International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

RETINAL VESSEL SEGMENTATION USING DEEP LEARNING

Aditya Sonawane[1], Anushka Sawanat[2], Zeel Rajpara[3], Prof. Snigdha Bangal[4]

[1]Aditya Sonawane, Dept. of Information Technology Engineering, Atharva College of Engineering
[2]Anushka Sawant, Dept of Information Technology Engineering, Atharva College of Engineering
[3]Zeel Rajpara, Dept of Information Technology Engineering, Atharva College of Engineering
[4]Prof. Snigdha Bangal, Dept. of Information Technology Engineering, Atharva College of Engineering

---

Abstract - *A serious deficit of professional viewers has prompted computer assisted monitoring. Assessment of blood vessels network plays an important role in diagnosis of ophthalmic pathologies. This work examines the blood vessel segmentation methodologies in two dimensional retinal images acquired from a Fundus Image. Digital images are obtained from the retina and graded by trained professionals (Ophthalmologist). We use a GPU implementation of deep max-pooling convolutional neural networks to segment blood vessel. Our technique is tested on publicly available DRIVE dataset and the results demonstrate the high effectiveness of the deep learning technique.*

Key Words: **Deep Learning, Convolutional Neural Networks, Artificial Neural Networks (ANN), DRIVE dataset, Retina, Fundus Image.**

1. INTRODUCTION

Segmentation of retinal vessels helps ophthalmologists in finding various attributes such as thickness, run length, tortuosity, and this pattern can be used to find first level pathological cue to find age related hypertension, and other cardiovascular ophthalmologic diseases like diabetes, hypertension and arteriosclerosis.

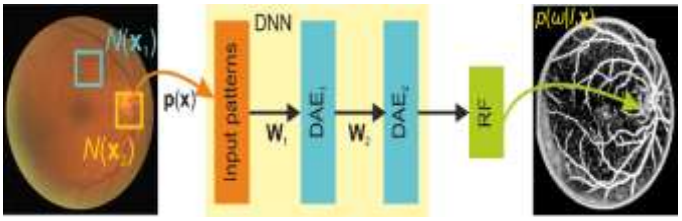
A medical procedure, *fluorescein angiography* is used in which a *fluorescent* dye is injected into the bloodstream. The dye focuses the blood vessels in the back of the eye with a unique colour so they can be photographed. This test is often used to manage eye diseases and conditions such as diabetes and more. It has a lot of side effects on patient's kidney and heart, also dye needs to be discharged from body soon.

Computer assisted analysis of retinal vessel topography assists in developing powerful screening systems for diabetic retinopathy, thinning of arteries, laser surgery and localizing of foveal avascular region.*[1]* Vessel tortuosity is a source of significant information about hypertensive retinopathy whereas vessel diameter had been studied to be in connection with hypertension.*[3]*

Such a segmentation along with using modern technologies like deep learning can provide us with more accurate results. In this method, deep learning architecture generates the vessel probability map which distinguishes the vessels and the background in adequate contrast region. In our approach we integrate fully-connected conditional random fields to combine the vessel probability map and long-range interactions among pixels. Fully-connected conditional random fields produce binary vessel segmentation as output. Deep learning method and fully connected treats vessel segmentation as a boundary detection problem.*[2]* This method is generally used to distinguish the vessels from the background in pathological regions in retinal fundus images.

2. PROPOSED APPROACH

The procedure of proposed Retinal Vessel classification method is shown in below figure. It contains training and testing stages. In training stage, fundus samples are used as input and the output is a trained classifier model.



Using the local patch set, local features are extracted by unsupervised learning model, the deep autoencoder. In the next step, visual vocabulary is constructed based on clustering all local feature vectors. Finally, classifier is trained by supervised learning with labels. In testing stage, the input is a Fundus image with unknown type, and the output is its predicted type label. Bearing similarity to the training stage, the image is again divided into patches.

An autoencoder is as a merger of encoder and decoder which is used to learn data coding under unsupervised conditions. The encoder is built up of an input layer and a hidden layer, which converts an input image into feature vector. The decoder in turn is made up of a hidden layer and an output layer that transform feature to output feature. Functions can be either sigmoid or tanh activation functions, which is used to activate the unit in each layer. The reconstruction of the input feature from an abstract and compressed output feature vector is considered when approximated.

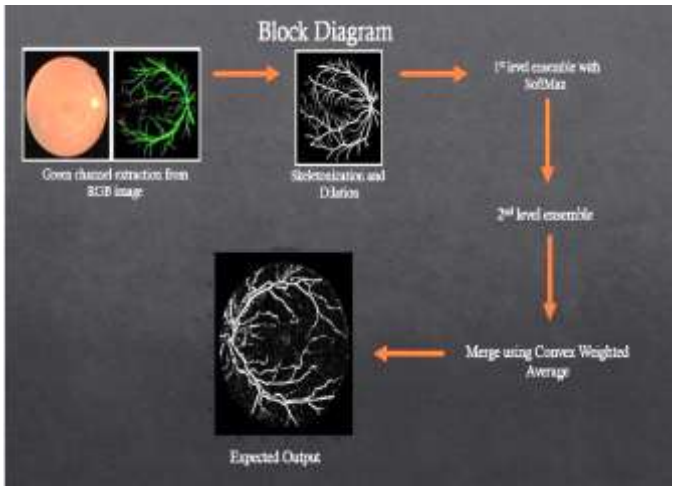
3. METHODOLOGY

Neural Network

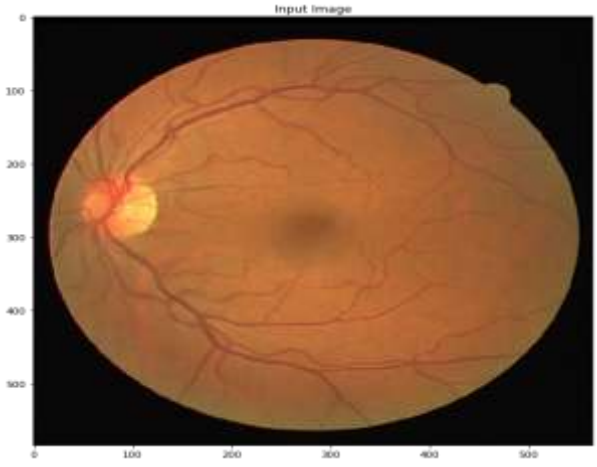
In image recognition, neural networks are largely responsible to analyse images in biological and artificial neural systems. Just like a human brain, ANN is based on a collection of artificial neurons which mimic the behaviour of traditional biological neurons and can transmit signals via edges which are nothing but the equivalent of synapses of biological brain.*[4]*

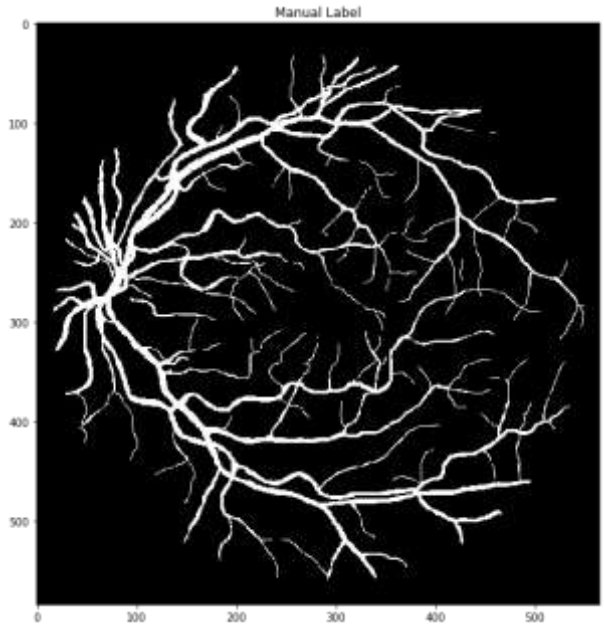
ANNs were built to learn techniques like a human brain does and use it to solve problems in a similar way. This not only allowed for computation of complex problems at faster and more accurate rate, but also it was able to perform tasks that were known to be performed by only humans, like drawing and painting. [5]

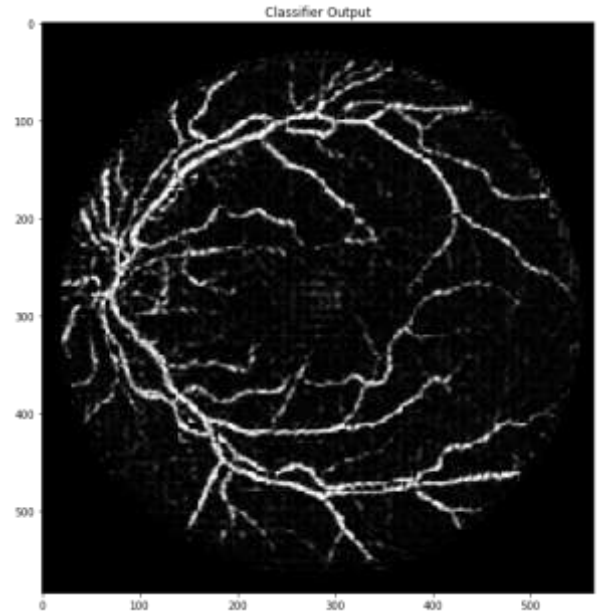
4. BLOCK DIAGRAM



5. RESULT AND DISCUSSION







We have implemented Retinal Vessel Segmentation by taking input fundus image and training and then testing it on the actual test data set. We obtain an output segmented vessel in Black and white.

6. CONCLUSION

Without any domain knowledge, DNN can learn hierarchical feature representations from the raw pixel data. In medical imaging this has amazing possibilities where manual segmentation of features can be tedious. Thus, we propose a fully convolutional architecture capable of prediction for retinal vessel segmentation task. We have shown state-of-the-art performance of our proposed architecture on DRIVE database tests.

REFERENCES

[1] S. Chaudhuri; S. Chatterjee; N. Katz; M. Nelson; M. Goldbaum" Detection of blood vessels in retinal images using two-dimensional matched filters"- IEEE Transactions on Medical Imaging, 1989.

[2] E.O. Velipasaoglu; K.L. Berrier; H. Sun; D.S. Khoury," Determining locations of intracardiac basket and probe electrodes from multiplane fluoroscopic images" Computers in Cardiology 1998. Vol. 25 (Cat. No.98CH36292)17.

[3] Michael D. Abramoff; Mona K. Garvin; Milan Sonka;" Retinal Imaging and Image Analysis" IEEE Reviews in Biomedical Engineering (Volume: 3)

[4] Xiaoyi Jiang; D. Mojon" Adaptive local thresholding by verification-based multi threshold probing IEEE Transactions on Pattern Analysis and Machine Intelligence (Volume: 25, Issue: 1, Jan. 2003)

[5] Ahmed Elgammal Sigma Xi, the Scientific Research Society Paper published AI Is Blurring the Definition of Artist: Advanced algorithms are using machine learning to create art autonomously, 2019.