Image Quality Classification For Diagnosing Retinal Fundus Diseases

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Background

There are many types of fundus diseases, including diabetic retinopathy, glaucoma, and age-related macular degeneration. These diseases can weaken or even cause loss of sight in many people. We usually use machine learning to diagnose these fundus diseases. we need a lot of learning data to use machine learning. The learning data can be to includes data that does not need to be entered. It can be adversely affect learning model creation if the learning data include not available images. So we have to classify available or not available images. we are classified through image processing because these cannot be classified manually. Through the feature extraction, the images classified as the fundus image is filtered out of the blackout image and the not available image that is the light reflection.

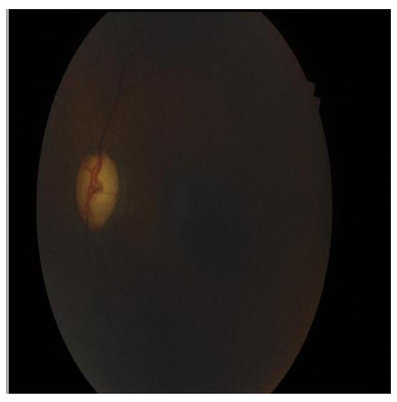

Fig 1 Blackout images

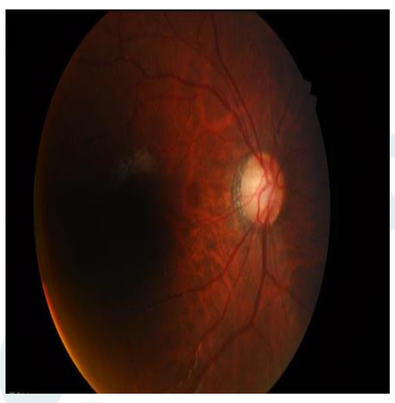

Fig 1.1 partial blackout images

Methods

1.Histogram analysis for blackout image classification.
Fig. 1, Fig. 1 .1 shows the types of blackout images. We analyzed the histograms of the images to classify such images[3]. We analyze the histogram then we can see that the 0 and 1 values are very high. However, since this is a black background outside the fundus image, the histogram value is 0 or 1 except that.

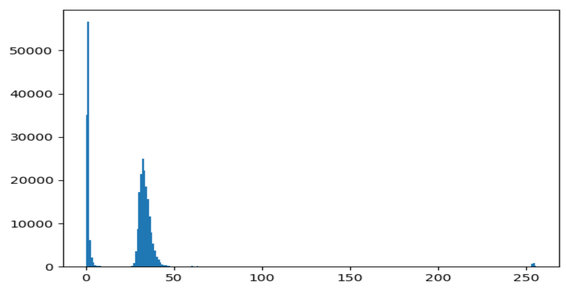

Figure 2. Histogram of fully blackout images.

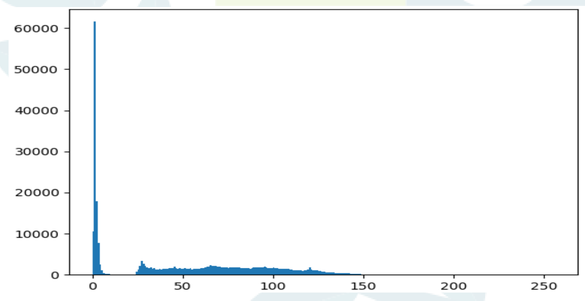

Figure 3. Histogram of partial blackout images.

Fig. 2, Except for the 0 and 1 values, most fully black images have histogram values less than 50. Therefore, we set the threshold at 50, if the histogram value of image is less than or equal 50 so mean this image is full black else not full black, **Fig. 3** Histogram of fully blackout image', the partial black image cannot be classified because of the value range from under threshold to the upper threshold. Also, if there are value more than the threshold, they may be not classified.

Figure 4 normal image.

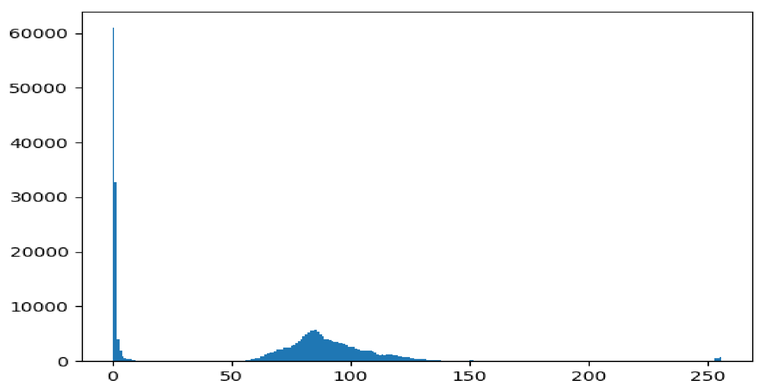

Figure 5 Histogram of Normal image.

We weighted histogram values to solve this problem. Therefore, the lower the histogram value, the more influential it is. If the histogram is 2-15 the weight is 1000, 16-23 is 100, and 24-30 is 10. As a result, the lower is the luminance value, the higher score evaluated, so the partial blackout images can be classified. **Fig. 5** shows the histogram distribution of the normal image. Normal images(**Fig. 4)** have a high distribution at luminance values above 50.

Figure 6 reflected images

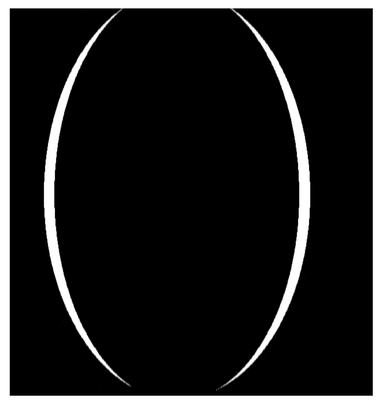

Figure 7 mask

Fig. 6 shows an image that light reflection occurs at the outer part of the fundus. Some light reflection images may be used, but they cannot be used if the light reflection is severe. **Fig. 7** is used for light reflection image detection. In **Fig. 7**, the Left one is a mask that detects the outer of the fundus, and the other is an area next to the light reflection area. We are classified as light reflected images if the difference in brightness between these two areas is dynamic. Light reflections, like blackouts, can occur on all sides of the fundus and may occur partially. Thus, the masked region of interest was divided into 4 areas. The difference of luminance was checked in each area, and if there was a difference of luminance in only one zone, it was classified as a light reflection image

Result

Table 1		Predicted class	
		P	N
Actual class	T	131	3
	F	4	73

Table 1 shows the results for 144 normal images, 77 not available images, and 211 total images. Misclassified images in the reflection classifier don't have a dramatic change of luminance. These have a very slow change of luminance. Finally, This table showed an accuracy of 96.6%, a precision of 97.0%, and a recall of 97.7%.

Conclusions

We will get better quality data when gathering training datasets for machine learning training. We can expect a better effect on the training model generation if we get good quality data. Of course, there are still kinds of images that need to be classified. For instance, an image that is out of focus, an uncleared feature, and so on. However, blacked out or reflected images can be classified with high probability.

References

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