

Least Squares

Experiment details:

In this section we compare performance of our least squares algorithms to Matlab's implementations which is complete analogs. In the following table you can see what methods were tested and what matlab's functions were chosen as competitor:

FinMath	Matlab
OrdinaryLS	Lscov(A,b), with default parameters.
WeightedLS	Lscov(A,b,w), where w is weight vector.
GeneralizedLS	Lscov(A,b,V), where V is covariance matrix.
StepwiseLS	Stepwisefit(X,y) , with default parameters.

We will test those on data sets with different sizes. There are three main parameters which influence on experiment computation time:

- Number of observations or points (N).
- Number of regressors or series (M).
- Type of the metric to compute.

Performance metrics:

In this test we use the following performance metrics:

1. Total working time – time which was needed to complete specified numbers of computations.
2. Time of single computation – time which was needed to solve one problem with selected parameters.

Note: We do not calculate number of floating point operations per second for this test due to slight difference in calculation algorithms.

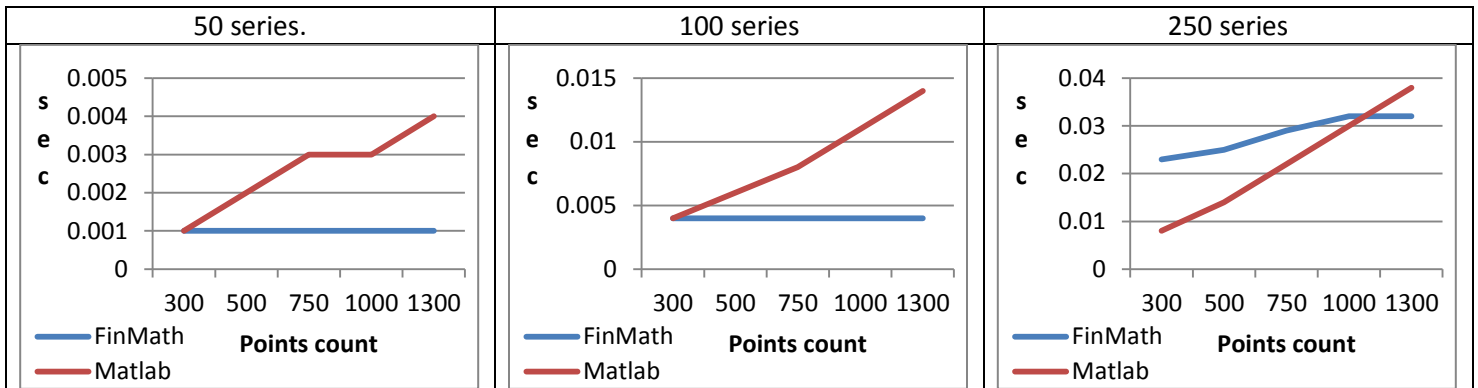
Testing system details:

All tests were performed on typical medium class desktop machine.

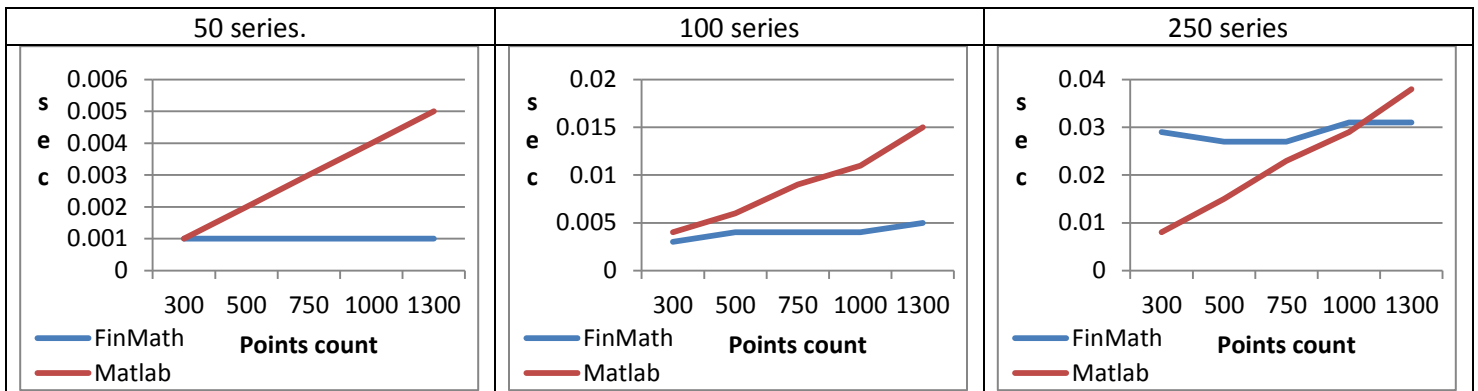
CPU: Core i7 870 (2.93GHz)
Memory: 8GB RAM
OS: Windows 7 x64

All source code of this test are available, one can get performance results on his own system. Changing test parameters is also possible.

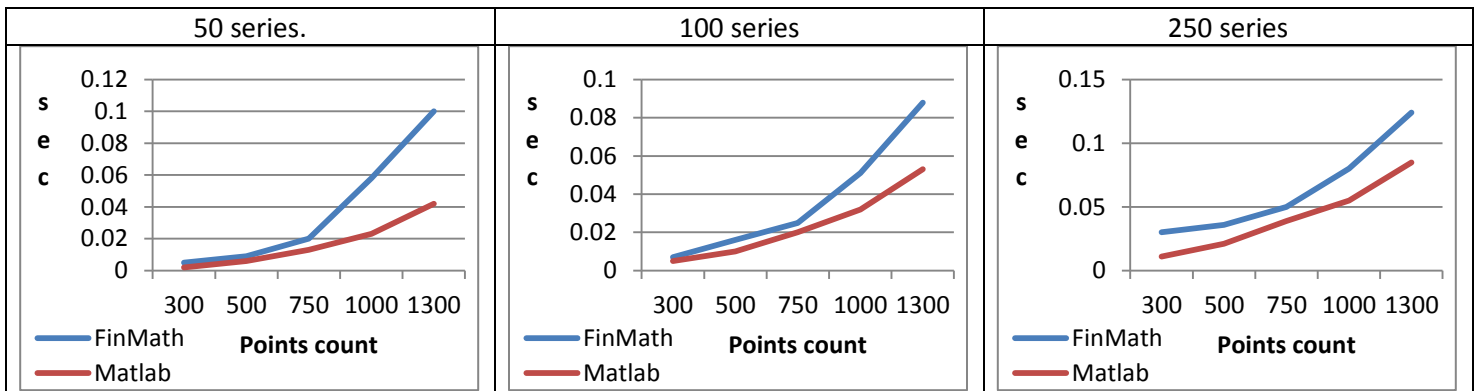
Ordinary Least Squares						
Points	Series	Repeats	FinMath		Matlab	
			Total Time	Single Time	Total Time	Single Time
300	50	500	0.484	0.001	0.557	0.001
500	50	500	0.468	0.001	0.935	0.002
750	50	500	0.484	0.001	1.32	0.003
1000	50	500	0.609	0.001	1.7	0.003
1300	50	500	0.577	0.001	2.17	0.004
300	100	100	0.39	0.004	0.359	0.004
500	100	100	0.375	0.004	0.586	0.006
750	100	100	0.39	0.004	0.84	0.008
1000	100	100	0.437	0.004	1.088	0.011
1300	100	100	0.437	0.004	1.365	0.014
300	250	20	0.468	0.023	0.167	0.008
500	250	20	0.499	0.025	0.287	0.014
750	250	20	0.577	0.029	0.443	0.022
1000	250	20	0.64	0.032	0.599	0.03
1300	250	20	0.64	0.032	0.759	0.038



Weighted Least Squares						
Points	Series	Repeats	FinMath		Matlab	
			Total Time	Single Time	Total Time	Single Time
300	50	500	0.499	0.001	0.596	0.001
500	50	500	0.499	0.001	0.944	0.002
750	50	500	0.546	0.001	1.379	0.003
1000	50	500	0.671	0.001	1.778	0.004
1300	50	500	0.702	0.001	2.27	0.005
300	100	100	0.343	0.003	0.378	0.004
500	100	100	0.375	0.004	0.606	0.006
750	100	100	0.406	0.004	0.871	0.009
1000	100	100	0.437	0.004	1.114	0.011
1300	100	100	0.546	0.005	1.488	0.015
300	250	20	0.577	0.029	0.164	0.008
500	250	20	0.546	0.027	0.307	0.015
750	250	20	0.546	0.027	0.452	0.023
1000	250	20	0.624	0.031	0.583	0.029
1300	250	20	0.624	0.031	0.763	0.038



Generalized Least Squares						
Points	Series	Repeats	FinMath		Matlab	
			Total Time	Single Time	Total Time	Single Time
300	50	500	2.279	0.005	1.177	0.002
500	50	500	4.261	0.009	2.881	0.006
750	50	500	10.082	0.02	6.585	0.013
1000	50	500	28.919	0.058	11.496	0.023
1300	50	500	50.183	0.1	21.104	0.042
300	100	100	0.687	0.007	0.503	0.005
500	100	100	1.638	0.016	1.015	0.01
750	100	100	2.512	0.025	2.044	0.02
1000	100	100	5.102	0.051	3.248	0.032
1300	100	100	8.831	0.088	5.3	0.053
300	250	20	0.593	0.03	0.211	0.011
500	250	20	0.718	0.036	0.412	0.021
750	250	20	0.999	0.05	0.781	0.039
1000	250	20	1.591	0.08	1.107	0.055
1300	250	20	2.481	0.124	1.694	0.085



Stepwise Least Squares						
Points	Series	Repeats	FinMath		Matlab	
			Total Time	Single Time	Total Time	Single Time
300	50	500	2.715	0.054	2.811	0.056
500	50	500	4.993	0.1	4.42	0.088
750	50	500	6.678	0.134	5.022	0.1
1000	50	500	5.804	0.116	4.871	0.097
1300	50	500	10.126	0.203	7.514	0.15
300	100	100	2.247	0.225	2.044	0.204
500	100	100	2.715	0.271	2.238	0.224
750	100	100	4.618	0.462	3.487	0.349
1000	100	100	6.147	0.615	4.835	0.484
1300	100	100	8.691	0.869	6.449	0.645
300	250	20	1.155	0.577	1.118	0.559
500	250	20	3.183	1.591	2.906	1.453
750	250	20	6.787	3.394	6.099	3.049
1000	250	20	8.332	4.166	8.054	4.027
1300	250	20	11.359	5.679	10.332	5.166

