Early Detection of Lazy Eye Using Digital Image Processing and Ultra Sonography

Karthikeyan. Karunakaran, Prasanna. Desikan, Nikil. Ravi

Abstract— Amblyopia (Lazy eye) is one of the major eye diseases which affect the vision of children and kids; most of them under the age of 10[1]. Amblyopia is nothing but the lack of coordination between the eye and the brain [2]. This happens due to increased optical disc diameter and raised optical nerve diameter. Since many people are unaware of this disease, it becomes hard to cure it during its latter stage. So we use two techniques to detect Amblyopia. These can be implemented for all kids under the age of 10, since the disease will only be at its initial stage during this age-group.

Keywords-- Amblyopia, Optical disc.

I. INTRODUCTION

Amblyopia means that visual images captured by the eyes fail to transmit or is poorly transmitted through the optic nerve to the brain. It often occurs for infants and kids resulting in blurry vision. Amblyopia normally affects only one eye in most cases. However, it is possible, though rare, to be amblyopic in both eyes if both fail to receive clear visual images. If the condition is detected at its initial stages or before the age of five, it will increase the patient’s chances for cure considerably. If the detection is made early, it can be corrected through surgery. The two techniques which we use to detect are

- Determination of optical discs by performing a two-step process:
  a) Identification of optical disc using microscopic analysis of Fundus Images.
  b) Segmentation of disc and finding the K value [3] [4].
- Determination of diameter of dural sheath in the Optical nerve by using Ultrasonic Images [5].

II. DETECTION TECHNIQUES:

As said before determination of optical discs diameter is important since it should not contract with the nasal side of the fovea and the dural sheath in the optical nerve should not be thick since it raises the intracranial pressure. First let’s see about the determination of the optical disc.

II. DETERMINATION OF OPTICAL DISC

Optic disc is bright in the received Fundus Image. Before segmenting the optical disc diameter, we have to magnify on the area of the optical disc.

III. IDENTIFICATION OF THE OPTICAL DISC AREA

The Received Fundus Image is transferred to a RGB image. The RGB image has three planes-Red plane, Blue plane and Green plane. But we are going to use Green plane (G-Plane) because the contrasting ratio of G-plane is better than the other two since higher the contrast, optical disc can easily be identified. The region of the optical disc is to be selected around the brightest point. The general pixel size of the Fundus image is 1440x960. But we are going to reduce this pixel image to a 360X360 image with the optical disc getting covered in this square image. Thus the area of the optical disc is determined.

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IV. SEGMENTATION OF THE IMAGE

Now since the area is determined, now we should segment the image to find its diameter. There are many algorithms to segment an image but we are using Hill Climbing algorithm since a local optimum is enough to calculate the diameter. One of the main problems of Hill Climbing Algorithm is that of the plateau. But here in the minimized Square image, there is minimal to nil possibility of a plateau. We are implementing Stochastic Hill Climbing since it does not consider the neighbors and focuses on the examining area.

Thus we can evidently see that affected kids have the optical disc diameter more than 2.0mm. So after the optical disc analysis, the chances of Amblyopia is 50%. To confirm the fact, we have to measure the dural sheath in optical nerve.

V. DETERMINATION OF OPTICAL NERVE

If the optical nerve diameter is higher than normal 4.5mm, then there will be an increase in the intracranial pressure which affects the co-ordination between the eyes and the brain. We are going to use ultrasonography to measure the diameter of the optical nerve.

VI. ULTRASONOGRAPHY DETECTION

<table>
<thead>
<tr>
<th>PERSONNEL</th>
<th>OPTICAL DISC DIAMETER(MM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal kid1</td>
<td>1.92</td>
</tr>
<tr>
<td>Normal kid2</td>
<td>1.90</td>
</tr>
<tr>
<td>Normal kid3</td>
<td>1.89</td>
</tr>
<tr>
<td>Normal kid4</td>
<td>1.87</td>
</tr>
<tr>
<td>Normal kid5</td>
<td>1.79</td>
</tr>
<tr>
<td>Normal kid6</td>
<td>1.83</td>
</tr>
<tr>
<td>Normal kid7</td>
<td>1.89</td>
</tr>
<tr>
<td>Affected kid1</td>
<td>2.09</td>
</tr>
<tr>
<td>Affected kid2</td>
<td>2.17</td>
</tr>
<tr>
<td>Affected kid3</td>
<td>2.01</td>
</tr>
</tbody>
</table>

The patients will undergo ultrasonographic examination under the protection of a radiologist since he is the person who would have enough experiences in handling the patients if they get anxious anytime during the process. The radiologist will use an Acuson pediatric Transducer with a range of 7MHz. When consulting a radiologist, he suggested the room should be dimly lit to reduce the pressure of the kids. This
probe will be applied with a gel which couples with the closed eyelid. Standardized Instrument settings which follow the department protocol for Ultrasonography. Digital cursor and Measurement software is used for assistance. The resulting image will look like a negative of a photographic image. The optical nerve will not be clear in the received image. So, as before, we apply stochastic hill climbing Algorithm, to determine the diameter. If the diameter is more than 4.5 mm then the kid is sure to be affected from Amblyopia.

VII.CONCLUSION

Amblyopia is a dangerous disease. Since it is not familiar for many people, they lack awareness on the disease and they leave their children without treatment. It becomes more dangerous and difficult to cure after 10 years. So it should be treated before 10 years. Our techniques are non-invasive and will cause less discomfort to the children. Amblyopia can easily be detected by our method. After all, every nation’s future depends upon its younger generation. If the younger generation’s vision is blurry, it affects the nation ultimately.

REFERENCES