

Machine Learning Exercise 3

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Features

Just by looking at the pictures one can see that most of the positive examples have more red pixels than the negative examples — except for negative sample n06.png which is red as well. I tried to predict n06.png correctly so I choose 7 features: R_{\min} , G_{\min} , B_{\min} , R_{avg} , G_{avg} , B_{avg} and an edge score E .

I calculated E by applying a 3×3 convolution matrix C to the greyscale image and then counting the resulting pixels having a value above 0.5

$$C = \begin{pmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{pmatrix}$$

The resulting model is shown on page 2.

Analysis

If the model is calculated based on all 60 samples it is able to predict all samples correctly. Unfortunately if only a specific subset of the samples are used for training the model does not predict all remaining samples correctly.

Resulting model

$$\phi = 0.5$$

$$\mu_0 = \begin{pmatrix} 0.4180392156862745 \\ 0.17856209150326796 \\ 0.3354248366013072 \\ 0.5568282498184458 \\ 0.5423443173565721 \\ 0.6827700617283943 \\ 7.533333333333333 \end{pmatrix}$$

$$\mu_1 = \begin{pmatrix} 0.39686274509803915 \\ 0.4033986928104575 \\ 0.5458823529411764 \\ 0.4891503267973856 \\ 0.4861347131445169 \\ 0.6305274146695714 \\ 0.0 \end{pmatrix}$$

$$\sigma = \begin{pmatrix} 0.0023857490 \dots & 0.0021892092 \dots & 0.0014766628 \dots & 0.0016981595 \dots & 0.0021013043 \dots & 0.0016273495 \dots & -0.0244183006 \dots \\ 0.0021892092 \dots & 0.0029483361 \dots & 0.0024201631 \dots & 0.0018708316 \dots & 0.0025702620 \dots & 0.0018607307 \dots & -0.0290544662 \dots \\ 0.0014766628 \dots & 0.0024201631 \dots & 0.0034951343 \dots & 0.0016663501 \dots & 0.0024509522 \dots & 0.0020225360 \dots & 0.0253246187 \dots \\ 0.0016981595 \dots & 0.0018708316 \dots & 0.0016663501 \dots & 0.0017118434 \dots & 0.0021481383 \dots & 0.0017946104 \dots & -0.0096619613 \dots \\ 0.0021013043 \dots & 0.0025702620 \dots & 0.0024509522 \dots & 0.0021481383 \dots & 0.0031567000 \dots & 0.0023979170 \dots & 0.0008216987 \dots \\ 0.0016273495 \dots & 0.0018607307 \dots & 0.0020225360 \dots & 0.0017946104 \dots & 0.0023979170 \dots & 0.0022084171 \dots & 0.0100072319 \dots \\ -0.0244183006 \dots & -0.0290544662 \dots & 0.0253246187 \dots & -0.0096619613 \dots & 0.0008216987 \dots & 0.0100072319 \dots & 6.9244444444 \dots \end{pmatrix}$$