BMMC Dataset Classification

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%% Read the Data and Preprocess

>> DataTable = readtable('BMMC_benchmark.csv');

% Separate Data points and Labels
>> Labels=DataTable.cell_type;
>> DataTable.cell_type=[];
>> Data = table2array(DataTable);
>> clear DataTable

% clear NotGated
>> Data(strcmp('NotGated',Labels),:)=[];
>> Labels(strcmp('NotGated',Labels))=[];

% Apply arcsinh5 transformation
>> Data=asinh((Data-1)/5);

%% run LDA Classifier with 5-fold cross-validation
>> CVO = cvpartition(Labels,'k',5);
>> Accuracy = zeros(CVO.NumTestSets,1);
>> training_time = zeros(CVO.NumTestSets,1);
>> testing_time = zeros(CVO.NumTestSets,1);
>> CellTypes = unique(Labels);
>> ConfusionMat = zeros(length(CellTypes));
>> for i = 1:CVO.NumTestSets
>>     trIdx = CVO.training(i);
>>     teIdx = CVO.test(i);
>>     tic
>>     classificationLDA = fitcdiscr(...
>>         Data(trIdx,:), ...
>>         Labels(trIdx));
>>     training_time(i)=toc;          %in seconds
>>
>>     tic
>>     Predictor = predict(classificationLDA,Data(teIdx,:));
>>     testing_time(i)=toc;           %in seconds
>>     Accuracy(i) =nnz(strcmp(Predictor,Labels(teIdx))) ...
       /size(Labels(teIdx),1);
>>     ConfusionMat = ConfusionMat + ...
       confusionmat(Labels(teIdx),Predictor,'order',CellTypes);

>> end
>> Total_time = sum(training_time)+sum(testing_time);
>> training_time = mean(training_time);
>> testing_time = mean(testing_time);
>> cvAcc = mean(Accuracy)*100;
>> cvSTD = std(Accuracy)*100;
>> disp(['LDA Accuracy = ' num2str(cvAcc) ' ' char(177) ' '...
   num2str(cvSTD) ' %'])
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LDA Accuracy = 95.8408 ± 0.068389 %

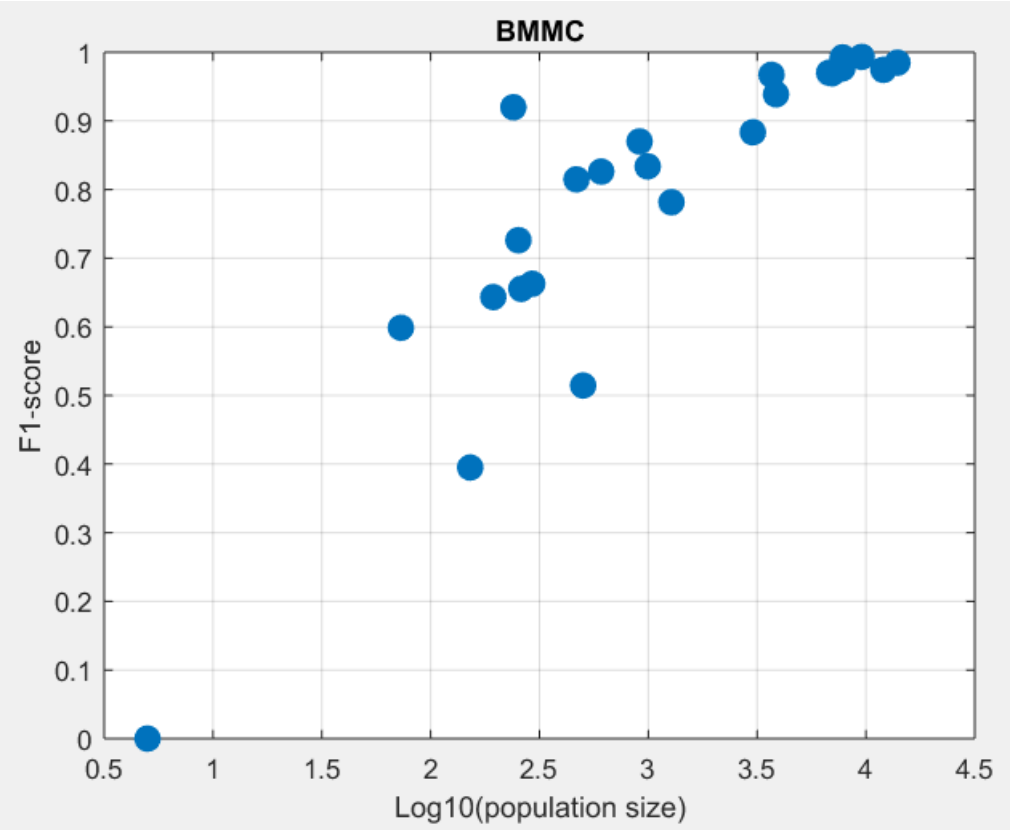
>> clear i Predictor classificationLDA trIdx teIdx CVO Accuracy

%% Performance evaluation
% F1 measure
>> Precision = diag(ConfusionMat)./sum(ConfusionMat,1)';
>> Recall = diag(ConfusionMat)./sum(ConfusionMat,2);
>> Fmeasure = 2 * (Precision.*Recall)./(Precision+Recall);
>> Fmeasure(isnan(Fmeasure)) = 0;
>> MedianFmeasure = median(Fmeasure);
>> Subset_size = sum(ConfusionMat,2);
>> WeightedFmeasure = (Subset_size./size(Data,1))'*Fmeasure;

>> disp(['Median F1-score = ' num2str(MedianFmeasure)])

Median F1-score = 0.85192

>> figure,scatter(log10(Subset_size),Fmeasure,100,'filled')
>> title('BMMC')
>> xlabel('Log10(population size)'),ylabel('F1-score')
>> box on, grid on
```




```
%% Population Frequency
>> True_Freq = sum(ConfusionMat,2)./sum(sum(ConfusionMat));
>> Predicted_Freq = sum(ConfusionMat,1)'./sum(sum(ConfusionMat));
>> Max_Freq_diff = max(abs(True_Freq-Predicted_Freq))*100;

>> disp(['delta_f = ' num2str(Max_Freq_diff)])
```

```
delta_f = 0.641

>> figure,bar([True_Freq*100 Predicted_Freq*100])
>> xticks(1:24)
>> xticklabels(CellTypes)
>> xtickangle(90)
>> set(gca,'FontSize',10)
>> legend({'True','Predicted'},'FontSize',10)
>> legend show
>> ylabel('Freq. %'),title('BMMC')
```