Spatial Bloom Filter - Experiment results

Test datasets used in the experiments

8-bit datasets	Elements (n)	Sets (s)	Elements allocation and number (n_i)
area-element-unif	65 280	255	Linear, $n_i = 256$
area-element-lindec	65 280	255	Decremental, $n_1 = 510,\ n_2 = 508,\ \ldots,\ n_{256} = 2$
area-element-lininc	65 280	255	Incremental, $n_1 = 2,\ n_2 = 4,\ \ldots,\ n_{256} = 510$
area-element-rand	65 280	255	Random, n_i varies in $[209, 298]$
non-elements	500 000	-	-
8-bit-large datasets	**Elements (n)**	**Sets (s)**	**Elem. allocation, number (n_i)**
area-element-unif	16 776 960	255	Linear, $n_i = 65\,792$
non-elements	14 097 123	-	-
16-bit datasets	**Elements (n)**	**Sets (s)**	**Elem. allocation, number (n_i)**
area-element-unif	16 776 960	65 535	Linear, $n_i = 256$
area-element-lindec	16 776 960	65 535	Decremental, $n_{[1,257]} = 510,\ n_{[258,514]} = 508,\ \ldots,\ n_{[65279,65535]} = 2$
area-element-lininc	16 776 960	65 535	Incremental, $n_{[1,257]} = 2,\ n_{[258,514]} = 4,\ \ldots,\ n_{[65279,65535]} = 510$
area-element-rand	16 776 960	65 535	Random, n_i varies in $[191, 324]$
non-elements	14 097 123	-	-

SBF paramenters

Dataset family	Experiment description	Filter cells (m)	Hash family and number (k)
8-bit datasets	Set-specific evaluation of emersion, false positives and inter-set errors	2^{20}	MD5, $k = 10$
	Evaluation of safeness over the entire filter	$m = 2^{17}, \ldots, 2^{25}$	MD5, $k = 10$
8-bit-large datasets	Set-specific evaluation of emersion, false positives and inter-set errors	2^{28}	MD5, $k = 10$
16-bit datasets	Set-specific evaluation of emersion, false positives and inter-set errors	2^{28}	MD5, $k = 10$

Implementation performance

Dataset	Filter construction	Probabilistic properties	Self-check	Non-elements testing
8-bit	173ms	1ms	170ms	38ms
8-bit-large	57 462ms	1ms	55 571ms	13 053ms
16-bit	59 718ms	12 892ms	57 859ms	14 291ms

Average time for a single membership query: 0.00076ms.

These tests were performed on a Intel Xeon CPU 3.30GHz machine with 16.0GB RAM and refer to our C++ library implementing SBF.

Authors

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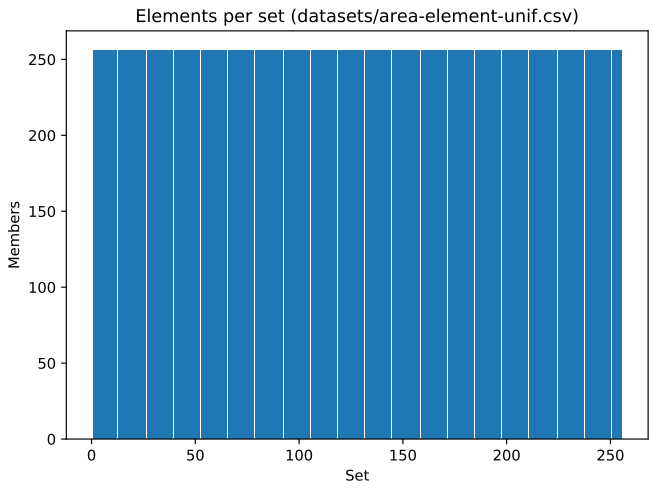
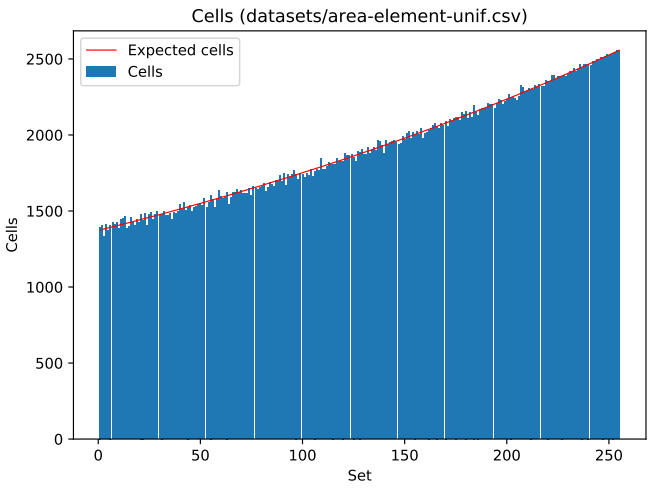
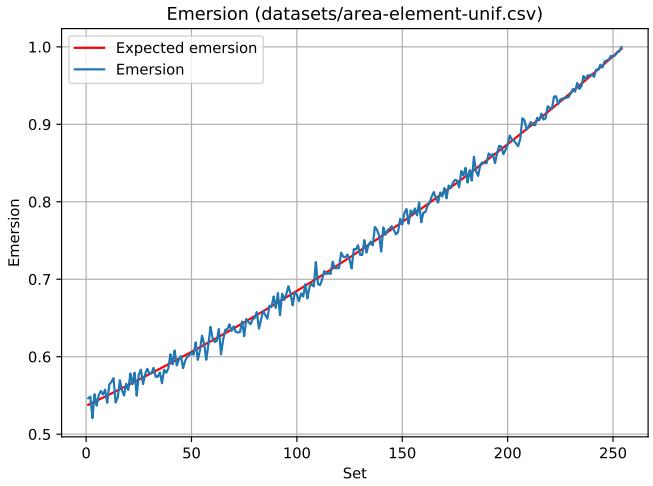
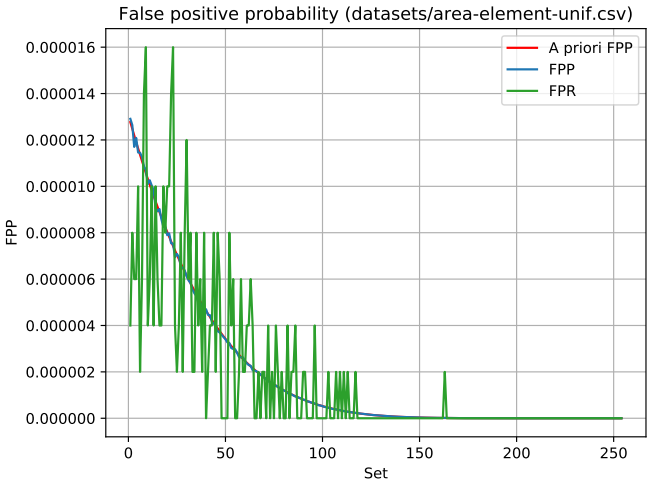
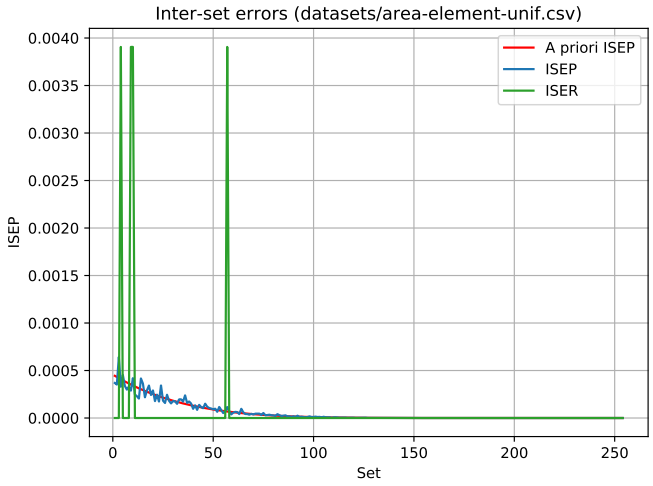
area-element-unif (8-bit)

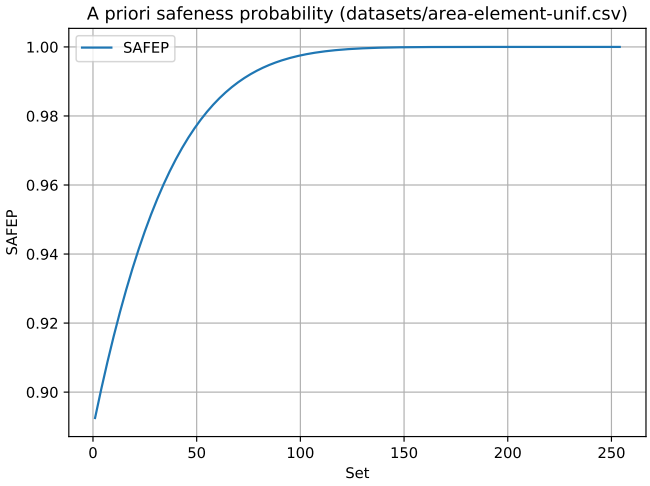








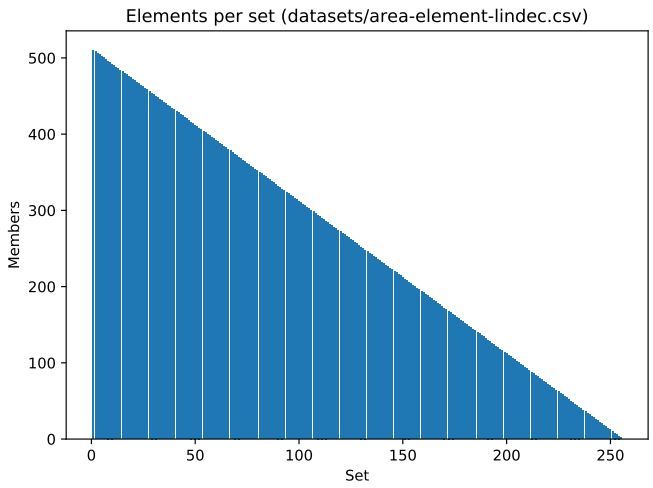


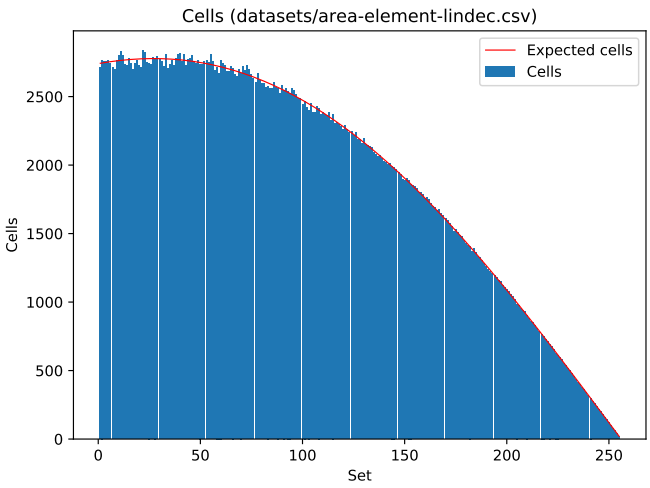


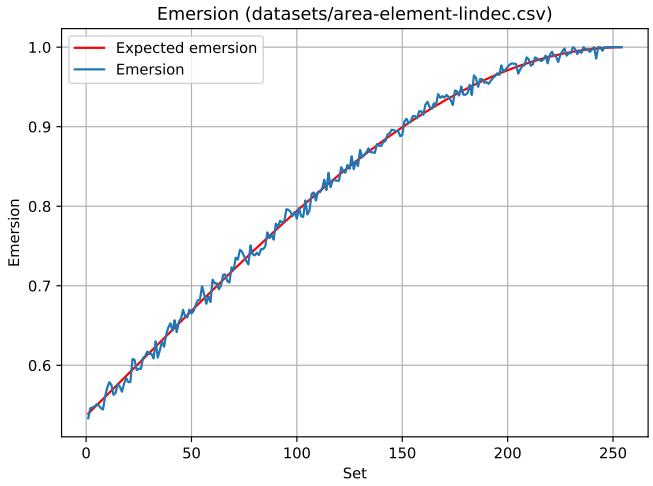
Overall filter safeness probability

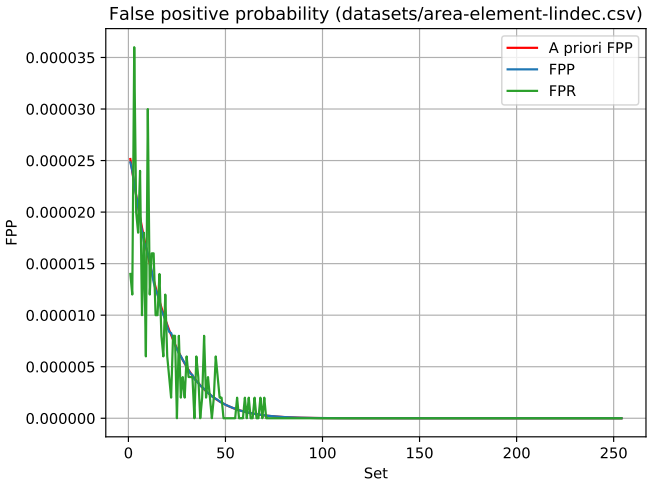
Dataset	$m = 2^{17}$	$m = 2^{18}$	$m = 2^{19}$	$m = 2^{20}$	$m = 2^{21}$	$m = 2^{22}$	$m = 2^{23}$	$m = 2^{24}$	$m = 2^{25}$
area-element-unif	0.00000	0.00000	0.00000	0.03131	0.98764	0.99998	1.00000	1.00000	1.00000

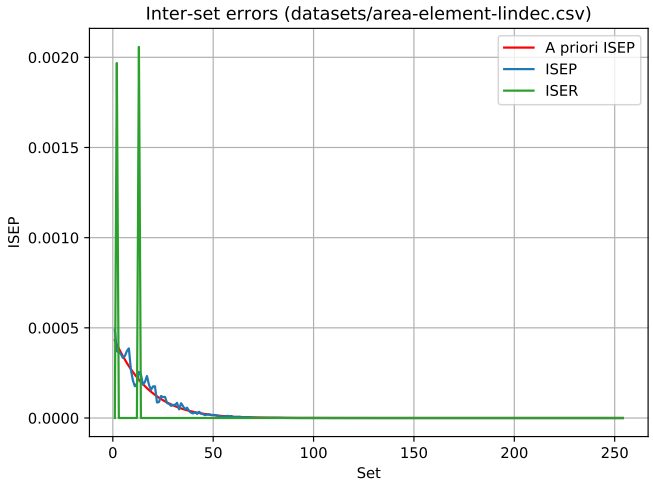
area-element-lindec (8-bit)

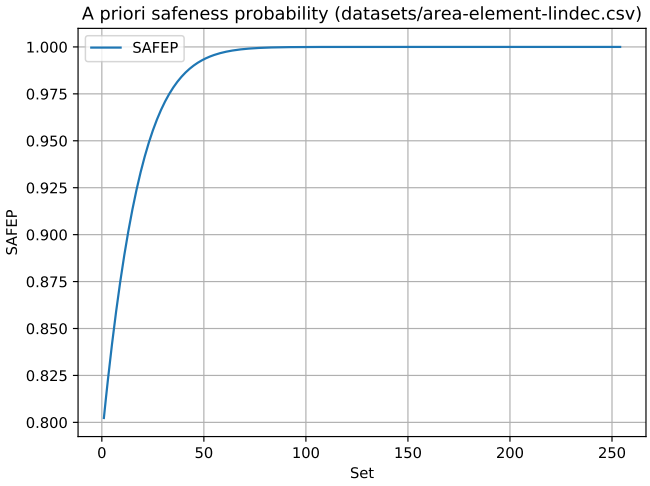








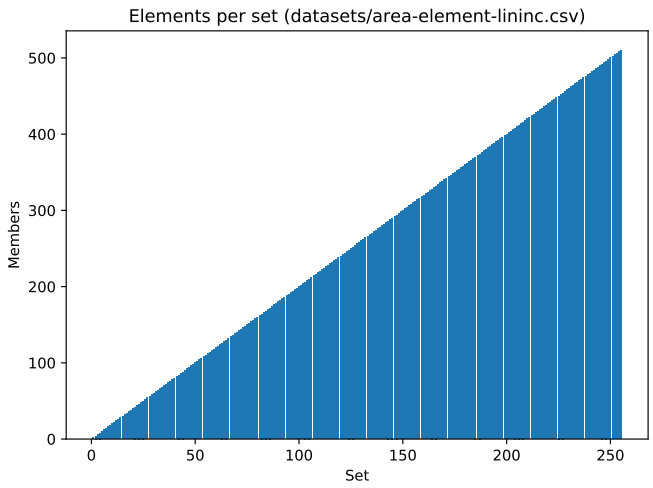


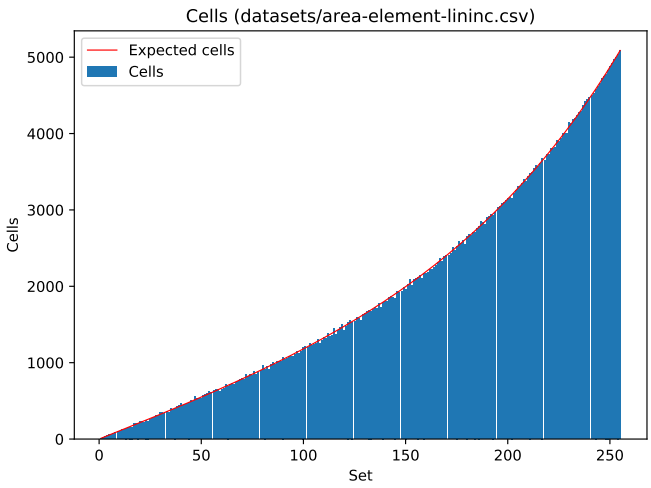


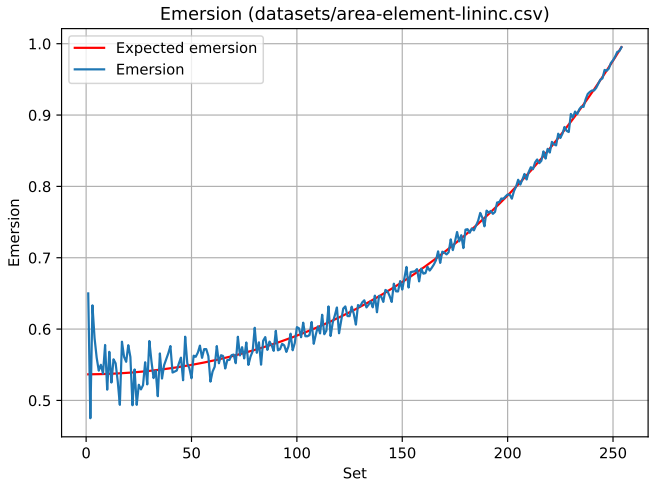
Overall filter safeness probability

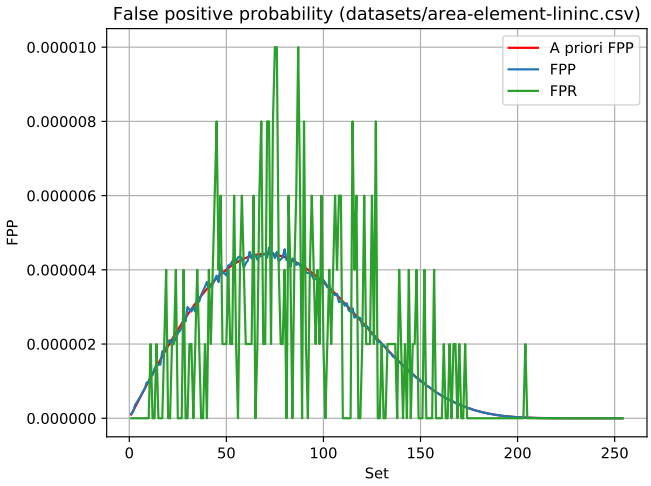
Dataset	$m = 2^{17}$	$m = 2^{18}$	$m = 2^{19}$	$m = 2^{20}$	$m = 2^{21}$	$m = 2^{22}$	$m = 2^{23}$	$m = 2^{24}$	$m = 2^{25}$
area-element-lindec	0.00000	0.00000	0.00000	0.03292	0.98784	0.99998	1.00000	1.00000	1.00000

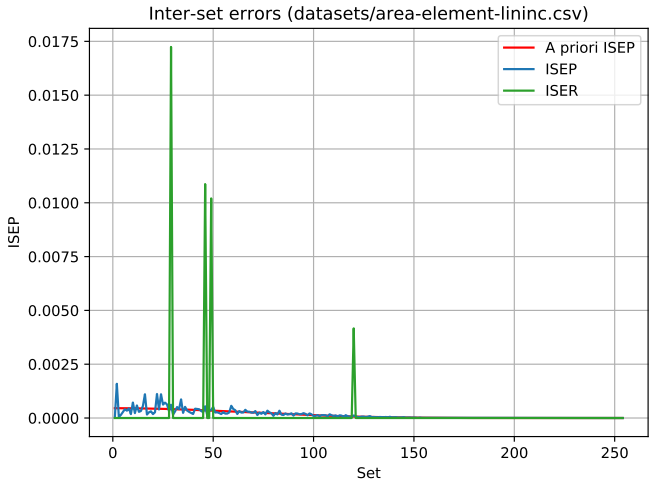
area-element-lininc (8-bit)

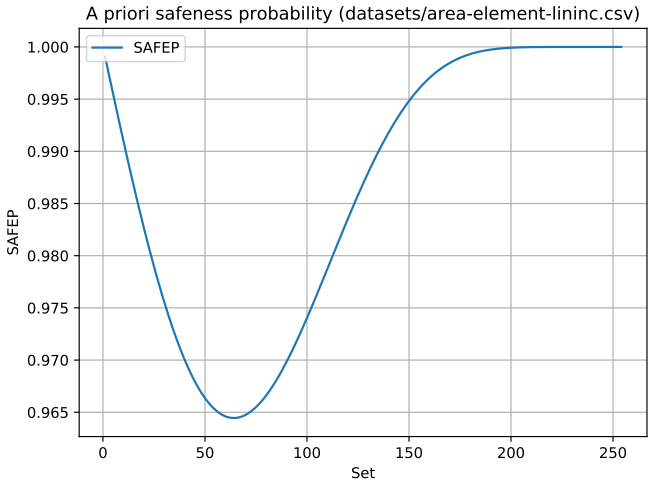












Overall filter safeness probability

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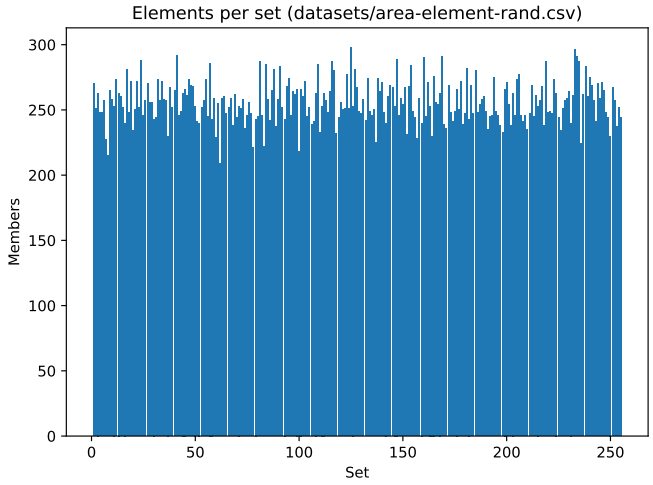
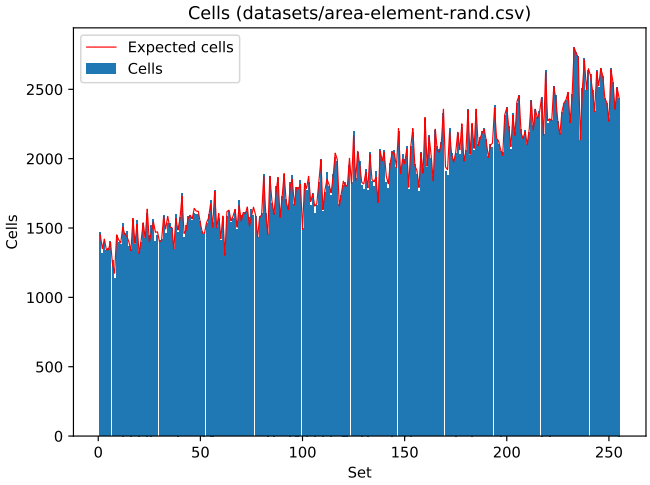
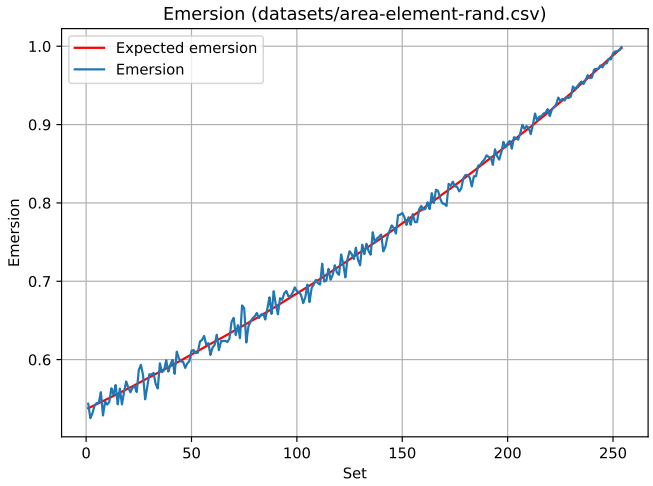
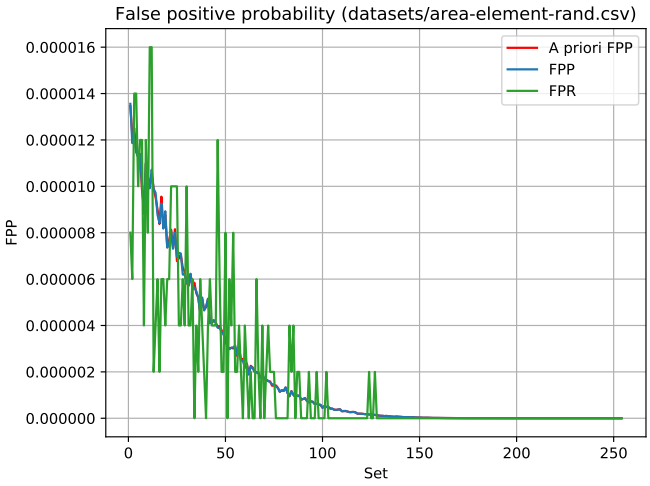
area-element-lininc	0.00000	0.00000	0.00000	0.03062	0.98754	0.99998	1.00000	1.00000	1.00000

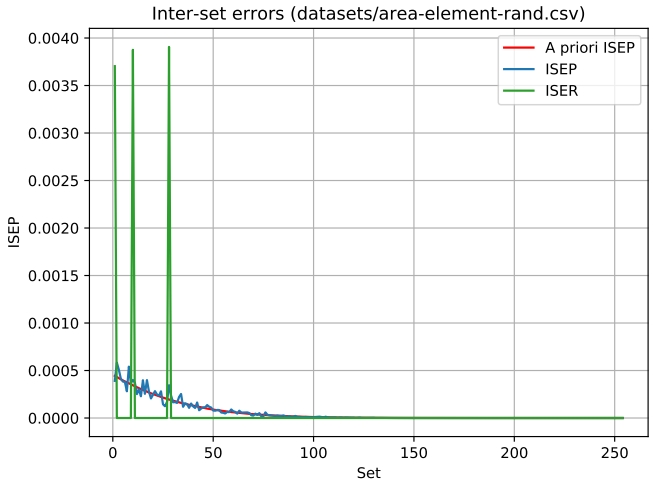
area-element-rand (8-bit)

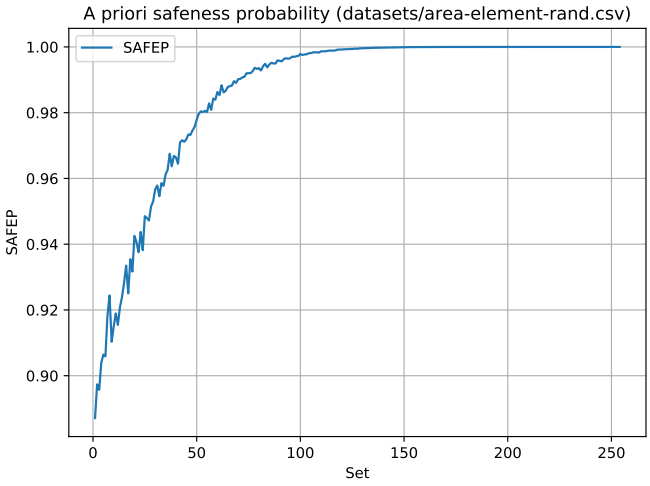












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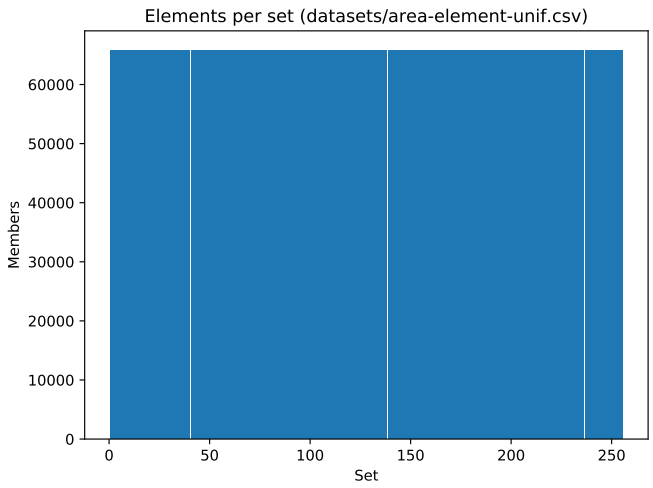
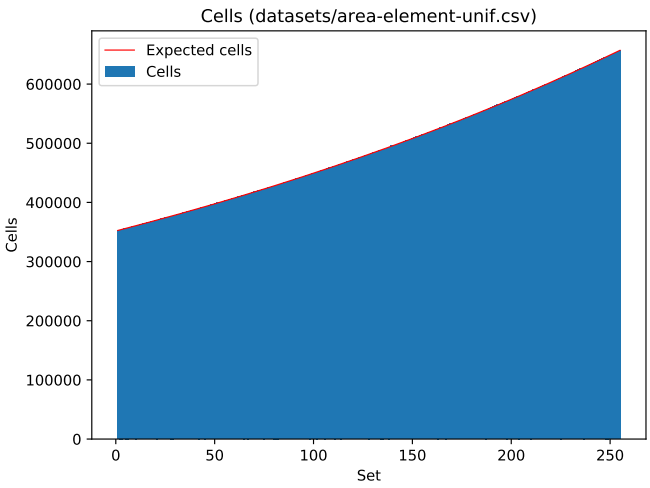
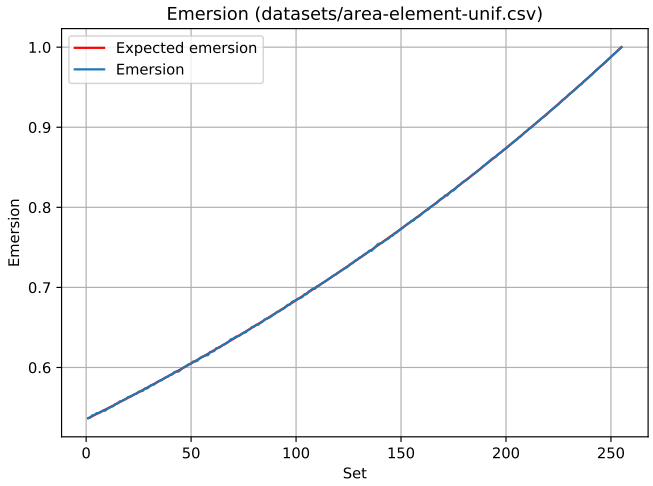
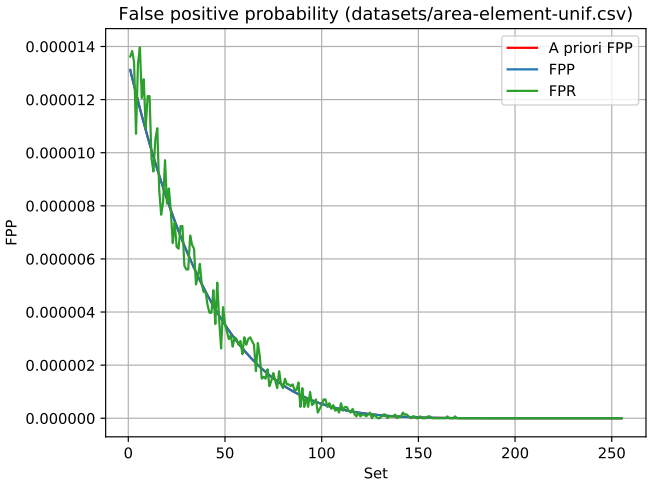
area-element-rand	0.00000	0.00000	0.00000	0.03131	0.98764	0.99998	1.00000	1.00000	1.00000

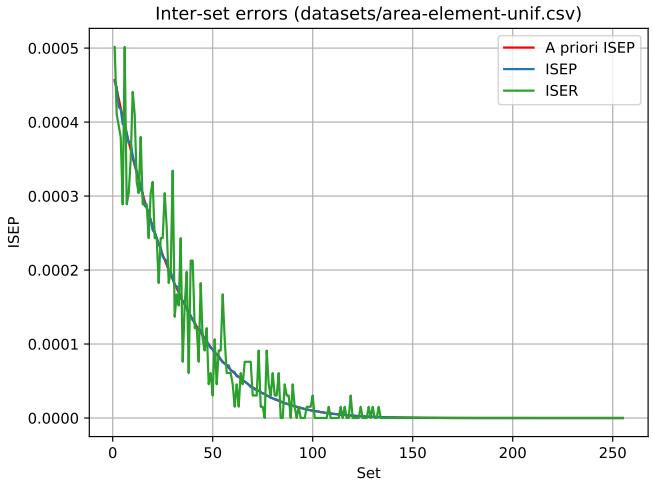
area-element-unif (8-bit large)

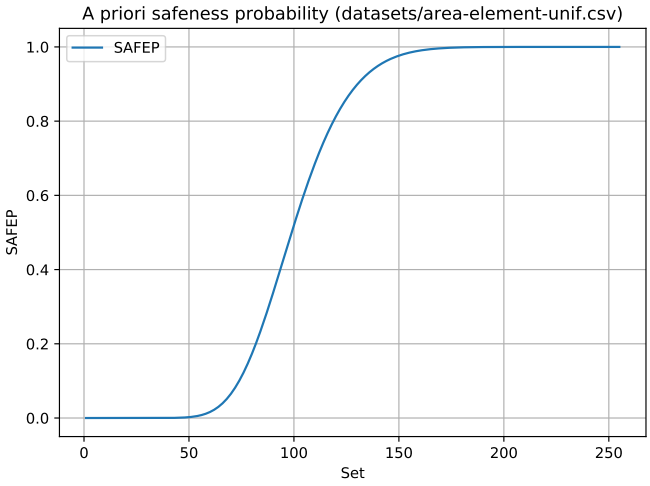




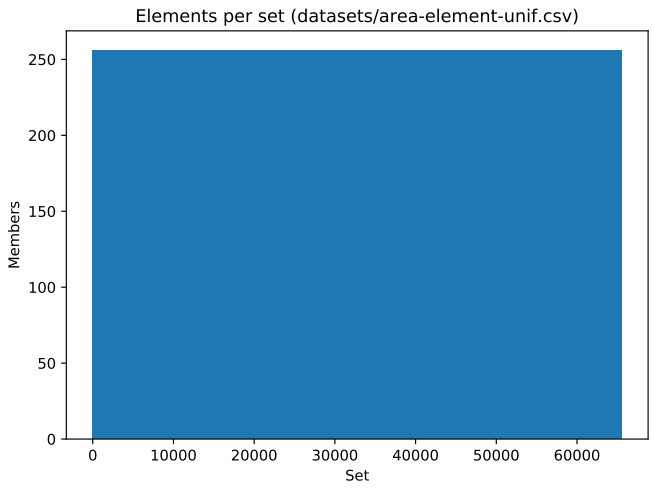


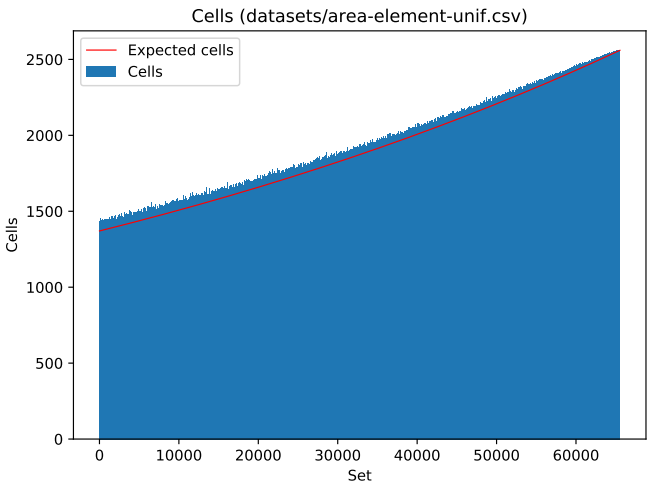


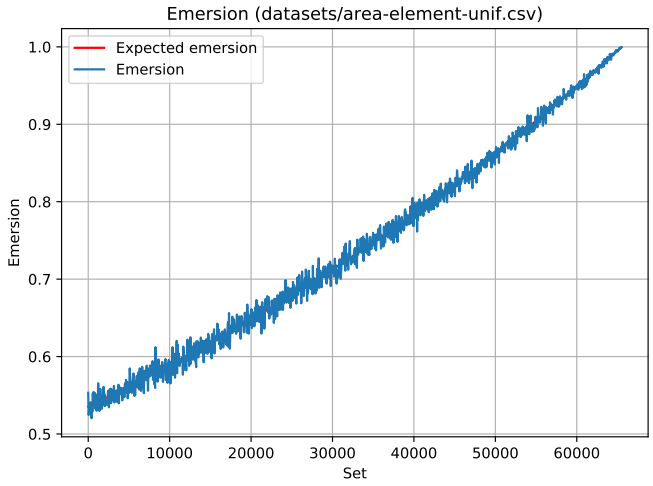


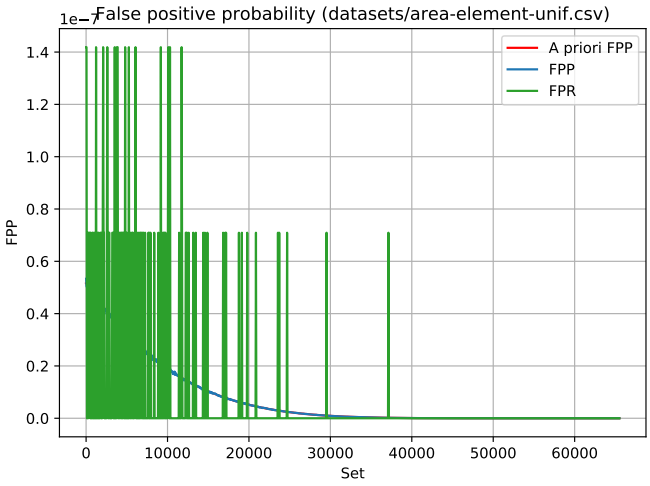


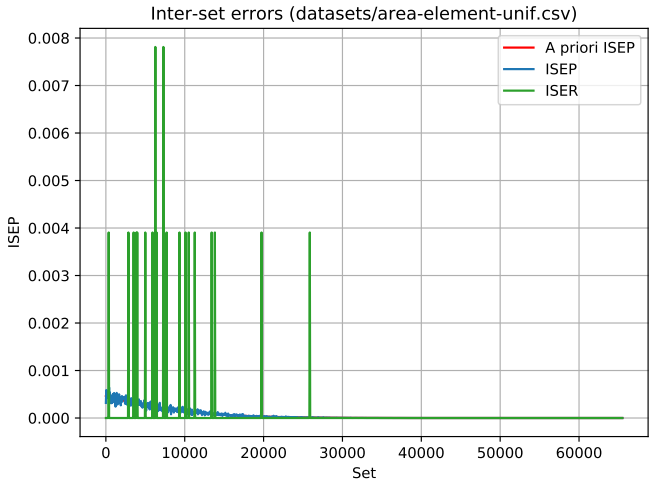
area-element-unif (16-bit)

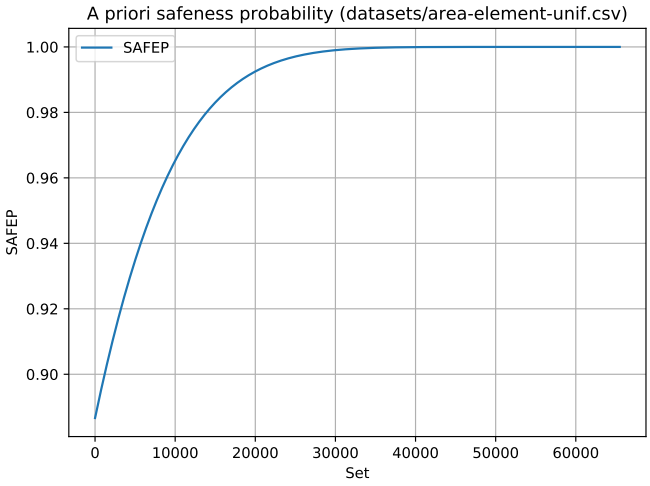




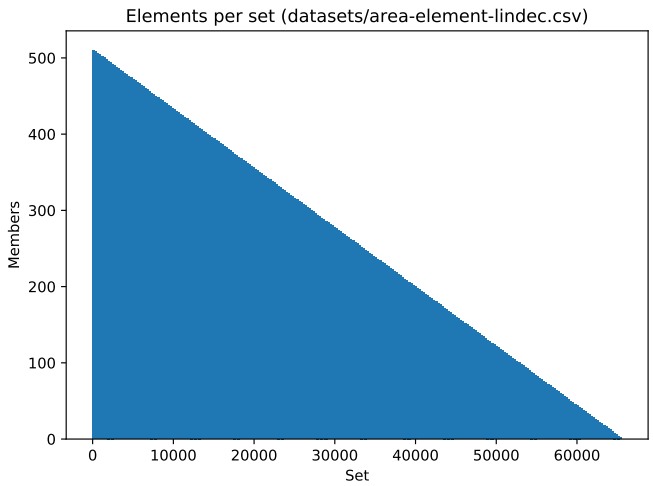


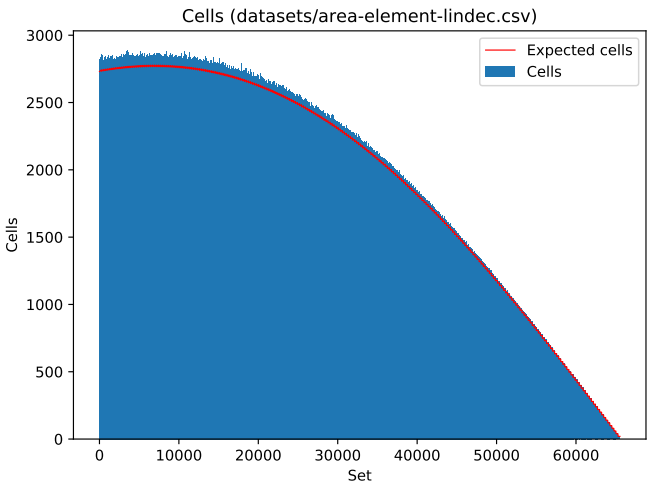


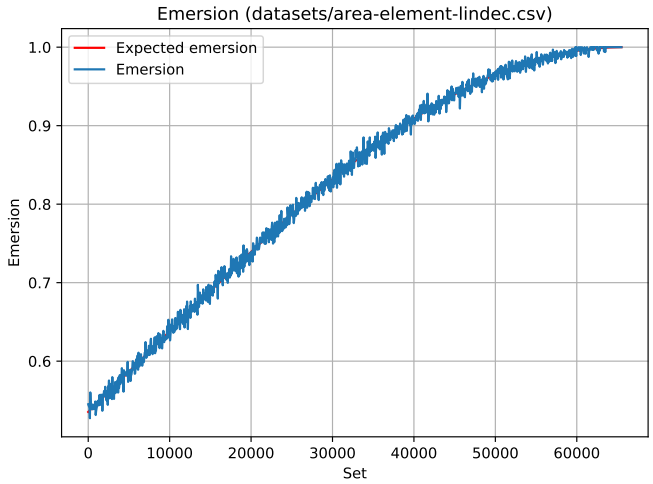


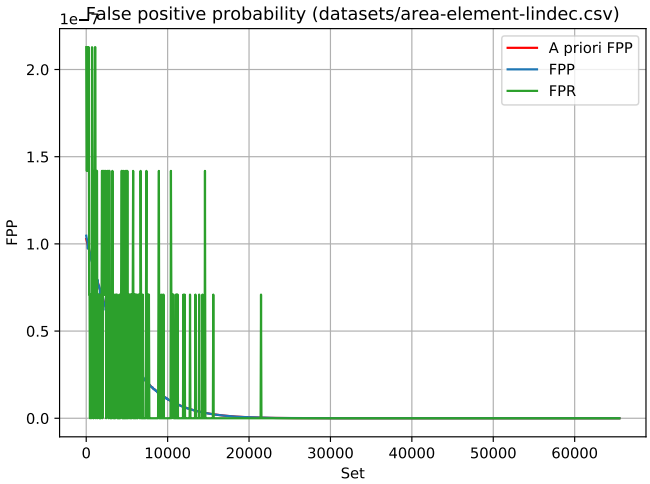


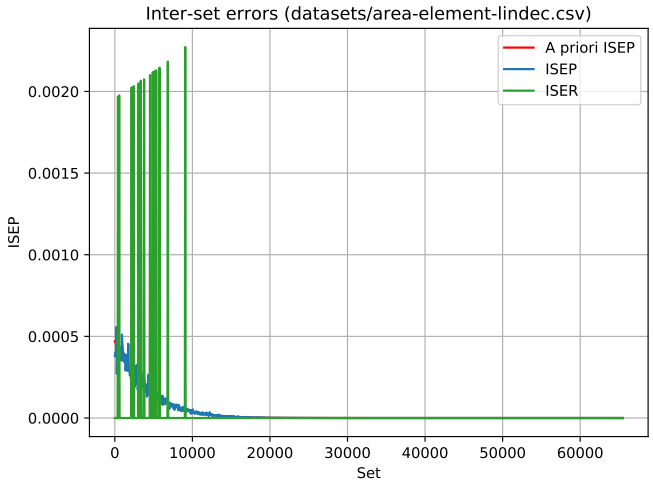
area-element-lindec (16-bit)

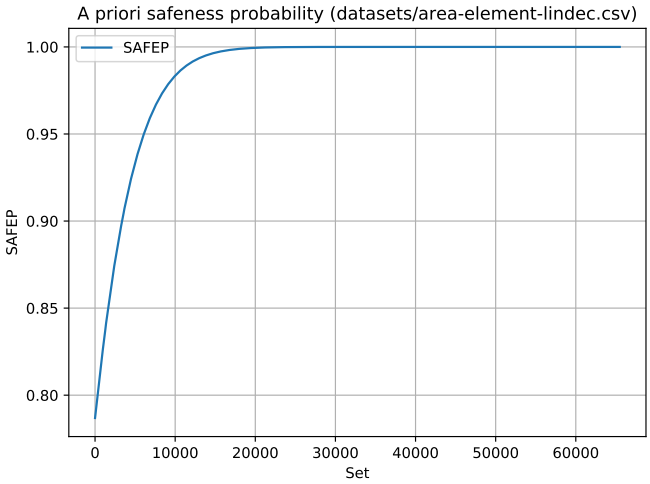




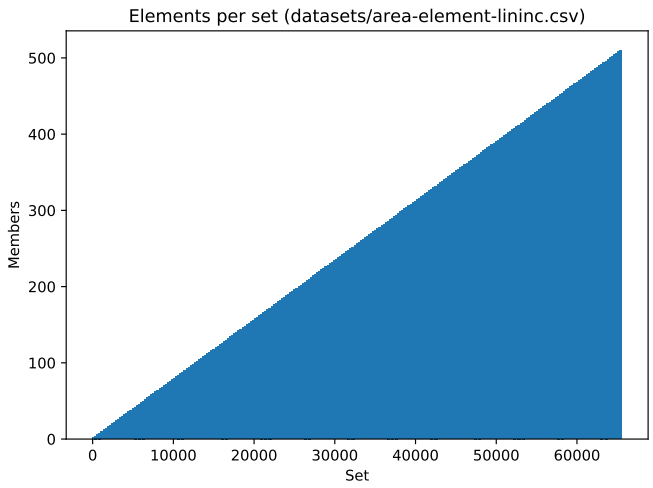


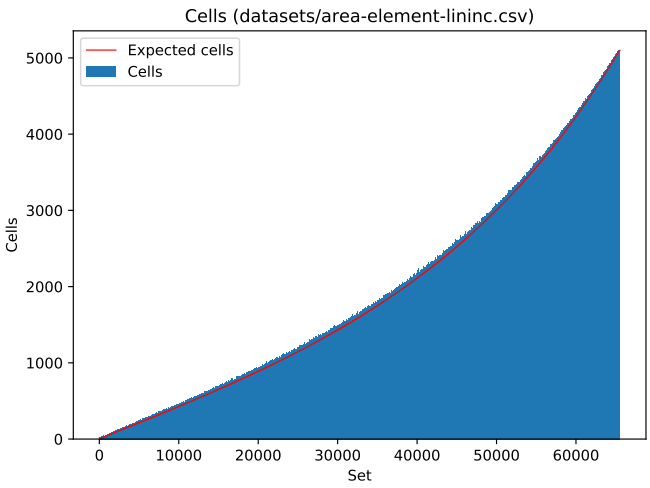


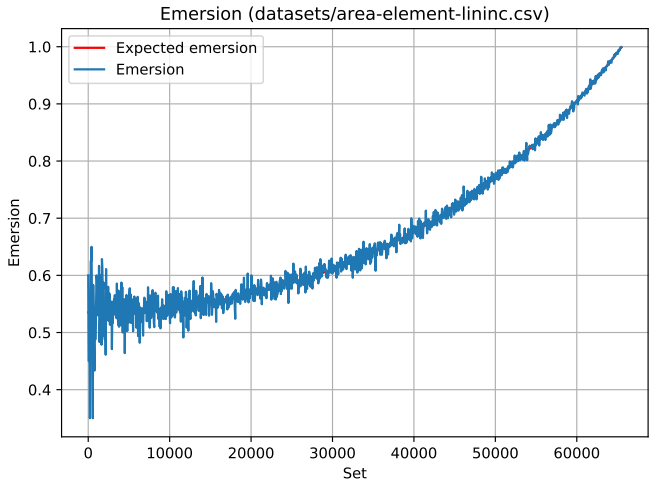


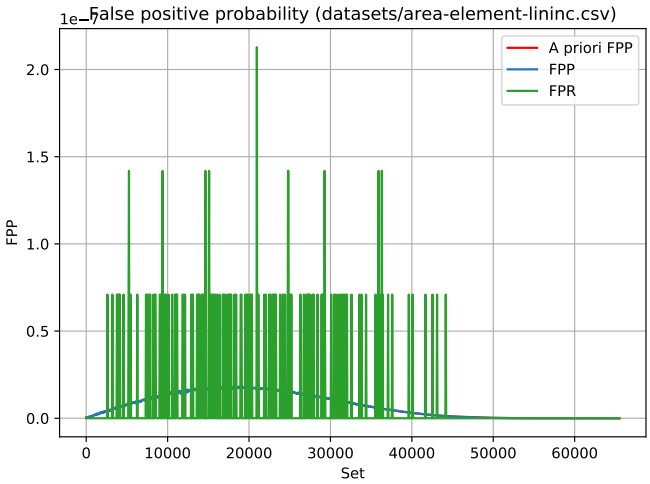


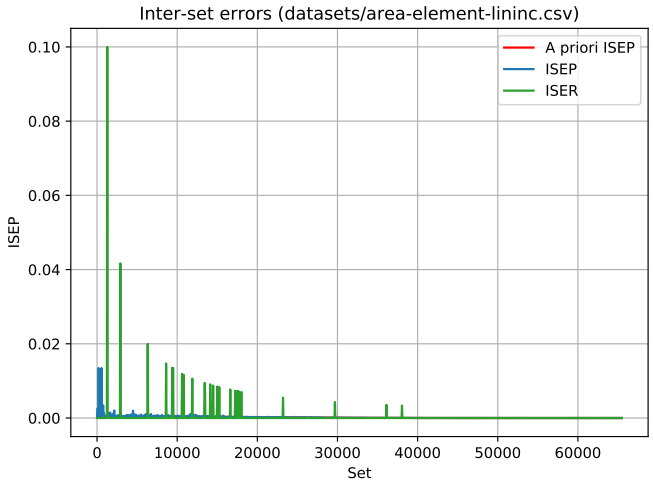
area-element-lininc (16-bit)

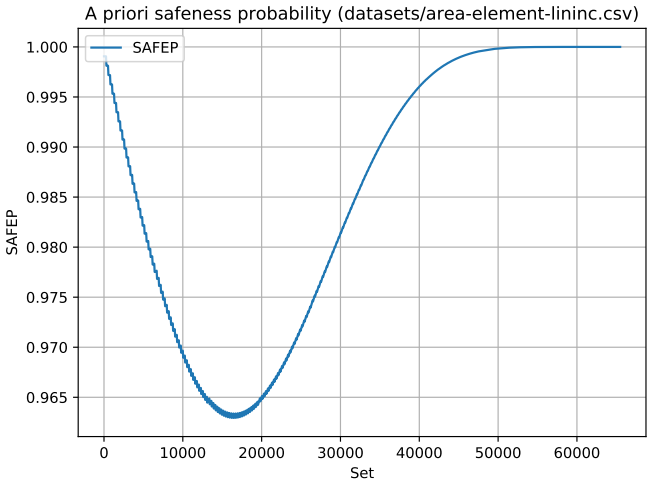




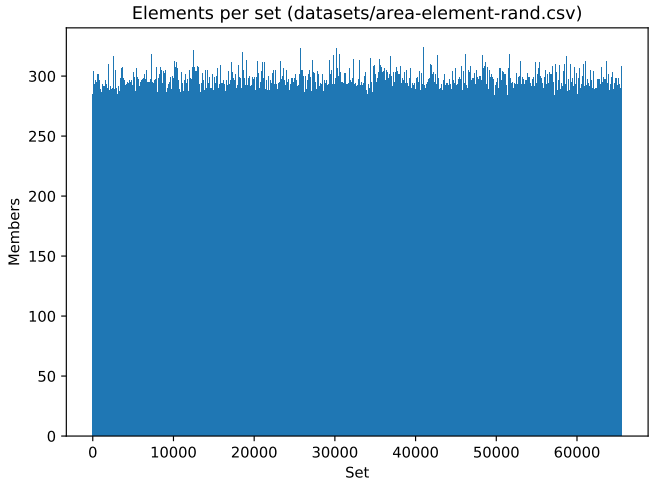


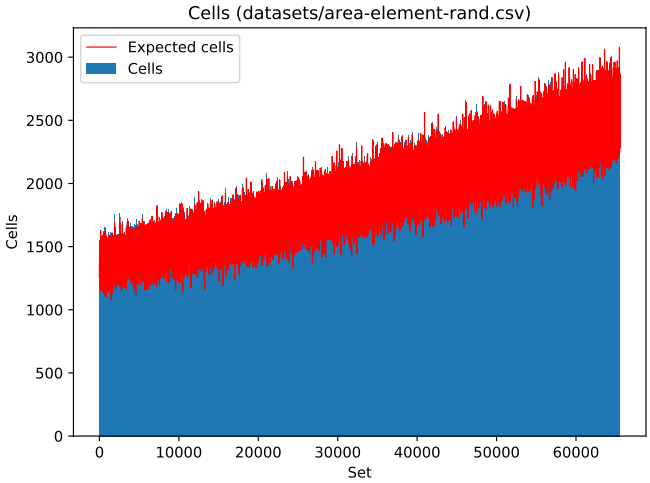


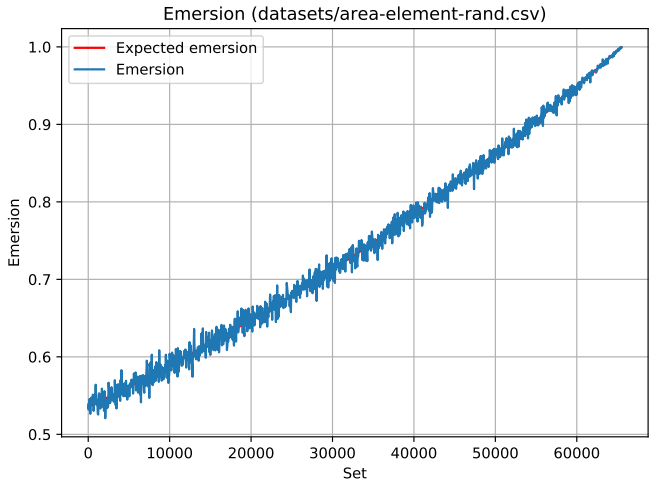


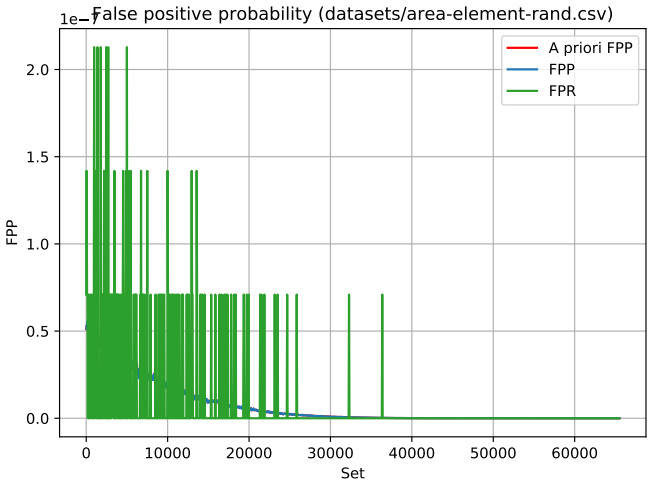


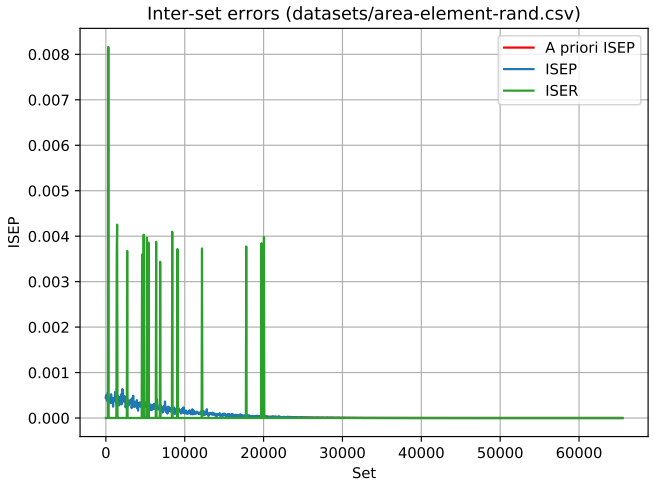
area-element-rand (16-bit)

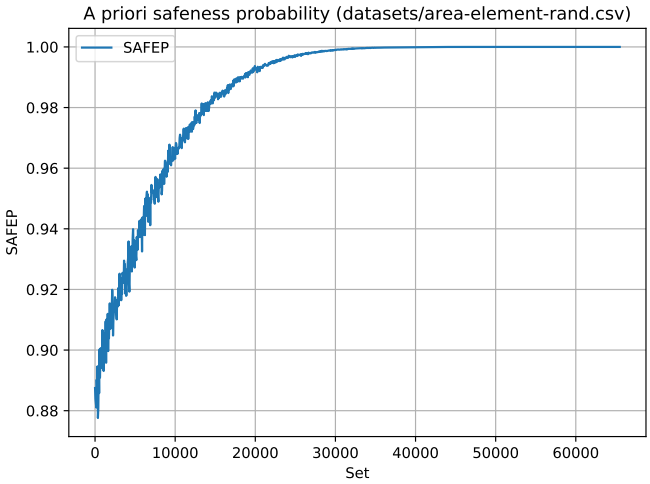












Hash salt

Hereunder you may find the base64 encoded version of the hash salt used during our experiments. Each line corresponds to a hash function. The hash standard used is MD5.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