
Supplemental Materials for Active Manifolds: A non-linear analogue to Active Subspaces

Performance Results on Initial Implementation

The following experiment was run to provide a timing comparison, using $f(x) = |x|^2$ as the test function and a 2013 Macbook Pro with 16GB of RAM and a 2.4 GHz Intel I7:

1. A uniform grid of dimension m was constructed, consisting of n points in each dimension. Function values and gradients were then sampled on this grid, with the gradients normalized to unit length. For each of the 3 tests, the data set was randomly partitioned into 3 training/testing sets according to the test proportion in Table 1, and the AM was built on the training set using 3 random initial points.
2. Step size for AM was chosen to be $2/3$ times the length of the longest grid diagonal i.e. $2/3 * (1/n)\sqrt{m}$. Execution time was recorded.
3. AS was run on the data (with un-normalized gradients) and execution time was recorded.

We note as an aside that error estimates in both AS and AM remained relatively unchanged despite variation in these experimental parameters. The execution time comparison is shown in Table 1.

m	n	Test Fraction	AM time	AS time
2	15	1/6	324ms	21.9ms
		1/3	522ms	20.0ms
	30	1/6	2.62s	24.7ms
		1/3	5.61s	25.1ms
3	15	1/6	5.17s	50.6ms
		1/3	10.9s	60ms
	30	1/6	120s	606ms
		1/3	246s	1.64s

Table 1. Execution time results for AS vs. AM. Main takeaway is AM is consistently an order of magnitude slower than AS in initial testing (but also an order of magnitude more accurate).