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DETECTION OF VIRUS IN SHRIMP USING DIGITAL COLOR CORRELATION.

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Abstract

Detection of virus in shrimp tissue using digital color correlation is presented. Phase filters in three channels (red, green and blue) were used in order to detect HPV virus like target. These first results obtained showed that is possible to detect virus in shrimp tissue. More research must be made with color correlation in order to consider natural morphology of the virus, color, scale and rotation and noise in the samples.

Introduction

Shrimp culture has been suffering from outbreaks of disease which are significantly affecting the economy and restraining aquaculture production in many countries of the world. Each year are devastating epizootics which impact the shrimp farming industry . The causes are complex and many are attributed to viruses, bacteria, fungi, pesticides and environmental degradation (Gjedrem and Fimland, 1995). It is widely recognized that improved regulatory and technical measures are necessary to prevent the introduction and spread of diseases, to protect the industry based on aquaculture and to protect the aquatic environment from the adverse effects of such diseases or pests. Uniform practices and procedures designed to study the diseases in each country have been developing in Asia, Europe, Canada and the United States. Therefore, many countries are now involved in determining which diseases are present in wild and cultured aquatic organisms in order to facilitate development of national and international codes of practice on health certification.

Histology is an useful technique for diagnosing diseases by looking at the pathological changes in the cells. The technique involves a serious of steps to obtain a slide containing a layer of tissue of 1 to 5 microns for analyzing under the microscope. However, this useful technique has some drawbacks: a) to analyse the histological slide, it is necessary to "sweep" the lit under the microscope, which takes long time in front of the microscope for the histologists, however the diagnoses must be obtained in the shortest time to carry out measures to control the disease; b) to obtain a precise diagnosis it is necessary to analyze many slides from a large sample; c) when viral diseases are not very well developed, it is difficult to make a proper diagnosis or it is impossible to identify them.

The introduction of techniques such as digital processing of images could significantly reduce the time taken up by the histologist in obtaining precise results.

Methodology

In general, a plychromatic object shows a different shape and amplitude distribution when illuminated with different wavelengtht. On the other hand, two differents objects may present similar amplitude distribution when they are illuminated with a determinated wavelength. So, in an optical pattern recognition process using a correlator illuminated with a wavelength, these objects will give very similar amplitude correlation distributions, and some false alarms will appear. To avoid this problem, it is necessary to use the information about the dependence of the object amplitude distributions on the wavelength. Most of the natural colours can be obtained as a combination of three colours (called primaries) if they are well selected. Each of them has to be on the red, green and blue regions of the visible spectrum respectively. Three correlations between the scene to be analysed and the object to be detected are obtained by illuminating an optical correlator set up with three wavelengths (red, green, blue), which cover the visible spectrum (Campos J., et al., 1991).

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Results

Figure 1 shows an image with virus HPV in shrimp tissue. The virus is the black circle to the right of the center. Figure 2 shows a profile where the virus is recognized with a peak exactly in the same place where the virus is localized in the image. Phase filters were used in the three channels (red, blue and green) in the digital color correlation.

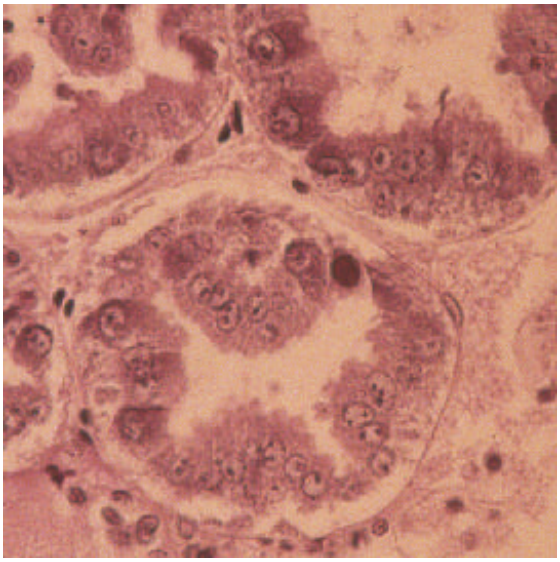

Fig. 1 HPV virus in shrimp tissue

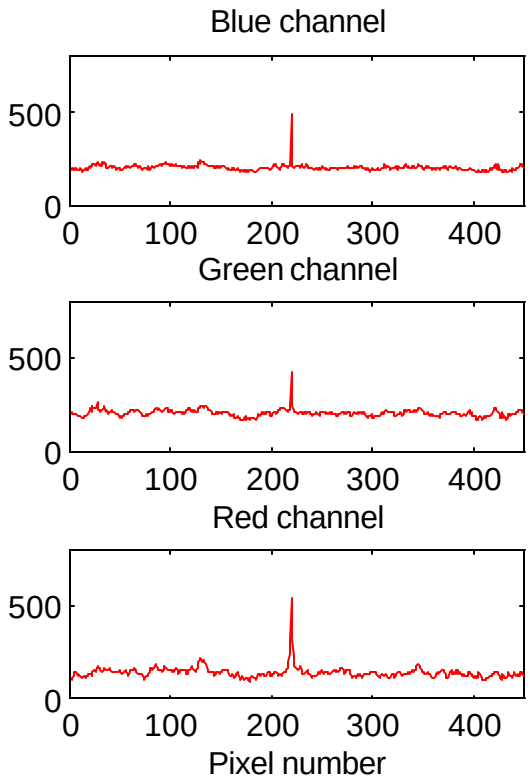

Fig. 2 Profile of the digital color correlation result in the three channels.

In this result, invariant correlation has not been considered. In the x axis of the figure 2 we see the pixel number corresponding to the pixels in the image and in the y axis we have a relative value for the correlation. In these preliminar results we can appreciate good results using this technique. More research must be made in this direction in order to consider several factors like scale, rotation, color, natural morphology of the virus and the use of different kind of filters depending of the complexity of the virus to recognize. However, the time consuming is so reduced.

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