Glaucoma is one of the major leading causes of blindness worldwide. In addition to functional deficits, monitoring and evaluating the disease-related structural changes in the human retina also helps with diagnosis and management of this progressive disease. Color (stereo) fundus photography and, more recently, spectral-domain optical coherence tomography (SD-OCT) are two types of imaging modalities that are currently utilized for monitoring the characteristic changes of retinal structures such as the optic nerve head (ONH). With the inherent subjectivity and time required for manually segmenting retinal structures, there has been a great interest in automated approaches. Hence, we propose machine-learning graph-theoretic based approaches to automatically segment the retinal structures and extract the proper parameters of the optic nerve head related to the diagnosis and management of glaucoma. The structural parameters include: 1) cup-to-disc ratio (CDR) which is a 2D parameter and is obtainable from both fundus and SD-OCT modalities, and 2) Bruch's membrane opening-minimum rim width (BMO-MRW) which is a recently introduced 3D structural parameter that is obtainable from the SD-OCT modality only. Since both fundus and SD-OCT images are often acquired for the assessment of glaucoma, we propose to use the complementary information from both modalities in order to enhance the segmentation of structures of interest.

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