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Intensity And Compactness Enabled Saliency Estimation For Leakage Detection In Diabetic And Malarial Retinopathy

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Abstract-Abnormality detection is the first step performed by doctors during evaluation of medical images in image-based diagnosis, followed by disease-specific evaluation of abnormalities. Perception studies have shown that experts primarily focus on abnormal structures during visual examination for diagnosis. One way to model this behavior in automated image analysis is through visual saliency computation. In this paper, we investigate the potential role of visual saliency for computer aided diagnosis algorithm design. We propose a framework for detecting abnormalities that uses visual saliency computation for sparse representation of the image data that preserves the essential features of a normal image. The proposed method is evaluated for the task of bright lesion detection and classification in color retinal images which is of significance in disease screening Leakage in retinal angiography currently is a key feature for confirming the activities of lesions in the management of a wide range of retinal diseases, such as diabetic maculopathy and pediatric malarial retinopathy. This paper proposes a new saliency-based method for the detection of leakage in fluorescein angiography. A super pixel approach is firstly employed to divide the image into meaningful patches (or super pixels) at different levels. Two saliency cues, intensity and compactness, are then proposed for the estimation of the saliency map of each individual super pixel at each level.

Index Terms- Diabetic,Fluorescein angiogram,Malarial, Retinopathy, Saliency, Segmentation

I. Introduction

Fundus fluorescein angiography (FA) is a valuable imaging modality that provides a map of retinal vascular structure and function by highlighting blockage of, and leakage from, retinal vessels. Although FA is invasive and expensive, and exposes patients with rare but potentially serious side effects.it isindispensable in differential diagnosis ofretinal diseases such as diabetic retinopathy (DR), age-related macular degeneration (AMD), malarial retinopathy (MR). Incarnated as useful signal of high intensity, retinal leakage in angiography is currently a key feature for clinicians to determine the activities and development of lesions in the retina. Fig. 1 shows the appearance of leakages in MR and DR respectively. MR is believed to be important for the differential diagnosis of cerebral malaria, while DR is a leading cause of vision loss in the working age population. Identification of sites and evaluation of the extent of leakage enable decision making for treatment and monitoring of disease activities.

Current practical approaches for quantitative analysis of FA features require extensive manual delineation by experienced graders. There is an increasing demand for the automated detection of the leakage in FA. First, we propose a novel efficient way to enhance leakage regions by using the concept of saliency. Saliency indicates the relative importance of visual features, and is closely related to the characteristics of human perception. Saliency emerges from such characteristics in features of the image as visual uniqueness, unpredictability, or rarity.

II. Existing Work or Literature Survey

Pathak D. et al., (2012) described about the PKC and VEGF receptors. PKC isomer selective inhibitors and VEGF trap are likely to be new therapeutics, which can delay the onset or stop the progression of diabetic vascular disease. A new promising therapy for diabetic retinopathy is undergoing Phase III trials, in which they proposed to target PKC beta II isomer using ruboxistaurin by oral administration. Besides retina, PKC beta II isomer is found in higher concentration in brain, spleen, etc. So, oral targeting may be a questionable approach since generalized inhibitors may prove toxic in the treatment of diabetic retinopathy and ocular delivery may be a better alternative approach.

AnantPai et al. (2010) discussed the current concepts and the role of these novel therapeutic approaches in the management of diabetic retinopathy. The standard of care for patients with DR include strict metabolic control of hyperglycemia, blood pressure control, normalization of serum lipids, prompt retinal laser photocoagulation and vitrectomy. For patients who respond poorly and who progressively lose vision in spite of the standard of care, intravitreal administration of steroids or/and antivascular endothelial growth.

Thomas W. Gardner et al., (2002**)** described recent observations regarding the cellular anatomy thatcontributes to the blood–retinal barrier and its breakdown, the alterations of microglial, neuronal, andmicroglial cells in diabetes, and how these changes lead to loss of vision, an overview of inflammatorymechanisms and responses in the retina in diabetes is provided. These new observations provide aborder clinical and research perspective on diabetic retinal vascular dysfunction and provide newavenuesforimprovedtreatmentstopreventlossofvision.

III. PROPOSED WORK

The entire framework for detecting leakages in FA images is summarized in Algorithm 1. It includes two main steps: saliency detection and leakage detection. In the following subsections, each step will be detailed.

SALIENCY DETECTION 'Salient' regions are those regions of a medical image that contain meaningful information for diagnostic purposes. Typically, the intensities and/or shapes of these regions are significantly different from their surroundings or neighbors. The intensity-based approach seems to be a natural choice for computational leakage area detection [11]. However, large vessels and the optic disc might also be falsely detected as salient regions for similar reasons in this application. Consequently, the vessel extraction and optic disc detection are essential in this framework: simply masking them will help to improve the accuracy of leakage detection. In this paper, for convenience we define all the aforementioned regions that might be assigned a high saliency value as the regions of interest (ROIs). After the whole process, the false ones such as large vessels and the optic disc will be removed while only the leakage regions will be retained. In the following subsections, the super pixel based saliency detection method will be detailed.

Condition	Expected dissimilarity	Expected salience
$\mathcal{P}_i$ is distinct from $\mathcal{P}_j$	large $\text{dis}_C(\mathcal{P}_i, \mathcal{P}_j)$	$\mathcal{S}_C(\mathcal{P}_i) > \mathcal{S}_C(\mathcal{P}_j)$
$\mathcal{P}_i$ is similar to $\mathcal{P}_j$	small $\text{dis}_C(\mathcal{P}_i, \mathcal{P}_j)$	$\mathcal{S}_C(\mathcal{P}_i) \approx \mathcal{S}_C(\mathcal{P}_j)$
$c(\mathcal{P}_i) > c(\mathcal{P}_j)$	large $\text{dis}_C(\mathcal{P}_i, \mathcal{P}_j)$	$\mathcal{S}_C(\mathcal{P}_i) > \mathcal{S}_C(\mathcal{P}_j)$
$c(\mathcal{P}_i) < c(\mathcal{P}_j)$	small $\text{dis}_C(\mathcal{P}_i, \mathcal{P}_j)$	$\mathcal{S}_C(\mathcal{P}_i) < \mathcal{S}_C(\mathcal{P}_j)$

SUPERPIXEL SEGMENTATION: A region-based approach is well established in saliency measurement: for example, Cheng et al. [8] have used a histogram-based contrast method: the saliency value of each pixel relative to the others in the entire image is estimated and then smoothed in the color space, and further improved through partitioning the given image into regions and assigning saliency values to such regions through considering both their global contrast score and local spatial coherence. This is a two-step method and the first step may assign different saliency values to similar colors due to color quantization. In our method, super pixels are employed to avoid discontinuities at the bin edges of the histogram.

IV. RESULTS AND DISCUSSION

The proposed saliency-guided leakage detection method is evaluated from two aspects: leakage detection over different datasets, and the comparison with existing state-of-the-art saliency detection methods. An experimental investigation will also be carried out in the next section on the effectiveness of different saliency cues and parameter setting - i.e., the level of superpixel maps and the number of superpixels in each level, the threshold value for the generation of the ROIs from the final saliency map and the region weight λ. A. Results on different datasets To this end, the method proposed by Rabbani et al. was re-implemented in our study, and applied to the MR dataset. For the DR dataset, however, we directly quoted the results reported in their paper in the hope that their results are the best achievable.

DR DATASET: The proposed method was also tested on the DR dataset with the aim of detecting the leakage areas caused by diabetic macular edema. As suggested in , quantitative analysis of a circular region centered at the fovea with a radius of 1500 μm is of greatest significance for clinical diagnosis and treatment. For a fair comparative study, we also limited our method in detecting the leakages in this area. Fig. 4 shows the results of different methodsin detecting the leaking regions abound the fovea. It can be seen that most of the leaking areas have been detected by both methods, and that the segmentation results are very similar to those of manual annotations.

Original Image Final Segmented Image

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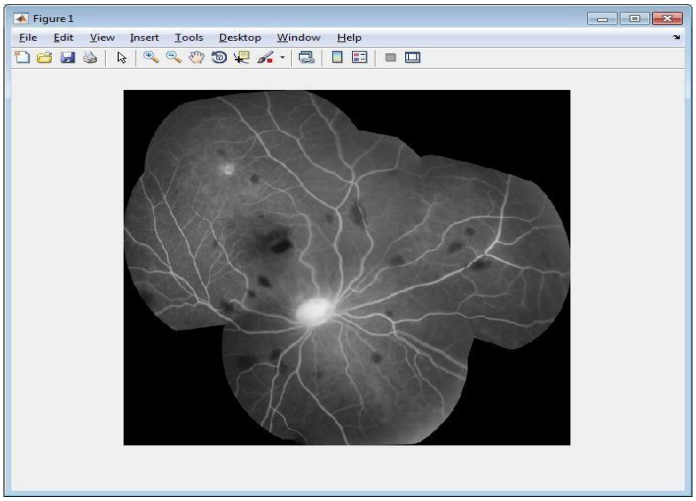
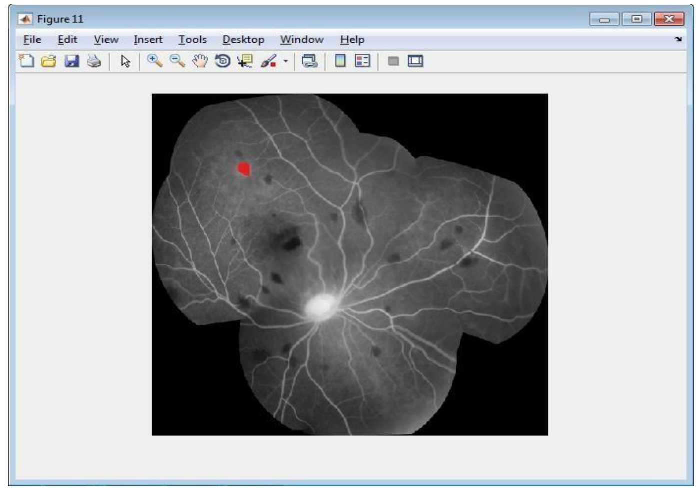
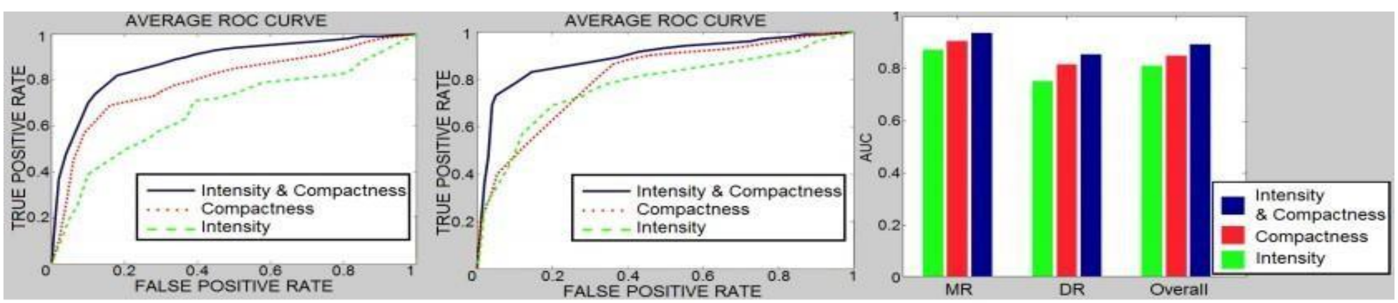




V. CONCLUSION

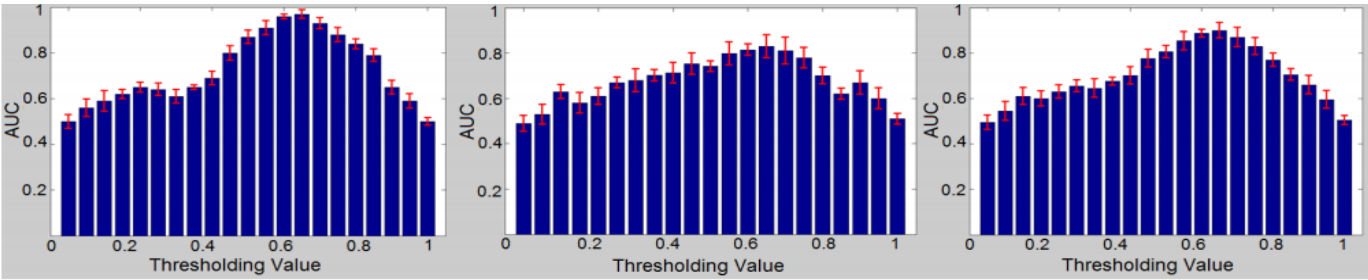
It is important to distinguish between leakage in FA and retinal lesions (e.g., drusen, exudate, micro aneurysm, pigment abnormalities) commonly seen in colourfundus photograph. Leakage shows activities of retinal diseases while lesions reveals existence or absence of certain types of disease. An extensive literature review shows that automated retinal image analysis of FA images, especially for leakage detection, is relatively unexplored. To the best of our knowledge, this is the first report on the automated detection of the leakage over both DR and MR datasets with the largest number of cases. In this paper, we have proposed a multiscale saliency detection method for the detection of focal leakagesin FA images.

The proposed method is based on two saliency cues: intensity and compactness features under multi-level super pixels. Then the saliency values of the superpixels at different levels are estimated in the intensity and compactness channels respectively. While the intensity cue characterizes the intensity contrast among different superpixels, the compactness cue characterizes how densely (or sparsely) the salient pixels distribute inside a super pixel. The superpixel representation helps capture large objects of interest but at a low computational cost, and multiscale analysis helps capture the objects of interest with different sizes.



(a) MR (b) DR (c) *AUC* values

The saliency maps over the same cues at different levels are fused using a pixel-wise multiplication operator, so that only such regions that are salient in both channels are detected as salient. The saliency detection step can generate accurate saliency maps with well-highlighted leakage sites and areas. Thus, it can provide both the qualitative and quantitative information for the analysis of the FA images.To further demonstrate the merits of our proposed method and justify its remarkable performance, we carried out an extensive comparative study with other methods for saliency detection. The experimental results based on the MR and DR datasets show that our method is superior for the detection of salient objects and structures in the FA images. We plan to apply this new tool to assist the management of retinal diseases such as DR and MR. We also plan to automate the parameter tuning process. We also plan to apply the proposed saliency detection method to other types of images, and evaluate its performance on other benchmark datasets.



(a) MR (b) DR (c) Overall

References

Young, G. O. 1964. “Synthetic structure of industrial plastics (Book style with paper title and editor),” in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.

Chen, W.-K. 1993. *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.

Poor, H. . 1985. *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.

Smith, B. “An approach to graphs of linear forms (Unpublished work style),” unpublished.

Miller, E. H. “A note on reflector arrays (Periodical style—Accepted for publication),” *IEEE Trans. Antennas Propagat.*, to be published.

Wang, J. “Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication),” *IEEE J. Quantum Electron.*, submitted for publication.