



RESEARCH ARTICLE

Prediction of ROP Zones Using Deep Learning Algorithms and Voting Classifier Technique

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Abstract

Retinopathy of prematurity (ROP) can cause blindness in premature neonates. It is diagnosed when new blood vessels form abnormally in the retina. However, people at high risk of ROP might benefit significantly from early detection and treatment. Therefore, early diagnosis of ROP is vital in averting visual impairment. However, due to a lack of medical experience in detecting this condition, many people refuse treatment; this is especially troublesome given the rising cases of ROP. To deal with this problem, we trained three transfer learning models (VGG-19, ResNet-50, and EfficientNetB5) and a convolutional neural network (CNN) to identify the zones of ROP in preterm newborns. The dataset to train the model contains 1365 fundus images from the ROP screening. This dataset was gathered from the Private Clinic Al-Amal Eye center in Baghdad, Iraq. The models above are ensemble through voting classifier techniques to increase the performance. The proposed method had an overall accuracy of 88.82 percent when employing the voting classifier. On the other hand, EfficientNetB5 has outperformed other models in terms of accuracy with 87.27%.

Keywords Artificial intelligence · Machine learning · Deep learning · Deep convolutional neural networks · Voting classifier · Retinopathy of prematurity · Fundus images

Abbreviations

ROP	Retinopathy of prematurity
AI	Artificial intelligence
ICROP	International classification of retinopathy of prematurity
RETCAM	Retinal camera
DL	Deep learning
ML	Machine learning
CNN	Convolutional neural network
DCNN	Deep convolutional neural network
DNN	Deep neural network
AUC	Area under the curve
ROC	Receiver operating characteristics

KIDROP	Karnataka internet-assisted diagnosis of retinopathy of prematurity
VGG	Visual geometry group
GA	Genetic algorithm
GPU's	Graphics processing units
SVM	Support vector machine
Tele- ROP	Telemedical retinopathy of prematurity

1 Introduction

In 1940, Terry was the primary researcher to define and characterize retinopathy of prematurity (ROP) as retrolental fibroplasia caused by a retinal detachment behind the lens [1]. Since then, it has been generally accepted that this is the primary cause of childhood blindness worldwide [2–4]. As a result, with the advent of neonatal intensive care units, there has been an increase in the percentage of newborns that survive birth at a gestational age of fewer than 37 weeks [2]. As many as 15 million infants are born each year prematurely worldwide [3]. These days, ROP is a major public health issue [4]. Some significant causes of ROP-related blindness are a paucity of ophthalmologists trained to diagnose and treat the disease and a lack of delayed screening [4]. If

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