A Deep Learning Model for Retinopathy of Prematurity Stage III Disease Diagnosis
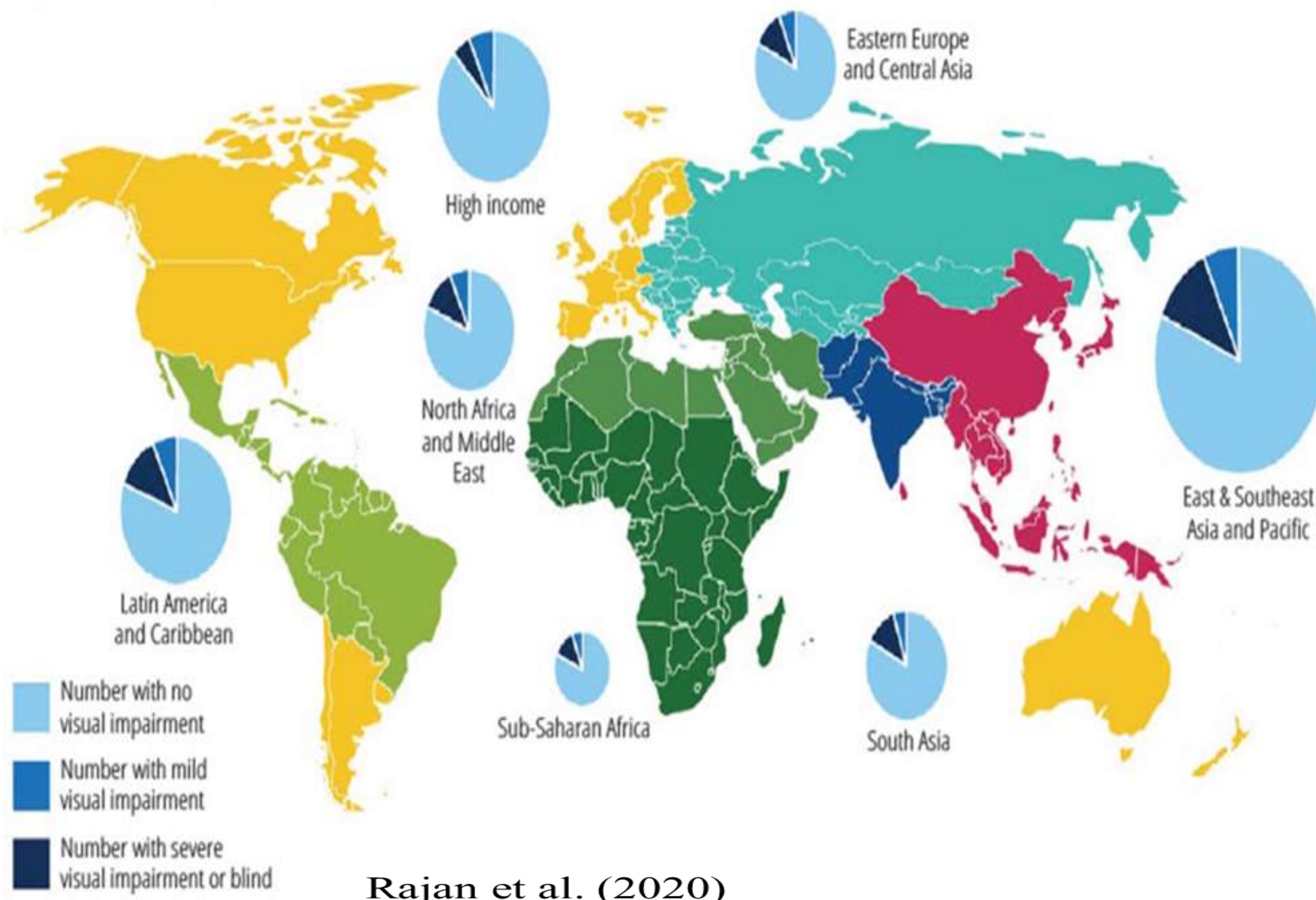
## Elizabeth Ndunge Mutua
Strathmore University

Introduction

- Neonatal Retinopathy of Prematurity (ROP) is an eye disease which affects newborn babies born after thirty-two weeks and or with a weight of less than 1.5kg (Palmer et al., 2021)
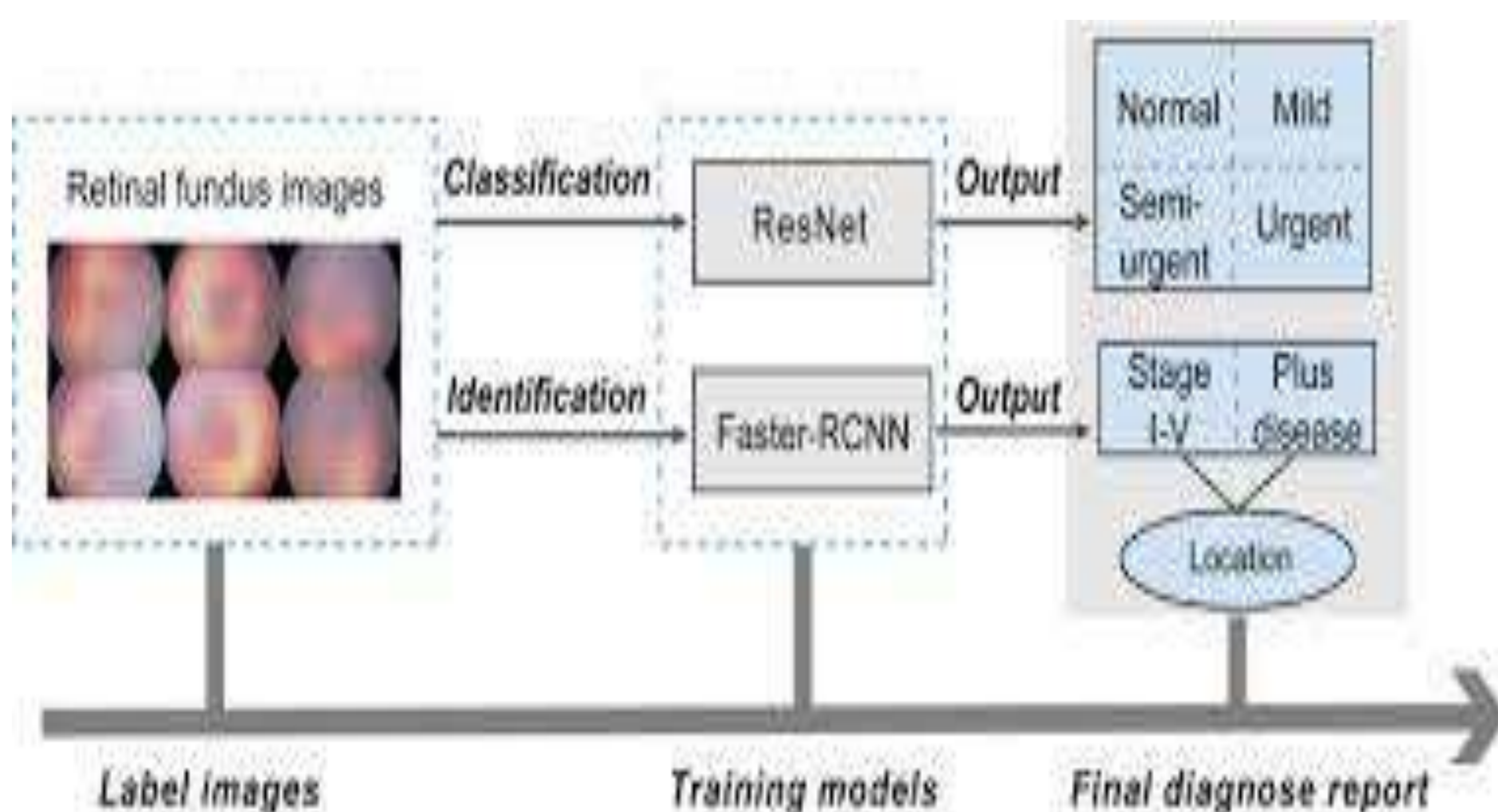

Eastern Europe and Central Asia
High income
North Africa and Middle East
East & Southeast Asia and Pacific
Latin America and Caribbean
Sub-Saharan Africa
South Asia

- Number with no visual impairment
- Number with mild visual impairment
- Number with severe visual impairment or blind

Rajan et al. (2020)

Objectives

- To develop a Deep Learning Model to diagnose Retinopathy of Prematurity stage III Disease

Stage 1 Stage 2 Stage 3 Stage 4 Stage 5
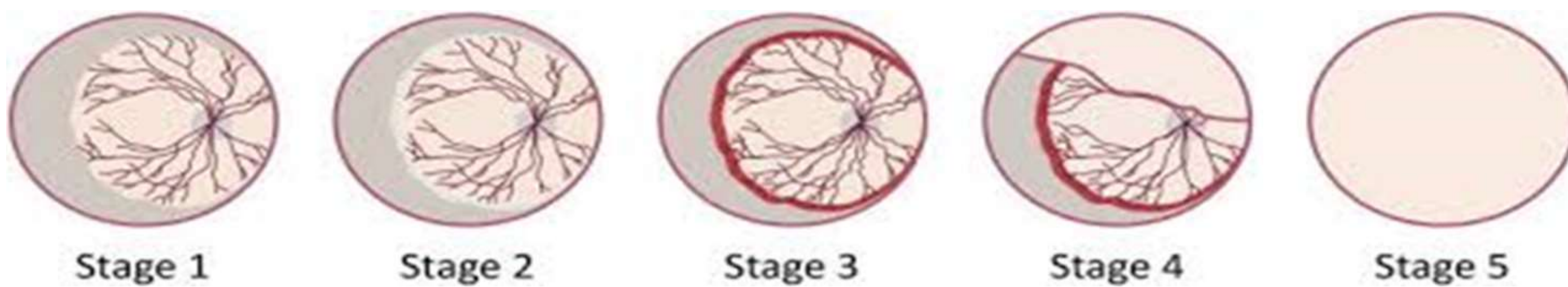
Retinopathy of prematurity Stages (Tsai et al., 2021, P.10)

Methodology

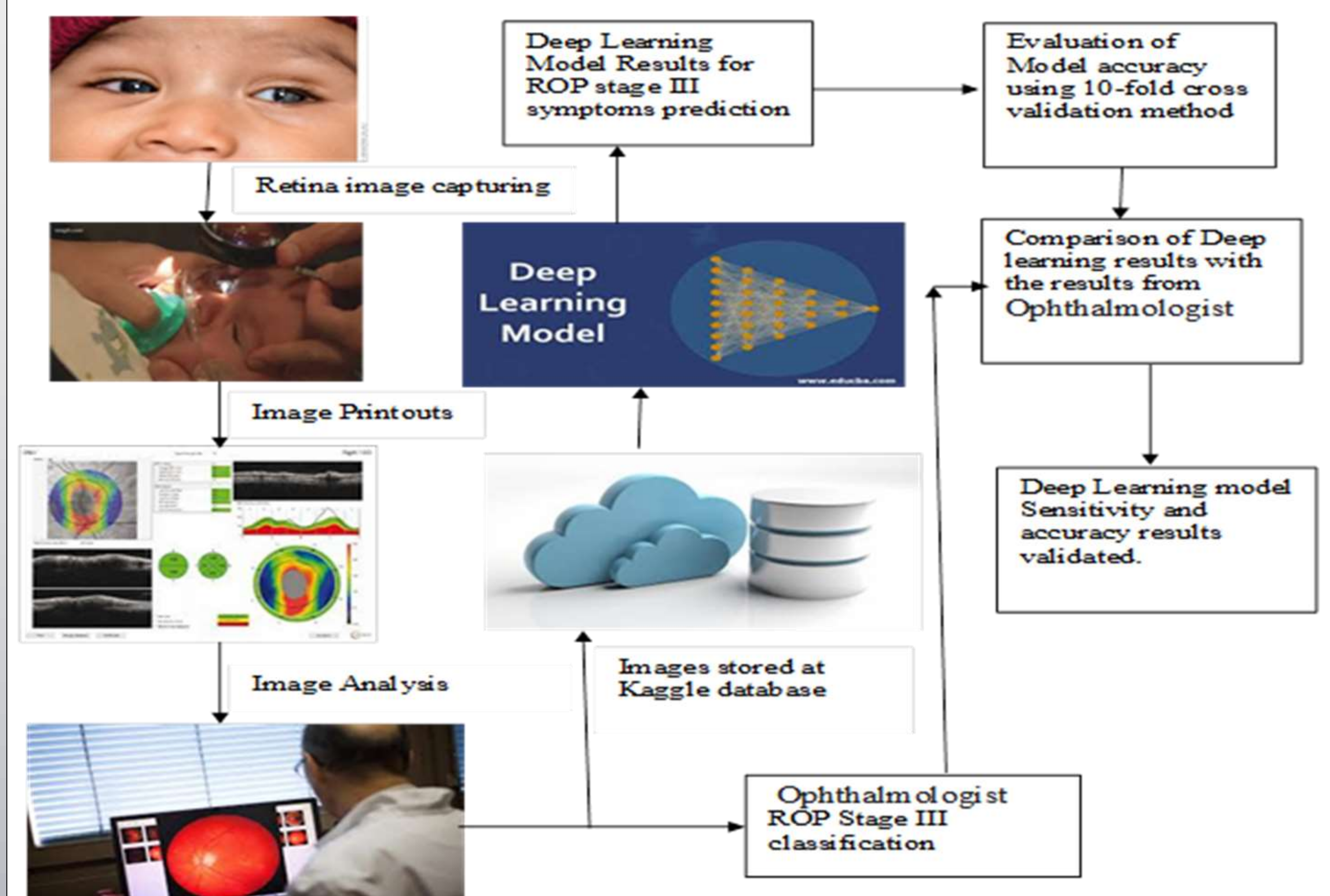- The study used secondary data from Kaggle online database. Access to this database can be done through this link (https://www.kaggle.com/c/diabetic-retinopathy-detection/data).

Retinal fundus images
Classification → ResNet → Output → Normal | Mild | Semi-urgent | Urgent
Identification → Faster-RCNN → Output → Stage I-V | Plus disease → Location

Label images → Training models → Final diagnose report

Results

- Table 1

	Without Augmentation			With Augmentation		
	Train	Test	Validation	Train	Test	Validation
Stage 1	141	70	23	705	70	23
Stage 2	796	398	132	796	398	132
Stage 3	720	360	119	720	360	119

- Confusion matrix of the hybrid architecture. Each row refers to the distribution of predictions for images of a particular stage; each column refers to the true stages of images predicted as a particular stage.

	Stage 1	Stage 2	Stage 3
Stage 1	271	56	23
Stage 2	39	245	114
Stage 3	37	98	225

	Proposed CNN Architecture		Abràmoff et al. (2020)	Dekhil et al. (2021)	Acharya et al. (2019)	El-Hang et al. (2021)
	5-Fold Cross Validation	10-Fold Cross Validation				
Accuracy	88%	89%	75%	75%	82%	85.9%
Sensitivity	87%	89%	30%	N/A	82%	82%
Specificity	94%	95%	95%	N/A	88%	86%

Retina image capturing
Deep Learning Model Results for ROP stage III symptoms prediction
Evaluation of Model accuracy using 10-fold cross validation method
Image Printouts
Deep Learning Model
Comparison of Deep learning results with the results from Ophthalmologist
Image Analysis
Images stored at Kaggle database
Deep Learning model Sensitivity and accuracy results validated.
Ophthalmologist ROP Stage III classification

Conclusions

- Retina Image segmentation is an important step for image preprocessing.
- This helps to increase the accuracy of the Deep learning model to disease diagnosis
- Other methods such as transfer learning can be used to learn the features from the images and compare the results with those of images segmentation.

Bibliography

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Contact
Elizabeth Ndunge Mutua
Phd Student, Strathmore University,
Email: emutua09@gmail.com
+254727448796