Blind Detection

Sckitlearn classification

New model created using evenly distributed categories.

Note: Apply grid search and cross validation after getting it to work.

On the data set

The dataset provides a large set of retina images taken using fundus photography under a variety of imaging conditions.

A clinician has rated each image for the severity of diabetic retinopathy(DRP) on a scale of 0 to 4:

1. No DR
2. Mild
3. Moderate
4. Severe
5. Proliferative DR

In [1]:

```
# File moving imports
import os
import shutil

# Standard scientific Python imports
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np

# Import datasets, classifiers and performance metrics
import skimage.io as io
from skimage.color import rgb2gray
from skimage.transform import resize
from sklearn import svm, metrics
from sklearn.linear_model import SGDClassifier
from sklearn.model_selection import train_test_split

#save model
from joblib import dump, load
```

Sorting all images by category into folders

Sort all images into diffrent folders based on category to remove bias in the data.

All images from the "DrpTest" folder are copied over and sorted into 5 diffrent folders inside the "Sorted" folder.

In [51]:

```
srcpath = "Data/DrpTest"
labels = pd.read_csv("C:/Users/mauri/Documents/GitHub/EyeDiseaseDetection/Data/train
srcfiles = labels.index
```

```
labels = labels.set_index('image')
# extract the extension from filenames and filter out duplicates

#create a category img limit
limit = 600
limitTracker = [0,0,0,0,0]
# create destination directories and store their names along with full paths
for filename in labels.index:
    filename = filename + '.png'
    fileCategory = labels.loc[(filename)[0:-4], 'level']
    if limitTracker[fileCategory] < limit:
        limitTracker[fileCategory]+=1
        oldFolder = srcpath + '/' + filename
        # newFolder = 'Data/Sorted/testSet' + str(labels.loc[(filename)[0:-4], 'leve
        newFolder = 'Data/Sorted/' + str(labels.loc[(filename)[0:-4], 'level']) + '_
        shutil.copy(oldFolder, newFolder)
# note: might give keyerror if it reaches the labels.csv file
```

Labels

Load the labels containing the DRP category of the images used while training the model.

In [2]:

```
labels = pd.read_csv("C:/Users/mauri/Documents/GitHub/EyeDiseaseDetection/Data/train
```

In [3]:

```
labelsIndexed = labels.set_index('image')
labelsIndexed.sample(10)
```

Out[3]:

	level
image	
31705_right	0
35067_right	2
43541_left	0
8807_left	0
21834_right	0
24549_left	2
39526_right	0
17686_right	0
1077_left	1
11152_left	0

Sorting labels

Create diffrent label dataframes for each DRP category and link them back together to sort them.

This makes it so that the labels lign up with the new data folders createded.

In [6]:

```
# Sort labels by category, then take the first x images
imagesPerCategory = limit
SortedLabels = (labelsIndexed.loc[labelsIndexed['level']==0])[0:imagesPerCategory]
SortedLabels = SortedLabels.append((labelsIndexed.loc[labelsIndexed['level']==1])[0:
```

```
SortedLabels = SortedLabels.append((labelsIndexed.loc[labelsIndexed['level']==2])[0:
SortedLabels = SortedLabels.append((labelsIndexed.loc[labelsIndexed['level']==3])[0:
SortedLabels = SortedLabels.append((labelsIndexed.loc[labelsIndexed['level']==4])[0:
SortedLabels.head(limit+3)
```

Out[6]:

	level
image	
10_left	0
10_right	0
13_left	0
13_right	0
17_left	0
...	...
969_right	0
970_left	0
15_left	1
17_right	1
30_left	1

603 rows × 1 columns

In [55]:

```
# Turn the pandas dataframe into a numpy array that can be read by the model
label_list =(SortedLabels[['level']].values.flatten().tolist())
label_list = np.asarray(label_list)
label_list
```

Out[55]:

```
array([0, 0, 0, ..., 4, 4, 4])
```

In [56]:

```
# Used in the evaluation section, translates the category number into readable text
label_names = ["No DR", "Mild", "Moderate", "Severe", "Proliferative DR"]
label_names[label_list[1]]
```

Out[56]:

```
'No DR'
```

Model

Loading the images

First, load the images using a load function that resizes all images to the same resolution and greyscale them to remove a third demension from the array.

In [57]:

```
standerdImgHeight = 597
standerdImgWidth = 896

def transformImage(f, img_num=None):
        img = io.imread(f)
        im_res = resize(img,(standerdImgHeight, standerdImgWidth))
        return im_res

def transformImageFlat(f, img_num=None):
        img = io.imread(f)
        # im_res = resize(img,(597, 896))
        ## Turn images grey
        img_gray = rgb2gray(img)
        im_res = resize(img_gray,(standerdImgHeight, standerdImgWidth))
        # Reshape 2d array into 1d array
        im_res = np.reshape(im_res, (standerdImgHeight*standerdImgWidth))

        return im_res
```

In [58]:

```
if __name__ == "__main__":
    img_collections = io.ImageCollection('Data/testSet/*.png',load_func=transformIma
    img_collectionsFlat = io.ImageCollection('Data/Sorted/*.png',load_func=transform
```

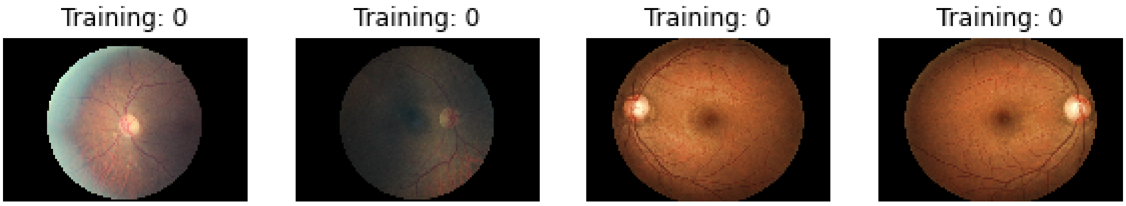
In [59]:

```
# Difrent shape of the 2 imgCollections
i = 0
print(img_collections[i].shape)
print(img_collectionsFlat[i].shape)
```

```
(597, 896, 3)
(534912,)
```

In [60]:

```
# Code for drawing example images (colored version used since 1d array is not recogn
_, axes = plt.subplots(nrows=1, ncols=4, figsize=(10, 3))
for ax, image, label in zip(axes, img_collections, label_list):
    ax.set_axis_off()
    ax.imshow(image, cmap=plt.cm.gray_r, interpolation="nearest")
    ax.set_title("Training: %i" % label)
```



Training: 0

Training: 0

Training: 0

Training: 0

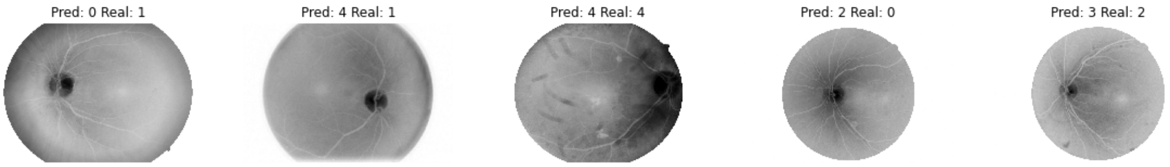
Creating the model

In [61]:

```
# flatten the images
n_samples = len(img_collectionsFlat)
data = img_collectionsFlat

# Create a classifier: a support vector classifier
clf = svm.SVC(gamma=0.001)
# clf = svm.LinearSVC()
# clf = SGDClassifier(random_state=42, max_iter=1000, tol=1e-3)

# Split data into 50% train and 50% test subsets
X_train, X_test, y_train, y_test = train_test_split(
    data, label_list, test_size=0.3, shuffle=True
)

# Learn the digits on the train subset
clf.fit(X_train, y_train)

# Predict the value of the digit on the test subset
predicted = clf.predict(X_test)
```

In [62]:

```
_, axes = plt.subplots(nrows=1, ncols=5, figsize=(20, 6))
for ax, image, prediction, realCat in zip(axes, X_test, predicted, y_test):
    ax.set_axis_off()
    image = image.reshape(597, 896)
    ax.imshow(image, cmap=plt.cm.gray_r, interpolation="nearest")
    ax.set_title(f"Pred: {prediction} Real: {realCat}")
```



Evaluation

In [63]:

```
print(
    f"CLassification report for classifier {clf}:\n"
    f"{metrics.classification_report(y_test, predicted)}\n"
)
```

```
CLassification report for classifier SVC(gamma=0.001):
              precision    recall  f1-score   support

           0       0.26      0.15      0.19       202
           1       0.24      0.23      0.23       173
           2       0.23      0.17      0.20       187
           3       0.34      0.22      0.27       186
           4       0.23      0.57      0.33       152

    accuracy                           0.25       900
   macro avg       0.26      0.27      0.25       900
weighted avg       0.27      0.25      0.24       900
```

In [65]:

```
# Save the model to a file for later evaluation/testing
dump(clf, 'Models/ModelSorted600.joblib')
```

Out[65]:

```
['Models/ModelSorted600.joblib']
```