

Department of Electrical, Electronic  
and Computer Engineering

## Key words

human interface, embedded systems, machine learning  
image processing, control system, autonomous driving, service robot

Doctor of Engineering / Professor

**Yoshihiro Nishida**

## Education

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

## Professional Background

Advanced Technology R&amp;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

## e-mail address

nishida@fukui-ut.ac.jp

## Main research themes and their characteristics

## [Handwritten text input in the air" (touchless interface)]

We had prototyped an aerial handwritten hiragana character recognition system that detect single character period by hovering in the air using DP (dynamic programming) matching.

Recently, we investigate an aerial handwritten character recognition system using machine learning. We use two features, vector and picture. Feature of vector is relative direction of handwriting information. It is a time series information so we use LSTM(Long Short Term Memory) to learn data of characters. Feature of picture is absolutely handwriting information. We use CNN(Convolution Neural Network) to learn data of characters, because this model is suitable for picture recognize. We compared correct recognition rate of using LSTM and using CNN. We estimated features of both methods.

Fig. 1 shows an example of studying recognition of characters written in the air.

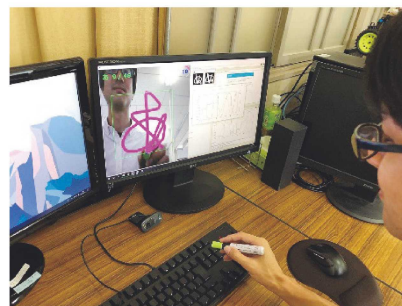


Fig.1 an example of studying recognition of characters written in the air.

## [Weeding Robot "TAMBA" for Paddy Fields]

Since the agricultural population is decreasing and the agricultural workers are aging, it is required to efficiently perform agricultural work and reduce the load.

On the other hand, increased public interest in food safety and clean agriculture (e.g., ecological agriculture, organic culture and agrochemical-free cultivation) is driving a production system change from dependence on and use of agrochemicals toward their elimination. However, this raises a huge time- and labor-consuming problem with weeds. The weeding robot "TAMBA" we propose decreases weeds in paddy fields without resorting to herbicides.

"TAMBA" is supposed to run along a row of rice. Therefore, we studied the function of detecting rice rows by image processing based on the images taken by the camera mounted on "TAMBA". Additionally, we implemented a web server so that "TAMBA" can be operated and monitored from a home PC or a local smartphone.

Fig.2 shows a prototype of "TAMBA" developed jointly with Shimano Co., Ltd. and National Institute of Technology, Fukui College.

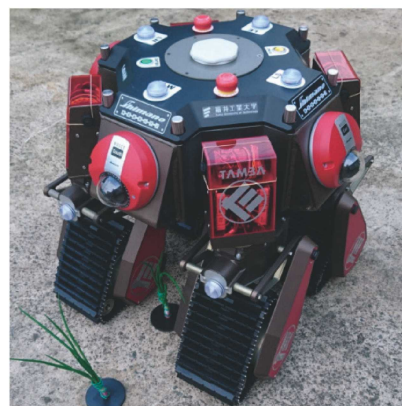


Fig.2 a prototype of "TAMBA"

## 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