Editorial

Underwater Optical Image Processing

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Image processing can be defined as performing any process on the visual data or vision signals such as a stored digital image, a photo from a scene or a video frame [1]. The output of an image processor might be another image or a set of special signals and sometimes some variables related to that image. Most of image processing techniques consider an image as a 2-D signal and then do a suitable signal processing on it. Nowadays, image processing is one of the best tools for feature extraction in natural studies like environmental interactions and behavior analysis. In human visual system, a similar process is done by our brain which finally helps us to better decision making, however, the main aim of image processing is not implementation of intellectual functions of human in terms of received data from our eye (as an optical bio-sensor) related to various observations, because these functional activities are so complex. In fact, pre-processing and some specific processing steps in order to data mining, pattern recognition and knowledge extraction are key approaches of image processing in analysis of nature. An image usually follows the following steps after creation by imaging sensor:

a)   Digitalization including sampling and quantization after reception from imaging block (camera and so on), this process is required to give us the ability for processing and storage.

b)   Pre-processing, this step contains some corrections and image enhancements in order to do main processing (e.g., noise reduction, image alignment, histogram equalization).

c)   Classification (supervised or unsupervised), it is done for recognizing patterns.

d)   Data Analysis, which is related to a practical, natural or industrial application.

Based on the recent advances in developing optical devices for underwater imaging and also image processing tools, detection, tracking and recognition of underwater objects and targets are possible and underwater optical image processing has become a hot topic of research. In addition, some real systems for practical aspects in undersea/ocean monitoring [2,3] have been made. Thus, we want to emphasize on this research field as a critical and interesting area and encourage relevant researches to have attention to these new findings. In order to have some detailed information about underwater optical imaging and image processing, we should firstly know the behavior of sunlight in undersea environment. Its wavelength includes a range from 400 to 700 nm. Since the light is an electromagnetic wave, it has a limited propagation range in water and so it is damped soon. Figure 1 shows that the range of propagation before a full damp is depended on the frequency of light components (from red to blue in the spectrum of white light) such that the blue wavelength has the highest range and the red has the lowest. Such restrictions are factors that make images low quality in which they are needed to image processing (images taken by underwater optical sensors), so their quality is highly related to the depth of imaging. Another similar area is sonar image processing which is done on the images taken by a type of acoustic imaging sensors.
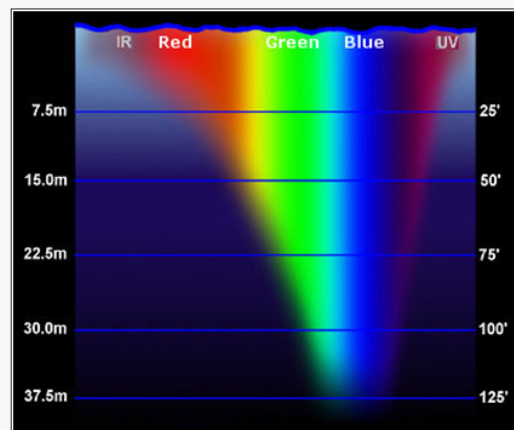

Figure 1: The range for different components of white light.

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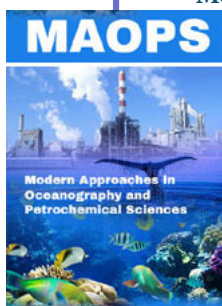
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