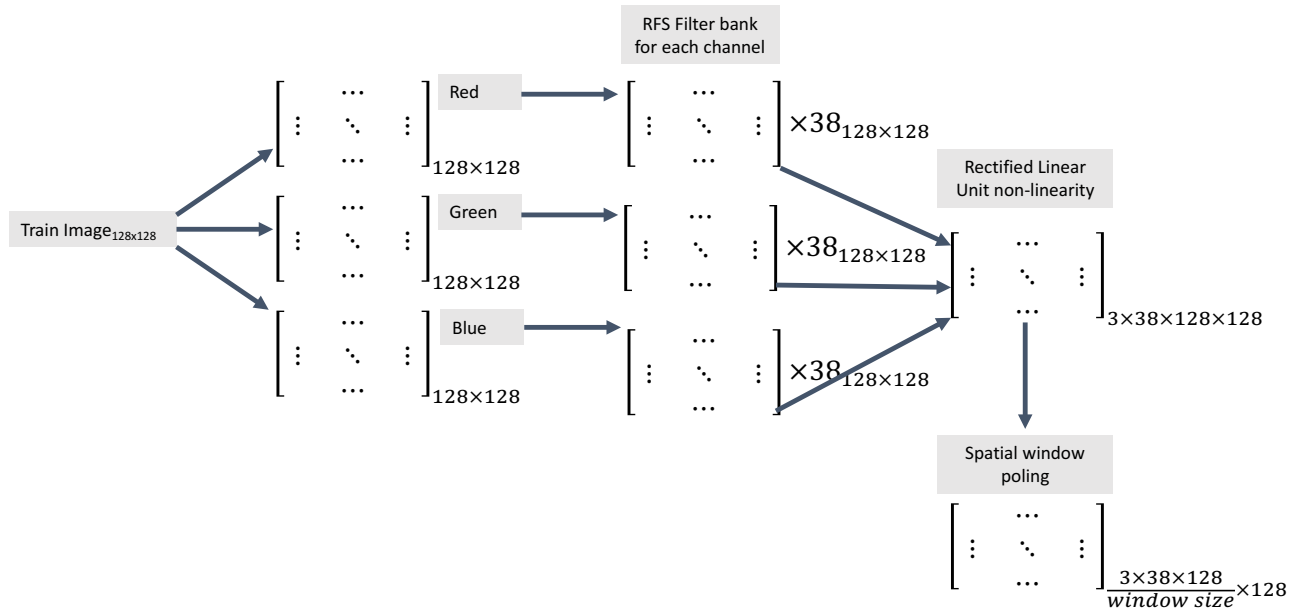


In this homework, we are given 32 products with various instances. For each class, 50 instances are randomly selected for training and the remaining is left for testing.

1. Feature Extraction

We are given to use RFS filter bank for feature extraction. The RFS filter consist of 38 filters; i.e. it produces 38 different results for a given image color channel (R, G, B).



The procedure can be summarized with the following schema:

- Each train image within each class is normalized to 128x128 size.
- Normalized image is broken into r, g, b channels.
- Each channel is convolved with RFS filter bank. The resulting 3x38=114 matrices are concatenated.
- The resulting (114x128)x128 matrix is applied to Rectified Linear non-linearity ReLU.
- The resulting matrix is applied to spatial window pooling. The resulting matrix's size is flattened to a vector. This vector has the size of $114 \times 128 \times 128 / \text{window size}^2$. For instance, for 8x8 windowing, the vector has the size of 1x29184. For 16x16, the size reduces to 7296 and for 32x32 to 1824.
- Each train image is stacked under each other to form a train data matrix.
- The same procedure is repeated for test images.

2. Training

Training is done with “AdaBoost” classifier with different iterations and window pooling sizes. This done via MATLAB’s built-in “fitensemble” function with “AdaboostM2” parameter. The predictions are done with again a built-in function “predict”.

3. Results

window size/iteration	100	500	1000	5000
8x8	0.2037	0.2888	0.3946	0.5139
16x16	0.2291	0.3461	0.3954	0.5776
32x32	0.1870	0.3930	0.4598	0.6301

From the table, we can conclude that iteration size and windowing size effects the performance positively. While it’s normal to expect that the iteration size will have a positive effect on the performance, it is interesting to see that increasing the windowing size boosts the performance.

Below is the heat map of the best parameter combination in the table, with 32x32 windowing and 5000 iterations.

