Neurodata Lunch Talk – Circle Experiment

Jesse L. Patsolic

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Motivation

The recent arXiv paper *Diffeomorphic Learning* by L. Younes in the CIS/AMS department brought up an interesting problem.

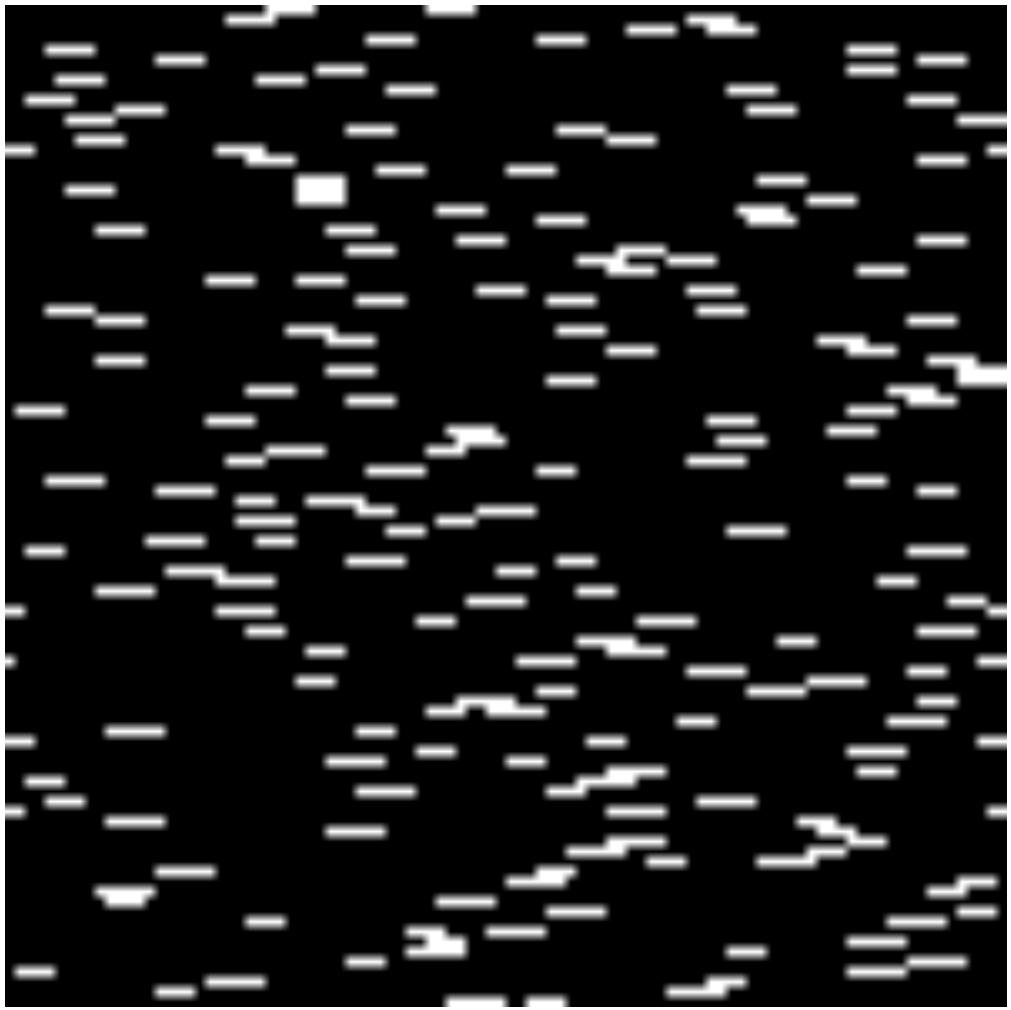
Deep learning and diffeomorphic learning have similar properties. The only algorithm that did well on the following problem was **MLP**.

Problem statement

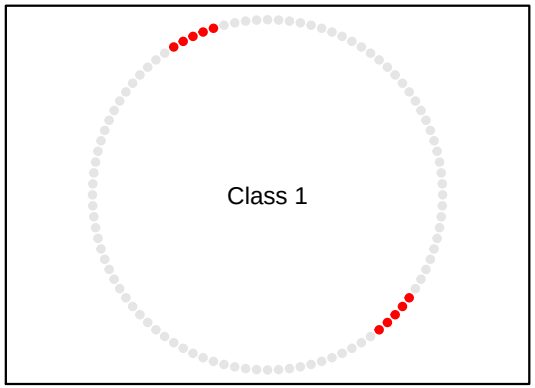
Consider a 100-gon where 10 vertices are colored 'black' and the rest are colored 'white' according to the following rules:

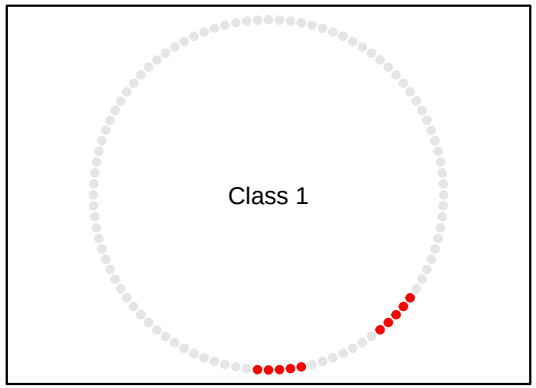
- Class 1: two groups of 5 contiguous vertices colored 1.
- Class 2: two groups of 6 and 4 contiguous vertices colored 1.

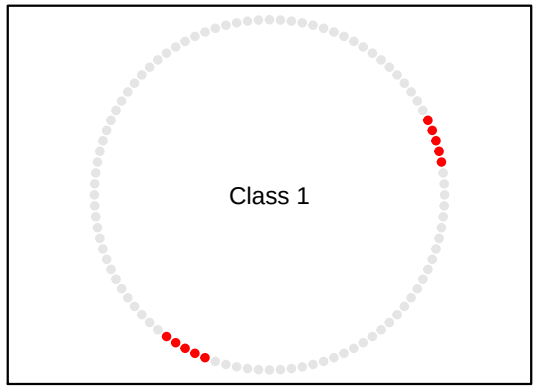
Visualizing some of the data as an image

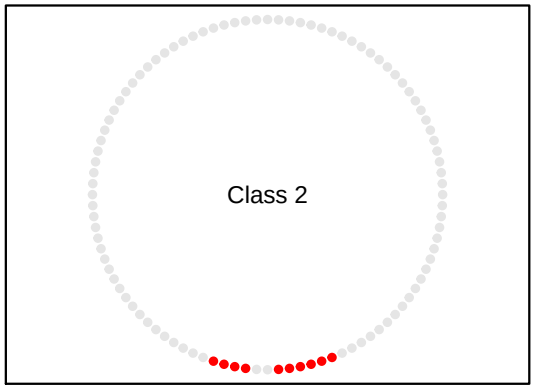


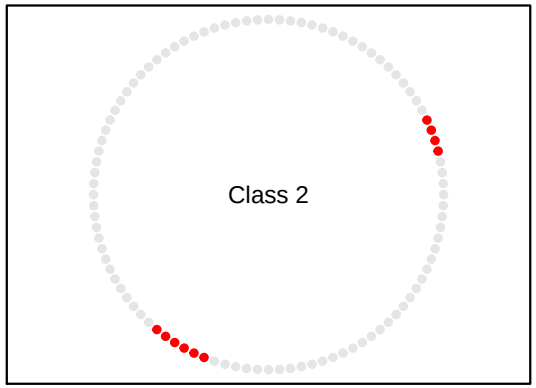
Visualizing some of the data as circles

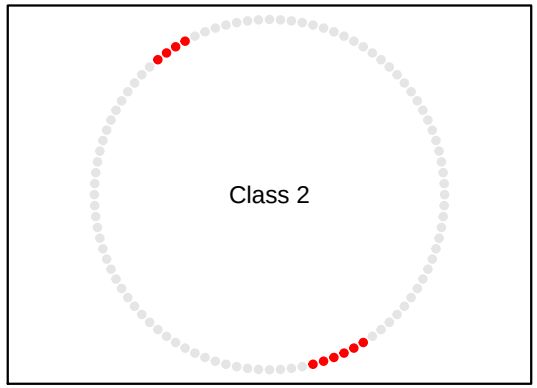












Structured RerF (S-RerF)

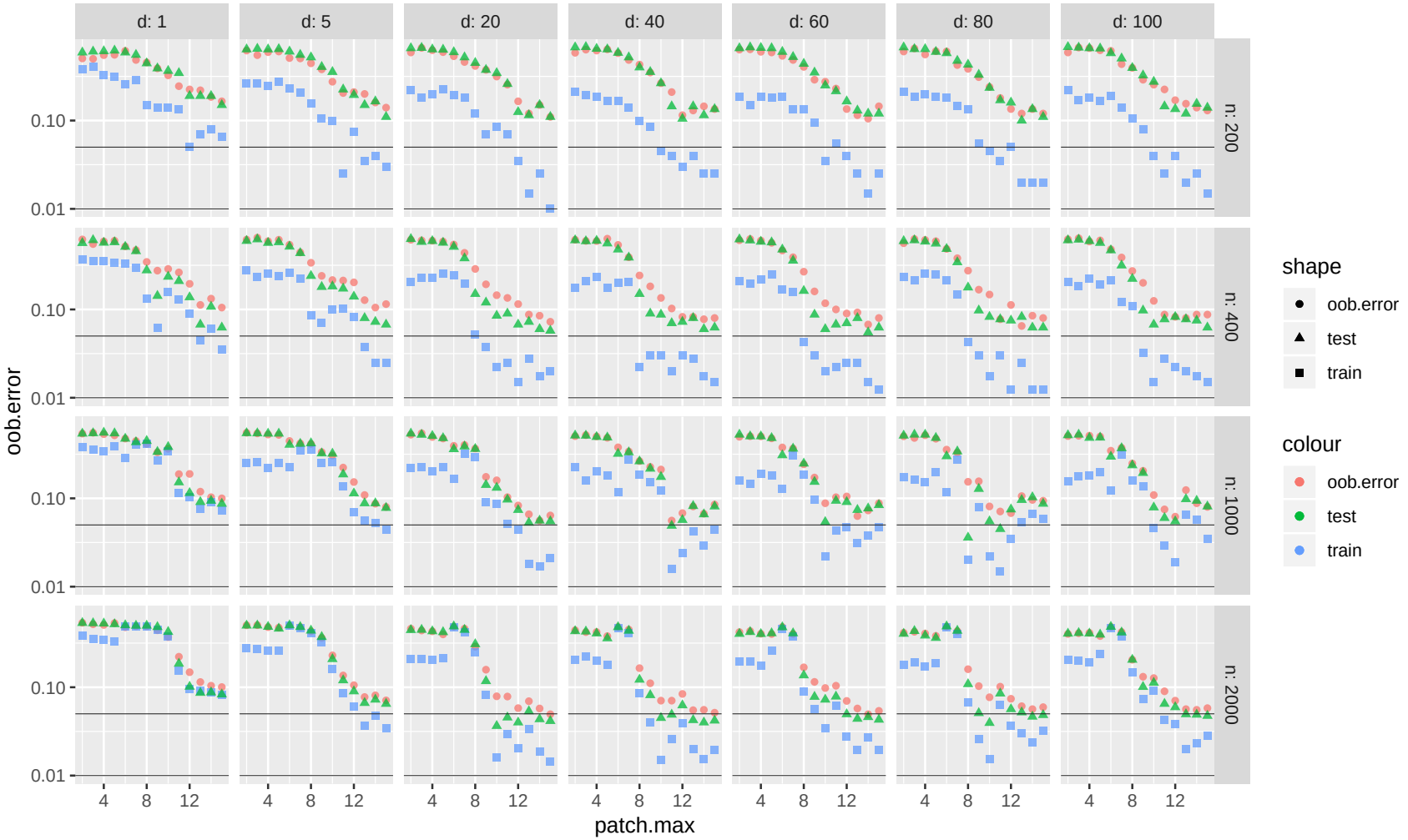
Structured RerF is a variant of RerF that takes into account the spatial dependency of pixels in images.

The data are taken down decision trees and at each split node S-RerF randomly samples d patches of contiguous pixels. The constructed features are then linear combinations with random weights of the patches.

image-patch-rectangles

Below are the results of each run sweeping over $w \in [2, 15]$ for each of the n. Horizontal lines are plotted at 0.05 and 0.01.

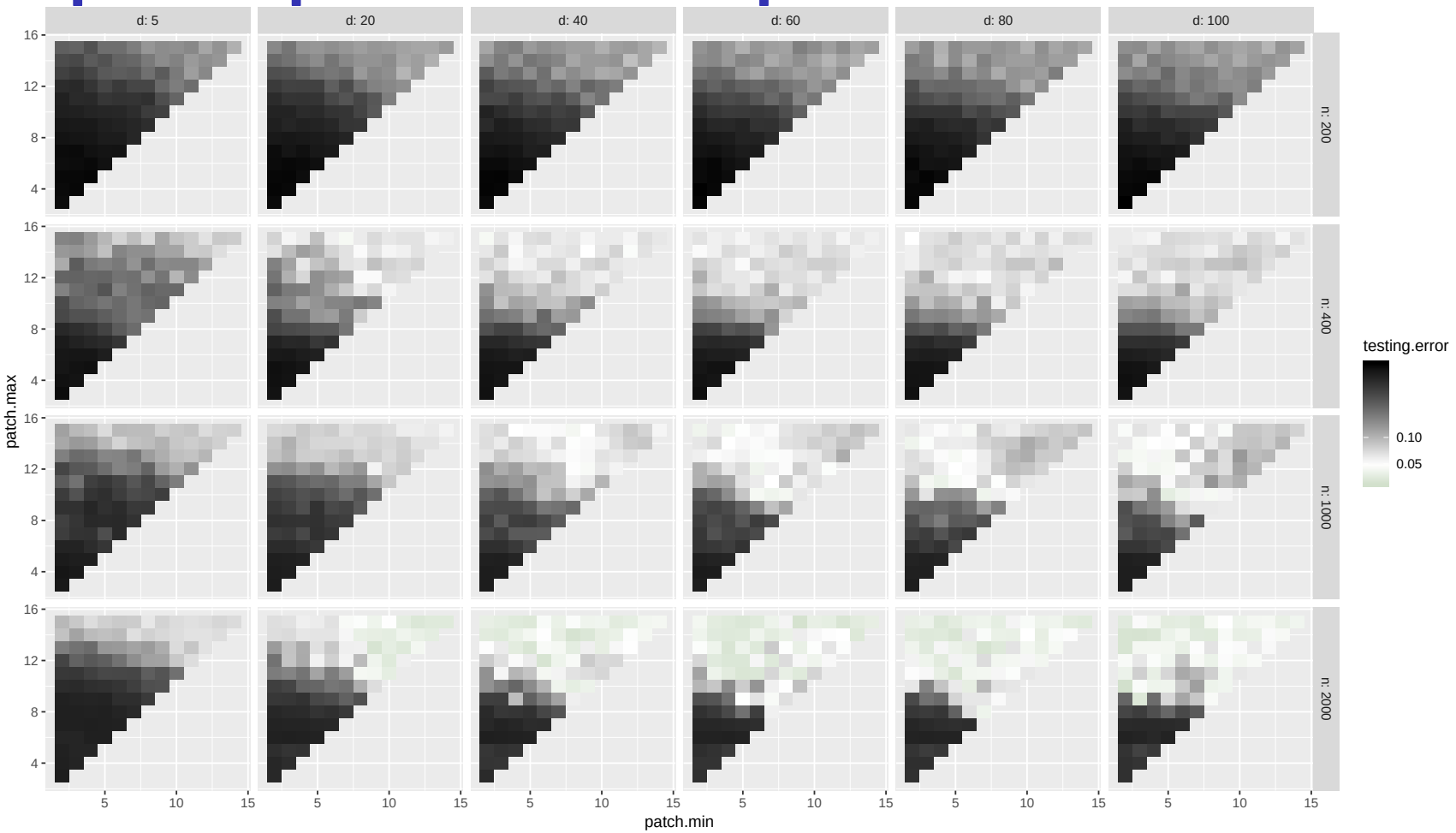
Plot of parameter sweep



Best $\hat{L}$

n	d	patch.max	testing.error	oob.error	training.error
200	80	13	0.1	0.12	0.02
400	60	14	0.055	0.0675	0.015
1000	80	8	0.036	0.154	0.02
2000	20	10	0.0365	0.079	0.016

Sweep over patch.min and patch.max

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## pdf
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Best $\hat{L}$

n	d	testing.error	patch.max	patch.min
200	40	0.09	14	12
400	20	0.045	15	7
1000	100	0.037	10	5
2000	100	0.03	10	2

Merge of table 5.

training samples	Log. Reg.	Lin. SVM	SVM	RF	kNN	MLP	R-RerF
200	0.513	0.515	0.460	0.505	0.532	0.411	0.09
400	0.465	0.467	0.498	0.497	0.488	0.144	0.045
1000	0.543	0.549	0.450	0.499	0.403	0.024	0.037
2000	0.514	0.512	0.442	0.510	0.283	0.013	0.03

Comparison of R-Rerf to other algorithms