Incorporating Recognition in Catfish Counting Algorithm Using Artificial Neural Network and Geometry

Ibrahim Aliyu[1], Kolo Jonathan Gana[2], Aibinu Abiodun Musa[3], Mutiu Adesina Adegboye[4], and Chang Gyoon Lim[1*]

[1] Department of Computer Engineering, Chonnam National University
50 Daehakro, Yeosu, Jeonnam, South Korea
[e-mail: ibal2010@yahoo.com, cglim@jnu.ac.kr]
[2] Department of Electrical and Electronics Engineering, Federal University of Technology, Minna
Niger State, Nigeria
[e-mail: jgkolo@futminna.edu.ng]
[3] Department of Mechatronics Engineering, Federal University of Technology, Minna
Niger State, Nigeria
[e-mail: maibinu@gmail.com]
[4] Department of Computer Engineering, Federal University Oye-Ekiti, Ekiti State, Nigeria
[e-mail: mutiu.adegboye@fuoye.edu.ng]
*Corresponding author: Chang Gyoon Lim

Received July 13, 2020; revised October 5, 2020; accepted December 7, 2020; published December 31, 2020

Abstract

One major and time-consuming task in fish production is obtaining an accurate estimate of the number of fish produced. In most Nigerian farms, fish counting is performed manually. Digital image processing (DIP) is an inexpensive solution, but its accuracy is affected by noise, overlapping fish, and interfering objects. This study developed a catfish recognition and counting algorithm that introduces detection before counting and consists of six steps: image acquisition, pre-processing, segmentation, feature extraction, recognition, and counting. Images were acquired and pre-processed. The segmentation was performed by applying three methods: image binarization using Otsu thresholding, morphological operations using fill hole, dilation, and opening operations, and boundary segmentation using edge detection. The boundary features were extracted using a chain code algorithm and Fourier descriptors (CH-FD), which were used to train an artificial neural network (ANN) to perform the recognition. The new counting approach, based on the geometry of the fish, was applied to determine the number of fish and was found to be suitable for counting fish of any size and handling overlap. The accuracies of the segmentation algorithm, boundary pixel and Fourier descriptors (BD-FD), and the proposed CH-FD method were 90.34%, 96.6%, and 100% respectively. The proposed counting algorithm demonstrated 100% accuracy.

Keywords: Aquaculture, Catfish, Counting Algorithm, Digital Image Processing, ANN

http://doi.org/10.3837/tiis.2020.12.014 **ISSN : 1976-7277**