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% MaTLab
% The "Chest X-Ray Images (Pneumonia)" Dataset
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% The "Chest X-Ray Images (Pneumonia)" dataset is a collection of chest X-
ray images that have been labeled as
% normal or containing pneumonia, along with a file containing the image
labels.
% The dataset is labeled by experienced radiologists from the NIH.
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% Define the path to the image directory
dataDir = '/MATLAB Drive/Chest X-Ray Images (Pneumonia)';

% Create an imageDatastore for the entire dataset
imds = imageDatastore(dataDir, "IncludeSubfolders", true, 'LabelSource',
'foldernames');

% Define the number of classes
num_classes = 2;

% Define the size of each set
num_train = 320;    % number of samples in the training set
num_val = 32;       % number of samples in the validation set
num_test = 32;      % number of samples in the test set

% Shuffle the data
imds = shuffle(imds);

% Split the data into the train, validation, and test sets
[imdsTrain, imdsVal, imdsTest] = splitEachLabel(imds, num_train, num_val,
num_test, 'randomized');

% Get the unique labels from the image datastore
labels = unique(imds.Labels);

% Set the image augmentation options
augmenter = imageDataAugmenter( ...
    'RandXReflection', true, ...
    'RandRotation', [-20 20], ...
    'RandXTranslation', [-10 10], ...
    'RandYTranslation', [-10 10]);

% Create augmented image datastores for the train, val, and test sets
augimdsTrain = augmentedImageDatastore([224, 224], imdsTrain, ...
    'DataAugmentation', augmenter, ...
    'ColorPreprocessing', 'gray2rgb');
augimdsVal = augmentedImageDatastore([224, 224], imdsVal, ...
    'DataAugmentation', augmenter, ...
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'ColorPreprocessing', 'gray2rgb');
augimdsTest = augmentedImageDatastore([224, 224], imdsTest, ...
'DataAugmentation', augmenter, ...
'ColorPreprocessing', 'gray2rgb');

% Load the pre-trained VGG-16 model
net = vgg16;
layers = net.Layers;

% Modify the network for transfer learning
layers(end-2) = fullyConnectedLayer(num_classes);
layers(end) = classificationLayer;

% Set the training options
options = trainingOptions('sgdm', ...
'MiniBatchSize', 32, ...
'MaxEpochs', 10, ...
'InitialLearnRate', 0.001, ...
'Verbose', true, ...
'Plots', 'training-progress', ...
'ValidationData', augimdsVal);

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% Train the network
net = trainNetwork(augimdsTrain, layers, options);

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Training on single CPU.

Initializing input data normalization.

Epoch	Iteration	Time Elapsed (hh:mm:ss)	Mini-batch Accuracy	Validation Accuracy	Mini-batch Loss	Validation Loss	Ba
1	1	00:00:17	43.75%	50.00%	2.2578	3.7333	
3	50	00:07:15	68.75%	93.75%	0.6759	0.1337	
5	100	00:14:40	100.00%	96.88%	0.0386	0.0502	
8	150	00:21:41	96.88%	95.31%	0.1982	0.1040	
10	200	00:28:55	96.88%	98.44%	0.0528	0.0720	

Training finished: Max epochs completed.

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% Evaluate the model on the test set
predicted_labels = classify(net, augimdsTest);
test_labels = imdsTest.Labels;

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% Get the unique labels from the test set
test_labels_unique = unique(test_labels);

% Add the missing label(s) to the labels variable
for i = 1:numel(test_labels_unique)
    if ~ismember(test_labels_unique(i), labels)
        labels = [labels; test_labels_unique(i)];
    end
end

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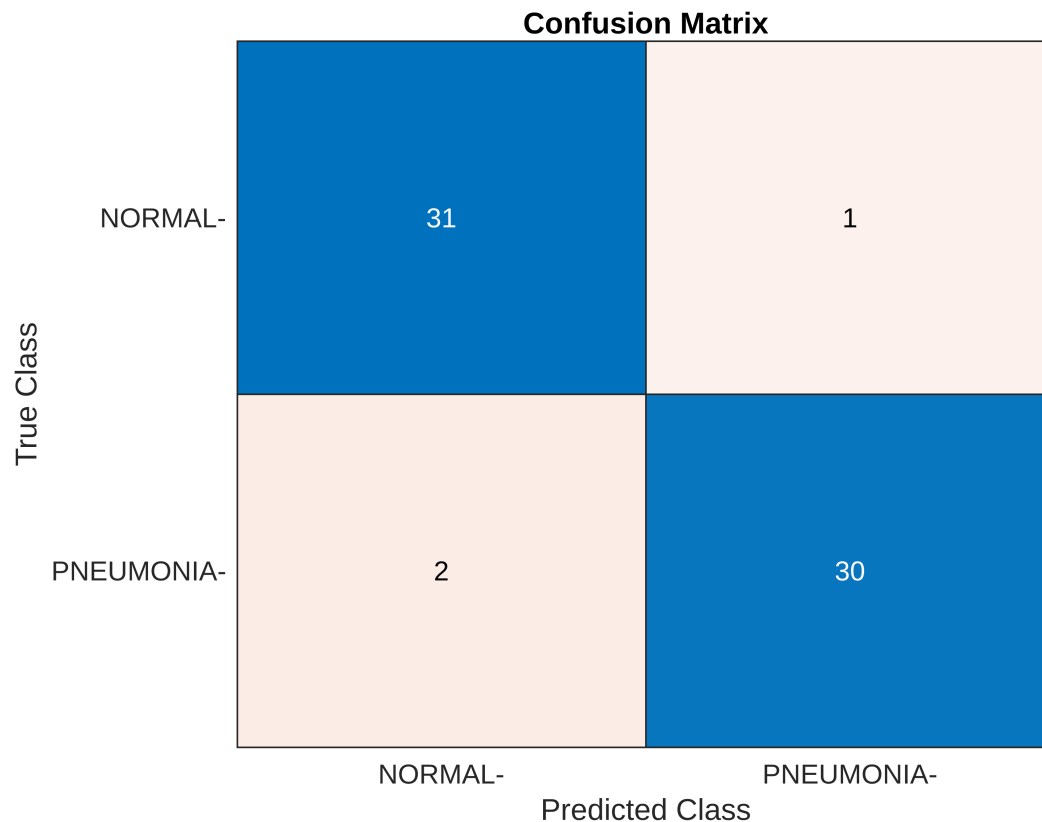
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end
end

% Calculate the confusion matrix
cm = confusionmat(test_labels, predicted_labels, 'Order', labels);

% Visualize the confusion matrix
figure
confusionchart(cm, labels)
title('Confusion Matrix')

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% Calculate the classification accuracy
accuracy = sum(predicted_labels == test_labels) / numel(test_labels);

% Print the classification accuracy
fprintf('Test Accuracy: %.2f%%\n', accuracy*100);

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Test Accuracy: 98.44%

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% Display two images from each class
figure
for i = 1:numel(labels)
    label = labels(i);
    idx = find(imdsTrain.Labels == label);
    idx = idx(randperm(numel(idx), 2));

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for j = 1:numel(idx)
    img = readimage(imdsTrain, idx(j));
    subplot(2, 2, i + (j-1)*numel(labels));
    imshow(img);
    title(char(label));
end
end

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NORMAL-



PNEUMONIA-



NORMAL-



PNEUMONIA-

