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Histogram bar color, specified as one of these values: 'none' — Bars are not filled.'auto' — Histogram bar color is chosen automatically (default).RGB triplet, hexadecimal color code, or color name — Bars are filled with the specified color.RGB triplets and hexadecimal color codes are useful for specifying custom colors. An RGB triplet is a three-element row vector whose elements specify the intensities of the red, green, and blue components of the color. The intensities must be in the range [0,1]; for example, [0.4 0.6 0.7].A hexadecimal color code is a character vector or a string scalar that starts with a hash symbol (#) followed by three or six hexadecimal digits, which can range from 0 to F. The values are not case sensitive. Thus, the color codes '#FF8800', '#f8800', '#F80', and '#80' are equivalent.Alternatively, you can specify some common colors by name. This table lists the named color options, the equivalent RGB triplets, and hexadecimal color codes.Color NameShort NameRGB TripletHexadecimal Color CodeAppearance'red''r'[1 0 0]#FF0000'green''g'[0 1 0]#00FF00'blue''b'[0 0 1]#0000FF'cyan''c'[0 1 1]#00FFFF'magenta''m'[1 0 1]#FF00FF'yellow''y'[1 1 0]#FFFF00'black''k'[0 0 0]#000000'white''w'[1 1 1]#FFFFFF'Here are the RGB triplets and hexadecimal color codes for the default colors MATLAB uses in many types of plots.RGB TripletHexadecimal Color CodeAppearance[0 0.4470 0.7410]#0072BD[0.8500 0.3250 0.0980]#D95319[0.9290 0.6940 0.1250]#EDB12E[0.4960 0.1840 0.5560]#7E2F82[0.4660 0.6740 0.1860]#77AC30[0.3010 0.7450 0.9330]#4DBEEF[0.6350 0.0780 0.1840]#A2142F If you specify DisplayStyle as 'stairs', then histogram does not use the FaceColor property. Example: histogram(X,'FaceColor','g') creates a histogram plot with green bars. libsvm is a great tool for SVM as it is very easy to use and is documented well. The libsvm package webpage is maintained by Chih-Chung Chang and Chih-Jen Lin of NTU. The webpage can be found here. I made this tutorial as a reminder for myself when I need to use it again. All the credits go for the libsvm developers. Here is how you can cite the libsvm.In this short tutorial, the following topics will be discussed:How to install the libsvm for MATLAB on Unix machine.Linear-kernel SVM for binary classificationkernel SVM for binary classificationcross validation for C and Gammamulti-class SVM: one-vs-rest (OVR)More ready-to-use matlab exampleAvailable matlab codes to downloadHere is how to install the toolboxJust read the readme file in the package. It's very easy. You can do it in both terminal and in MATLAB workspace. On Ubuntu machine, just to make sure you have gcc in your machine. If not, you need to install it using the command below:sudo apt-get install build-essential g++Basic SVM: Linear-kernel SVM for binary classificationBelow is the first code to run. The code is for binary classification and use the variable c = 1, gamma (g) = 0.07 and '-b 1' denotes the probability output.% This code just simply run the SVM on the example data set 'heart_scale',% which is scaled properly. The code divides the data into 2 parts: train: 1 to 200% test: 201:270% Then plot the results vs their true class. In order to visualize the high-dimensional data, we apply MDS to the 13D data and reduce the dimension% to 2Dclearcldclose all% addpath to the datadirData = './libsvm-3.12/matlab';% addpath to the datadirData = './libsvm-3.12/addpath(dirData);% read the data set[heart_scale_label, heart_scale_inst] = libsvmread(fullfile(dirData,'heart_scale'));[N DJ] = size(heart_scale_inst);% Determine the train and test indextrainIndex = zeros(N,1); testIndex = zeros(N,1); trainIndex(1:200) = 1; testIndex = zeros(N,1); trainData = heart_scale_inst(trainIndex==1,:); trainLabel = heart_scale_label(trainIndex==1,:); testData = heart_scale_inst(testIndex==1,:); testLabel = heart_scale_label(testIndex==1,:);% Train the SVMmodel = svmtrain(trainLabel, trainData, '-c 1 -g 0.07 -b 1');% Use the SVM model to classify the data[predict_label, accuracy, prob_values] = svmpredict(testLabel, testData, model, 'b 1');% run the SVM model on the test data, and filled color represents the class label assigned by SVM whereas the edge color represents the true (ground-truth) label. The marker size of the test set represents the probability that the sample instance is assigned with its corresponding class label; the bigger, the more confidence. Kernel SVM for binary classificationtrueClassIndex = zeros(N,1);trueClassIndex(heart_scale_label==1) = 1;trueClassIndex(heart_scale_label==2) = 2;colorTrueClass = colorList(trueClassIndex,:);% result ClassresultClassIndex = zeros(length(predict_label),1);resultClassIndex(predict_label==1) = 1;resultClassIndex(predict_label==2) = 2;colorResultClass = colorList(resultClassIndex,:);% Reduce the dimension from 13D to 2DdistanceMatrix = pdist(heart_scale_inst,'euclidean');newCoor = mdscale(distanceMatrix,2);% Plot the whole data set = newCoor(:,1);y = newCoor(:,2);patchSize = 30; %max(prob_values,[1,2]);colorTrueClassPlot = colorTrueClass;figure; scatter(x,y,patchSize,colorTrueClassPlot,'filled');title('whole data set');% Plot the test data x = newCoor(testIndex==1,2);y = newCoor(testIndex==1,1);% Plot the training set x = newCoor(trainIndex==1,1);y = newCoor(trainIndex==1,2);patchSize = 30;colorTrueClassPlot = colorTrueClass(trainIndex==1,:);scatter(x,y,patchSize,colorTrueClassPlot,'o','filled');% Plot the training set x = newCoor(trainIndex==1,1);y = newCoor(trainIndex==1,2);patchSize = 30;colorTrueClassPlot = colorTrueClass(trainIndex==1,:);scatter(x,y,patchSize,colorTrueClassPlot,'o');title('classification results');The result shows:optimization finished, #iter = 137nu = 0.4574220obj = -76.730867, rho = 0.435233nSV = 104, nBSV = 81Total nSV = 104Accuracy = 81.4286% (57/70) (classification)The whole data set is plotted:The clustering results might look like this:The unfilled markers represent data instance from the train set. The filled markers represent data instance from the test set, and filled color represents the class label assigned by SVM whereas the edge color represents the true (ground-truth) label. The marker size of the test set represents the probability that the sample instance is assigned with its corresponding class label; the bigger, the more confidence. Kernel SVM for binary classificationNow let's apply some kernel to the SVM. We use almost the same code as before, the only exception is the train data set, trainData, is replaced by the kernelized version [(1:200)' trainData*trainData'] and the test data, testData, is replaced by its kernelized version [(1:70)' testData*trainData'] as appeared below.% Train the SVMmodel = svmtrain(trainLabel, [(1:200)' trainData*trainData'], '-c 1 -g 0.07 -b 1 -t 4');% Use the SVM model to classify the data[predict_label, accuracy, prob_values] = svmpredict(testLabel, [(1:70)' testData*trainData'], model, 'b 1');% run the SVM model on the test dataThe complete code can be found here. The resulting clusters are shown in the figure below.'Linear' kerneloptimization finished, #iter = 403796nu = 0.335720obj = -67.042781, rho = -1.252604nSV = 74, nBSV = 60Total nSV = 74Accuracy = 85.7143% (60/70) (classification)'polynomial' kerneloptimization finished, #iter = 102385nu = 0.000010obj = -0.000086, rho = -0.465342nSV = 69, nBSV = 0Total nSV = 69Accuracy = 72.8571% (51/70) (classification)'RBF' kerneloptimization finished, #iter = 372nu = 0.890000obj = -97.594730, rho = 0.194414nSV = 200, nBSV = 90Total nSV = 200Accuracy = 57.1429% (40/70) (classification)'sigmoid' kerneloptimization finished, #iter = 90nu = 0.870000obj = -195.417169, rho = 0.999993nSV = 174, nBSV = 174Total nSV = 174Accuracy = 60% (42/70) (classification)'MLP' kerneloptimization finished, #iter = 1247nu = 0.352616obj = -68.842421, rho = -0.552693nSV = 77, nBSV = 63Total nSV = 77Accuracy = 82.8571% (58/70) (classification)Linear-kernel SVM: 85.7% accuracyPolynomial-kernel SVM: 72.86% accuracyRBF-kernel SVM: 57.14% accuracy Sigmoid-kernel SVM: 60% accuracy MLP-kernel SVM: 82.86% accuracyThe option for svmtrain-fold cross validation: n must >= 2Usage: model = svmtrain(training_label_vector, training_instance_matrix, 'libsvm_options');libsvm_options:-s svm_type : set type of SVM (default 0) 0 - C-SVC 1 - nu-SVC 2 -- one-class SVM 3 -- epsilon-SVR 4 -- nu-SVR-t kernel_type : set type of kernel function (default 2) 0 -- linear: u^v 1 -- polynomial: (gamma*u^v + coef0)^degree 2 -- radial basis function: exp(-gamma*|u-v|^2) 3 -- sigmoid: tanh(gamma*u^v + coef0) 4 -- precomputed kernel (kernel values in training_instance_matrix)-d degree : set degree in kernel function (default 3)-g gamma : set gamma in kernel function (default 1)-num_features-r coef0 : set coef0 in kernel function (default 0)-c cost : set the parameter C of C-SVC, epsilon-SVR, and nu-SVR (default 1)-nu : set the parameter nu of nu-SVC, one-class SVM, and nu-SVR (default 0.5)-p epsilon : set the epsilon in loss function of epsilon-SVR (default 0.1)-m cachesize : set cache memory size in MB (default 100)-e epsilon : set tolerance of termination criterion (default 0.001)-h shrinking : whether to use the shrinking heuristics, 0 or 1 (default 1)-b probability estimates : whether to train a SVC or SVR model for probability estimates, 0 or 1 (default 0)-wi weight : set the parameter C of class i to weight*C, for C-SVC (default 1)-v n : n-fold cross validation mode-q : quiet mode (no outputs)In this example, we will use the option enforcing n-fold cross validation in svmtrain, which is simply put the '-v n' in the parameter section, where n denote n-fold cross validation. Here is the example of using 3-fold cross validation:param = ['-q -v 3 -c', num2str(c), '-g', num2str(g)];cv = svmtrain(trainLabel, trainData, param);In the example below, I will show the nested cross validation. First, we search for the optimal parameters (c and gamma) in the big scale, then the searching space is narrowed down until satisfied. The results are compared with the first experiment which does not use the optimal parameters. The full code can be found here. Big scale parameters searching Medium scale parameters searching Small scale parameters searching Accuracy = 84.29% which is better than using the non-really-optimal parameter c=1 and gamma=0.07 in the previous experiment which gives 81.43% accuracy.Naturally, SVM is a binary classification model, how can we use SVM in the multi-class scenario? In this example, we will show you how to do multi-class classification using libsvm. A simple strategy is to do binary classification 1 pair at a time. Here we will use one-versus-rest approach. In fact, we can just use the original codes (svmtrain and svmpredict) from the libsvm package to do the job by making a 'wrapper code' to call the original code one pair at a time. The good news is that libsvm tutorial page provides a wrapper code to do so already. Yes, we will just use it properly.Just download the demo code from the end of this URL, which says[trainY trainX] = libsvmread('dna.scale'); [testY testX] = libsvmread('dna.scale.t'); [model = ovrtrain(trainY, trainX, '-c 8 -g 4'); [pred ac decv] = ovrpredict(testY, testX, model); fprintf('Accuracy = %g%%', ac * 100);The codes ovrtrain and ovrpredict are the wrapper. You can also do the cross validation from the demo code below, where get_cv_ac is again the wrapper code.bestcv = 0; for log2c = -1:2:3, for log2g = -4:2:1, cmd = ['-q -c', num2str(2^log2c), '-g', num2str(2^log2g)]; cv = get_cv_ac(trainY, trainX, cmd, 3); if (cv >= bestcv), bestcv = cv; bestc = 2^log2c; bestg = 2^log2g; end fprintf('%g %g %g (best c=%g, g=%g, rate=%g)', log2c, log2g, cv, bestc, bestg, bestcv); end endThe full-implemented code can be found here. Results show that row 1-2000: training set.The one-vs-rest multiclass SVM results. Here we do parameter selection on the train set yielding the accuracy for each class: class1: Accuracy = 94.3508% (1119/1186) (classification)class2: Accuracy = 95.4469% (1132/1186) (classification)class3: Accuracy = 94.1821% (1117/1186) (classification)overall class: Accuracy = 94.0135%The best parameters are c=8 and gamma=0.0625.Note when the parameters are not select properly, say c=8, gamma=4, the accuracy is as low as 60%. So, parameter selection is really important!!!!You may find the following examples useful. Each code is built for some specific application, which might be useful to the reader to download and tweak just to save your developing time.Big picture: In this scenario, I compiled an easy example to illustrate how to use svm in full process. The code contains: data generation, determining train and test data set, parameter selection using n-fold cross validation, both semi-manual and the automatic approach, train the svm model using one-versus-rest (OVR) approach, use the svm model to classify the test set in OVR mode, make confusion matrix to evaluate the results, show the decision boundary on the feature space. Reporting a results using n-fold cross validation: In case you have only 1 data set (i.e., there is no explicit train or test set), n-fold cross validation is a conventional way to assess a classifier. The overall accuracy is obtained by averaging the accuracy per each of the n-fold cross validation. The observations are separated into n folds equally, the code use n+1 folds to train the svm model which will be used to classify the remaining 1 fold according to standard OVR. The code can be found here.Using multiclass ovr-svm with kernel: So far I haven't shown the usage of ovr-svm with kernel specific ('-t x'). In fact, you can add the kernel to any ovr code, they will work. The complete code can be found here.For parameter selection using cross validation, we use the code below to calculate the average accuracy cv. You can just add '-t x' to the code.cmd = ['-q -c', num2str(2^log2c), '-g', num2str(2^log2g), '-t 0'];cv = get_cv_ac(trainLabel, [(1:NTrain)' trainData*trainData'], cmd, Ncv);Training: just add '-t x' to the training code.bestParam = ['-q -c', num2str(bestc), '-g', num2str(bestg), '-t 0'];model = ovrtrainBot(trainLabel, bestParam);Classification: the '-t x' is included in the variable model already, so you don't need to specify '-t x' again when classifying.[predict_label, accuracy, decv_values] = ovrpredictBot(testLabel, [(1:NTest)' testData*trainData'], model);[decv_value winner, label_out] = max(decv_values,[1,2]);However, I found that the code can be very slow in parameter selection routine when the number of class and the number of cross validation are big (e.g., Nclass = 10, Ncv=3). I think the slow part might be caused by [(1:NTrain)' trainData*trainData'] which can be huge. Personally I like to use the default kernel (RBF), which we don't need to make the kernel matrix X*X, which might contribute to a pretty quick speed.Complete example for classification using n-fold cross validation: This code works on the single data where the train and test set are combined within one single set. More details can be found here.Complete example for classification using train and test data set separately: This code works on the data set where the train and test set are separated, that is, train the model using train set and use the model to classify the test set. More details can be found here.How to obtain the SVM weight vector w: Please see the example code and discussion from StackOverflow.List of available matlab codesAll the code can be found in the zip file here.

Step 3: perform a convolution using a conv function on matlab; Step 4: If we want to plot three signals we use a subplot and stem functions. Examples of Convolution Matlab. Following are the examples are given below. Example #1. This example is about how to calculate the result of the convolution of two different signals in a matlab. MATLAB uses the number to calculate indices for assigning colors when you call plotting functions. The indices refer to the rows of the arrays stored in the ColorOrder property of the axes. MATLAB automatically updates the face color of the Histogram object when you change its SeriesIndex, or when you change ColorOrder property on the axes ... Apr 21, 2021 · In this article, we will see how to find Laplace Transform in MATLAB. Laplace Transform helps to simplify problems that involve Differential Equations into algebraic equations. As the name suggests, it transforms the time-domain function f(t) ... Compute the mel frequency cepstral coefficients of a speech signal using the mfcc function. The function returns delta, the change in coefficients, and deltaDelta, the change in delta values.The log energy value that the function computes can prepend the coefficients vector or replace the first element of the coefficients vector. Jan 21, 2022 · Calculate bias and variance in ridge regression MATLAB - I can't get my mind around the concept of how to calculate bias and variance from a random set. I have created the code to generate a random normal set of numbers.% ... 4:5613:43How to calculate the Bias Ratio on Excel - YouTubeYouTubeStart of suggested clipEnd of suggested clipSo ... Copy and paste this code into your website.

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