

Natural Image Segment Classification

- Student: Brian Rigling
- Delve image dataset
 - <http://www.cs.toronto.edu/~delve/data/datasets.html>
 - Classify 3x3 (9 pixel) full color image segments
 - Classes: cement, brickface, grass, foliage, sky, path, window
 - Source: Carla Brodley, Vision Group, U. of Massachusetts, Nov. 1990 - segments extracted from 7 outdoor images
- Dataset contents
 - 210 training instances (30 of each class)
 - 2100 testing instances (300 of each class)
 - 16 continuous valued features
 - No information is missing.

Extracted Features

Feature:	Range:	Description:
1. short-line-density-5	[0,1]	Low contrast line count
2. short-line-density-2	[0,1]	High contrast line count
3. vedge-mean	[0, ∞)	Mean horizontal contrast
4. vedge-sd	[0, ∞)	Standard deviation of horizontal contrast
5. hedge-mean	[0, ∞)	Mean vertical contrast
6. hedge-sd	[0, ∞)	Standard deviation of vertical contrast
7. intensity-mean	[0, ∞)	Average intensity, $(R+G+B)/3$
8. rawred-mean	[0, ∞)	Average red over segment
9. rawblue-mean	[0, ∞)	Average blue over segment
10. rawgreen-mean	[0, ∞)	Average green over segment
11. exred-mean	$(-\infty, \infty)$	Excess red, $(2R - (G + B))$
12. exblue-mean	$(-\infty, \infty)$	Excess blue, $(2B - (G + R))$
13. exgreen-mean	$(-\infty, \infty)$	Excess green, $(2G - (T + B))$
14. value(V)-mean	$(-\infty, \infty)$	3-D non-linear transformation of RGB
15. saturation(S)-mean	$(-\infty, \infty)$	$(H,S,V) = f(R, G, B)$
16. hue(H)-mean	$(-\infty, \infty)$	

Methods Previously Applied

Radford Neal

- **1-NN1:** Classify by comparing to the instance's nearest neighbor in the training data

CART software provided by California Statistical Software, Inc.

- **cart-1:** Creates decision boundaries parallel to the input axes

Michael Revow

- **knn-class-1:** Classify by comparing to the instance's K nearest neighbors in the training data

Steve Waterhouse

- **hme-el-1:** Hierarchical mixtures-of-experts trained with Bayesian methods (ensemble learning)
- **hme-ese-1:** Hierarchical mixtures-of-experts trained with early stopping
- **hme-grow-1:** Hierarchical mixtures-of-experts trained with growing and early stopping
- **me-el-1:** Mixtures-of-experts trained with Bayesian methods (ensemble learning)
- **me-ese-1:** Mixtures-of-experts trained with early stopping

Related Work

- Song Chun Zhu - CIS OSU
 - Segmentation of full images
 - Z.W. Tu, S. C. Zhu, "Image Segmentation by Data Driven Markov Chain Monte Carlo", To appear in PAMI.
- Delve: Michael Revow:
 - Classifying hand-written characters
 - <http://www.cs.toronto.edu/~revow/>
- Delve: Steve Waterhouse: PhD thesis (Oct. 1997)
 - Mixtures of experts
 - <http://www.oigeeza.com/steve/>