

1. ABSTRACT

In this project a deep learning algorithm was developed using transfer learning to retrain the **Inceptionv3** convolutional neural network multiple times. The algorithm uses data from 516 Diabetic Retinopathy images (more information about the data can be found here: <https://idrid.grand-challenge.org/Home/>) provided for this project. The algorithm trains on 413 images and is tested on 103 images.

To train the algorithm, transfer learning is used to retrain the Inceptionv3 CNN 11 different times. A new data set is used each time the CNN is retrained. The data is divided into 5 classes(0, 1, 2, 3, 4). The first time the CNN is retrained, all the classes are used for training and testing. The remaining 10 times the CNN is retrained, only a combination of 2 classes are used for testing and training. Using 2 sets at a time, with 5 different sets of data, gives 10 possible combinations. Every time the CNN is retrained, new predicted probabilities are calculated. The predicted probabilities are all added together to create a single set of predicted probabilities. After retraining the CNN 11 times, each class for each sample will have a summation of 5 different probabilities. The maximum probability score for each class is 5.0 (minimum 0.0). From the final predicted set of probabilities, the algorithm classifies each image by choosing the class with the highest score.

The algorithm follows this order:

1. Retrain CNN using all classes of data
2. Make a matrix with 'Samples x Classes' size and save all probabilities within this matrix
3. Retrain CNN using one combination of 2 Classes
4. Add the probabilities to the matrix made in step 2
5. Start at step 3 again (go to step 6 only when all combinations of 2 classes have been used to retrain the CNN)
6. Classify all samples based on the class with the highest probability score

2. TEST RESULTS

The CNNs were retrained; see the following pages of this report and PredictionResults.xlsx for the updated results.