Progress Report on Speech Data: ACF, classification learner

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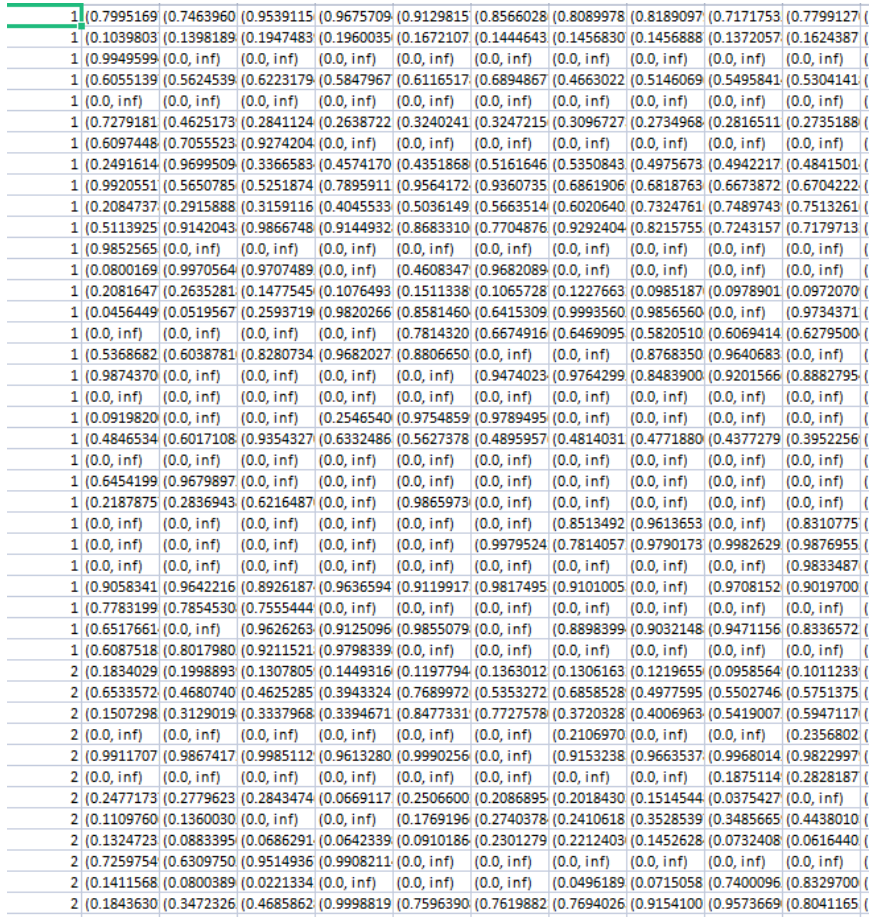
ACF here refers to the autocorrelation function to analyze the fundamental frequency of audio data. This gives a faster and more accurate way(compared to Fast Fourier Analysis)to obtain the period of the audio signal. ACF will not be mentioned again in later slides.

Matlab classification learner

1 Tree	Accuracy (Validation): **61.9%**	
Last change: Fine Tree		8/8 features
2.1 Tree	Accuracy (Validation): **61.9%**	
Last change: Fine Tree		8/8 features
2.2 Tree	Accuracy (Validation): **61.9%**	
Last change: Medium Tree		8/8 features
2.3 Tree	Accuracy (Validation): **61.9%**	
Last change: Coarse Tree		8/8 features
2.4 Naive Bayes		Failed
Last change: Gaussian Naive Bayes		8/8 features
2.5 Naive Bayes		Failed
Last change: Kernel Naive Bayes		8/8 features
2.6 SVM	Accuracy (Validation): **61.9%**	
Last change: Linear SVM		8/8 features
2.7 SVM	Accuracy (Validation): **61.9%**	
Last change: Quadratic SVM		8/8 features
2.8 SVM	Accuracy (Validation): **61.9%**	
Last change: Cubic SVM		8/8 features
2.9 SVM	Accuracy (Validation): **61.9%**	
Last change: Fine Gaussian SVM		8/8 features

1 Tree	Accuracy (Validation): 35.7%	
Last change: Fine Tree		5/5 features
2 SVM	Accuracy (Validation): 17.9%	
Last change: Linear SVM		5/5 features
3 KNN	Accuracy (Validation): 28.6%	
Last change: Fine KNN		5/5 features
4 KNN	Accuracy (Validation): **46.4%**	
Last change: Optimizable KNN		5/5 features
5 Kernel	Accuracy (Validation): 17.9%	
Last change: SVM Kernel		5/5 features
6 Ensemble	Accuracy (Validation): **46.4%**	
Last change: Boosted Trees		5/5 features
7 Neural Network	Accuracy (Validation): **46.4%**	
Last change: Narrow Neural Network		5/5 features
8 Neural Network	Accuracy (Validation): **46.4%**	
Last change: Hyperparameter option(s)		5/5 features
9 Ensemble	Accuracy (Validation): 39.3%	
Last change: RUSBoosted Trees		5/5 features
10 SVM	Accuracy (Validation): 28.6%	
Last change: Optimizable SVM		5/5 features



1	(0.7995169	(0.7463960	(0.9539115	(0.9675709	(0.9129815	(0.8566028	(0.8089978	(0.8189097	(0.7171753	(0.7799127
1	(0.1039803	(0.1398189	(0.1947483	(0.1960035	(0.1672107	(0.1444643	(0.1456830	(0.1456888	(0.1372057	(0.1624387
1	(0.9949599	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.6055139	(0.5624539	(0.6223179	(0.5847967	(0.6116517	(0.6894867	(0.4663022	(0.5146069	(0.5495841	(0.5304141
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.7279181	(0.4625173	(0.2841124	(0.2638722	(0.3240241	(0.3247215	(0.3096727	(0.2734968	(0.2816511	(0.2735188
1	(0.6097448	(0.7055523	(0.9274204	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.2491614	(0.9699509	(0.3366583	(0.4574170	(0.4351868	(0.5161646	(0.5350843	(0.4975673	(0.4942217	(0.4841501
1	(0.9920551	(0.5650785	(0.5251874	(0.7895911	(0.9564172	(0.9360735	(0.6861906	(0.6818763	(0.6673872	(0.6704222
1	(0.2084737	(0.2915888	(0.3159116	(0.4045533	(0.5036149	(0.5663514	(0.6020640	(0.7324761	(0.7489743	(0.7513261
1	(0.5113925	(0.9142043	(0.9866748	(0.9144932	(0.8683310	(0.7704876	(0.9292404	(0.8215755	(0.7243157	(0.7179713
1	(0.9852565	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.0800169	(0.9970564	(0.9707489	(0.0, inf)	(0.4608347	(0.9682089	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.2081647	(0.2635281	(0.1477545	(0.1076493	(0.1511338	(0.1065728	(0.1227663	(0.0985187	(0.0978901	(0.0972070
1	(0.0456449	(0.0519567	(0.2593719	(0.9820266	(0.8581460	(0.6415309	(0.9993560	(0.9856560	(0.0, inf)	(0.9734371
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.7814320	(0.6674916	(0.6469095	(0.5820510	(0.6069414	(0.6279500
1	(0.5368682	(0.6038781	(0.8280734	(0.9682027	(0.8806650	(0.0, inf)	(0.0, inf)	(0.8768350	(0.9640683	(0.0, inf)
1	(0.9874370	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.9474023	(0.9764299	(0.8483900	(0.9201566	(0.8882795
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.0919820	(0.0, inf)	(0.0, inf)	(0.2546540	(0.9754859	(0.9789495	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.4846534	(0.6017108	(0.9354327	(0.6332486	(0.5627378	(0.4895957	(0.4814031	(0.4771880	(0.4377279	(0.3952256
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.6454199	(0.9679897	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.2187875	(0.2836943	(0.6216487	(0.0, inf)	(0.9865973	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.8513492	(0.9613653	(0.0, inf)	(0.8310775
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.9979524	(0.7814057	(0.9790173	(0.9982629	(0.9876955
1	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.9833487
1	(0.9058341	(0.9642216	(0.8926187	(0.9636594	(0.9119917	(0.9817495	(0.9101005	(0.0, inf)	(0.9708152	(0.9019700
1	(0.7783199	(0.7854530	(0.7555444	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
1	(0.6517661	(0.0, inf)	(0.9626263	(0.9125096	(0.9855079	(0.0, inf)	(0.8898399	(0.9032148	(0.9471156	(0.8336572
1	(0.6087518	(0.8017980	(0.9211521	(0.9798339	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
2	(0.1834029	(0.1998893	(0.1307805	(0.1449316	(0.1197794	(0.1363012	(0.1306163	(0.1219655	(0.0958564	(0.1011233
2	(0.6533572	(0.4680740	(0.4625285	(0.3943324	(0.7689972	(0.5353272	(0.6858528	(0.4977595	(0.5502746	(0.5751375
2	(0.1507298	(0.3129019	(0.3337968	(0.3394671	(0.8477331	(0.7727578	(0.3720328	(0.4006963	(0.5419007	(0.5947117
2	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.2106970	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.2356802
2	(0.9911707	(0.9867417	(0.9985112	(0.9613280	(0.9990256	(0.0, inf)	(0.9153238	(0.9663537	(0.9968014	(0.9822997
2	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.1875114	(0.2828187
2	(0.2477173	(0.2779623	(0.2843474	(0.0669117	(0.2506600	(0.2086895	(0.2018430	(0.1514544	(0.0375427	(0.0, inf)
2	(0.1109760	(0.1360030	(0.0, inf)	(0.0, inf)	(0.1769196	(0.2740378	(0.2410618	(0.3528539	(0.3485665	(0.4438010
2	(0.1324723	(0.0883395	(0.0686291	(0.0642339	(0.0910186	(0.2301279	(0.2212403	(0.1452628	(0.0732408	(0.0616440
2	(0.7259754	(0.6309750	(0.9514936	(0.9908211	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0, inf)
2	(0.1411568	(0.0800389	(0.0221334	(0.0, inf)	(0.0, inf)	(0.0, inf)	(0.0496189	(0.0715058	(0.7400096	(0.8329700
2	(0.1843630	(0.3472326	(0.4685862	(0.9998819	(0.7596390	(0.7619882	(0.7694026	(0.9154100	(0.9573669	(0.8041165

9-17 Left: Using 43 audio(8 voiced, 8 voiceless, 27vowels), first 5 features(longest barcode of first 5 diag), 1 response. This gives a rather coarse result. More data is needed. Inf number type seems to negatively affect the process. Middle: Using 41 voiced, 43 voiceless, 31 vowels, first 6 features, and 1 response. The consonants have no preprocess. This gives an even coarser result. Right: Glimpse of the data.

1	Tree	Accuracy (Validation): **77.1%**	
Last change: Fine Tree			5/5 features
2	KNN	Accuracy (Validation): 75.0%	
Last change: Optimizable KNN			5/5 features
3	Quadratic Dis…	Accuracy (Validation): 64.6%	
Last change: Quadratic Discriminant			5/5 features
4	Neural Network	Accuracy (Validation): 70.8%	
Last change: Optimizable Neural Network			5/5 features
5	Kernel	Accuracy (Validation): 72.9%	
Last change: SVM Kernel			5/5 features
6	Ensemble	Accuracy (Validation): 72.9%	
Last change: RUSBoosted Trees			5/5 features
7	SVM	Accuracy (Validation): 64.6%	
Last change: Cubic SVM			5/5 features
8	Tree	Accuracy (Validation): **77.1%**	
Last change: Optimizable Tree			5/5 features

9-22: 48 audio, 32 vowels, 16 consonants. Each audio has 5 diag(fractions are linearly spaced throughout sig), features are the number of barcode in each diag.

10	Ensemble	Accuracy (Validation): **81.2%**	
Last change: Optimizable Ensemble			5/5 features
12	Ensemble	Accuracy (Validation): 79.2%	
Last change: Subspace KNN			5/5 features
9	KNN	Accuracy (Validation): 79.2%	
Last change: Optimizable KNN			5/5 features
2	Tree	Accuracy (Validation): 79.2%	
Last change: Optimizable Tree			5/5 features
6	SVM	Accuracy (Validation): 75.0%	
Last change: Hyperparameter option(s)			5/5 features
3	Optimizable Di…	Accuracy (Validation): 75.0%	
Last change: Optimizable Discriminant			5/5 features
7	SVM	Accuracy (Validation): 72.9%	
Last change: Optimizable SVM			5/5 features
11	Neural Network	Accuracy (Validation): 70.8%	
Last change: Optimizable Neural Network			5/5 features
5	Naive Bayes	Accuracy (Validation): 70.8%	
Last change: Gaussian Naive Bayes			5/5 features
1	Tree	Accuracy (Validation): 70.8%	
Last change: Fine Tree			5/5 features

9-23: same data as 9-22, but use barcode of one dimension only. Even if only the number of diag is used, the result is much better than using the longest barcode as feature.

Struggles & Future work

1. 9-17: Choices of features? How to choose features so that they can capture the shape of data in a maximum way? It is ok to see that classification learner classifies data in such a poor way, since little preprocess is done to the data. How to choose barcodes? How to choose features? How to split consonants? All should be considered in a formal way.