

Accepted Manuscript

Title: Detection of Uneaten Fish Food Pellets in Underwater Images for Aquaculture

Authors: Dawei Li, Lihong Xu, Huanyu Liu

PII: S0144-8609(16)30224-2

DOI: <http://dx.doi.org/doi:10.1016/j.aquaeng.2017.05.001>

Reference: AQUE 1901

To appear in: *Aquacultural Engineering*

Received date: 15-12-2016

Revised date: 14-4-2017

Accepted date: 1-5-2017



Please cite this article as: Li, Dawei, Xu, Lihong, Liu, Huanyu, Detection of Uneaten Fish Food Pellets in Underwater Images for Aquaculture. *Aquacultural Engineering* <http://dx.doi.org/10.1016/j.aquaeng.2017.05.001>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Regular Papers:

Detection of Uneaten Fish Food Pellets in Underwater Images for Aquaculture

Dawei Li ¹, Lihong Xu ^{2,*} and Huanyu Liu ³

¹ College of Information Science and Technology, Donghua University, Shanghai, China 201620; daweilidhu.edu.cn

² College of Electronics and Information Engineering, Tongji University, Shanghai, China 201804; xulihong@tongji.edu.cn

³ Huawei Technologies Co. Ltd., Shanghai, China 200120; liuhuanyu2@huawei.com

* Correspondence: xulihong@tongji.edu.cn; Tel.: +86-1-363-636-2684

Abstract: The waste of fish food has always been a serious problem in aquaculture. On one hand, the leftover fish food spawns a big economic loss in the industry because feedstuff accounts for a large proportion of the investment. On the other hand, the left over fish food may pollute the water and worsen the living environment of aquatic products. In this paper, we develop an adaptive thresholding method for detecting uneaten fish food in underwater images. To deal with non-uniform illumination in underwater environments, we focus on analyzing the local histogram of intensities in a mask for each pixel. The Expectation-maximization-guided Gaussian mixture is used to fit the histogram to figure out its type, and then an adaptive threshold is computed accordingly. At last the central pixel of the mask is compared with the threshold to generate the binary detection result. Experimental results show that the proposed method obtains desirable detection of leftover fish food in many underwater environments with different water turbidity levels and with different extent of unevenness of illumination. In the four test underwater environments, the lowest True Positive Rate of the proposed method is higher than 80%, and the highest rate reaches 95.9%. The False Positive Rates of the proposed method are no higher than 2.7%.

Keywords: fish food detection; aquaculture; image segmentation; Gaussian Mixture Model; EM algorithm; non-uniform illumination

1. Introduction

With the growing demand of aquatic products, aquaculture today has been punching above its weight in human food production. Due to the lack of feedback information from actual consumption, waste of feedstuff has been a common and disturbing problem for workers in traditional aquaculture. On one hand, the leftover fish food spawns a big economic loss in the aquaculture industry because feedstuff accounts for a large proportion of the investment. Feed makes up as much as 82% and 70% of total costs for tilapia farming in ponds and cages respectively, more than 50% for milk fish, sea-bass cage culture as well as for shrimp pond culture [1]. The energy use of feed production also takes up the majority of the total energy use in Atlantic salmon production, currently making up about 50% of total cost [2]. Thus, improving feed efficiency in industrial aquaculture systems is already a priority [3]. On the other hand, the leftover fish food may lead to eutrophication of water and worsen the aquatic environment. The most common sign of an environmental problem caused by nutrient discharges in aquaculture is the accumulation of organic

Download English Version:

<https://daneshyari.com/en/article/5763898>

Download Persian Version:

<https://daneshyari.com/article/5763898>

[Daneshyari.com](https://daneshyari.com)