Digital Image Processing and Its Application in Fisheries

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A digital image, also known as a pixel or picture element, represents a two-dimensional image as a limited set of digital values. The smallest unit of information in a digital image is called a pixel (or picture element). A 2-dimensional grid made up of squares is used to organize pixels. Pixel values commonly represent colours, heights, opacities, and other properties. Each pixel serves as a sample of the original image, whereas additional models typically yield more accurate duplicates of the original. The application of digital image processing in fisheries or marine fields is technically still under study by researchers. Image processing techniques play a big role in ocean conservation.

Types of digital images

Generally, we consider four types of images; Binary, Grey-scale, Colour, and Multispectral.

Binary images

Binary images frequently occur in black and white or the 0 and 1 values. Binary images are also called 1-bit images since they only require 1 binary number to represent each pixel. Optical character recognition (OCR), for instance. Binary pictures are produced using threshold operation from grayscale images. Every pixel over the threshold value is converted white during a threshold operation, while every pixel below the threshold is turned black (zero).

Grey-scale image

These images are additionally referred to as monochromatic or one-colour photos. Images with a grey level only include information at the grey level; no colour information is present. The number of bits used for each pixel determines the range of available grey levels. For instance, an image with 256 different grey levels should include 8 data bits per pixel. For astronomy and medical imaging, 12 or 16 bits per pixel are utilised.

Colour images

Three-band monochrome image data, where each band of data represents a different colour, is used to create colour images. Because red, green, and blue are the primary colours used to represent colour images, colour images are also referred to as RGB images. Using the 8-bit monochrome standard as a model and 8 bits for each of the three colour bands (red, green, and blue), colour images would have 24 bits/pixel.

Multispectral images

Information that is outside the usual human perceptual range is contained in these kinds of images. These are not images in the traditional sense because the human eye cannot directly see the information provided. However, the information is visualized by mapping the various spectral bands to RGB components. Radar data, X-rays, ultraviolet, infrared, and acoustic waves are all included in multispectral photographs.

What is a Digital Image Processing

Using a digital computer to run an algorithm on digital photographs is known as "digital image processing." Digital image processing has significant

benefits over analogue image processing as a subfield or area of digital signal processing. Multidimensional systems can be used to model digital image processing. The key factors influencing the creation and advancement of digital image processing include

1. First, the development of computers
2. The second concern is the advancement of mathematics
3. particularly the growth and refinement of discrete mathematics theory
4. Third, there is a growing need for various environmental, agricultural, industrial, military, and medical science applications

Key stages in digital image processing:

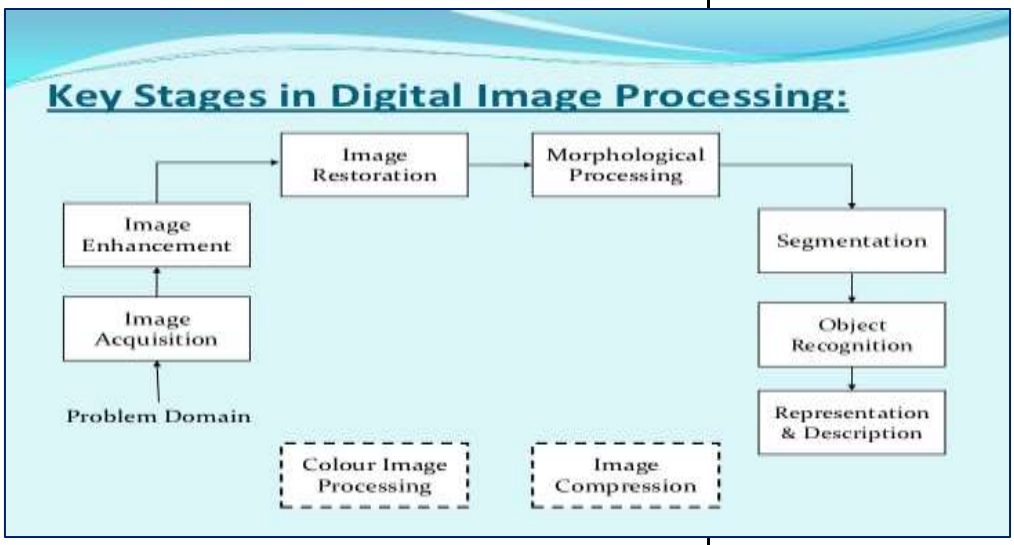

Fig. 1: Key stages in Digital Image Processing

Gonzalez *et al.*, 2002

Image acquisition: The image is captured by a sensor (e.g. Camera), and digitised if the output of the camera or sensor is not already in digital form, using an analogue-to-digital convertor.

Image enhancement: The process of manipulating an image to make the result more suitable than the original for specific applications. The idea behind enhancement techniques is to bring out hidden or simple details to highlight certain features of interest in an image.

Image Restoration: Improving the appearance of an image tend to be mathematical or probabilistic models. On the other hand, enhancement is based on subjective human preferences regarding what constitutes a "good" enhancement result.

Colour image processing: Use the colour of the image to extract features of interest in an image.

Wavelets: These are the foundation of representing images in various degrees of resolution. It is used for image data compression.

Compression: Techniques for reducing the storage required to save an image or the bandwidth required to transmit it.

Morphological processing: Tools for extracting image components that represent and describe shape. In this step, there would be a transition from processes that output images to processes that output image attributes.

Image segmentation: Segmentation procedures partition an image into its constituent parts or objects

The use of image processing techniques in fisheries

Image processing is used in many fields of knowledge because it allows automated processes to get more information about the examined object. Studying fish diseases by applying the methodology of colour image segmentation. The surfaces of the fish body are considered the main information source to detect infections. They successfully

detected infected areas on the fish body and identified a total area of lesions.

The proposed method makes it possible to automate the process and reduce the time of diagnosis of Infectious dangerous fish diseases. Fish affected with Epizootic Ulcerative Syndrome (EUS) were collected from the different parts of the Barak Valley, Assam and identified by human experts. The SLR camera took pictures of diseased fish. Images were 200 by 200 pixels, so an engineering compromise can be obtained between the processing time of algorithms and clarity retention of input images [Fig 2].

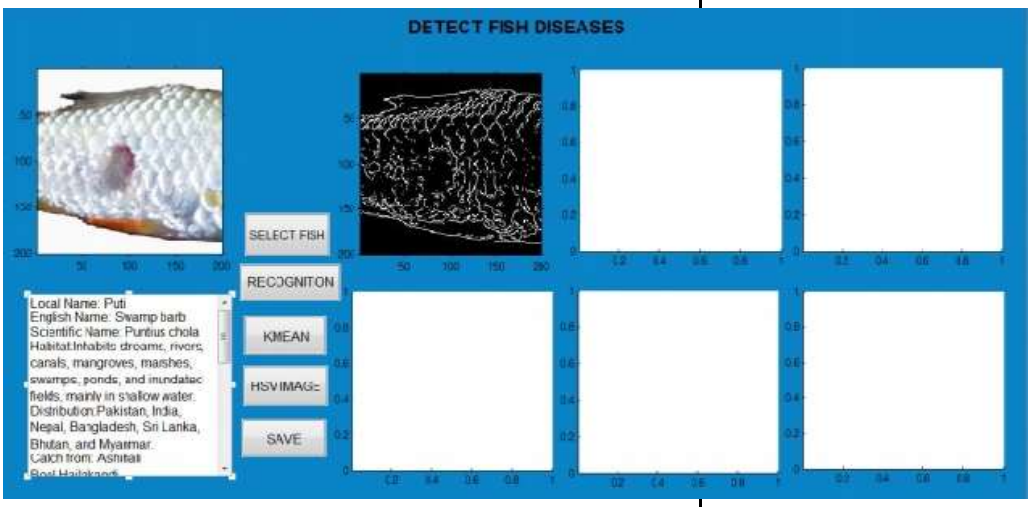

Fig 2: Image processing to detect fish diseases

Fish Classification

Hu *et al*. (2012) used colour model space of (RGB and HSV), Color feature extraction, and applying the classifier of multi-class support vector machine (MGSVM).

Fish weight and length measurement:

Islamadina *et al*. (2018) used an automatic visual capture to estimate the fish's length, width, weight and height. Image processing techniques involved in the study consist of segmentation, feature extraction and statistical analysis. Image modelling in the form of fish length estimation is calculated through the scaling process to equalize and reduce the size to make it easier to calculate in the system so that the results are obtained from estimating the length of the fish automatically. Estimated length of fish through a web service application using anaconda navigator. Bounding boxes from fish show that fish is estimated by estimating their body length from the tip of the jaw to the tail.

Fish Detection /Tracking/ Identification

Allken *et al*. (2018) utilised a deep learning neural network (NN) to identify fish species that are present in the images from the Deep Vision trawl camera system.

Fish tissue

Sengar *et al*. (2018) proposed using image processing techniques to extract the skin tissue of fish in order to identify fish freshness. The HSV colour model is used to identify degradation patterns for fish freshness.

Coral reef study and fish abundance

Kaeli *et al*. (2006) proposed using morphological operator and texture features extraction to segment out areas of coral reef cover in the image. Awalludin *et al*. Proposed using colour feature extraction from Hue Saturation Value (HSV) colour model and texture feature from Local Binary Pattern (LBP). All the features of colour and texture were used in the Multilayer Perceptron Neural Network (MPLNN) classifier to estimate coral reef distribution.

Conclusion

Digital image processing uses a computer algorithm to perform image processing on the digital

image. It deals with sharpening, converting, blurring, detecting edge detection, and recognition. The application of digital image processing in fisheries or marine fields is technically still under study by researchers. Image processing techniques play a big role in ocean conservation. Therefore, monitoring activity by applying image processing will be able to maintain a healthy ecosystem by lowering the possibility of extinction of species.

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