Assignment A8: Classification using Neural Networks

CS 4640
Fall 2021

Assigned: 30 November 2021

Due: 10 December 2021 no later than 5pm

Investigate the use of neural networks to classify defects in the Coke bottle inspection problem. Develop the functions indicated below, and discuss the issues that arose and how they were addressed. For each give the performance results on the complete image dataset, and discuss possible improvements.

Note: DO NOT USE SCRIPTS. No function should write to the interpreter, draw, read or write files, etc., unless explicitly required in assignment. Headers must be indented correctly.

1. Develop a neural network that takes as input a vector of feature values (floats) which serve as inputs to the net and which produces eight binary outputs which represent the presence of the eight defects (i.e., output 1 has value 1 if the bottle is underfilled, etc.). Describe the following:

- features selected, why selected and how computed
- how the neural net was created
- how the neural net was trained
- give results on the 141 image dataset

Use the neural net in a function called *CS4640_NN_inspect* as decribed in the given header.

```
function defects = CS4640_NN_inspect(dir_name)
```

```
% CS4640_NN_inspect - inspect Coke images with neural net
% On input:
%     dir_name (string): directory path
% On output:
%     defects (nx8 array): Coke defect data
% Call:
%     dd_NN = CS4640_NN_inspect('bottle_images');
% Author:
%     <Your name>
%     UU
%     Fall 2021
%
```

2. Develop a neural net based approach to determine if there is a bottle in the middle of the image to be inspected. Describe your approach, issues faced, how they were resolved and any possible improvement ideas. Describe the following:

- features selected, why selected and how computed
- how the neural net was created
- how the neural net was trained
- give results on the 141 image dataset

Based on this, develop a Matlab function *CS4640_NN_no_bottle* as described below.

```
function b = CS4640_NN_no_bottle(im)
% CS4640_NN_no_bottle - detect missing bottle with neural net
% On input:
%     im (MxNx3 array): RGB image
% On output:
%     b (Boolean): 1 if no bottle; else 0
% Call:
%     d(8) = CS4640_NN_no_bottle(I);
% Author:
%     <Your name>
%     UU
%     Fall 2021
%
```