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# Review and Analysis of Optical Coherence Tomography (OCT) mages as AS-Modality

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***Abstract*—Recently, compressive sampling has expected noteworthy attention as an promising technique for rapid volumetric image techniques . This paper investigated optical coherence tomography (OCT) image acquisition using compressive sampling techniques .Previous researches used the multidimensional wavelet transform as the domain of sparsification for recovering OCT images in volumes. In this paper we analyzed and compared the potential and efficiency of other image transforms to recreate the similar OCT image. The two quantitative measures, the mean square errorand the structural similarity index, were applied to compare the quality of the reconstructed volumetric images. We observed that fast fourier transformation and wavelet transformation both are able to reconstruct OCT image volumes for the orthogonal sparse sampling masks used in this report, but with different merits.**

***Index Terms*—Biomedical image processing, image processing,image reconstruction, image sampling.**

## I Introduction

This paper presents certain issues that have been addressed for OCT images over last few years. Optical Coherence tomography technique is used to capture visual images[1]. The retina is a layered organization and in OCT each of these layer has a precise pdf which is tarnished by stain noise, therefore a blended model for statistical modelling of OCT images was proposed[2]. A Laplace distribution, which is a convolution of a Laplace pdf and Gaussian noise, was planned as the distribution of every constituent of this model.These methods are based on learning depth maps from a large dataset of two dimensional (2D) depth images. However, current translation systems, while general, create low-quality results with artefacts that are not satisfactory to many researchers[3] . In the next section we will explore the methods analyse their outcomes for OCT images.

## II Literature Review

Reza Rastiet. al. [2018] presented Segmentation and Quantification for Angle-Closure Glaucoma Assessment in Anterior Segment OCT . Computer-aided diagnosis (CAD) of optical pathologies is a recent active area in retinal image analysis[1,3]. Due to the growing use of retinal optical coherence tomography imaging procedure, a CAD method in OCT is necessary to help ophthalmologist in the premature finding of retinal diseases and treatment supervision . This paper described a new CAD system which was based on a multi-scale convolution combination of expert (MCME) ensemble model to classify normal retina, and two general kind of retinal pathologies, namely, dry age-related retinal degeneration, and diabetic macular edema. The projected MCME modular scheme is a data-driven neural organization, that uses a new cost function for discriminative and fast learning of image features by using convolutional neural networks on multiple-scale sub-images. The MCME make the most of the possibility function of the training data set and position truth by considering a mix model, that also tries to model the combined interaction between individual experts by using a related multivariate constituent for each expert module in place of only modelling the trivial distributions by autonomous Gaussian mechanism[2,9]. Two different retinal OCT data sets from Heidelberg apparatus were considered for the assessment of the method, i.e., a narrow data set of the OCT images of 148 subjects and a public data set of 45 the OCT acquisitions. For evaluation purpose, they carried out a wide range of categorization processes to assess the results with the top configurations of the MCME method[18].

Huazhu Fu et. al.[2017] presented Segmentation and Quantification for Angle-Closure Glaucoma Assessment in Anterior Segment OCT. Angle-closure glaucoma is a main cause of irreparable optical impairment and can be recognized by calculating the anterior chamber angle (ACA) of the eye. The ACA can be seen as clearly from anterior segment optical coherence tomography (AS-OCT), but the imaging characteristics and the shapes and locations of major optical organization can change notably among various AS-OCT modalities, hence complicating image analysis[6,17]. To tackle this problem, they proposed a data driven method for automatic AS-OCT organization segmenting, measuring, and screening. This method initially estimate first markers in the eye by label transfer from a hand labeled exemplar data set, whose images are aggregated over diverse patients and AS-OCT modalities. This initial marker is then refined by by a graph based flattening system that is guide by AS-OCT structural information. These indicators assist segmentation of main retinal structures, which are then used to recover normal medical parameters[11]. These parameter could be used not only to support ophthalmologists in building anatomical assessment, but also to provide as attributes for identifying anterior angle closure in mechanical glaucoma identification algorithms[12].

Zahra Aminiet. al.[2016] presented Statistical Modeling of Retinal Optical Coherence Tomography. In this paper, a new model for retinal Optical Coherence Tomography (OCT) images was proposed. This statistical model was based on bringing up in a linear Gaussianization transformation to convert the likelihood distribution function of each OCT intra-retinal layer to a Gaussian distribution. The retina is a layered organization and in OCT each of these layer has a precise pdf which is tarnished by stain noise, therefore a blended model for statistical modeling of OCT images was proposed. A Laplace distribution, which is a convolution of a Laplace pdf and Gaussian noise, was planned as the distribution of every constituent of this model. The cause for selecting Laplacepdf is the monotonically decomposing behavior of OCT intensities in every layer for healthy cases. once fitting a mixture model to the data is done , every element is gaussianized and every one of them are mingled by Averaged Maximum A Posterior (AMAP) technique[8]. To show the capability of this technique, a novel contrast enhancement process based on this statistical model is planned and analyzed on fourteen well 3D OCTs taken by the Topcon 3D OCT and six 3D OCTs from Age-related Macular Degeneration (AMD) patients, captured by Zeiss Cirrus HD-OCT. By comparing the results with two competing techniques, the eminence of the proposed method is verified both visually and mathematically . Also, to prove the effectiveness of the proposed method for a further direct and definite purpose, an enhancement in the segmentation of retinal layers by the proposed contrast improvement method as a pre processing step, is established[7,2].

Andy et. al [2013] stated that compressive sampling of images has received considerable interest as a promising technique for quick volumetric imaging. They had investigated volumetric OCT image acquisition by compressive sampling method and demonstrated that it was probable to pick up image volumes from bset of sampled images. Their results used the multidimensional wavelet transform as the area of sparsification for getting better OCT image volumes. In their report, they analyzed and evaluated the possible efficiency of three different image transforms to rebuild the similar volumetric OCT image[6,17,18].
The two other quantitative measures, mean square error and structural similarity index, applied to evaluate the value of the rebuild volumetric images. They observed that fast Fourier transformation and wavelet both weree able of recreating OCT image volumes for the orthogonal sparse sampling cover used in their report, but with altered qualities[3,8,11].

Heiko et. al. [2013] explained The rising market of digital three dimensional film creation in HD resolution has lead to the requirement for high-quality apparatus in the production series . The incoming video stream of the cameras need a picture rectification due to inevitable alignments within the stereoscopic camera setup. This improvement can also take place in post processing of the record objects or it may be applied in real time while the film shooting.
particularly in the case of stream and record of live events, real-time processing is essential and moreover, the system has to give a extremely small latency[7,8]. They present a hardware image renovation engine, that could support the processing of stereo HD serial digital interface video streams by up to 1080p30 video with a latency under 0.5 ms. The picture restructuring engines for the two channel were implemented . They could be controlled by the stereoscopy examination software, which then computed the factors necessary for the image rectification at runtime[9,12].

ShahriarNegahdaripour[2013] in their paper explained Visual odometry that involved the calculation of three dimensional motion and path by track attributes in the video or image sequence record by the cameras on some independent robotics , aerial, terrestrial, and marine platform[7,12]. For mapping, exploration, surveillance , and inspection operations within turbid waters, very high-frequency two dimensional forward scan sonar scheme gave a noteworthy benefit over cameras by giving both scenery with object details and striking trade off in resolution, range and data rate. Functioning these at graze occurrence gives larger outlook coverage and better image quality due to the power of dispersed backscattered reflectance but also induce cast shadows that are usually more discrete than brilliance pattern due to the direct reflectance of casting substance. For the calculation of three dimension motion by automatic video processing, the assessment correctness and sturdiness can be enhanced by incorporating the optical cues from shadow dynamics with the image flow of stationary three dimensional objects, equally provoked by sonar motion. In this paper, they presented the numerical models of picture flow for three dimension(3D) objects and their shadows, use them in developing a variety of three dimensional(three dimensional) sonar motion evaluation solutions, and analyze their robustness. They presented results of trials with both artificial and actual data in order to measure the correctness and performance of these techniques[12].

Sieunet. al.[2015] Nonrigid listing of optical coherence tomography (OCT) images is a very important problem in study of optical diseases, evaluating the effect of pharmaceuticals in treating vision loss, and performing group-wise cross-sectional analysis. Multi dimensional non rigid registration algorithms necessitate for cross sectional and longitudinal examination are still being developed for precise registration of OCT images, with the stain noise in images presents a challenge for registration[17]. Design of algorithms for segmentation of OCT images to create surface models of ocular layers has advanced significantly and numerous algorithms are available which could segment optical OCT images into essential retinal surfaces. A significant morphometric measurement could be extract if precise surface registration algorithm for registering ocular surfaces onto consequent template surfaces were accessible. In this paper, they presented a new way to perform multiple and concurrent retinal surface registration, targeted for registering surfaces extract from optical volumetric OCT images. that enabled a point-to-point communication between template and subject surfaces, allow for a direct, vertex-wise comparison of morphometric measurements across subject groups. They demonstrated that their approach could be utilized to localize and to analyze regional change in choroidal and nerve fiber level thickness, between healthy and glaucomatous objects, which allows for cross-sectional population wise analysis. They also demonstrated the system's ability to trace longitudinal modification in optic nerve head morphometry, which allows for individual tracking of morphometric changes. The technique also, in future, can be used as a precursor to three dimensional OCT image registration to better initialize non rigid image registration algorithms that are closer to the required solution[20].

Zahra et. al.[2016] described a new method for visual Optical Coherence Tomography (OCT) images . The statistical model was based on bringing aGaussianization transform to alter the probability distribution function (pdf) of every OCT intra ocular layer to a Gaussian distribution Function . The retina is a layered arrangement and in OCT every layer has a precise pdf that is corrupted by speckle noise, thus a fusion model for numerical modeling of OCT images was proposed[6.7]. The Normal-Laplace distribution, that was a convolution of a Laplace pdf and Gaussian noise, was projected as the distribution of every constituent of this form. The basis for selecting Laplacepdf is the monotonically decomposing behaviour of all OCT intensities in every layer for healthy cases[8,9]. Once fitting a mixture model to the data, every constituent is gaussianized and every one of them are collected by Averaged Maximum A Posterior method(AMAP). To exhibit the capability of this scheme, a novel contrast enhancement scheme based on this statistical model was planned and tested on Fourteen healthy three dimensional OCTs taken by the Topcon 3D OCT and six 3D OCTs from Age-related Macular Degeneration (AMD) patients, taken by Zeiss Cirrus HD-OCT.By comparing the results with two competing methods, the importance of the proposed system is exhibited both visually and arithmetically. Also, to show the effectiveness of the planned method for a more
direct and precise purpose, an improvement in the segmentation of intra-retinal layers using the proposed contrast enhancement method as a pre processing step, is demonstrated[13].

Huazhuet. al.[2017] explained Angle-closure glaucoma is a main reason of irreparable visual impairment and can be recognized by measuring the anterior chamber angle (ACA) of the eye. The ACA can be viewed clearly through anterior segment optical coherence tomography (AS-OCT), but the imaging features and the shape and location of major optical structures can vary significantly among different AS-OCT modalities, thus complicating image analysis. To address this problem, they proposed a data-driven approach for automatic AS-OCT structure segmentation, measurement, and screening[14]. Their technique first estimated early markers in the eye through label transfer from a hand-labeled exemplar data set, whose images are composed over diverse patients and AS-OCT modalities. These initial signs are then refined by means of a graph-based smooth system that is directed by AS-OCT structural information. These signs assist segmentation of main scientific structures, which are used to improve standard clinical factors . These factors can be used not only to help ophthalmologists in making anatomical assessments, but also to give as factors for identifying anterior angle closure in automatic glaucoma selection algorithms. Trials on the Visante AS-OCT and the Cirrus high-definition-OCT data sets reveal the effectiveness of their method[15] .YANG ZHAO et. al. [2017 ] explained The Web images and videos are regularly down sampled and compressed to save the bandwidth and storage. Therefore, the low-grade and low- resolution images or videos could not match the high-definition demonstration devices nowadays. But , conventional image super resolution methods(SR) are not robust enough to compression artefacts. In their paper, they proposed an efficient joint SR and de blocking method based on simple three step procedure, that consists of a block-matching and three dimensional altering process, the local binary encoding procedure , and a matching restoration process[18]. Also, the cascade structure and an additional post-processing are also accessible for huge enlargement parameters . Investigational results on real world images with noticeable compression artefacts reveal that the planned process can replicate apparent and sharp SR results, and efficiently eradicate the unnatural artifacts at the same time[3].KianaCalagariet. al. [2018] explained A wide acceptance of three dimensional videos is hindered by the short of very high-quality three dimensional content. One promising solution to this problem is through data-driven two dimensional-to-three dimensional video translation. These methods are based on learning depth maps from a large dataset of two dimensional (2D) depth images[8]. However, current translation systems, while general, create low-quality results with artifacts that are not satisfactory to many researchers . They proposed a new , data-driven scheme for two dimensional-to-three dimensional video translation. Their method transfers the depth gradient from a large database of two dimensional+Depth images. Taking twodimensional+Depth databases, yet, are very complex and much costly, particularly for outside sports games[13]. They addressed this situation by generating an artificial database from computer games and presenting that this artificial database may efficiently be used to translate real videos. They proposed a spatial-temporal method to make sure that the smoothness of the produced depth within individual frames and across succeeding frame. Additionally, they presented an object border detection technique modified for two dimensional-to-three dimensional translation systems, which create clear depth borders for players. They applied this method and validated it by conduct user study that evaluated depth awareness and visual comfort of the transformed three dimensional videos. They displayed that their method produced high-quality three dimensional(3-D) videos that are almost indistinguishable from videos shot by digital cameras. Additionally, their method considerably outperforms the present state-of-the-art techniques . For instance, up to 23% enhancement in the perceived depth is attained by their method, that transforms for improving the mean estimation score from good to better[19].

Pedro Costa et. al. [2018] explained in optical image investigation , the availability of the great quantity of annotated data is becoming more and more significant. Still, annotatedoccular data is often limited and costly to obtain. In their paper, they addressed the difficulty of combining optical colour images by applying current methods based on adversarial learning. In the setting, a generative model is skilled to exploit a loss function offered by a second model attempt to classify its output into actual or artificial[11]. Particularly, they proposed to employ an adversarial encoder for the task of occular vessel network synthesis. They used thegenerated vessel trees as an intermediary stage for the generation of colour retinal images, that is accomplished with a generative adversarial system. Both the models need the optimization of nearly every differentiable loss functions, that allow them to train them mutually[13]. The resultant model recommends an end-to-end ocular image synthesis scheme capable of producing as many retinal images as any user necessitate, with their analogous vessel system, by sampling from a simple probability distribution function they impose to the linked latent space. They proved that the learned latent space consist of a well-defined semantic structure, imply that they may carry out computation in the space of optical images, e.g., easily interpolating new data points between two ocular images. Visual and quantitative results reveal that the artificial images are considerably dissimilar from those in the training set, while being also anatomically reliable and exhibit a reasonable visual quality[15].

III Cnclusion

This paper analyzed the study of various authors presented for visual process. Study of eye structure was presented by some authors. Then capturing of Eye through camera/or eye instruments. How These images are converted for analysis to ophthalmologists. The pattern of OCT images . Their characteristics is analyzed. High quality 2 D and 3 D images can add good treatment for patients. The paper generally focuses on Anterior Segment Optical Coherence Tomography (AS-OCT) . Here measurement could be extracted if specific registration algorithm to register visual surfaces onto resultant model surfaces were available.

[1] Reza Rasti, Hossein Rabbani , Ali reza Mehridehnavi, Fedra Hajizadeh "Macular OCT Classification Using a Multi-Scale Convolutional Neural Network Ensemble" , IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL. 37, NO. 4, APRIL 2018. PP: 1024-1034.

[2] T. Vos et al., "Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: A systematic analysis for the global burden of disease study 2013," Lancet, vol. 386, no. 9995, pp. 743–800, 2015.

[3] S. Mehta, "Age-related macular degeneration," Primary Care, Clin. Office Pract., vol. 42, no. 3, pp. 377–391, 2015.

[4] M. M. Engelgau et al., "The evolving diabetes burden in the United States," Ann. Internal Med., vol. 140, no. 11, pp. 945–950, 2004.

[5] S. Pershing, E. A. Enns, B. Matesic, D. K. Owens, and J. D. Goldhaber-Fiebert, "Cost-effectiveness of treatment of diabetic macular edema," Ann. Internal Med., vol. 160, no. 1, pp. 18–29, 2014.

[6] R. Bernardes and J. Cunha-Vaz, Optical Coherence Tomography: A Clinical and Technical Update. Springer, 2012.

[7] https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Provider-Charge-Data/Physician-and-Other-Supplier.html

[8] M. E. van Velthoven, D. J. Faber, F. D. Verbraak, T. G. van Leeuwen, and M. D. de Smet, "Recent developments in optical coherence tomography for imaging the retina," Prog. Retinal Eye Res., vol. 26, no. 1, pp. 57–77, 2007.

[9] H. Rabbani, M. Sonka, and M. D. Abramoff, "Optical coherence tomography noise reduction using anisotropic local bivariate Gaussian mixture prior in 3D complex wavelet domain," Int. J. Biomed. Imag., vol. 2013, Jun. 2013, Art. no. 417491.

[10] R. Kafieh, H. Rabbani, and I. Selesnick, "Three dimensional data-driven multi scale atomic representation of optical coherence tomography," IEEE Trans. Med. Imag., vol. 34, no. 5, pp. 1042–1062, May 2015.

[11] Z. Amini and H. Rabbani, "Statistical modeling of retinal optical coherence tomography," IEEE Trans. Med. Imag., vol. 35, no. 6, pp. 1544–1554, Jun. 2016.

[12] R. Kafieh, H. Rabbani, M. D. Abramoff, and M. Sonka, "Curvature correction of retinal OCTs using graph-based geometry detection," Phys. Med. Biol., vol. 58, no. 9, pp. 2925–2938, 2013.

[13] M. D. Abràmoff et al., "Automated segmentation of the cup and rim from spectral domain OCT of the optic nerve head," Inv. Ophthalmol. Vis. Sci., vol. 50, no. 12, pp. 5778–5784, 2009.

[14] Q. Yang et al., "Automated layer segmentation of macular OCT images using dual-scale gradient information," Opt. Exp., vol. 18, no. 20, pp. 21293–21307, 2010.

[15] G. Quellec, K. Lee, M. Dolejsi, M. K. Garvin, M. Abràmoff, and M. Sonka, "Three-dimensional analysis of retinal layer texture: Identification of fluid-filled regions in SD-OCT of the macula," IEEE Trans. Med. Imag., vol. 29, no. 6, pp. 1321–1330, Jun. 2010.

[16] R. Kafieh, H. Rabbani, M. D. Abramoff, and M. Sonka, "Intra-retinal layer segmentation of 3D optical coherence tomography using coarse grained diffusion map," Med. Image Anal., vol. 17, no. 8, pp. 907–928, 2013.

[17 ] P. A. Dufouret al., "Graph-based multi-surface segmentation of OCT data using trained hard and soft constraints," IEEE Trans. Med. Imag., vol. 32, no. 3, pp. 531–543, Mar. 2013.

[18 ] Y. Sun, T. Zhang, Y. Zhao, and Y. He, "3D automatic segmentation method for retinal optical coherence tomography volume data using boundary surface enhancement," J. Innov.Opt. Health Sci., vol. 9, no. 2, p. 1650008, 2016.

[19 ] M. Esmaeili, A. M. Dehnavi, and H. Rabbani, "3D curvelet-based segmentation and quantification of drusen in optical coherence tomography images," J. Elect. Comput.Eng., vol. 2017, Jan. 2017, Art.no. 4362603.\

[20 ] Y.-Y. Liu, M. Chen, H. Ishikawa, G. Wollstein, J. S. Schuman, and J. M. Rehg, "Automated macular pathology diagnosis in retinal OCT images using multi-scale spatial pyramid and local binary patterns in texture and shape encoding," Med. Image Anal., vol. 15, no. 5, pp. 748–759, 2011.