Detecting Blindness Before it Happens

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Object and Context

Dataset provided by
Aravid Eye Hospital in India

- Help detect and prevent diabetic retinopathy in rural areas
- Currently rely on highly trained doctors for diagnosis
- Fast and reliable classification for treatment and prevention of blindness

Diabetic Retinopathy

- Damage occurs to the retina due to diabetes
- Around 40% to 45% of Americans with diabetes have some stage of the disease.
- All forms of diabetic eye disease have the potential to cause severe vision loss and blindness.
- The early stages of diabetic retinopathy usually have no symptoms.
- Early detection reduces blindness risk by 80%

Source: mayoclinc.org and https://nei.nih.gov/

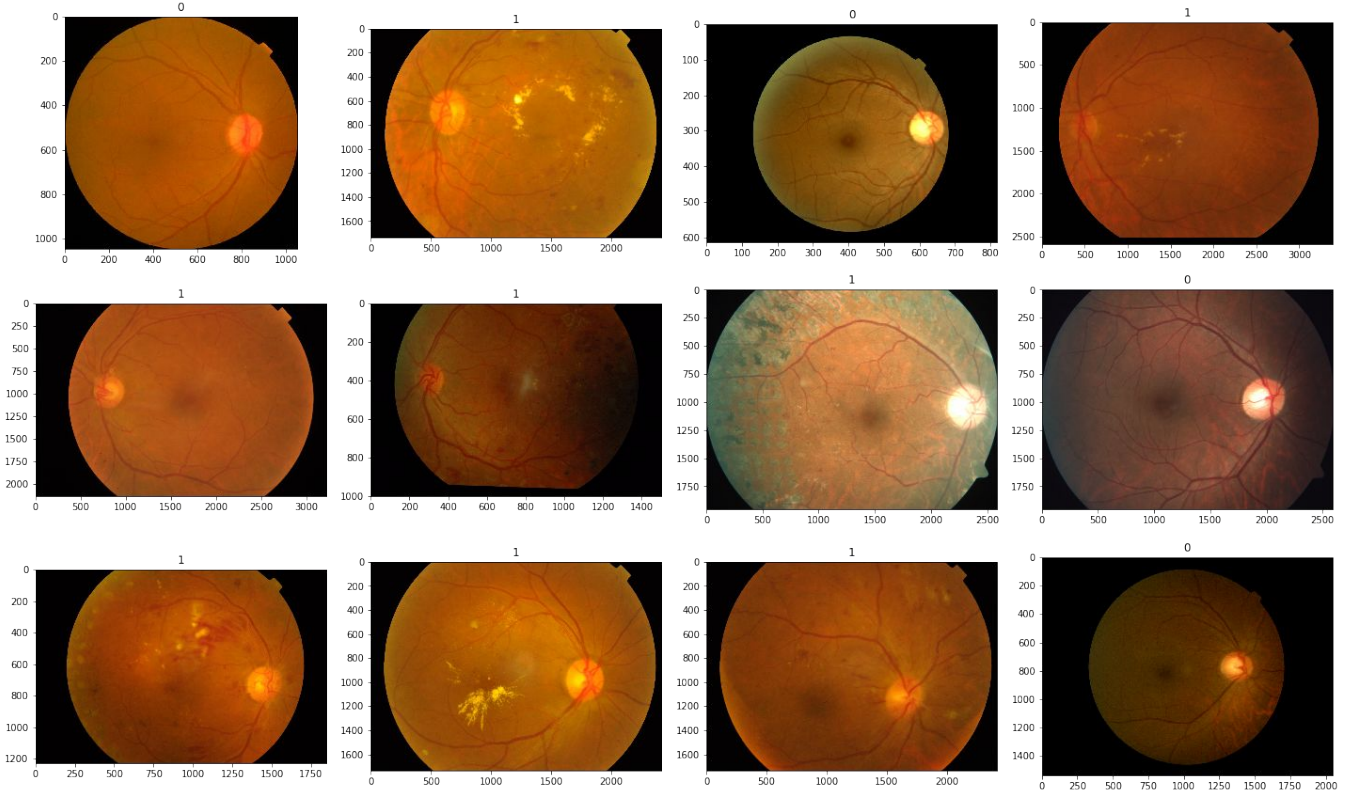
Diabetic Retinopathy is leading causes of **preventable** blindness!

The Dataset

- Fundus Photography - photographic the rear of the eye
- Different Fundus cameras with different resolutions
- Different orientations and center points of focus
- Noise was introduced into the photos to help generalize the model

- 1928 categorized photos
- 50/50 split between healthy and diabetic retinopathy

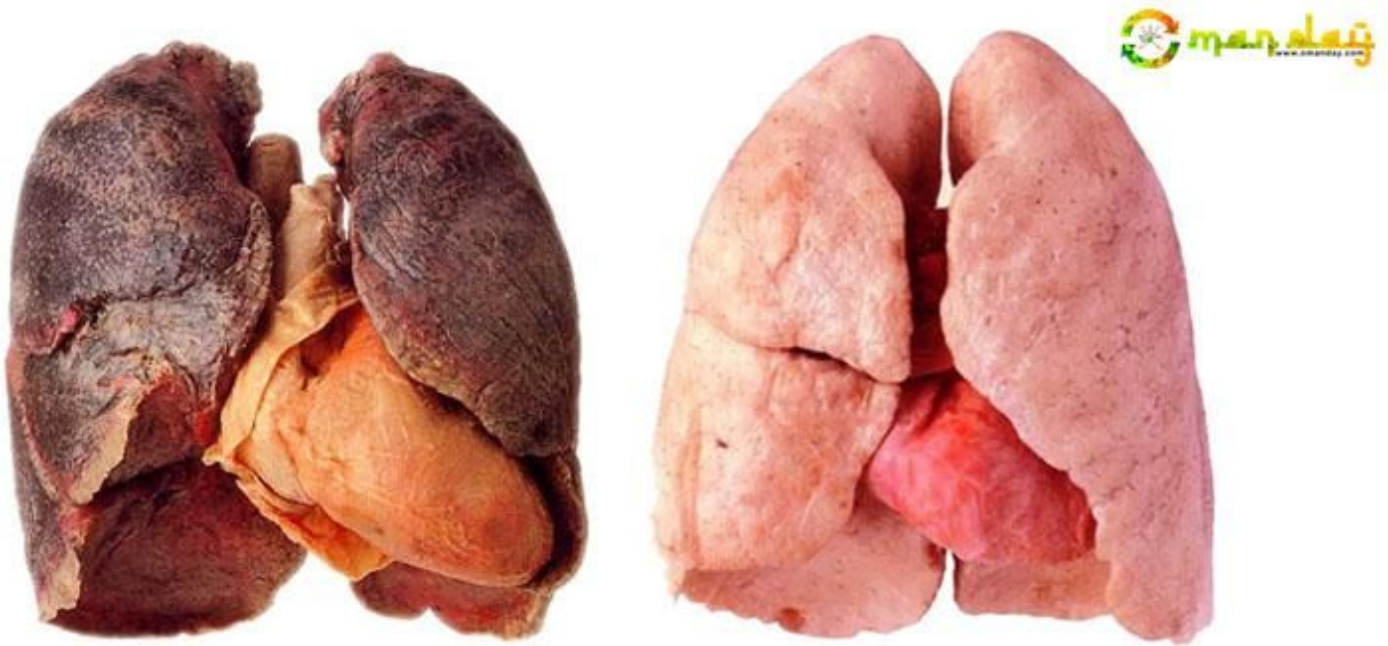
The Dataset



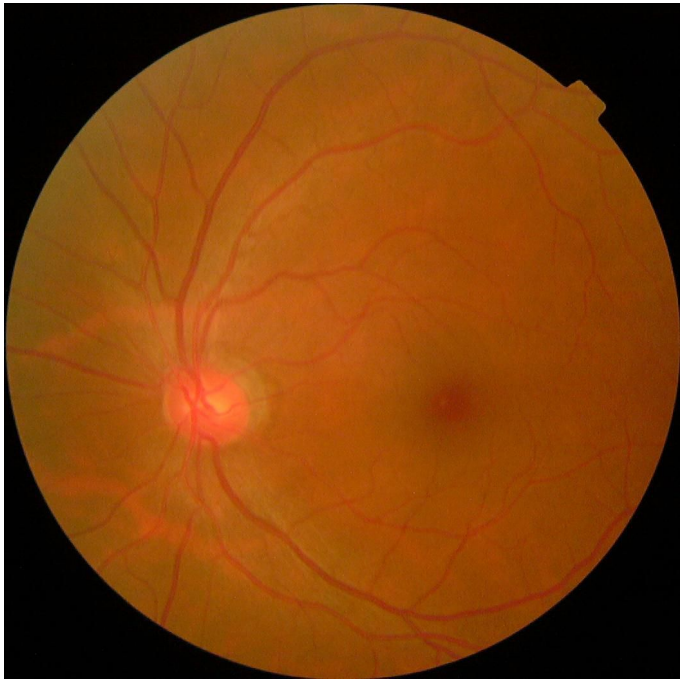
Problem: Computer Vision

Which one is a dog?

Which one is the healthy lung?

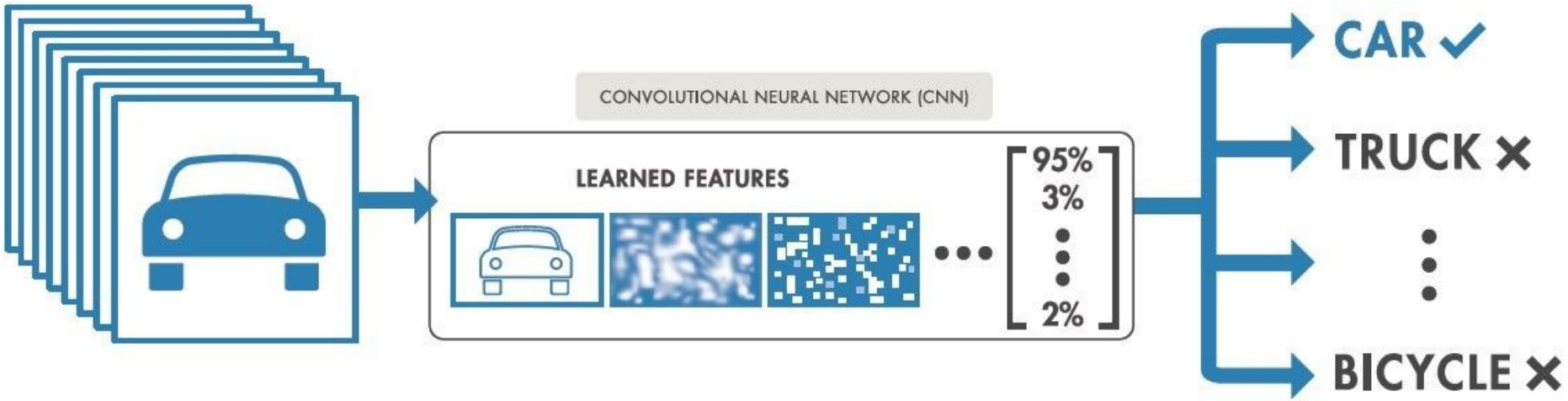


This is a healthy eye

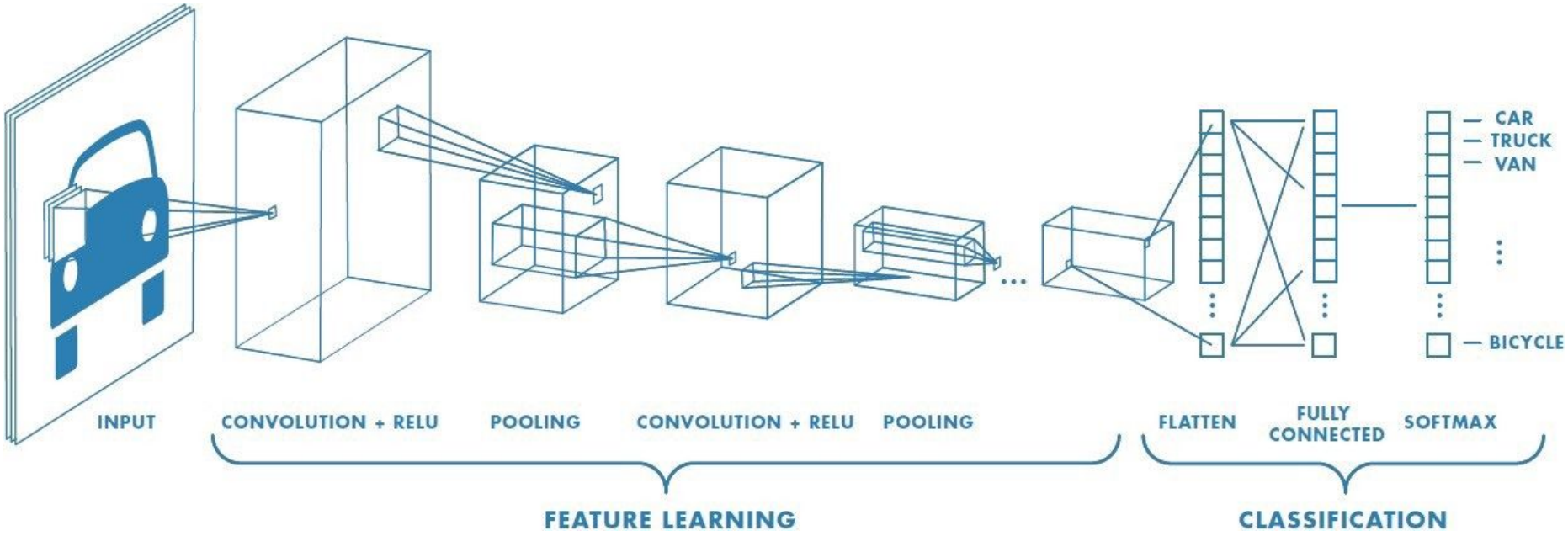


Which is the healthy eye?

Convolutional Neural Network

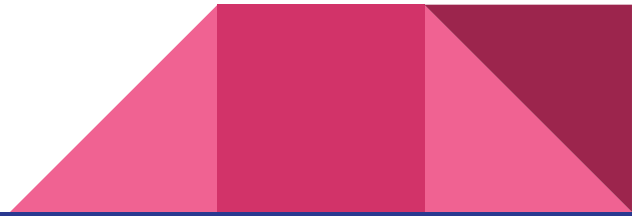


Convolutional Neural Network



Convolutional Neural Network

- Allow us the extract features from images
- Convolution of multiple layers
- These convolutions act as filters
- Filters are simply math matrices that detect the presence of a feature
- Weights are then backpropaged to optimize for loss



We don’t need to be highly trained doctors to diagnose Diabetic Retinopathy!

Model Details

Convolution Neural Network

- `Total params: 2,913,281`
- `Trainable params: 2,913,025`
- 3.5 hours to run model
- 74s to predict 549 images
- 7.4 diagnosis per second!

93%

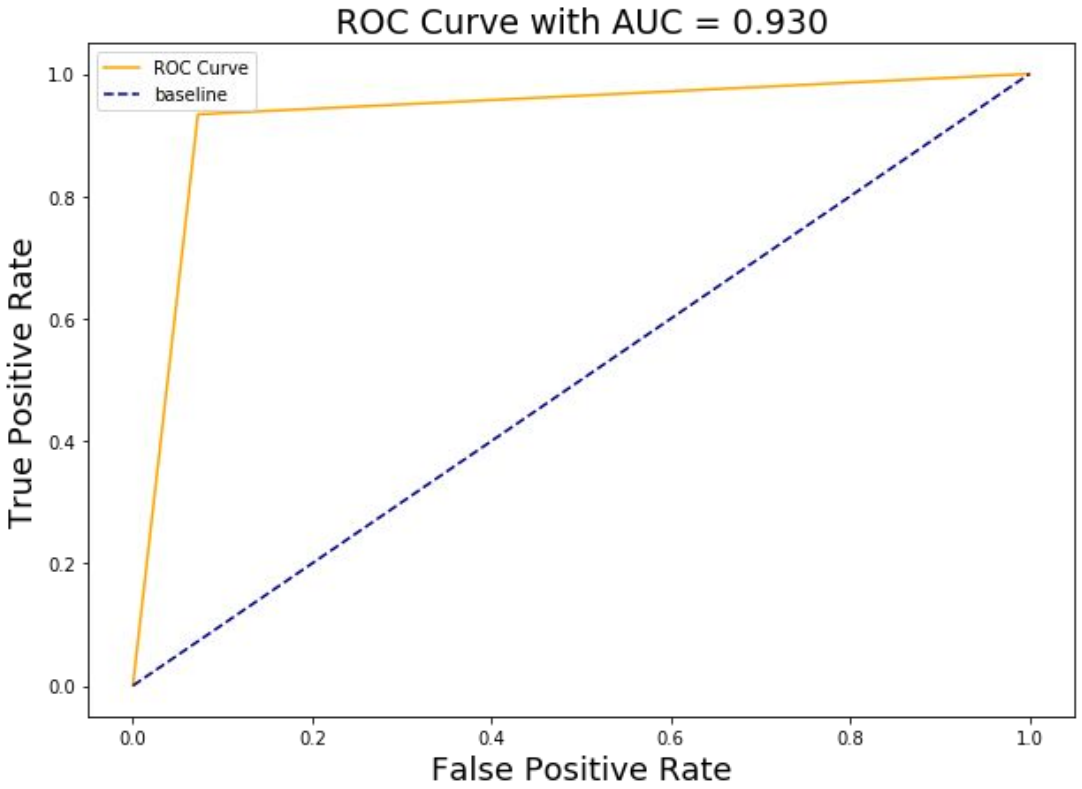
F1-score AND ROC AUC Score

Confusion Matrix

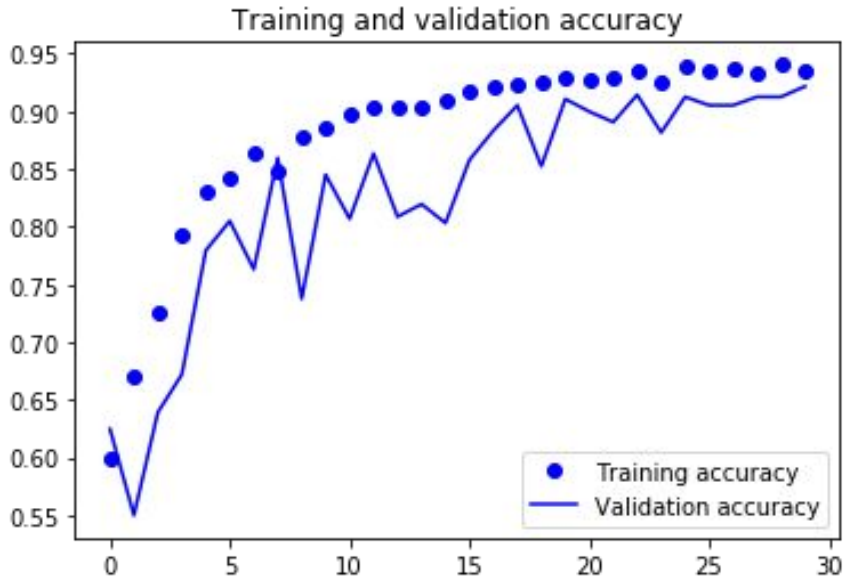
	Actual Healthy	Actual DR
Predicted Healthy	243	19
Predicted DR	19	268

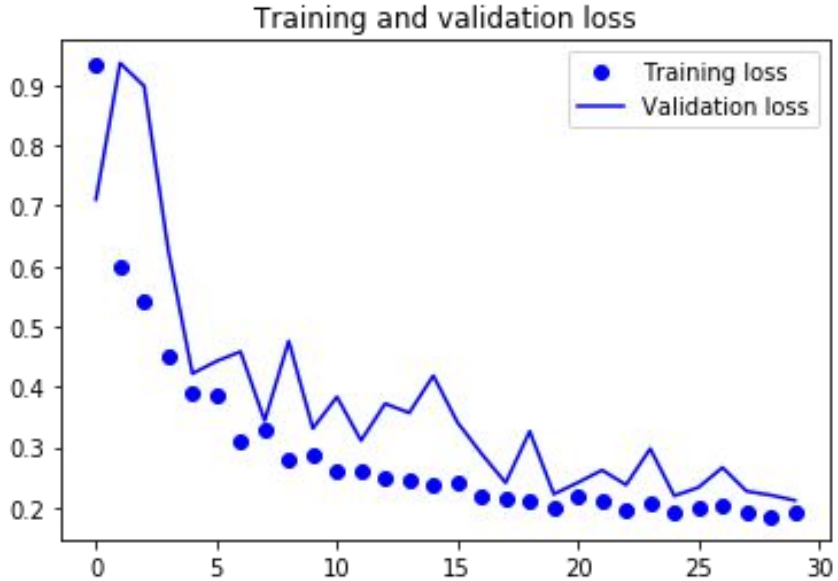
93% F1-score

Very effective at diagnosing Diabetic Retinopathy



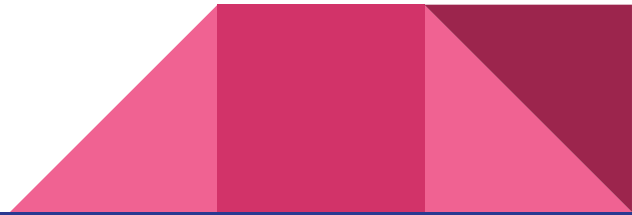
Model Accuracy and Loss





Recommendations

- Only use model for preliminary screening
- Reduce overfitting
- More data for better accuracy
- Use predetermined weights for new models
- Kaggle.com for community insights



Questions?