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The Restoration Method for Recognition of Asterias Amurensis

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Abstract. This paper aims to recognize and extract deformed Asterias amurensis through the use of the concave and convex feature points, central moment, and short lines and long lines. Another purpose of this paper is to restore Asterias amurensis using the radial symmetry. Marked by the characteristics that include pentaradiality and the ability to vary in outward shapes according to circumstances, Asterias amurensis is hard to recognize. With this in mind, this paper propose a simple method for improve rates of recognition of starfish.

Keywords: Starfis, Asterias amurensis, Radian Symmetry

1 Introduction

Currently, studies are vigorously in progress about how to deal with and utilize captured starfish. Research needs to be conducted on the image processing technique, which is used to capture Asterias amurensis and Asterina pectinifera causing much damage to fishing grounds [1-3].

There is a limit as to how starfish have to be captured, given that starfish rapidly propagate in number and size. That impels us to facilitate the use of underwater robots to capture starfish. Regarding how to capture starfish, an image processing technique should be in place to recognize starfish among input images[4].

Recent studies being conducted in Korea on the recognition of starfish are as follows. An improved Asterias amurensis recognition method based on the morphological characteristics of Asterias amurensis was proposed in [5]. They acquired better images to analyze recognition rates of starfish, and were also able to obtain much more satisfactory recognition rates for Asterias amurensis by adopting the most suitable adaptive filter method [6]. This technique [7] classifies the concave and convex features by using the multi-directional linear scanning, forms the candidate groups of the concave and convex feature points, decides the feature points of the candidate groups, and applies a convex hull algorithm to the extracted feature points.

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2 Structural Features

Their legs are thinner than those of indigenous Asterina pectinifera. They are 20 ㎝ tall on average, but bigger ones grow to be 40 ㎝ and more.

The starfish-specific feature is used to detect the end of each arm as well as the inner boundary part where the arms meet each other.

Among the starfish candidate regions for the detected image boundaries from which noise is removed, any region where - the number of pixels present in the 20 x 20 block - fails to meet the condition of the Equation (1) is excluded from the candidate regions that have starfish features.

$$\mathrm{MIN_{count}} < \mathrm{Pixel_{count}} < \mathrm{MAX_{count}} \quad (1)$$

Starfish are marked by five arms with the concave and convex feature points each.

Based on one concave point for each concave edge, with the adjacent points excluded, connecting the remaining two points leads to the formation of a star-shaped inner area.

Long-line refers to the line formed when each convex edge connects from the central moment, while short line to the line formed by connecting each concave endpoint from the central moment. If the gradient is larger than 1, on the other hand, the variations of the value of x are larger than those of the value of y. Then entering the y-value leads to obtaining the x-value, which is expressed in Equation (2).

$$\mathrm{x} = \frac{\mathrm{y} + \mathrm{mx_1} - \mathrm{y_1}}{\mathrm{m}}$$

The variations for different gradients are shown in Fig. 5.

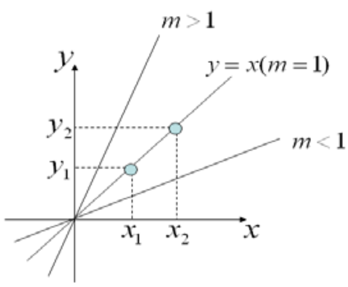

Fig. 5 Variations by Gradient

3 Restoration for Recognition

Boundary correction is then used to remove noise, which is followed by boundary connection. What needs to be done next is finding the structural features, comparing the number of concave feature points, and identifying the type of the population. Concerning the restoration of the region of a starfish from the population by using the structural features, what is restored is a deformed population, not the original one. Any deformed population, which is different from the original population, refers to the one with the arms dismembered or the one whose dismembered arms are growing. It is such deformed populations that restoration is conducted for. Fig. 6 shows the deformed population for which restoration was conducted.

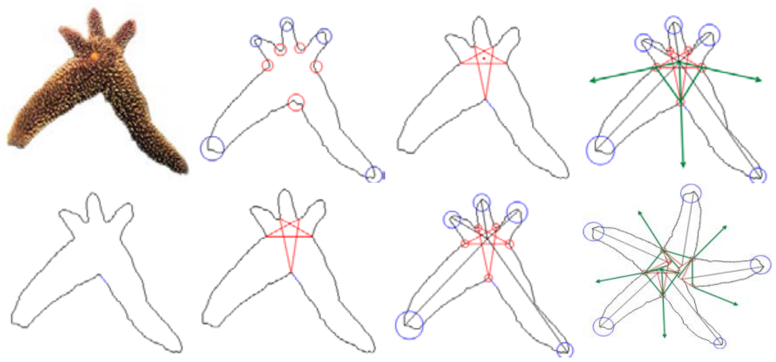

Fig. 5 Restoration

The deformed population, before it was restored, had 21 long lines and short lines each. After restoration, it had 25 long lines and short lines, respectively. Table 1 shows an analysis of the characteristics identified during the region restoration.

Table 1. Result of Region Restoration

Population			*Area*	*Boundary length*	*Number of long-line*	*Short-line length*
Deformed population	Before restoration	*1*	*49065*	*730*	*5*	*5*
		2	*49506*	*867*	*5*	*5*
	After restoration	*1*	*43182*	*1001*	*5*	*5*
		2	*47552*	*997*	*5*	*5*

4 Conclusion

This paper proposed a method for restoring deformed starfish populations. This method was designed to improve recognition rates for images of the starfish collected by underwater robots. The input images obtained by the underwater robots were for a single starfish population and based on optimal distances and directions. Starfish have significant structural features: concave and convex feature points. With this in mind, the proposed method was geared toward distinguishing the concave and convex features of a starfish. During the experiments in which the region of a starfish image was restored from a deformed population, the deformed population showed high restoration rates.

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