Chapter 7
Fish Monitoring, Sizing, and Detection Using Stereovision, Laser Technology, and Computer Vision

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ABSTRACT

Stereovision and laser techniques allow for getting knowledge about fish, mostly when they are combined with computer vision. This kind of techniques avoid to use traditional procedures such as direct observation, which are impractical or can affect the fish behavior, in task such as aquarium and fish farm management or fishway, like vertical slot fishway, evaluation. This chapter describes in a first stage, the use stereovision join with computer vision to fish monitoring and measure size of fishes. In the second part, using laser technology and computer vision to fish detection, especially in slot fishways. Vertical slot fishways are structures that are placed in rivers to allow fish to avoid obstacles such as dams, hydroelectric plants. Then, it shows a results section and finally authors’ conclusions.

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1. INTRODUCTION

Inspection of the appearance or behavior of fishes can provide a variety of information regarding the fish species, including their health and development, and its relations with the ecosystem. In particular it can be used to provide early indications of health problems, estimating growth rates and predicting the optimal development stage for an eventual commercial exploitation.

Non invasive fish inspection is an important issue in fields related with fish studies; such as marine biology or oceanography, where it is common to maintain specimens of different fish species in closed and controlled ecosystems, which need to be managed.

Additionally, fish size inspection is a critical question in fish farming applications consisting of raising fish in tanks or enclosures, usually to be used in the food industry. In this applications, the optimum fish size and the parameters concerning fish growth have to be studied and monitored (Leon-Santana & Hernandez, 2008).

In rivers, fish passage structures (e.g., vertical slot fishways) allow fish to move upstream obstacles such as dams or weirs. Along the years, several researches have studied fishways and fish passage, including water flow features (Puertas, Pena, & Teijeiro, 2004; Tarrade, Texier, & David, 2008; Wu, Rajarattam, & Katopodis, 1999), fish swimming abilities (Blake, 2004; Dewar & Graham, 1994) or fish behavior within them (Rodríguez et al., 2011).

In order to detect the fish, several techniques have been applied. One of them is the sonar, which detects submerged objects presence and situation through acoustic waves. From the sixties this technique has been used in applications to detect fish (Craig & Forbes, 1969) or study fish features (Ehrenberg, 1972). More recently, systems as the DIDSON (Dual-frequency identification sonar), have reduced the previous acoustic systems limitations, obtaining higher quality images, and favoring the development of new studies for fish detection and counting (Balk & Lindem, 2000; Belcher, Matsuyama, & Trimble, 2001; Han, Honda, Asada, & Shibata, 2009; Holmes, Cronkite, Enzenhofer, & Mulligan, 2006).

In other works techniques based on infrared laser have been used for fish detection (Mitra, Wang, & Banerjee, 2006). One of the most well-known fish counter, the Riverwatcher Fish Counter (Baumgartner et al., 2010), is based on this technique.

Finally, other authors have obtained promising results using submarine cameras combined with computer vision techniques (White, Svellingen, & Strachan, 2006; Boaz Zion, Alchanatis, Ostrovsky, Barki, & Karplus, 2007) or Artificial Neural Networks (ANN) (Storbeck & Daan, 2001). Computer Vision is a rapid, economic, consistent, objective, and non-destructive inspection technique which may consti-
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