Design and implementation of a remapping algorithm for visual prosthesis

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Abstract

This paper describes a novel remapping algorithm using two CCD cameras and its implementation on a VLSI chip. This system allows to process these two images in real time and to get the resulting image with a high resolution at the center as it is the case for the central part of the retina. This chip can be used in a constant aid prosthesis for patient suffering of Macular Degeneration (MD) and Retinis Pigmentosa (RP).

1 Introduction

Most of actual aids for MD are optical devices that magnify the image seen by the patients such as hand-held and stand magnifiers, telescopes, microscopes or closed circuits television. These devices change the scale of the image in such a way that the image falls in the remaining field of view of the patient. This allows the patient to recover at least a part of the central field information, even if it is at the expense of losing a portion of the peripheral field. For low magnification, this is not a problem. However, for high magnification, the resulting reduced field size restricts the amount of the world that may be seen at one time. This is the case, for example, for face recognition where the partial view of the image (nose, eye, hairs,...) lead to a difficulty of recognising the face.

At the other hand, for RP patients, the defect field of view is the peripheral retina. For these patients, a reverse telecope is required. This device minimize the image so that the information from the peripheral field of view falls onto the central part of the retina.

However, if these devices could be used to help the patient, they can not be used as a constant aid because it is difficult to localise objects in the field of view. In that case, the patient must alternate between the all visual field and the field resulting of the use of such device. This is not really handy.

In this paper, we describe a remapping algorithm and its VLSI implementation that could be used in a constant aid visual prosthesis. The remapping algorithm is similar to the one described in [1]: the visual field or a part of it is remapped to the remaining part of the retina. The only problem with most of the remapping algorithm is the poor resolution of the central part of the image. If this image has to be projected on the retina of a RP patient, this problem is not acceptable because the central part of the retina has a high resolution in comparision to the peripheral one [2], [3].

To solve this problem, we will use two images coming from two video-cameras with different optics: the first one with a tele-lens, and the second one with a wide-angle. The remapping algorithm will be applied on both images. After that, the images will be clustered together (Figure 1).

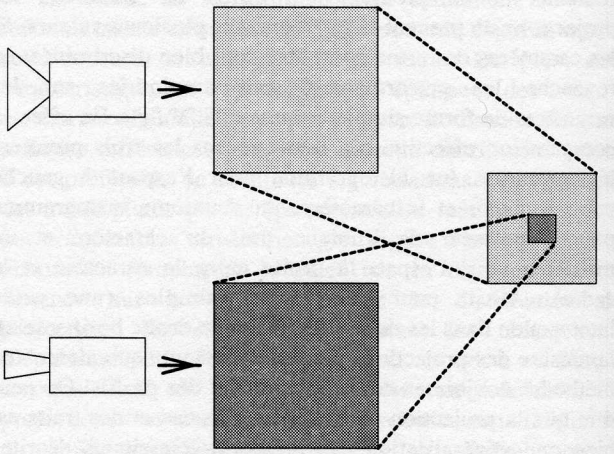

Figure 1: The clustered images

The resulting image will be projected on the remaining retina of the patient: for MD, the central part will not be helpful but for RP, the high resolution of this part will be helpful.