each figure can be viewed by scanning the QR code located at the top of each figure.

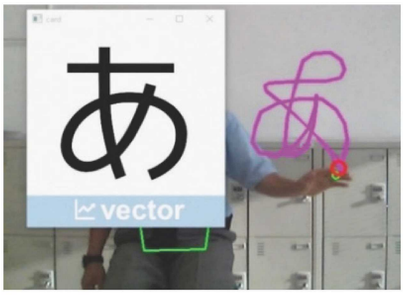

Fig.1 aerial handwriting input

Fig.2 aerial grip input

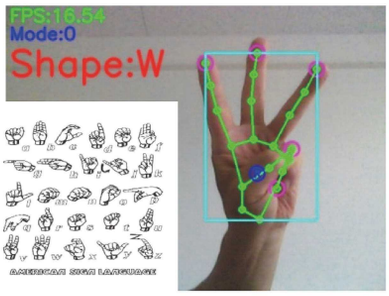

Fig.3 American Sign Language recognition

Major academic publications

"An Aerial Handwritten Character Recognition Using Moving Direction Only", Yoshihiro Nishida, Kazutaka Ogura, Hirokazu Miura, Noriyuki Matsuda, Hirokazu Taki and Norihiro Abe, Paper of Human Interface Society Vol.12, No.3, pp289-296, 2010

"An Aerial Handwritten Character Recognition Using Ratio of Stroke with Moving Direction", Yoshihiro Nishida, Kazutaka Ogura, Hirokazu Miura, Noriyuki Matsuda, Hirokazu Taki and Norihiro Abe, ARTIFICIAL LIFE AND ROBOTICS(AROB 16th), pp1008-1009, 2011

"A Study for Aerial Handwritten Character Recognition with Auto Period Detection", Yoshihiro Nishida, Shoko Noguchi, Human Interface Symposium2015, pp349-352, 2015