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An Enhanced Image Segmentation From 3D to 2D by Using Modified Neural Network

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Abstract: ***Optical coherence tomography angiography (OCTA) is an imaging which can applied in ophthalmology to provide detailed visualization of the perfusion of vascular networks in the eye. compared to previous state of the art dye-based imaging, such as fluorescein angiography. OCTA is non-invasive, time efficient, and it allows for the examination of retinal vascular in 3D. These advantage of the technique combined with the good usability in commercial devices led to a quick adoption of the new modality in the clinical routine. However, the interpretation of OCTA data is not without problems commonly observed image artifacts and the quite involved algorithmic details of OCTA signal construction can make the clinical assessment of OCTA exams challenging. In this paper we describe the technical background of OCTA and discuss the data acquisition process, common image visualization techniques, as well as 3D to 2D projection using high pass filtering, relu function and convolution neural network (CNN) for more accuracy and segmentation results.***

I. INTRODUCTION

The quantification of neural network performs a chief role inside the clinical selection and quantitative look at of neuroscience. A convolutional neural community (CNN) is a selected kind of artificial neural community that uses perceptions, a system studying unit set of rules, for supervised studying, to analyse facts. CNNs apply to photo processing, herbal language processing and other varieties of cognitive tasks. Convolution neural analyse multi-level capabilities and classifier in a joint fashion and perform an much higher than traditional strategies for various picture classification and segmentation troubles. Essentially neural networks that use convolution in area of widespread matrix multiplication in at least one among their layers. Convolution networks are very just like everyday neural networks. They are made up of neurons which have learnable weights and via biases. Each neuron receives a few inputs, plays a dot product and optionally follows it with a non-linearity. Convolution neural community is a excessive-performance classifier. Convolution neural network is a kind of neural network model which allows us to extract higher representation for the picture content material. A convolutional neural network, or CNN, is a deep gaining knowledge of neural community designed for processing dependent arrays of statistics together with pictures. Convolutional neural networks are broadly used in computer vision and feature become the nation of the art for plenty visible programs along with image class, and have additionally discovered fulfillment in herbal language processing for text category. Convolutional neural networks are very good at selecting up on styles within the enter photograph, consisting of lines, gradients, circles, or maybe eyes and faces. It is that this assets that makes convolutional neural networks so effective for laptop vision. Unlike in advance laptop imaginative and prescient algorithms, convolutional neural networks can function at once on a uncooked image and do no longer need any preprocessing.A convolutional neural community is a feed-forward neural community, frequently with up to 20 or 30 layers. The electricity of a convolutional neural network comes from a special form of layer referred to as the convolutional layer. Optical coherence tomography angiography (OCTA) is a singular noninvasive method for intensity-resolved visualization of retinal vasculature. Since the appearance of OCTA, our information concerning retinal microvasculature has improved exponentially and OCTA has proved to be beneficial in lots of ischemic and non-ischemic retinal issues together with diabetic retinopathy (DR)

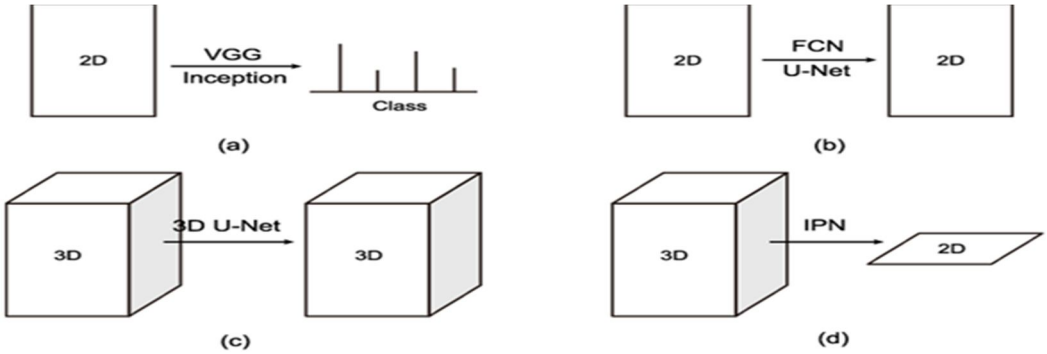


Fig.1.Task patterns of mainstreams end-to-end frame works.

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In this paper, we explore the way to quantifying the nueral indictoirs the usage of deep getting to know without layer segmentation. Deep learning knowledge of has made full-size achievements in photograph classification or segmentation. It can fulfill the venture of category and semantic sigmentation quit to cease. Figure suggests several foremost flow end to give up networks, including: the category network represented through VGG and inception that could attain the assignment from 2D to class. The 2D segmentation network represnted by way of fully convolution network (FCN) and U-internet that can attain 2D to 2D semantic segmentation. The three-D segmenatation community represented by means of 3-D U-internet that is characterized by the segmenetation effects from 3-d volume statistics to 3-D labels. Therefore, we suggest a novel stop to give up architecture named Image projection network(IPN).

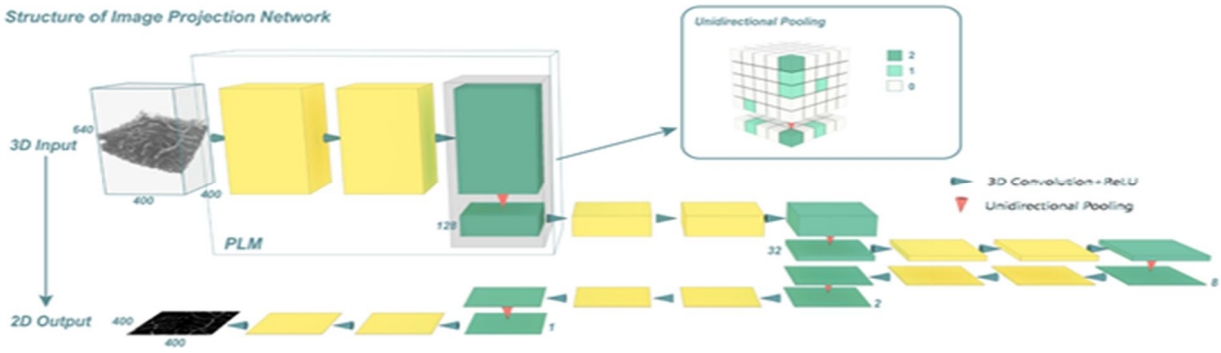
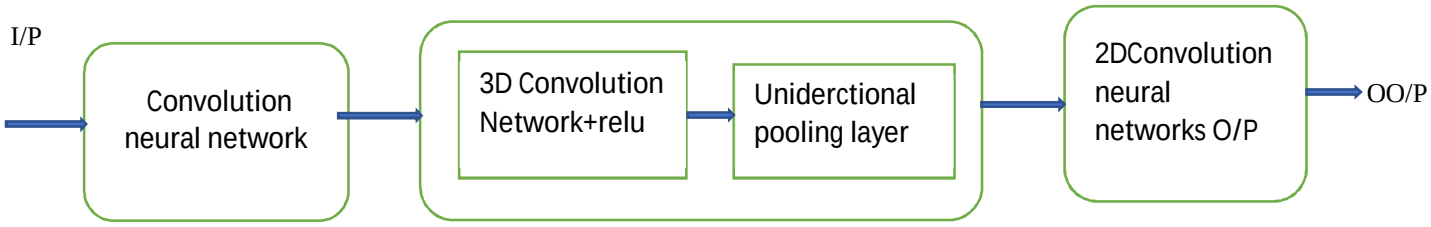


Fig.2. The Structure of IPN for 3D-to-2D end to end image segmentation

A. Flow Chart Of Proposed System



II. METHODS

Before designing the IPN from 3D to 2D, we first layout a projection network from 2D to 1D as a pre-experiment to confirm whether the neural network can summerise the powerful capabilities along side the projeection direction.

A. 2D-to-1D IPN

We use the framework of the classical VGG model for reference, remove all the full connection layers, and change the original pooling layer to the unidirectional pooling layer. The cause of these changes is to select powerful featues along the projection path and reduce the records size to condense the statistics onto the two-dimensional projection plane.

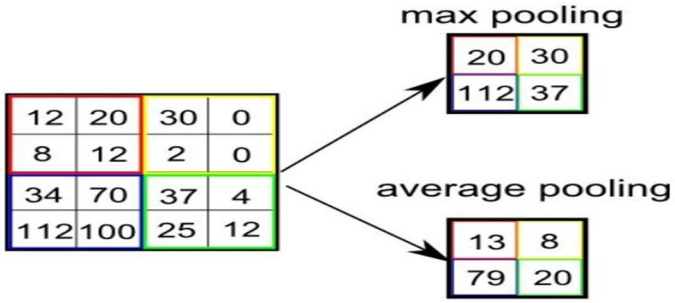


Fig.3.The structure of 2*2 max pooling and average pooling.

The pooling layer can reduce network parameters and control over fitting, specially max pooling layer to reduce the image dimension.figure shows 2*2 max pooling layer. After pooling, the Image size in all directions decreases.

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B. 3D-to-2D IPN

To keep away from the terrible spatial continuity inside the 2D-to-1D community and obtain beeter segmentation effects, we similarly proposed the 3D-to-2D photograph projection network. The shape of the 3-d to 2D IPN is shown in fig.Unlike 2D-to-3D IPN, 3D-to-2D IPN uses 3-d convolution and the unidirectional pooling extends from 2D to 3D.IPN can input 3-dimensional inputs and output two dimensional labels.

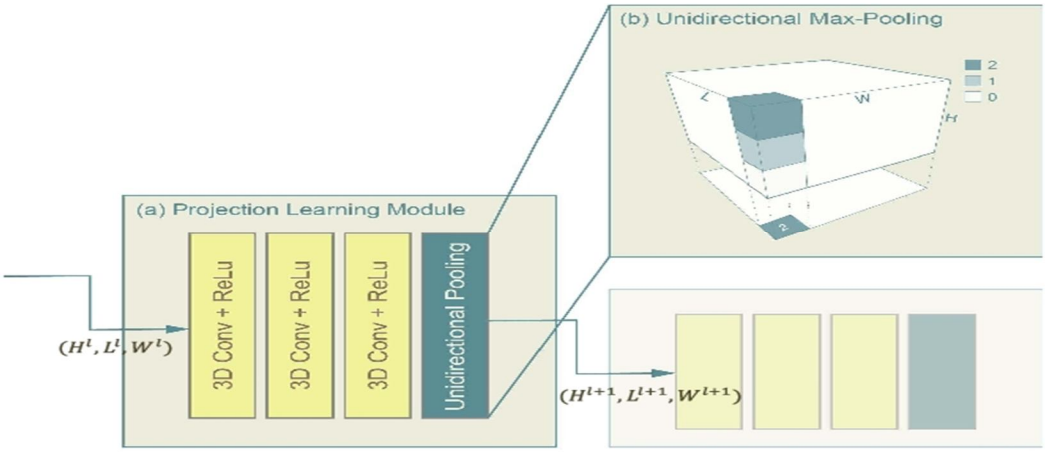


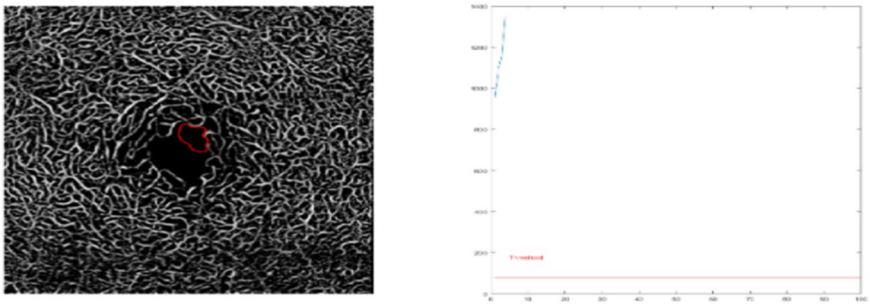
Fig. The structure of the PLM and the unidirectional pooling in 3D-To-2D IPN.

C. Projection Learning Module

PLM consists of three 3D convolution layers and one unidirectional pooling layer. The convolutional layers are used to extract image features and the unidirectional pooling layer is used to select effective features along the projection direction.

III. RESULTS

The results of FAZ segmentation using IPN. The red line represents the ground truth of threshold values of 3D to 2D IPN.



(a)

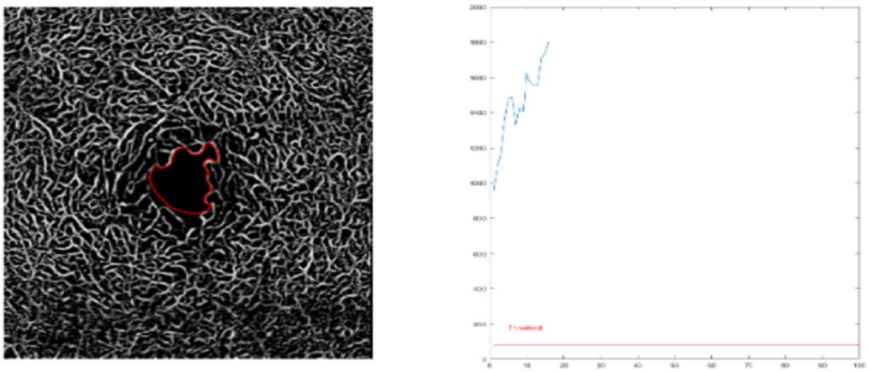


Fig.4.FAZ segmentation results.

The difference between vessel area density and vessel length density.

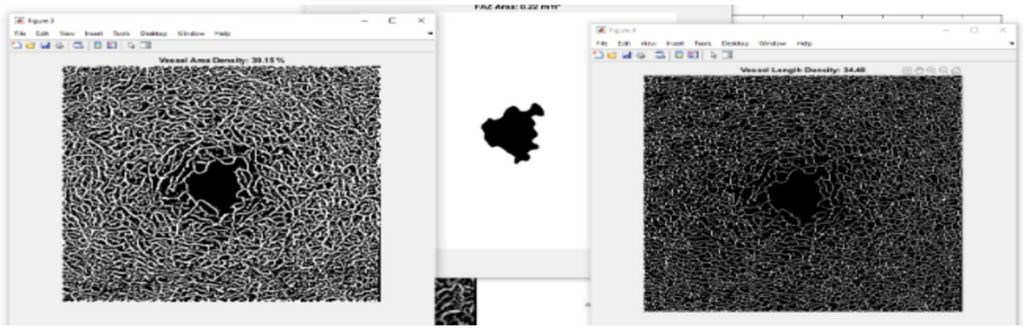


Fig.5.Differnce between vessel area density and vessel length density.

A. Comparitive Results of both OCTA and CNN by using IPN

s.no	Issue	Method	DICE (OCTA)	BACC (OCTA)	DICE (CNN)	BAAC (CNN)
1	FAZ	IPN	0.8861	0.9471	0.6229	0.9463
2	FAZ	IPN	0.8851	0.9171	0.6216	0.9739
3	FAZ	IPN	0.8861	0.9471	0.6250	0.9975
4	FAZ	IPN	0.8851	0.9171	0.6076	0.9947

Table 1 represents the comparitive results of DICE and BACC values.

B. Comparitive Experimental Results

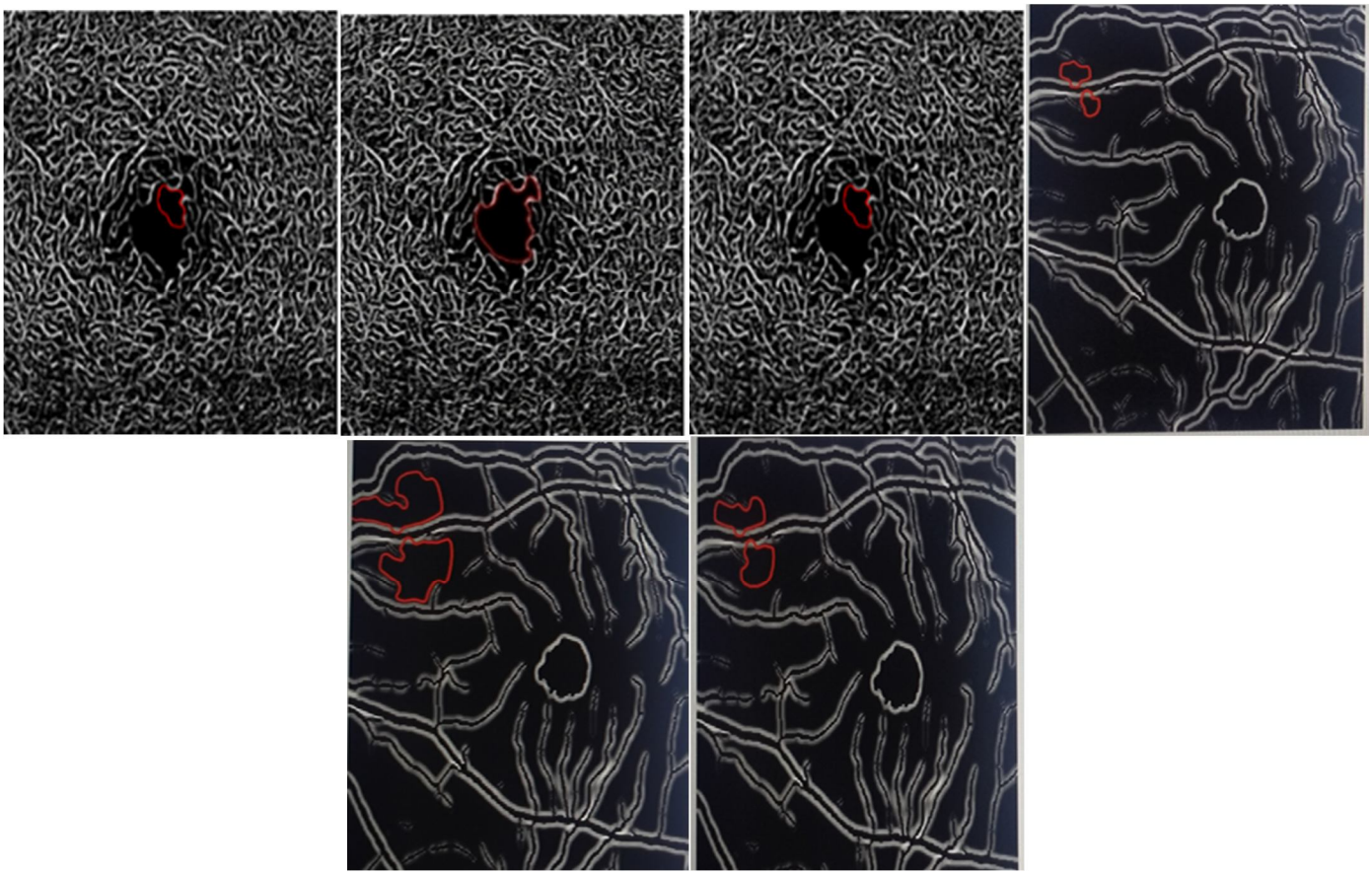


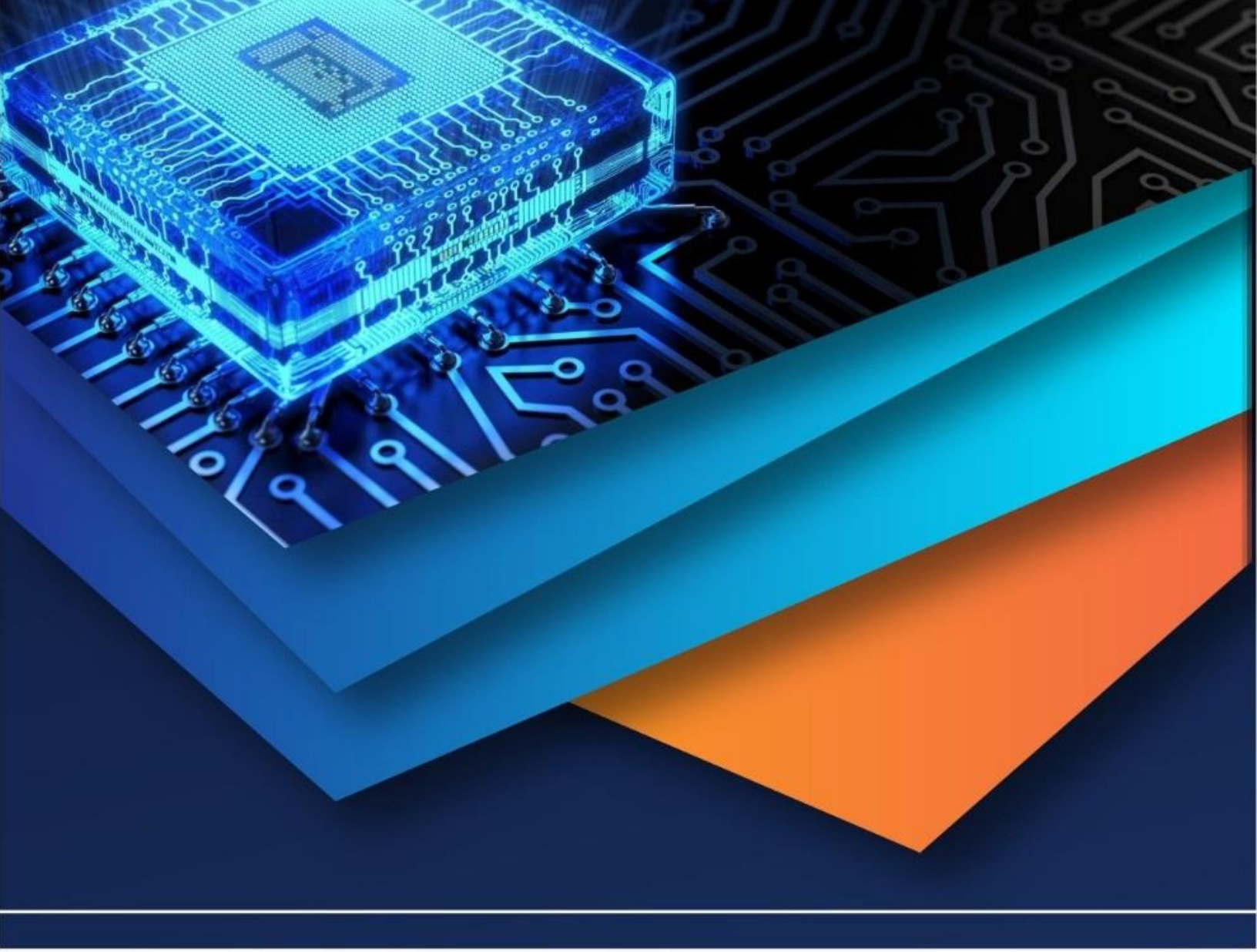
Fig comparitive results of CNN and OCTA

IV. CONCLUSION

The purpose of this study introduce anew deeop learning(DL) model for segmentation of the fovea avascular zone in OCTA images and comparitive results with those of the devices built in software and manual measurements in healthy subjects and diabetic patients.in this study, to train a deep convolution neural network(CNN) mode, OCTA images were used as training/validation dataset. we proposed a 3d to 2d segmentation network,IPN .which can be applied to FAZ segmentation results.The key insight is projection learning module, in which we introduce a unidirectional pooling layer is used effective information of 3D input data into 2D segmentation results.It does not need projection maps in the segmentation results.The uses of this information make the proposed method more accurate the basline methods.

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