Supporting Information for "Practical considerations for variable screening in the super learner"

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1 Numerical experiments

1.1 Values of n_{eff} and V

In Table S1, we display the effective sample size n_{eff} and the number of cross-validation folds V used in both the outer (to estimate cross-validated prediction performance of the convex ensemble super learner (cSL)) and inner (to select the weights in the cSL) cross-validation for each sample size in the binary-outcome settings. In the continuous-outcome settings, since $n_{\text{eff}} = n$, we set $V = 20$ for $n \leq 500$ and set $V = 10$ for $n > 500$. All values of V were chosen following Phillips et al. (2023).

	(n_{eff}, V)								
n	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
200	(89, 20)	(77, 20)	(81, 20)	(76, 20)	(91, 20)	(82, 20)	(27, 27)	(41, 20)	(10, 10)
500	(224, 20)	(193, 20)	(204, 20)	(190, 20)	(227, 20)	(205, 20)	(67, 20)	(103, 20)	(25, 25)
1000	(448, 20)	(387, 20)	(409, 20)	(380, 20)	(455, 20)	(410, 20)	(135, 20)	(206, 20)	(51, 20)
2000	(897, 10)	(774, 10)	(818, 10)	(761, 10)	(911, 10)	(821, 10)	(270, 20)	(412, 20)	(103, 20)
3000	(1346, 10)	(1161, 10)	(1227, 10)	(1142, 10)	(1367, 10)	(1231, 10)	(406, 20)	(618, 10)	(155, 20)

Table S1: Values of (n_{eff}, V) for each sample size and data-generating scenario in the binary-outcome simulations.

1.2 Additional numerical results

We first present results for the binary-outcome simulations in the main manuscript with respect to non-negative log likelihood.

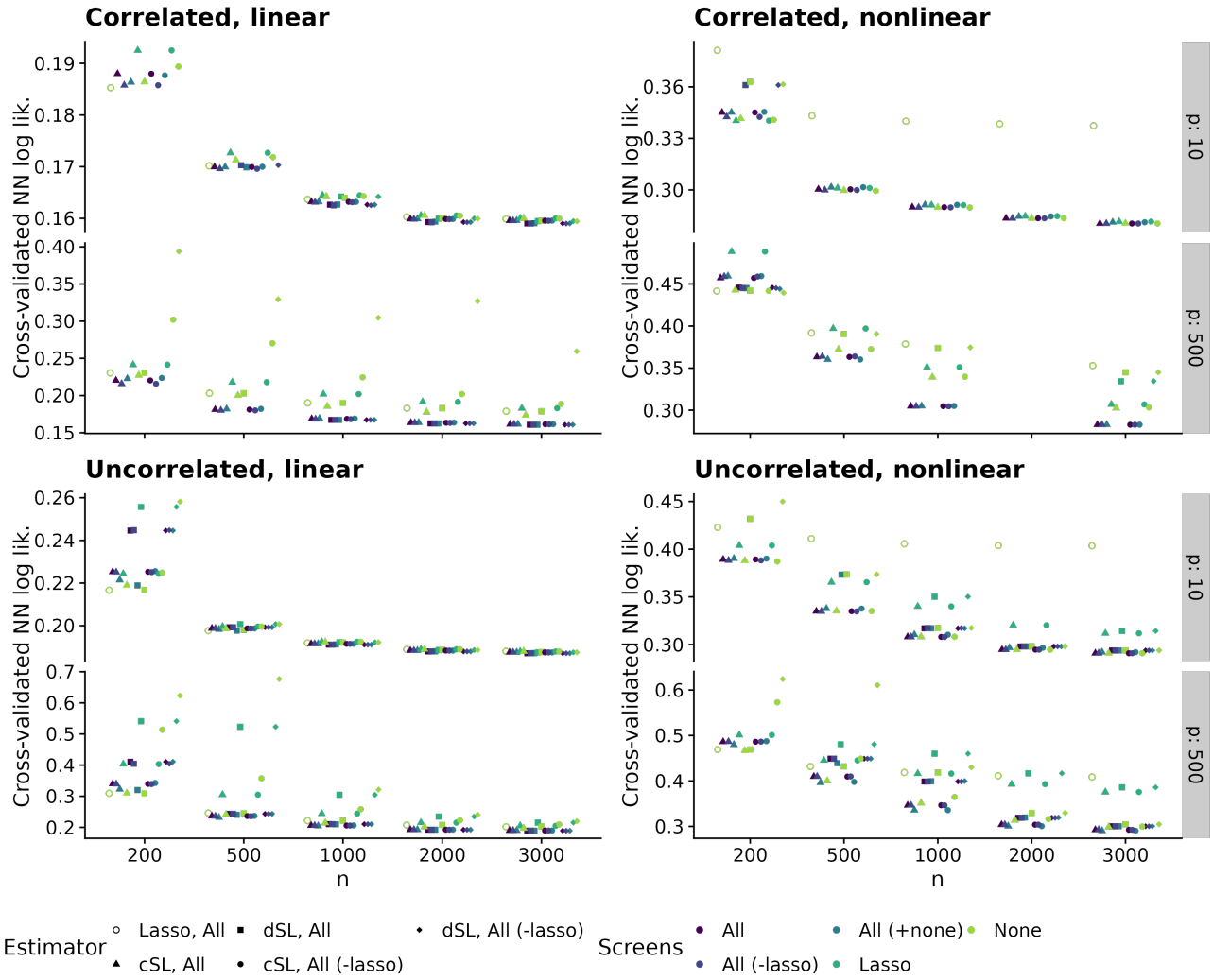

Figure S1: Prediction performance versus sample size n, measured using cross-validated non-negative log likelihood (NN log lik.), for predicting a binary outcome. There is a strong relationship between outcome and features. The top row shows results for correlated features, while the bottom row shows results for uncorrelated features. The left-hand column shows results for a linear outcome-feature relationship, while the right-hand column shows results for a nonlinear outcome-feature relationship. The dashed line denotes the best-possible prediction performance in each setting. Color denotes the variable screeners, while shape denotes the estimator (lasso, convex ensemble super learner [cSL], and discrete super learner [dSL]). Note that the y-axis limits differ between panels.

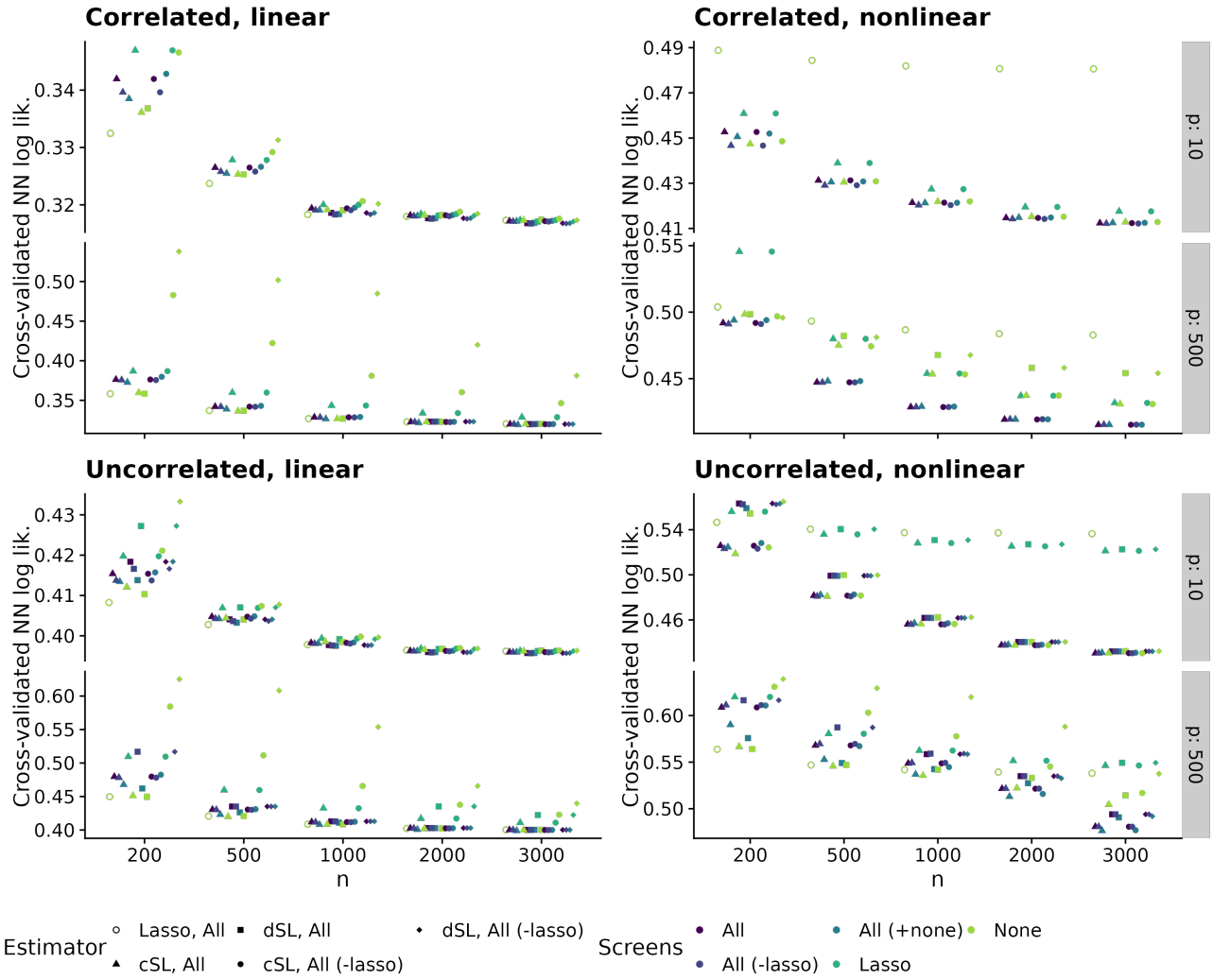

Figure S2: Prediction performance versus sample size n, measured using cross-validated non-negative log likelihood (NN log lik.), for predicting a binary outcome. There is a weak relationship between outcome and features. The top row shows results for correlated features, while the bottom row shows results for uncorrelated features. The left-hand column shows results for a linear outcome-feature relationship, while the right-hand column shows results for a nonlinear outcome-feature relationship. The dashed line denotes the best-possible prediction performance in each setting. Color denotes the variable screeners, while shape denotes the estimator (lasso, convex ensemble super learner [cSL], and discrete super learner [dSL]). Note that the y-axis limits differ between panels.

We provide results for $n = 500$ and $p = 2000$, along with results for each of the candidate learners in the super learner, in Tables S2–S9. In the high-dimensional case, performance tends to be worse than at smaller p (or with $n > p$), but this is unsurprising. Otherwise, the trends are similar.

Table S2: Cross-validated R-squared for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: continuous, relationship: strong.

n	p	Outcome relation-ship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction perfor-mance	Optimal prediction perfor-mance
500	2000	Nonlinear	Uncorrelated	All	All	dSL	0.634	0.856
500	2000	Nonlinear	Uncorrelated	All	All (+none)	dSL	0.736	0.856
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	dSL	0.634	0.856
500	2000	Nonlinear	Uncorrelated	All	Lasso	dSL	0.513	0.856
500	2000	Nonlinear	Uncorrelated	All	None	dSL	0.737	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	dSL	0.634	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.736	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.634	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	dSL	0.513	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	dSL	0.737	0.856
500	2000	Nonlinear	Uncorrelated	All	None	Lasso	0.585	0.856
500	2000	Nonlinear	Uncorrelated	All	All	cSL	0.673	0.856
500	2000	Nonlinear	Uncorrelated	All	All (+none)	cSL	0.744	0.856
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	cSL	0.673	0.856
500	2000	Nonlinear	Uncorrelated	All	Lasso	cSL	0.559	0.856
500	2000	Nonlinear	Uncorrelated	All	None	cSL	0.739	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	cSL	0.673	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.744	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.673	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	cSL	0.559	0.856
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	cSL	0.715	0.856
500	2000	Nonlinear	Correlated	All	All	dSL	0.678	0.758
500	2000	Nonlinear	Correlated	All	All (+none)	dSL	0.678	0.758
500	2000	Nonlinear	Correlated	All	All (-lasso)	dSL	0.678	0.758
500	2000	Nonlinear	Correlated	All	Lasso	dSL	0.223	0.758
500	2000	Nonlinear	Correlated	All	None	dSL	0.548	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	All	dSL	0.678	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	dSL	0.678	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	dSL	0.678	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	dSL	0.223	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.548	0.758
500	2000	Nonlinear	Correlated	All	None	Lasso	0.010	0.758
500	2000	Nonlinear	Correlated	All	All	cSL	0.688	0.758
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.565	0.758
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.689	0.758

Table S2: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relation-ship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction perfor-mance	Optimal prediction perfor-mance
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.264	0.758
500	2000	Nonlinear	Correlated	All	None	cSL	0.246	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.688	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.565	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.689	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.264	0.758
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.246	0.758
500	2000	Linear	Uncorrelated	All	All	dSL	0.913	0.932
500	2000	Linear	Uncorrelated	All	All (+none)	dSL	0.924	0.932
500	2000	Linear	Uncorrelated	All	All (-lasso)	dSL	0.911	0.932
500	2000	Linear	Uncorrelated	All	Lasso	dSL	0.907	0.932
500	2000	Linear	Uncorrelated	All	None	dSL	0.924	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	All	dSL	0.913	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.913	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.911	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	dSL	0.907	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	None	dSL	0.892	0.932
500	2000	Linear	Uncorrelated	All	None	Lasso	0.924	0.932
500	2000	Linear	Uncorrelated	All	All	cSL	0.895	0.932
500	2000	Linear	Uncorrelated	All	All (+none)	cSL	0.887	0.932
500	2000	Linear	Uncorrelated	All	All (-lasso)	cSL	0.890	0.932
500	2000	Linear	Uncorrelated	All	Lasso	cSL	0.913	0.932
500	2000	Linear	Uncorrelated	All	None	cSL	0.922	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	All	cSL	0.895	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.898	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.890	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	cSL	0.913	0.932
500	2000	Linear	Uncorrelated	All (-lasso)	None	cSL	0.876	0.932
500	2000	Linear	Correlated	All	All	dSL	0.950	0.951
500	2000	Linear	Correlated	All	All (+none)	dSL	0.950	0.951
500	2000	Linear	Correlated	All	All (-lasso)	dSL	0.950	0.951
500	2000	Linear	Correlated	All	Lasso	dSL	0.933	0.951
500	2000	Linear	Correlated	All	None	dSL	0.941	0.951
500	2000	Linear	Correlated	All (-lasso)	All	dSL	0.950	0.951
500	2000	Linear	Correlated	All (-lasso)	All (+none)	dSL	0.950	0.951
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	dSL	0.950	0.951
500	2000	Linear	Correlated	All (-lasso)	Lasso	dSL	0.933	0.951
500	2000	Linear	Correlated	All (-lasso)	None	dSL	0.919	0.951
500	2000	Linear	Correlated	All	None	Lasso	0.941	0.951
500	2000	Linear	Correlated	All	All	cSL	0.439	0.951

Table S2: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Correlated	All	All (+none)	cSL	0.926	0.951
500	2000	Linear	Correlated	All	All (-lasso)	cSL	0.438	0.951
500	2000	Linear	Correlated	All	Lasso	cSL	0.935	0.951
500	2000	Linear	Correlated	All	None	cSL	0.929	0.951
500	2000	Linear	Correlated	All (-lasso)	All	cSL	0.439	0.951
500	2000	Linear	Correlated	All (-lasso)	All (+none)	cSL	0.926	0.951
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	cSL	0.438	0.951
500	2000	Linear	Correlated	All (-lasso)	Lasso	cSL	0.935	0.951
500	2000	Linear	Correlated	All (-lasso)	None	cSL	0.877	0.951

Table S3: Cross-validated R-squared for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: continuous, relationship: weak.

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Uncorrelated	All	All	dSL	0.300	0.667
500	2000	Nonlinear	Uncorrelated	All	All (+none)	dSL	0.331	0.667
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	dSL	0.300	0.667
500	2000	Nonlinear	Uncorrelated	All	Lasso	dSL	0.250	0.667
500	2000	Nonlinear	Uncorrelated	All	None	dSL	0.324	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	dSL	0.300	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.303	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.300	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	dSL	0.250	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	dSL	0.091	0.667
500	2000	Nonlinear	Uncorrelated	All	None	Lasso	0.315	0.667
500	2000	Nonlinear	Uncorrelated	All	All	cSL	0.001	0.667
500	2000	Nonlinear	Uncorrelated	All	All (+none)	cSL	0.061	0.667
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	cSL	0.044	0.667
500	2000	Nonlinear	Uncorrelated	All	Lasso	cSL	0.263	0.667
500	2000	Nonlinear	Uncorrelated	All	None	cSL	0.327	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	cSL	0.001	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	cSL	-0.007	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.044	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	cSL	0.263	0.667
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	cSL	0.184	0.667
500	2000	Nonlinear	Correlated	All	All	dSL	0.681	0.744

Table S3: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Correlated	All	All (+none)	dSL	0.681	0.744
500	2000	Nonlinear	Correlated	All	All (-lasso)	dSL	0.681	0.744
500	2000	Nonlinear	Correlated	All	Lasso	dSL	0.601	0.744
500	2000	Nonlinear	Correlated	All	None	dSL	0.559	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	All	dSL	0.681	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	dSL	0.681	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	dSL	0.681	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	dSL	0.601	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.559	0.744
500	2000	Nonlinear	Correlated	All	None	Lasso	0.226	0.744
500	2000	Nonlinear	Correlated	All	All	cSL	0.257	0.744
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.409	0.744
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.078	0.744
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.621	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.257	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.409	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.078	0.744
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.621	0.744
500	2000	Linear	Uncorrelated	All	All	dSL	0.646	0.667
500	2000	Linear	Uncorrelated	All	All (+none)	dSL	0.648	0.667
500	2000	Linear	Uncorrelated	All	All (-lasso)	dSL	0.646	0.667
500	2000	Linear	Uncorrelated	All	Lasso	dSL	0.599	0.667
500	2000	Linear	Uncorrelated	All	None	dSL	0.651	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	All	dSL	0.646	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.646	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.646	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	dSL	0.599	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	None	dSL	0.450	0.667
500	2000	Linear	Uncorrelated	All	None	Lasso	0.651	0.667
500	2000	Linear	Uncorrelated	All	All	cSL	0.604	0.667
500	2000	Linear	Uncorrelated	All	All (+none)	cSL	0.557	0.667
500	2000	Linear	Uncorrelated	All	All (-lasso)	cSL	0.604	0.667
500	2000	Linear	Uncorrelated	All	Lasso	cSL	0.610	0.667
500	2000	Linear	Uncorrelated	All	None	cSL	0.595	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	All	cSL	0.604	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.554	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.604	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	cSL	0.610	0.667
500	2000	Linear	Uncorrelated	All (-lasso)	None	cSL	0.464	0.667

Table S3: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Correlated	All	All	dSL	0.785	0.796
500	2000	Linear	Correlated	All	All (+none)	dSL	0.786	0.796
500	2000	Linear	Correlated	All	All (-lasso)	dSL	0.785	0.796
500	2000	Linear	Correlated	All	Lasso	dSL	0.762	0.796
500	2000	Linear	Correlated	All	None	dSL	0.788	0.796
500	2000	Linear	Correlated	All (-lasso)	All	dSL	0.785	0.796
500	2000	Linear	Correlated	All (-lasso)	All (+none)	dSL	0.785	0.796
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	dSL	0.785	0.796
500	2000	Linear	Correlated	All (-lasso)	Lasso	dSL	0.762	0.796
500	2000	Linear	Correlated	All (-lasso)	None	dSL	0.659	0.796
500	2000	Linear	Correlated	All	None	Lasso	0.788	0.796
500	2000	Linear	Correlated	All	All	cSL	0.772	0.796
500	2000	Linear	Correlated	All	All (+none)	cSL	0.738	0.796
500	2000	Linear	Correlated	All	All (-lasso)	cSL	0.773	0.796
500	2000	Linear	Correlated	All	Lasso	cSL	0.770	0.796
500	2000	Linear	Correlated	All	None	cSL	0.734	0.796
500	2000	Linear	Correlated	All (-lasso)	All	cSL	0.772	0.796
500	2000	Linear	Correlated	All (-lasso)	All (+none)	cSL	0.737	0.796
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	cSL	0.773	0.796
500	2000	Linear	Correlated	All (-lasso)	Lasso	cSL	0.770	0.796
500	2000	Linear	Correlated	All (-lasso)	None	cSL	0.556	0.796

Table S4: Cross-validated AUC for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: binary, relationship: strong.

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Uncorrelated	All	All	dSL	0.866	0.955
500	2000	Nonlinear	Uncorrelated	All	All (+none)	dSL	0.876	0.955
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	dSL	0.866	0.955
500	2000	Nonlinear	Uncorrelated	All	Lasso	dSL	0.858	0.955
500	2000	Nonlinear	Uncorrelated	All	None	dSL	0.884	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	dSL	0.866	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.866	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.866	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	dSL	0.858	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	dSL	0.790	0.955

Table S4: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Uncorrelated	All	None	Lasso	0.884	0.955
500	2000	Nonlinear	Uncorrelated	All	All	cSL	0.882	0.955
500	2000	Nonlinear	Uncorrelated	All	All (+none)	cSL	0.890	0.955
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	cSL	0.882	0.955
500	2000	Nonlinear	Uncorrelated	All	Lasso	cSL	0.857	0.955
500	2000	Nonlinear	Uncorrelated	All	None	cSL	0.892	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	cSL	0.882	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.889	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.882	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	cSL	0.857	0.955
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	cSL	0.849	0.955
500	2000	Nonlinear	Correlated	All	All	dSL	0.601	0.880
500	2000	Nonlinear	Correlated	All	All (+none)	dSL	0.598	0.880
500	2000	Nonlinear	Correlated	All	All (-lasso)	dSL	0.599	0.880
500	2000	Nonlinear	Correlated	All	Lasso	dSL	0.609	0.880
500	2000	Nonlinear	Correlated	All	None	dSL	0.558	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	All	dSL	0.601	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	dSL	0.598	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	dSL	0.599	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	dSL	0.609	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.538	0.880
500	2000	Nonlinear	Correlated	All	None	Lasso	0.568	0.880
500	2000	Nonlinear	Correlated	All	All	cSL	0.674	0.880
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.689	0.880
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.669	0.880
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.619	0.880
500	2000	Nonlinear	Correlated	All	None	cSL	0.639	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.674	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.688	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.669	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.619	0.880
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.628	0.880
500	2000	Linear	Uncorrelated	All	All	dSL	0.959	0.979
500	2000	Linear	Uncorrelated	All	All (+none)	dSL	0.962	0.979
500	2000	Linear	Uncorrelated	All	All (-lasso)	dSL	0.959	0.979
500	2000	Linear	Uncorrelated	All	Lasso	dSL	0.912	0.979
500	2000	Linear	Uncorrelated	All	None	dSL	0.962	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	All	dSL	0.959	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.959	0.979

Table S4: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.959	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	dSL	0.912	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	None	dSL	0.840	0.979
500	2000	Linear	Uncorrelated	All	None	Lasso	0.962	0.979
500	2000	Linear	Uncorrelated	All	All	cSL	0.962	0.979
500	2000	Linear	Uncorrelated	All	All (+none)	cSL	0.964	0.979
500	2000	Linear	Uncorrelated	All	All (-lasso)	cSL	0.962	0.979
500	2000	Linear	Uncorrelated	All	Lasso	cSL	0.939	0.979
500	2000	Linear	Uncorrelated	All	None	cSL	0.962	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	All	cSL	0.962	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.962	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.962	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	cSL	0.939	0.979
500	2000	Linear	Uncorrelated	All (-lasso)	None	cSL	0.911	0.979
500	2000	Linear	Correlated	All	All	dSL	0.981	0.985
500	2000	Linear	Correlated	All	All (+none)	dSL	0.980	0.985
500	2000	Linear	Correlated	All	All (-lasso)	dSL	0.981	0.985
500	2000	Linear	Correlated	All	Lasso	dSL	0.976	0.985
500	2000	Linear	Correlated	All	None	dSL	0.976	0.985
500	2000	Linear	Correlated	All (-lasso)	All	dSL	0.981	0.985
500	2000	Linear	Correlated	All (-lasso)	All (+none)	dSL	0.981	0.985
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	dSL	0.981	0.985
500	2000	Linear	Correlated	All (-lasso)	Lasso	dSL	0.976	0.985
500	2000	Linear	Correlated	All (-lasso)	None	dSL	0.970	0.985
500	2000	Linear	Correlated	All	None	Lasso	0.976	0.985
500	2000	Linear	Correlated	All	All	cSL	0.981	0.985
500	2000	Linear	Correlated	All	All (+none)	cSL	0.981	0.985
500	2000	Linear	Correlated	All	All (-lasso)	cSL	0.981	0.985
500	2000	Linear	Correlated	All	Lasso	cSL	0.972	0.985
500	2000	Linear	Correlated	All	None	cSL	0.976	0.985
500	2000	Linear	Correlated	All (-lasso)	All	cSL	0.981	0.985
500	2000	Linear	Correlated	All (-lasso)	All (+none)	cSL	0.981	0.985
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	cSL	0.981	0.985
500	2000	Linear	Correlated	All (-lasso)	Lasso	cSL	0.972	0.985
500	2000	Linear	Correlated	All (-lasso)	None	cSL	0.963	0.985

Table S5: Cross-validated NN log lik. for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: binary, relationship: strong.

n	p	Outcome relation-ship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction perfor-mance	Optimal prediction perfor-mance
500	2000	Nonlinear	Uncorrelated	All	All	dSL	0.461	0.558
500	2000	Nonlinear	Uncorrelated	All	All (+none)	dSL	0.449	0.558
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	dSL	0.461	0.558
500	2000	Nonlinear	Uncorrelated	All	Lasso	dSL	0.499	0.558
500	2000	Nonlinear	Uncorrelated	All	None	dSL	0.440	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	dSL	0.461	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.461	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.461	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	dSL	0.499	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	dSL	0.643	0.558
500	2000	Nonlinear	Uncorrelated	All	None	Lasso	0.440	0.558
500	2000	Nonlinear	Uncorrelated	All	All	cSL	0.426	0.558
500	2000	Nonlinear	Uncorrelated	All	All (+none)	cSL	0.413	0.558
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	cSL	0.425	0.558
500	2000	Nonlinear	Uncorrelated	All	Lasso	cSL	0.466	0.558
500	2000	Nonlinear	Uncorrelated	All	None	cSL	0.415	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	cSL	0.426	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.415	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.425	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	cSL	0.466	0.558
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	cSL	0.486	0.558
500	2000	Nonlinear	Correlated	All	None	dSL	0.393	0.234
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.395	0.234
500	2000	Nonlinear	Correlated	All	None	Lasso	0.392	0.234
500	2000	Nonlinear	Correlated	All	All	cSL	0.379	0.234
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.375	0.234
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.380	0.234
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.411	0.234
500	2000	Nonlinear	Correlated	All	None	cSL	0.381	0.234
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.379	0.234
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.375	0.234
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.380	0.234
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.411	0.234
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.382	0.234
500	2000	Linear	Uncorrelated	All	All	dSL	0.262	0.689
500	2000	Linear	Uncorrelated	All	All (+none)	dSL	0.257	0.689
500	2000	Linear	Uncorrelated	All	All (-lasso)	dSL	0.262	0.689
500	2000	Linear	Uncorrelated	All	Lasso	dSL	0.538	0.689
500	2000	Linear	Uncorrelated	All	None	dSL	0.262	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	All	dSL	0.262	0.689

Table S5: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.262	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.262	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	dSL	0.538	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	None	dSL	0.669	0.689
500	2000	Linear	Uncorrelated	All	None	Lasso	0.262	0.689
500	2000	Linear	Uncorrelated	All	All	cSL	0.250	0.689
500	2000	Linear	Uncorrelated	All	All (+none)	cSL	0.245	0.689
500	2000	Linear	Uncorrelated	All	All (-lasso)	cSL	0.250	0.689
500	2000	Linear	Uncorrelated	All	Lasso	cSL	0.331	0.689
500	2000	Linear	Uncorrelated	All	None	cSL	0.257	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	All	cSL	0.250	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.251	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.250	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	cSL	0.331	0.689
500	2000	Linear	Uncorrelated	All (-lasso)	None	cSL	0.401	0.689
500	2000	Linear	Correlated	All	None	dSL	0.208	0.735
500	2000	Linear	Correlated	All (-lasso)	None	dSL	0.433	0.735
500	2000	Linear	Correlated	All	None	Lasso	0.208	0.735
500	2000	Linear	Correlated	All	All	cSL	0.181	0.735
500	2000	Linear	Correlated	All	All (+none)	cSL	0.182	0.735
500	2000	Linear	Correlated	All	All (-lasso)	cSL	0.180	0.735
500	2000	Linear	Correlated	All	Lasso	cSL	0.228	0.735
500	2000	Linear	Correlated	All	None	cSL	0.204	0.735
500	2000	Linear	Correlated	All (-lasso)	All	cSL	0.181	0.735
500	2000	Linear	Correlated	All (-lasso)	All (+none)	cSL	0.182	0.735
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	cSL	0.180	0.735
500	2000	Linear	Correlated	All (-lasso)	Lasso	cSL	0.228	0.735
500	2000	Linear	Correlated	All (-lasso)	None	cSL	0.313	0.735

Table S6: Cross-validated AUC for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: binary, relationship: weak.

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Uncorrelated	All	All	dSL	0.729	0.882
500	2000	Nonlinear	Uncorrelated	All	All (+none)	dSL	0.777	0.882
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	dSL	0.728	0.882

Table S6: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Uncorrelated	All	Lasso	dSL	0.731	0.882
500	2000	Nonlinear	Uncorrelated	All	None	dSL	0.779	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	dSL	0.729	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.729	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.728	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	dSL	0.731	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	dSL	0.665	0.882
500	2000	Nonlinear	Uncorrelated	All	None	Lasso	0.779	0.882
500	2000	Nonlinear	Uncorrelated	All	All	cSL	0.747	0.882
500	2000	Nonlinear	Uncorrelated	All	All (+none)	cSL	0.765	0.882
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	cSL	0.745	0.882
500	2000	Nonlinear	Uncorrelated	All	Lasso	cSL	0.733	0.882
500	2000	Nonlinear	Uncorrelated	All	None	cSL	0.776	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	cSL	0.747	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.747	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.745	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	cSL	0.733	0.882
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	cSL	0.681	0.882
500	2000	Nonlinear	Correlated	All	All	dSL	0.719	0.798
500	2000	Nonlinear	Correlated	All	All (+none)	dSL	0.719	0.798
500	2000	Nonlinear	Correlated	All	All (-lasso)	dSL	0.719	0.798
500	2000	Nonlinear	Correlated	All	Lasso	dSL	0.674	0.798
500	2000	Nonlinear	Correlated	All	None	dSL	0.645	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	All	dSL	0.719	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	dSL	0.719	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	dSL	0.719	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	dSL	0.674	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.645	0.798
500	2000	Nonlinear	Correlated	All	None	Lasso	0.644	0.798
500	2000	Nonlinear	Correlated	All	All	cSL	0.738	0.798
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.737	0.798
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.738	0.798
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.681	0.798
500	2000	Nonlinear	Correlated	All	None	cSL	0.667	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.738	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.737	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.738	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.681	0.798
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.667	0.798
500	2000	Linear	Uncorrelated	All	All	dSL	0.872	0.894

Table S6: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Uncorrelated	All	All (+none)	dSL	0.881	0.894
500	2000	Linear	Uncorrelated	All	All (-lasso)	dSL	0.872	0.894
500	2000	Linear	Uncorrelated	All	Lasso	dSL	0.843	0.894
500	2000	Linear	Uncorrelated	All	None	dSL	0.886	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	All	dSL	0.872	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.872	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.872	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	dSL	0.843	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	None	dSL	0.757	0.894
500	2000	Linear	Uncorrelated	All	None	Lasso	0.886	0.894
500	2000	Linear	Uncorrelated	All	All	cSL	0.874	0.894
500	2000	Linear	Uncorrelated	All	All (+none)	cSL	0.878	0.894
500	2000	Linear	Uncorrelated	All	All (-lasso)	cSL	0.874	0.894
500	2000	Linear	Uncorrelated	All	Lasso	cSL	0.846	0.894
500	2000	Linear	Uncorrelated	All	None	cSL	0.883	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	All	cSL	0.874	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.873	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.874	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	cSL	0.846	0.894
500	2000	Linear	Uncorrelated	All (-lasso)	None	cSL	0.803	0.894
500	2000	Linear	Correlated	All	All	dSL	0.920	0.935
500	2000	Linear	Correlated	All	All (+none)	dSL	0.926	0.935
500	2000	Linear	Correlated	All	All (-lasso)	dSL	0.920	0.935
500	2000	Linear	Correlated	All	Lasso	dSL	0.918	0.935
500	2000	Linear	Correlated	All	None	dSL	0.930	0.935
500	2000	Linear	Correlated	All (-lasso)	All	dSL	0.920	0.935
500	2000	Linear	Correlated	All (-lasso)	All (+none)	dSL	0.920	0.935
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	dSL	0.920	0.935
500	2000	Linear	Correlated	All (-lasso)	Lasso	dSL	0.918	0.935
500	2000	Linear	Correlated	All (-lasso)	None	dSL	0.906	0.935
500	2000	Linear	Correlated	All	None	Lasso	0.930	0.935
500	2000	Linear	Correlated	All	All	cSL	0.925	0.935
500	2000	Linear	Correlated	All	All (+none)	cSL	0.926	0.935
500	2000	Linear	Correlated	All	All (-lasso)	cSL	0.925	0.935
500	2000	Linear	Correlated	All	Lasso	cSL	0.915	0.935
500	2000	Linear	Correlated	All	None	cSL	0.929	0.935
500	2000	Linear	Correlated	All (-lasso)	All	cSL	0.925	0.935
500	2000	Linear	Correlated	All (-lasso)	All (+none)	cSL	0.925	0.935
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	cSL	0.925	0.935

Table S6: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Correlated	All (-lasso)	Lasso	cSL	0.915	0.935
500	2000	Linear	Correlated	All (-lasso)	None	cSL	0.883	0.935

Table S7: Cross-validated NN log lik. for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: binary, relationship: weak.

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Uncorrelated	All	None	dSL	0.550	0.335
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	dSL	0.647	0.335
500	2000	Nonlinear	Uncorrelated	All	None	Lasso	0.550	0.335
500	2000	Nonlinear	Uncorrelated	All	All	cSL	0.573	0.335
500	2000	Nonlinear	Uncorrelated	All	All (+none)	cSL	0.557	0.335
500	2000	Nonlinear	Uncorrelated	All	All (-lasso)	cSL	0.575	0.335
500	2000	Nonlinear	Uncorrelated	All	Lasso	cSL	0.592	0.335
500	2000	Nonlinear	Uncorrelated	All	None	cSL	0.550	0.335
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All	cSL	0.573	0.335
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.573	0.335
500	2000	Nonlinear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.575	0.335
500	2000	Nonlinear	Uncorrelated	All (-lasso)	Lasso	cSL	0.592	0.335
500	2000	Nonlinear	Uncorrelated	All (-lasso)	None	cSL	0.619	0.335
500	2000	Nonlinear	Correlated	All	None	dSL	0.494	0.158
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.494	0.158
500	2000	Nonlinear	Correlated	All	None	Lasso	0.495	0.158
500	2000	Nonlinear	Correlated	All	All	cSL	0.449	0.158
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.450	0.158
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.449	0.158
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.487	0.158
500	2000	Nonlinear	Correlated	All	None	cSL	0.485	0.158
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.449	0.158
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.450	0.158
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.449	0.158
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.487	0.158
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.486	0.158
500	2000	Linear	Uncorrelated	All	All	dSL	0.440	0.361
500	2000	Linear	Uncorrelated	All	All (+none)	dSL	0.431	0.361
500	2000	Linear	Uncorrelated	All	All (-lasso)	dSL	0.440	0.361
500	2000	Linear	Uncorrelated	All	None	dSL	0.425	0.361

Table S7: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Linear	Uncorrelated	All (-lasso)	All	dSL	0.440	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	dSL	0.440	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	dSL	0.440	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	None	dSL	0.636	0.361
500	2000	Linear	Uncorrelated	All	None	Lasso	0.425	0.361
500	2000	Linear	Uncorrelated	All	All	cSL	0.431	0.361
500	2000	Linear	Uncorrelated	All	All (+none)	cSL	0.424	0.361
500	2000	Linear	Uncorrelated	All	All (-lasso)	cSL	0.430	0.361
500	2000	Linear	Uncorrelated	All	Lasso	cSL	0.474	0.361
500	2000	Linear	Uncorrelated	All	None	cSL	0.423	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	All	cSL	0.431	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	All (+none)	cSL	0.432	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	All (-lasso)	cSL	0.430	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	Lasso	cSL	0.474	0.361
500	2000	Linear	Uncorrelated	All (-lasso)	None	cSL	0.532	0.361
500	2000	Linear	Correlated	All	None	dSL	0.341	0.484
500	2000	Linear	Correlated	All (-lasso)	None	dSL	0.572	0.484
500	2000	Linear	Correlated	All	None	Lasso	0.341	0.484
500	2000	Linear	Correlated	All	All	cSL	0.344	0.484
500	2000	Linear	Correlated	All	All (+none)	cSL	0.341	0.484
500	2000	Linear	Correlated	All	All (-lasso)	cSL	0.344	0.484
500	2000	Linear	Correlated	All	Lasso	cSL	0.369	0.484
500	2000	Linear	Correlated	All	None	cSL	0.339	0.484
500	2000	Linear	Correlated	All (-lasso)	All	cSL	0.344	0.484
500	2000	Linear	Correlated	All (-lasso)	All (+none)	cSL	0.345	0.484
500	2000	Linear	Correlated	All (-lasso)	All (-lasso)	cSL	0.344	0.484
500	2000	Linear	Correlated	All (-lasso)	Lasso	cSL	0.369	0.484
500	2000	Linear	Correlated	All (-lasso)	None	cSL	0.460	0.484

Table S8: Cross-validated AUC for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: binary (rare), relationship: strong.

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Correlated	All	All	dSL	0.537	0.9
500	2000	Nonlinear	Correlated	All	All (+none)	dSL	0.538	0.9
500	2000	Nonlinear	Correlated	All	All (-lasso)	dSL	0.535	0.9

Table S8: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Correlated	All	Lasso	dSL	0.561	0.9
500	2000	Nonlinear	Correlated	All	None	dSL	0.527	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	All	dSL	0.537	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	dSL	0.524	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	dSL	0.535	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	dSL	0.561	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.480	0.9
500	2000	Nonlinear	Correlated	All	None	Lasso	0.552	0.9
500	2000	Nonlinear	Correlated	All	All	cSL	0.561	0.9
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.560	0.9
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.553	0.9
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.562	0.9
500	2000	Nonlinear	Correlated	All	None	cSL	0.536	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.561	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.556	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.553	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.562	0.9
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.494	0.9

Table S9: Cross-validated NN log lik. for all candidate learners in the super learner ensemble (and the cSL and dSL for p = 2000). Outcome type: binary (rare), relationship: strong.

n	p	Outcome relationship	Feature correlation	Candidate Learners	Candidate Screeners	Learner	Prediction performance	Optimal prediction performance
500	2000	Nonlinear	Correlated	All	None	dSL	0.234	0.123
500	2000	Nonlinear	Correlated	All (-lasso)	None	dSL	0.239	0.123
500	2000	Nonlinear	Correlated	All	None	Lasso	0.232	0.123
500	2000	Nonlinear	Correlated	All	All	cSL	0.242	0.123
500	2000	Nonlinear	Correlated	All	All (+none)	cSL	0.241	0.123
500	2000	Nonlinear	Correlated	All	All (-lasso)	cSL	0.243	0.123
500	2000	Nonlinear	Correlated	All	Lasso	cSL	0.268	0.123
500	2000	Nonlinear	Correlated	All	None	cSL	0.233	0.123
500	2000	Nonlinear	Correlated	All (-lasso)	All	cSL	0.242	0.123
500	2000	Nonlinear	Correlated	All (-lasso)	All (+none)	cSL	0.242	0.123
500	2000	Nonlinear	Correlated	All (-lasso)	All (-lasso)	cSL	0.243	0.123
500	2000	Nonlinear	Correlated	All (-lasso)	Lasso	cSL	0.268	0.123
500	2000	Nonlinear	Correlated	All (-lasso)	None	cSL	0.238	0.123

Next, we provide additional numerical experiments under a larger range of p ($p \in \{10, 50, 100, 200\}$) for all sample sizes considered in the main manuscript, and the first eight data-generating mechanisms (the rare-outcome setting is omitted). We follow a similar approach as in the main manuscript, but used 5-fold nested cross-validation (i.e., 5-fold outer cross-validation to obtain the performance of the cSL and 5-fold inner cross-validation to select the cSL weights) in all cases. Importantly, this is not the recommended V following Phillips et al. (2023); however, this choice made the simulations more computationally feasible.

We display the results under a strong outcome-feature relationship in Figures S3 and S4. Focusing first on a continuous outcome, when the outcome-feature relationship is linear (Figure S3 left column), all estimators have prediction performance converging quickly to the best-possible prediction performance as the sample size increases. In small samples with a linear relationship, removing the lasso from the SL library results in decreased performance. When the outcome-feature relationship is nonlinear (Figure S3 right column), the results depend on the variable screeners and algorithm used. The lasso has poor performance regardless of sample size, particularly in the case with correlated features; this is consistent with theory (Leng et al., 2006). Also, particularly for large numbers of features (e.g., when $p = 500$), using the lasso screener alone within a super learner degrades performance, while using a large library of candidate screeners can improve performance over a super learner with no screeners. Having a large library of candidate screeners can protect against poor lasso performance. Results are similar for the binary outcome.

The results under a weak outcome-feature relationship follow similar patterns (Figures S5 and S6). In this case, the best-possible prediction performance is lower than in the strong-relationship case, as expected; and a larger sample size is required to achieve prediction performance close to this optimal level.

2 Additional results from predicting HIV-1 neutralization susceptibility

In Tables S10 and S11, we display the super learner coefficients and discrete super learner for each of the 10 cross-validation folds, for both the continuous and binary outcomes.

In Table S12, we display the cross-validated (CV) negative log-likelihood loss for all cSLs, dSLs, and the lasso. The results are largely similar to those for AUC: the lasso has the worst performance (here, largest negative log-likelihood loss), while having a large candidate screener set reduces negative log-likelihood loss.

In Table S13, we display the CV R-squared (continuous outcome) and CV AUC (binary outcome) for all candidate screener-learner pairs in all super learners. The generalize linear regression model often did not converge, because there were more variables than observations. The performance of the other algorithms varied.

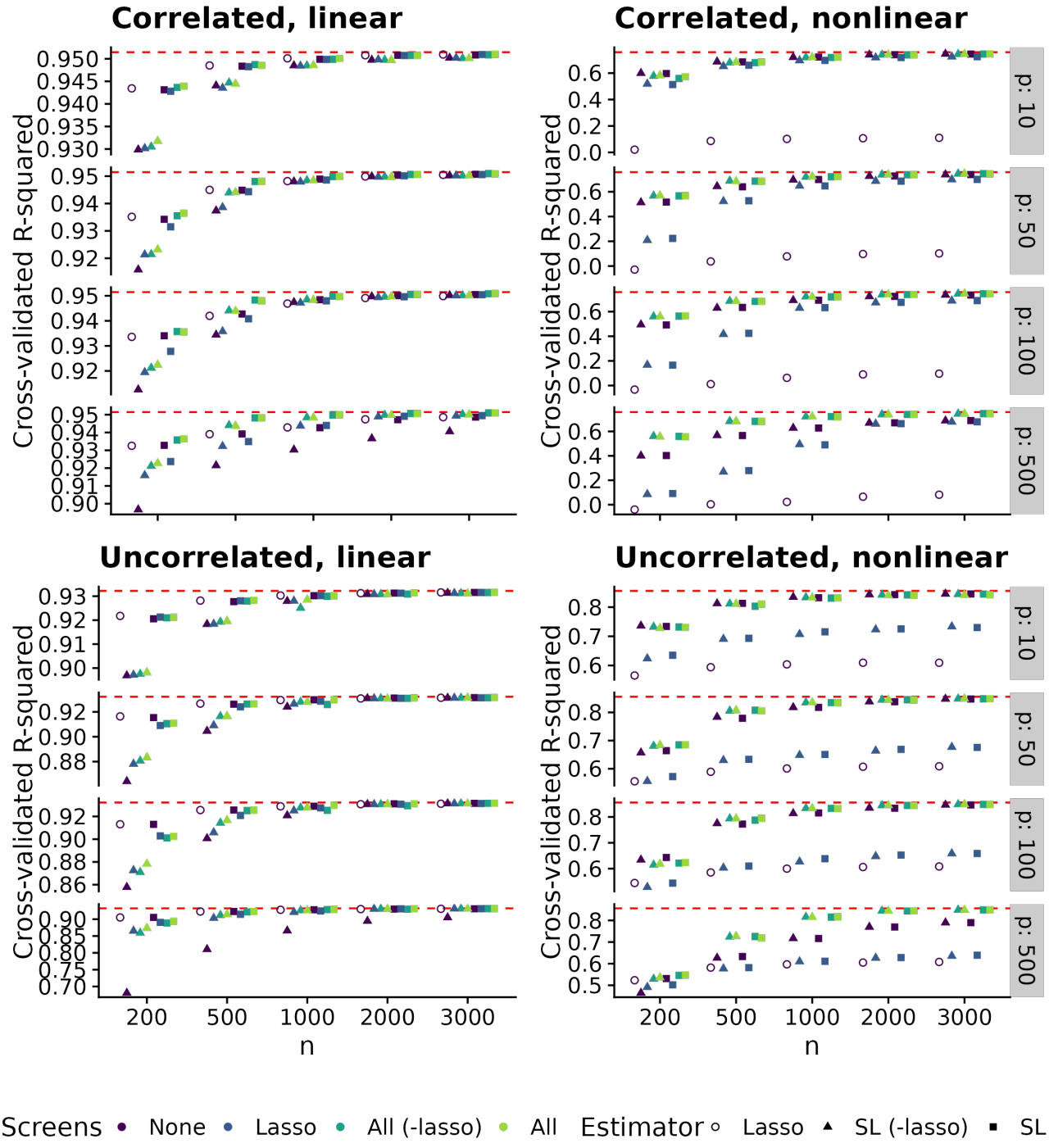

Figure S3: Prediction performance versus sample size n, measured using cross-validated R-squared, for predicting a continuous outcome. There is a strong relationship between outcome and features. The top row shows results for correlated features, while the bottom row shows results for uncorrelated features. The left-hand column shows results for a linear outcome-feature relationship, while the right-hand column shows results for a nonlinear outcome-feature relationship. The dashed line denotes the best-possible prediction performance in each setting. Color denotes the variable screeners, while shape denotes the estimator (lasso, discrete super learner (dSL), convex ensemble super learner [cSL], and dSL and cSL without lasso in its library [dSL (-lasso) and cSL (-lasso)]). Note that the y-axis limits differ between panels.

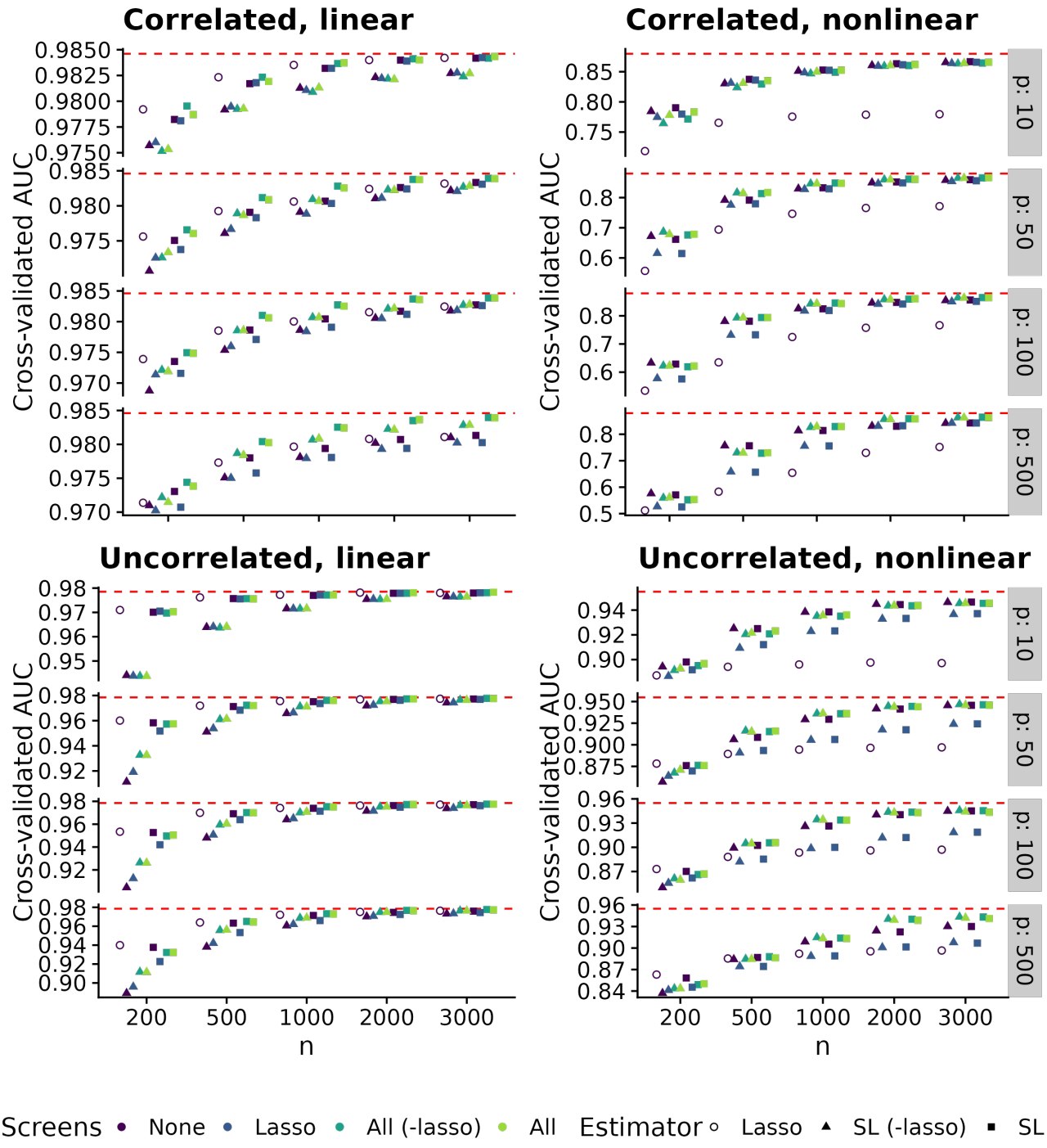

Figure S4: Prediction performance versus sample size n, measured using cross-validated AUC, for predicting a binary outcome. There is a strong relationship between outcome and features. The top row shows results for correlated features, while the bottom row shows results for uncorrelated features. The left-hand column shows results for a linear outcome-feature relationship, while the right-hand column shows results for a nonlinear outcome-feature relationship. The dashed line denotes the best-possible prediction performance in each setting. Color denotes the variable screeners, while shape denotes the estimator (lasso, discrete super learner (dSL), convex ensemble super learner [cSL], and dSL and cSL without lasso in its library [dSL (-lasso) and cSL (-lasso)]). Note that the y-axis limits differ between panels.

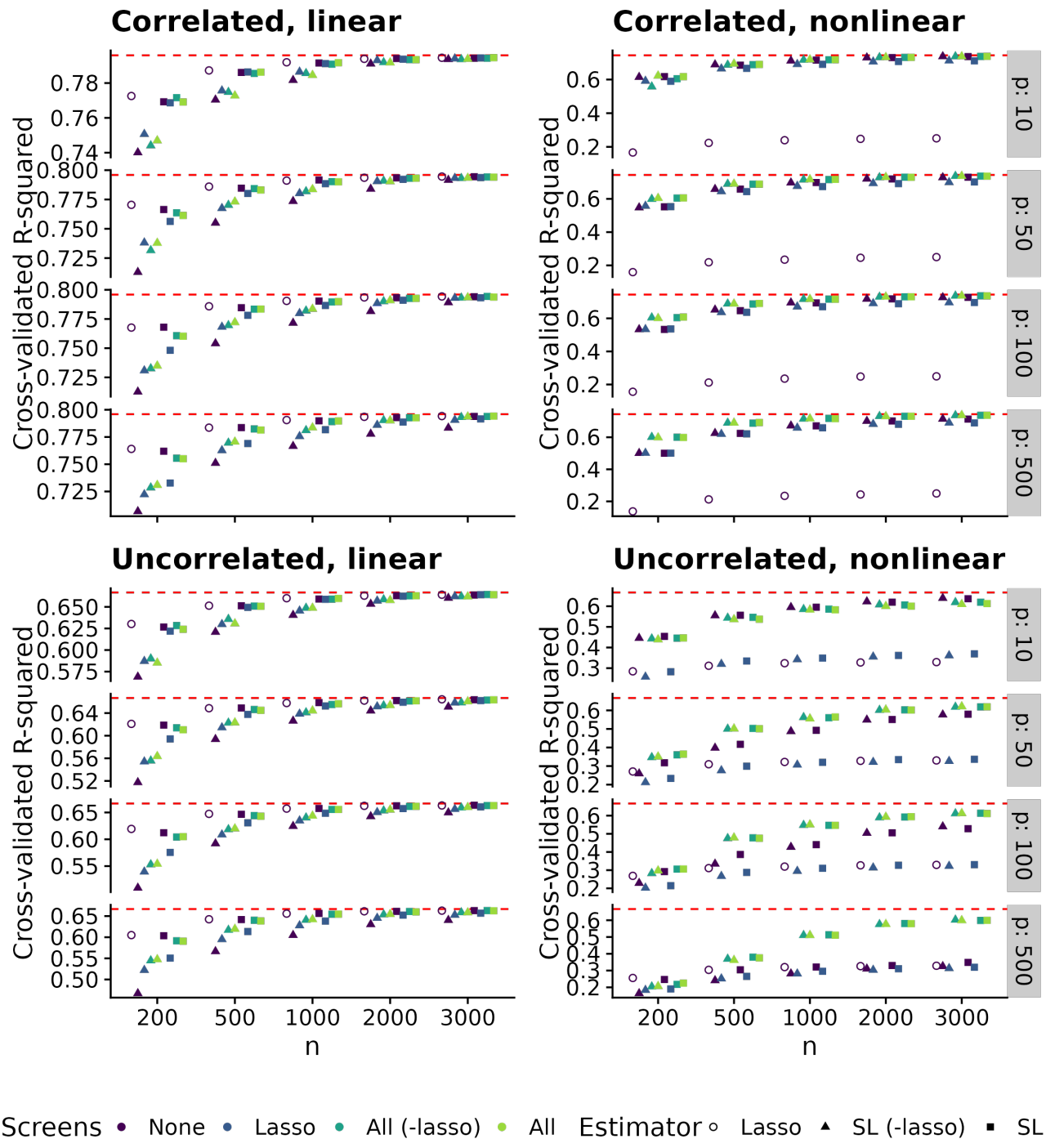

Figure S5: Prediction performance versus sample size n, measured using cross-validated R-squared, for predicting a continuous outcome. There is a weak relationship between outcome and features. The top row shows results for correlated features, while the bottom row shows results for uncorrelated features. The left-hand column shows results for a linear outcome-feature relationship, while the right-hand column shows results for a nonlinear outcome-feature relationship. The dashed line denotes the best-possible prediction performance in each setting. Color denotes the variable screeners, while shape denotes the estimator (lasso, discrete super learner (dSL), convex ensemble super learner [cSL], and dSL and cSL without lasso in its library [dSL (-lasso) and cSL (-lasso)]). Note that the y-axis limits differ between panels.

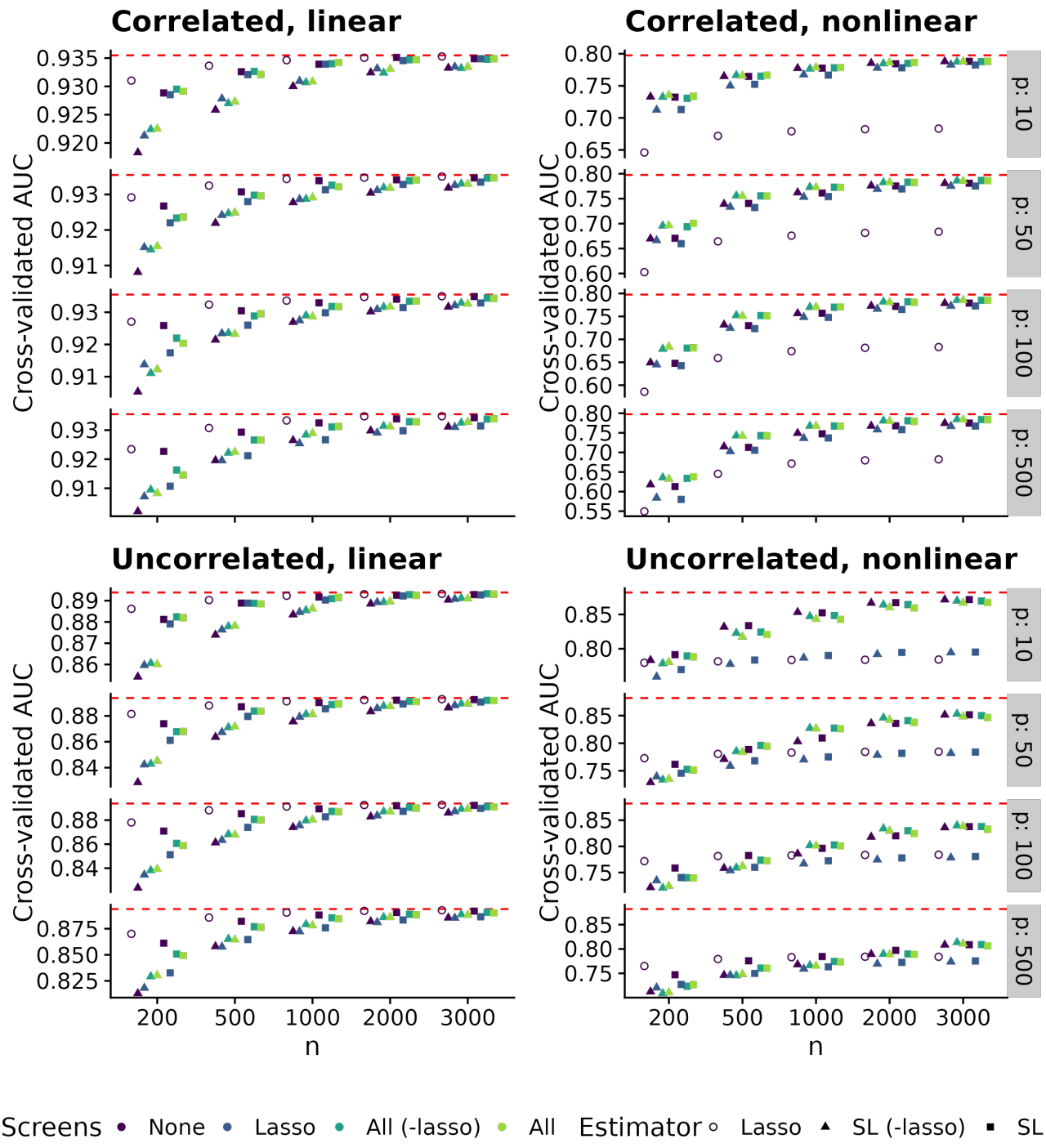

Figure S6: Prediction performance versus sample size n, measured using cross-validated AUC, for predicting a binary outcome. There is a weak relationship between outcome and features. The top row shows results for correlated features, while the bottom row shows results for uncorrelated features. The left-hand column shows results for a linear outcome-feature relationship, while the right-hand column shows results for a nonlinear outcome-feature relationship. The dashed line denotes the best-possible prediction performance in each setting. Color denotes the variable screeners, while shape denotes the estimator (lasso, discrete super learner (dSL), convex ensemble super learner [cSL], and dSL and cSL without lasso in its library [dSL (-lasso) and cSL (-lasso)]). Note that the y-axis limits differ between panels.

Table S10: IC_{50}: Ensemble super learner (cSL) coefficients for each learner-screener pair, for each of the 10 outer cross-validation folds, along with the algorithm selected as the discrete super learner (dSL).

Learner	Screener	1	2	3	4	5	6	7	8	9	10
glm		< 0.001	0	< 0.001	< 0.001	0	< 0.001	0	0	0	0
glm	corRank.10	0	0	0	0	0	0	0	0	0	0
glm	corRank.25	0	0	0	0	0	0	0	0	0	0
glm	corRank.50	0	0	0	0	0	0	0	0	0	0.021
glm	corP.20	0	0	0	< 0.001	0	0	0	0	0.002	0
glm	corP.40	0	0	< 0.001	0	0.005	0	0	0.002	0.003	< 0.001
glm	ranger.10	0	0	0	0	0	0	0	0	0	0
glm	ranger.25	0.015	0	0	0	0.026	0	0.012	0	0	< 0.001
glm	glmnet	0.026	0.101	0.083	0.106	0.147	0.007	0.128	0.087	0	0
ranger		0.571	0.276	0	0	0.572	0.191	0.486	0.305	0.287	0.407
ranger	corRank.10	0	0	0	0	0	0	0	0	0	0
ranger	corRank.25	0	0	0	0	0	0	0	0	0	0
ranger	corRank.50	0	0	0	0	0	0	0	0	0	0
ranger	corP.20	0	0	0.488	0	0	0	0.113	0	0.14	0.114
ranger	corP.40	0.167	0	0.28	0.599	0	0.402	0	0.436	0	0.086
ranger	ranger.10	0.051	0.055	0.046	0.038	0.09	0.078	0.049	0.074	0	0.019
ranger	ranger.25	0	0	0	0	0.024	0	0.045	0	0	0
ranger	glmnet	0	0.41	0	0.099	0	0.23	0.048	0	0.402	0.213
glmnet		0	0	0	0	0	0	0	0	0	0
earth		0	0	0	0.04	0.079	0.082	0	0.023	0.003	0.056
earth	corRank.10	0	0	0	0	0	0	0	0	0	0.007
earth	corRank.25	0	0	0	0	0.003	0	0	0	0	0
earth	corRank.50	0	0	0	0	0	0.01	0	0	0.028	0
earth	corP.20	0	0.015	0	0.054	0	0	0	0	0.019	0
earth	corP.40	0.04	0.043	0.057	0.014	0	0	0	0	0	0.015
earth	ranger.10	0	0.046	0.044	0	0.028	0	0.1	0	0	0.061
earth	ranger.25	0.097	0	0	0.05	0	0	0.019	0.071	0.044	0
earth	glmnet	0.033	0.053	0	0	0.026	0	0	0.001	0.072	0
dSL		ranger + glmnet	ranger + glmnet	ranger + corP.20	ranger + glmnet	ranger + glmnet	ranger + glmnet	ranger + glmnet	ranger + corP.20	ranger + glmnet	ranger + glmnet

Table S11: Susceptibility: Ensemble super learner (cSL) coefficients for each learner-screener pair, for each of the 10 outer cross-validation folds, along with the algorithm selected as the discrete super learner (dSL).

Learner	Screener	1	2	3	4	5	6	7	8	9	10
glm		0.007	0	0	0	0.019	0.012	0	0.005	0	0
glm	corRank.10	0.038	0.096	0.223	0.067	0.011	0.064	0.061	0	0	0
glm	corRank.25	0	0	0	0	0	0	0	0.105	0	0
glm	corRank.50	0.116	0	0	0.085	0	0.104	0.032	0.005	0	0.065
glm	corP.20	0.017	0.009	0.015	0.006	0	0.043	0	< 0.001	0	0
glm	corP.40	0.02	0	0.031	0	0	0.026	0.004	0	0	0.018
glm	ranger.10	0	0	0	0	0	0	0	0	0	0
glm	ranger.25	0.046	0	0	0.082	0.091	0	0.039	0	0.034	0.044
glm	glmnet	0.012	0.04	0.02	0	0.006	0	0.002	0	0.036	0.011
ranger		0.187	0.489	0.66	0.613	0	0	0	0	0.069	0.616
ranger	corRank.10	0	0	0	0	0	0	0	0	0	0
ranger	corRank.25	0	0	0	0	0	0	0	0	0	0
ranger	corRank.50	0	0.023	0	0	0	0	0	0	0	0.189
ranger	corP.20	0.039	0	0	0	0.813	0	0.653	0.497	0	0
ranger	corP.40	0.453	0	0	0.095	0.003	0.706	0.093	0.312	0.726	0
ranger	ranger.10	0	0	0.009	0	0	0	0.028	0	0	0
ranger	ranger.25	0	0	0	0	0	0	0	0	0	0
ranger	glmnet	0	0.264	0	0	0	0	0	0	0	0
glmnet		0	0	0	0	0	0	0	0	0	0
earth		0.03	0.025	0	0.023	0.025	0	0.029	0.01	0.016	0
earth	corRank.10	0.018	0	0	0	0	0	0	0.016	0.101	0
earth	corRank.25	0	0	0	0	0	0	0	0	0	0
earth	corRank.50	0	0	0	0	0	0	0	0	0	0.027
earth	corP.20	0	0	0.022	0.021	0	0	0	0	0.009	0
earth	corP.40	0.015	0.004	0.012	0.009	0.02	0.017	0.019	0.023	0.009	0.008
earth	ranger.10	0	0.036	0	0	0	0	0	0	0	0
earth	ranger.25	0	0	0	0	0	0	0.023	0.006	0	0.022
earth	glmnet	0	0.012	0.008	0	0.011	0.027	0.017	0.021	0	0
dSL		ranger + corP.40	ranger + glmnet	ranger + corP.40	ranger + corP.40	ranger + corP.20	ranger + corP.40	ranger + corP.20	ranger + corP.20	ranger + corP.40	ranger

Table S12: Estimates of cross-validated negative log likelihood for the binary sensitivity outcome, for the convex ensemble super learner (cSL), the discrete super learner (dSL), and the lasso, under each combination of learners and screeners. For screeners, 'None' denotes no screeners; 'Lasso' denotes only a lasso screener; 'All (-lasso)' denotes random forest, rank-correlation, and correlation-test p-value screening; 'All' denotes these three screener types plus the lasso; and 'All (+none)' denotes all screeners plus the 'none' screener.

Learners	Screeners	Algorithm	Min	Max	Point estimate
All	None	cSL	0.435	0.539	0.493
All	None	dSL	0.440	0.531	0.495
All	None	lasso	0.498	0.609	0.550
All	Lasso	cSL	0.446	0.564	0.501
All	Lasso	dSL	0.430	0.556	0.500
All	All (-lasso)	cSL	0.429	0.542	0.489
All	All (-lasso)	dSL	0.428	0.542	0.491
All	All	cSL	0.430	0.548	0.489
All	All	dSL	0.430	0.542	0.491
All	All (+none)	cSL	0.422	0.554	0.491
All	All (+none)	dSL	0.430	0.542	0.491

Table S13: Estimates of cross-validated R-squared (continuous outcome), AUC and negative log likelihood (binary outcome) for the learner-screener pairs under each combination of learners and screeners. For screeners, 'None' denotes no screeners; 'Lasso' denotes only a lasso screener; 'All (-lasso)' denotes random forest, rank-correlation, and correlation-test p-value screening; 'All' denotes these three screener types plus the lasso; and 'All (+none)' denotes all screeners plus the 'none' screener.

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	None	SL.glm_All	< -10	< -10	< -10	R-squared
All	None	SL.ranger_All	0.38	0.38	0.380 [0.364, 0.397]	R-squared
All	None	earth_1_All	-0.258	-0.258	-0.258 [NaN, NaN]	R-squared
All	Lasso	SL.glm_screen.glmnet	0.158	0.158	0.158 [0.131, 0.191]	R-squared
All	Lasso	SL.ranger_screen.glmnet	0.387	0.387	0.387 [0.366, 0.409]	R-squared
All	Lasso	earth_1_screen.glmnet	-0.054	-0.054	-0.054 [NaN, NaN]	R-squared
All	All (-lasso)	SL.glm_screen.corRank.10	0.192	0.192	0.192 [0.183, 0.200]	R-squared
All	All (-lasso)	SL.glm_screen.corRank.25	0.139	0.139	0.139 [0.130, 0.149]	R-squared
All	All (-lasso)	SL.glm_screen.corRank.50	0.161	0.161	0.161 [0.144, 0.180]	R-squared
All	All (-lasso)	SL.glm_screen.corP.20	-3.37	-3.37	-3.370 [NaN, NaN]	R-squared
All	All (-lasso)	SL.glm_screen.corP.40	< -10	< -10	< -10	R-squared
All	All (-lasso)	SL.glm_screen.ranger.10	0.149	0.149	0.149 [0.142, 0.157]	R-squared
All	All (-lasso)	SL.glm_screen.ranger.25	0.244	0.244	0.244 [0.226, 0.264]	R-squared
All	All (-lasso)	SL.ranger_screen.corRank.10	0.207	0.207	0.207 [0.196, 0.219]	R-squared
All	All (-lasso)	SL.ranger_screen.corRank.25	0.211	0.211	0.211 [0.200, 0.223]	R-squared
All	All (-lasso)	SL.ranger_screen.corRank.50	0.281	0.281	0.281 [0.261, 0.302]	R-squared
All	All (-lasso)	SL.ranger_screen.corP.20	0.391	0.391	0.391 [0.371, 0.411]	R-squared
All	All (-lasso)	SL.ranger_screen.corP.40	0.388	0.388	0.388 [0.370, 0.407]	R-squared
All	All (-lasso)	SL.ranger_screen.ranger.10	0.251	0.251	0.251 [0.230, 0.273]	R-squared
All	All (-lasso)	SL.ranger_screen.ranger.25	0.342	0.342	0.342 [0.318, 0.367]	R-squared
All	All (-lasso)	earth_1_screen.corRank.10	0.184	0.184	0.184 [0.171, 0.197]	R-squared
All	All (-lasso)	earth_1_screen.corRank.25	0.153	0.153	0.153 [0.142, 0.164]	R-squared
All	All (-lasso)	earth_1_screen.corRank.50	0.174	0.174	0.174 [0.157, 0.193]	R-squared
All	All (-lasso)	earth_1_screen.corP.20	-0.216	-0.216	-0.216 [NaN, NaN]	R-squared
All	All (-lasso)	earth_1_screen.corP.40	-0.119	-0.119	-0.119 [NaN, NaN]	R-squared
All	All (-lasso)	earth_1_screen.ranger.10	0.06	0.06	0.060 [0.052, 0.068]	R-squared

Table S13: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	All (-lasso)	earth_1_screen.ranger.25	-0.301	-0.301	-0.301 [NaN, NaN]	R-squared
All	All	SL.glm_screen.corRank.10	0.192	0.192	0.192 [0.183, 0.200]	R-squared
All	All	SL.glm_screen.corRank.25	0.139	0.139	0.139 [0.130, 0.149]	R-squared
All	All	SL.glm_screen.corRank.50	0.161	0.161	0.161 [0.144, 0.180]	R-squared
All	All	SL.glm_screen.corP.20	-3.37	-3.37	-3.370 [NaN, NaN]	R-squared
All	All	SL.glm_screen.corP.40	< -10	< -10	< -10	R-squared
All	All	SL.glm_screen.ranger.10	0.149	0.149	0.149 [0.142, 0.157]	R-squared
All	All	SL.glm_screen.ranger.25	0.244	0.244	0.244 [0.226, 0.264]	R-squared
All	All	SL.glm_screen.glmnet	0.158	0.158	0.158 [0.131, 0.191]	R-squared
All	All	SL.ranger_screen.corRank.10	0.207	0.207	0.207 [0.196, 0.219]	R-squared
All	All	SL.ranger_screen.corRank.25	0.211	0.211	0.211 [0.200, 0.223]	R-squared
All	All	SL.ranger_screen.corRank.50	0.281	0.281	0.281 [0.261, 0.302]	R-squared
All	All	SL.ranger_screen.corP.20	0.391	0.391	0.391 [0.371, 0.411]	R-squared
All	All	SL.ranger_screen.corP.40	0.388	0.388	0.388 [0.370, 0.407]	R-squared
All	All	SL.ranger_screen.ranger.10	0.251	0.251	0.251 [0.230, 0.273]	R-squared
All	All	SL.ranger_screen.ranger.25	0.342	0.342	0.342 [0.318, 0.367]	R-squared
All	All	SL.ranger_screen.glmnet	0.387	0.387	0.387 [0.366, 0.409]	R-squared
All	All	earth_1_screen.corRank.10	0.184	0.184	0.184 [0.171, 0.197]	R-squared
All	All	earth_1_screen.corRank.25	0.153	0.153	0.153 [0.142, 0.164]	R-squared
All	All	earth_1_screen.corRank.50	0.174	0.174	0.174 [0.157, 0.193]	R-squared
All	All	earth_1_screen.corP.20	-0.216	-0.216	-0.216 [NaN, NaN]	R-squared
All	All	earth_1_screen.corP.40	-0.119	-0.119	-0.119 [NaN, NaN]	R-squared
All	All	earth_1_screen.ranger.10	0.06	0.06	0.060 [0.052, 0.068]	R-squared
All	All	earth_1_screen.ranger.25	-0.301	-0.301	-0.301 [NaN, NaN]	R-squared
All	All	earth_1_screen.glmnet	-0.054	-0.054	-0.054 [NaN, NaN]	R-squared
All	All (+none)	SL.glm_All	< -10	< -10	< -10	R-squared
All	All (+none)	SL.glm_screen.corRank.10	0.192	0.192	0.192 [0.183, 0.200]	R-squared
All	All (+none)	SL.glm_screen.corRank.25	0.139	0.139	0.139 [0.130, 0.149]	R-squared
All	All (+none)	SL.glm_screen.corRank.50	0.161	0.161	0.161 [0.144, 0.180]	R-squared
All	All (+none)	SL.glm_screen.corP.20	-3.37	-3.37	-3.370 [NaN, NaN]	R-squared
All	All (+none)	SL.glm_screen.corP.40	< -10	< -10	< -10	R-squared
All	All (+none)	SL.glm_screen.ranger.10	0.149	0.149	0.149 [0.142, 0.157]	R-squared
All	All (+none)	SL.glm_screen.ranger.25	0.244	0.244	0.244 [0.226, 0.264]	R-squared
All	All (+none)	SL.glm_screen.glmnet	0.158	0.158	0.158 [0.131, 0.191]	R-squared
All	All (+none)	SL.ranger_All	0.38	0.38	0.380 [0.364, 0.397]	R-squared
All	All (+none)	SL.ranger_screen.corRank.10	0.207	0.207	0.207 [0.196, 0.219]	R-squared
All	All (+none)	SL.ranger_screen.corRank.25	0.211	0.211	0.211 [0.200, 0.223]	R-squared
All	All (+none)	SL.ranger_screen.corRank.50	0.281	0.281	0.281 [0.261, 0.302]	R-squared
All	All (+none)	SL.ranger_screen.corP.20	0.391	0.391	0.391 [0.371, 0.411]	R-squared
All	All (+none)	SL.ranger_screen.corP.40	0.388	0.388	0.388 [0.370, 0.407]	R-squared
All	All (+none)	SL.ranger_screen.ranger.10	0.251	0.251	0.251 [0.230, 0.273]	R-squared
All	All (+none)	SL.ranger_screen.ranger.25	0.342	0.342	0.342 [0.318, 0.367]	R-squared
All	All (+none)	SL.ranger_screen.glmnet	0.387	0.387	0.387 [0.366, 0.409]	R-squared
All	All (+none)	earth_1_All	-0.258	-0.258	-0.258 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.corRank.10	0.184	0.184	0.184 [0.171, 0.197]	R-squared
All	All (+none)	earth_1_screen.corRank.25	0.153	0.153	0.153 [0.142, 0.164]	R-squared
All	All (+none)	earth_1_screen.corRank.50	0.174	0.174	0.174 [0.157, 0.193]	R-squared
All	All (+none)	earth_1_screen.corP.20	-0.216	-0.216	-0.216 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.corP.40	-0.119	-0.119	-0.119 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.ranger.10	0.06	0.06	0.060 [0.052, 0.068]	R-squared
All	All (+none)	earth_1_screen.ranger.25	-0.301	-0.301	-0.301 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.glmnet	-0.054	-0.054	-0.054 [NaN, NaN]	R-squared
All	None	SL.glm_All	< -10	< -10	< -10	R-squared
All	None	SL.ranger_All	0.38	0.38	0.380 [0.364, 0.397]	R-squared
All	None	earth_1_All	-0.258	-0.258	-0.258 [NaN, NaN]	R-squared

Table S13: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	Lasso	SL.glm_screen.glmnet	0.158	0.158	0.158 [0.131, 0.191]	R-squared
All	Lasso	SL.ranger_screen.glmnet	0.387	0.387	0.387 [0.366, 0.409]	R-squared
All	Lasso	earth_1_screen.glmnet	-0.054	-0.054	-0.054 [NaN, NaN]	R-squared
All	All (-lasso)	SL.glm_screen.corRank.10	0.192	0.192	0.192 [0.183, 0.200]	R-squared
All	All (-lasso)	SL.glm_screen.corRank.25	0.139	0.139	0.139 [0.130, 0.149]	R-squared
All	All (-lasso)	SL.glm_screen.corRank.50	0.161	0.161	0.161 [0.144, 0.180]	R-squared
All	All (-lasso)	SL.glm_screen.corP.20	-3.37	-3.37	-3.370 [NaN, NaN]	R-squared
All	All (-lasso)	SL.glm_screen.corP.40	< -10	< -10	< -10	R-squared
All	All (-lasso)	SL.glm_screen.ranger.10	0.149	0.149	0.149 [0.142, 0.157]	R-squared
All	All (-lasso)	SL.glm_screen.ranger.25	0.244	0.244	0.244 [0.226, 0.264]	R-squared
All	All (-lasso)	SL.ranger_screen.corRank.10	0.207	0.207	0.207 [0.196, 0.219]	R-squared
All	All (-lasso)	SL.ranger_screen.corRank.25	0.211	0.211	0.211 [0.200, 0.223]	R-squared
All	All (-lasso)	SL.ranger_screen.corRank.50	0.281	0.281	0.281 [0.261, 0.302]	R-squared
All	All (-lasso)	SL.ranger_screen.corP.20	0.391	0.391	0.391 [0.371, 0.411]	R-squared
All	All (-lasso)	SL.ranger_screen.corP.40	0.388	0.388	0.388 [0.370, 0.407]	R-squared
All	All (-lasso)	SL.ranger_screen.ranger.10	0.251	0.251	0.251 [0.230, 0.273]	R-squared
All	All (-lasso)	SL.ranger_screen.ranger.25	0.342	0.342	0.342 [0.318, 0.367]	R-squared
All	All (-lasso)	earth_1_screen.corRank.10	0.184	0.184	0.184 [0.171, 0.197]	R-squared
All	All (-lasso)	earth_1_screen.corRank.25	0.153	0.153	0.153 [0.142, 0.164]	R-squared
All	All (-lasso)	earth_1_screen.corRank.50	0.174	0.174	0.174 [0.157, 0.193]	R-squared
All	All (-lasso)	earth_1_screen.corP.20	-0.216	-0.216	-0.216 [NaN, NaN]	R-squared
All	All (-lasso)	earth_1_screen.corP.40	-0.119	-0.119	-0.119 [NaN, NaN]	R-squared
All	All (-lasso)	earth_1_screen.ranger.10	0.06	0.06	0.060 [0.052, 0.068]	R-squared
All	All (-lasso)	earth_1_screen.ranger.25	-0.301	-0.301	-0.301 [NaN, NaN]	R-squared
All	All	SL.glm_screen.corRank.10	0.192	0.192	0.192 [0.183, 0.200]	R-squared
All	All	SL.glm_screen.corRank.25	0.139	0.139	0.139 [0.130, 0.149]	R-squared
All	All	SL.glm_screen.corRank.50	0.161	0.161	0.161 [0.144, 0.180]	R-squared
All	All	SL.glm_screen.corP.20	-3.37	-3.37	-3.370 [NaN, NaN]	R-squared
All	All	SL.glm_screen.corP.40	< -10	< -10	< -10	R-squared
All	All	SL.glm_screen.ranger.10	0.149	0.149	0.149 [0.142, 0.157]	R-squared
All	All	SL.glm_screen.ranger.25	0.244	0.244	0.244 [0.226, 0.264]	R-squared
All	All	SL.glm_screen.glmnet	0.158	0.158	0.158 [0.131, 0.191]	R-squared
All	All	SL.ranger_screen.corRank.10	0.207	0.207	0.207 [0.196, 0.219]	R-squared
All	All	SL.ranger_screen.corRank.25	0.211	0.211	0.211 [0.200, 0.223]	R-squared
All	All	SL.ranger_screen.corRank.50	0.281	0.281	0.281 [0.261, 0.302]	R-squared
All	All	SL.ranger_screen.corP.20	0.391	0.391	0.391 [0.371, 0.411]	R-squared
All	All	SL.ranger_screen.corP.40	0.388	0.388	0.388 [0.370, 0.407]	R-squared
All	All	SL.ranger_screen.ranger.10	0.251	0.251	0.251 [0.230, 0.273]	R-squared
All	All	SL.ranger_screen.ranger.25	0.342	0.342	0.342 [0.318, 0.367]	R-squared
All	All	SL.ranger_screen.glmnet	0.387	0.387	0.387 [0.366, 0.409]	R-squared
All	All	earth_1_screen.corRank.10	0.184	0.184	0.184 [0.171, 0.197]	R-squared
All	All	earth_1_screen.corRank.25	0.153	0.153	0.153 [0.142, 0.164]	R-squared
All	All	earth_1_screen.corRank.50	0.174	0.174	0.174 [0.157, 0.193]	R-squared
All	All	earth_1_screen.corP.20	-0.216	-0.216	-0.216 [NaN, NaN]	R-squared
All	All	earth_1_screen.corP.40	-0.119	-0.119	-0.119 [NaN, NaN]	R-squared
All	All	earth_1_screen.ranger.10	0.06	0.06	0.060 [0.052, 0.068]	R-squared
All	All	earth_1_screen.ranger.25	-0.301	-0.301	-0.301 [NaN, NaN]	R-squared
All	All	earth_1_screen.glmnet	-0.054	-0.054	-0.054 [NaN, NaN]	R-squared
All	All (+none)	SL.glm_All	< -10	< -10	< -10	R-squared
All	All (+none)	SL.glm_screen.corRank.10	0.192	0.192	0.192 [0.183, 0.200]	R-squared
All	All (+none)	SL.glm_screen.corRank.25	0.139	0.139	0.139 [0.130, 0.149]	R-squared
All	All (+none)	SL.glm_screen.corRank.50	0.161	0.161	0.161 [0.144, 0.180]	R-squared
All	All (+none)	SL.glm_screen.corP.20	-3.37	-3.37	-3.370 [NaN, NaN]	R-squared
All	All (+none)	SL.glm_screen.corP.40	< -10	< -10	< -10	R-squared
All	All (+none)	SL.glm_screen.ranger.10	0.149	0.149	0.149 [0.142, 0.157]	R-squared

Table S13: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	All (+none)	SL.glm_screen.ranger.25	0.244	0.244	0.244 [0.226, 0.264]	R-squared
All	All (+none)	SL.glm_screen.glmnet	0.158	0.158	0.158 [0.131, 0.191]	R-squared
All	All (+none)	SL.ranger_All	0.38	0.38	0.380 [0.364, 0.397]	R-squared
All	All (+none)	SL.ranger_screen.corRank.10	0.207	0.207	0.207 [0.196, 0.219]	R-squared
All	All (+none)	SL.ranger_screen.corRank.25	0.211	0.211	0.211 [0.200, 0.223]	R-squared
All	All (+none)	SL.ranger_screen.corRank.50	0.281	0.281	0.281 [0.261, 0.302]	R-squared
All	All (+none)	SL.ranger_screen.corP.20	0.391	0.391	0.391 [0.371, 0.411]	R-squared
All	All (+none)	SL.ranger_screen.corP.40	0.388	0.388	0.388 [0.370, 0.407]	R-squared
All	All (+none)	SL.ranger_screen.ranger.10	0.251	0.251	0.251 [0.230, 0.273]	R-squared
All	All (+none)	SL.ranger_screen.ranger.25	0.342	0.342	0.342 [0.318, 0.367]	R-squared
All	All (+none)	SL.ranger_screen.glmnet	0.387	0.387	0.387 [0.366, 0.409]	R-squared
All	All (+none)	earth_1_All	-0.258	-0.258	-0.258 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.corRank.10	0.184	0.184	0.184 [0.171, 0.197]	R-squared
All	All (+none)	earth_1_screen.corRank.25	0.153	0.153	0.153 [0.142, 0.164]	R-squared
All	All (+none)	earth_1_screen.corRank.50	0.174	0.174	0.174 [0.157, 0.193]	R-squared
All	All (+none)	earth_1_screen.corP.20	-0.216	-0.216	-0.216 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.corP.40	-0.119	-0.119	-0.119 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.ranger.10	0.06	0.06	0.060 [0.052, 0.068]	R-squared
All	All (+none)	earth_1_screen.ranger.25	-0.301	-0.301	-0.301 [NaN, NaN]	R-squared
All	All (+none)	earth_1_screen.glmnet	-0.054	-0.054	-0.054 [NaN, NaN]	R-squared
All	None	SL.glm_All	11.075	19.185	15.621	Negative log likelihood
All	None	SL.ranger_All	0.44	0.531	0.495	Negative log likelihood
All	None	earth_1_All	4.814	11.496	8.686	Negative log likelihood
All	Lasso	SL.glm_screen.glmnet	0.694	3.835	2.173	Negative log likelihood
All	Lasso	SL.ranger_screen.glmnet	0.43	0.556	0.500	Negative log likelihood
All	Lasso	earth_1_screen.glmnet	1.664	2.967	2.230	Negative log likelihood
All	All (-lasso)	SL.glm_screen.corRank.10	0.454	0.865	0.573	Negative log likelihood
All	All (-lasso)	SL.glm_screen.corRank.25	0.499	0.865	0.656	Negative log likelihood
All	All (-lasso)	SL.glm_screen.corRank.50	0.492	1.16	0.673	Negative log likelihood
All	All (-lasso)	SL.glm_screen.corP.20	6.88	14.518	10.715	Negative log likelihood
All	All (-lasso)	SL.glm_screen.corP.40	9.592	17.505	11.491	Negative log likelihood
All	All (-lasso)	SL.glm_screen.ranger.10	0.491	0.681	0.601	Negative log likelihood
All	All (-lasso)	SL.glm_screen.ranger.25	0.47	0.953	0.617	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.corRank.10	0.486	0.606	0.557	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.corRank.25	0.506	0.614	0.561	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.corRank.50	0.481	0.604	0.528	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.corP.20	0.428	0.542	0.490	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.corP.40	0.445	0.54	0.494	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.ranger.10	0.471	0.689	0.561	Negative log likelihood
All	All (-lasso)	SL.ranger_screen.ranger.25	0.417	0.596	0.523	Negative log likelihood
All	All (-lasso)	earth_1_screen.corRank.10	0.462	0.839	0.575	Negative log likelihood
All	All (-lasso)	earth_1_screen.corRank.25	0.5	0.849	0.593	Negative log likelihood
All	All (-lasso)	earth_1_screen.corRank.50	0.468	0.872	0.618	Negative log likelihood
All	All (-lasso)	earth_1_screen.corP.20	2.003	12.015	6.455	Negative log likelihood
All	All (-lasso)	earth_1_screen.corP.40	4.28	14.587	8.290	Negative log likelihood
All	All (-lasso)	earth_1_screen.ranger.10	0.456	0.777	0.625	Negative log likelihood
All	All (-lasso)	earth_1_screen.ranger.25	0.473	0.818	0.661	Negative log likelihood
All	All	SL.glm_screen.corRank.10	0.454	0.865	0.573	Negative log likelihood
All	All	SL.glm_screen.corRank.25	0.499	0.865	0.656	Negative log likelihood
All	All	SL.glm_screen.corRank.50	0.492	1.16	0.673	Negative log likelihood
All	All	SL.glm_screen.corP.20	6.88	14.518	10.715	Negative log likelihood
All	All	SL.glm_screen.corP.40	9.592	17.505	11.491	Negative log likelihood
All	All	SL.glm_screen.ranger.10	0.491	0.681	0.601	Negative log likelihood
All	All	SL.glm_screen.ranger.25	0.47	0.953	0.617	Negative log likelihood
All	All	SL.glm_screen.glmnet	0.694	3.835	2.173	Negative log likelihood

Table S13: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	All	SL.ranger_screen.corRank.10	0.486	0.606	0.557	Negative log likelihood
All	All	SL.ranger_screen.corRank.25	0.506	0.614	0.561	Negative log likelihood
All	All	SL.ranger_screen.corRank.50	0.481	0.604	0.528	Negative log likelihood
All	All	SL.ranger_screen.corP.20	0.428	0.542	0.490	Negative log likelihood
All	All	SL.ranger_screen.corP.40	0.445	0.54	0.494	Negative log likelihood
All	All	SL.ranger_screen.ranger.10	0.471	0.689	0.561	Negative log likelihood
All	All	SL.ranger_screen.ranger.25	0.417	0.596	0.523	Negative log likelihood
All	All	SL.ranger_screen.glmnet	0.43	0.556	0.500	Negative log likelihood
All	All	earth_1_screen.corRank.10	0.462	0.839	0.575	Negative log likelihood
All	All	earth_1_screen.corRank.25	0.5	0.849	0.593	Negative log likelihood
All	All	earth_1_screen.corRank.50	0.468	0.872	0.618	Negative log likelihood
All	All	earth_1_screen.corP.20	2.003	12.015	6.455	Negative log likelihood
All	All	earth_1_screen.corP.40	4.28	14.587	8.290	Negative log likelihood
All	All	earth_1_screen.ranger.10	0.456	0.777	0.625	Negative log likelihood
All	All	earth_1_screen.ranger.25	0.473	0.818	0.661	Negative log likelihood
All	All	earth_1_screen.glmnet	1.664	2.967	2.230	Negative log likelihood
All	All (+none)	SL.glm_All	11.075	19.185	15.621	Negative log likelihood
All	All (+none)	SL.glm_screen.corRank.10	0.454	0.865	0.573	Negative log likelihood
All	All (+none)	SL.glm_screen.corRank.25	0.499	0.865	0.656	Negative log likelihood
All	All (+none)	SL.glm_screen.corRank.50	0.492	1.16	0.673	Negative log likelihood
All	All (+none)	SL.glm_screen.corP.20	6.88	14.518	10.715	Negative log likelihood
All	All (+none)	SL.glm_screen.corP.40	9.592	17.505	11.491	Negative log likelihood
All	All (+none)	SL.glm_screen.ranger.10	0.491	0.681	0.601	Negative log likelihood
All	All (+none)	SL.glm_screen.ranger.25	0.47	0.953	0.617	Negative log likelihood
All	All (+none)	SL.glm_screen.glmnet	0.694	3.835	2.173	Negative log likelihood
All	All (+none)	SL.ranger_All	0.44	0.531	0.495	Negative log likelihood
All	All (+none)	SL.ranger_screen.corRank.10	0.486	0.606	0.557	Negative log likelihood
All	All (+none)	SL.ranger_screen.corRank.25	0.506	0.614	0.561	Negative log likelihood
All	All (+none)	SL.ranger_screen.corRank.50	0.481	0.604	0.528	Negative log likelihood
All	All (+none)	SL.ranger_screen.corP.20	0.428	0.542	0.490	Negative log likelihood
All	All (+none)	SL.ranger_screen.corP.40	0.445	0.54	0.494	Negative log likelihood
All	All (+none)	SL.ranger_screen.ranger.10	0.471	0.689	0.561	Negative log likelihood
All	All (+none)	SL.ranger_screen.ranger.25	0.417	0.596	0.523	Negative log likelihood
All	All (+none)	SL.ranger_screen.glmnet	0.43	0.556	0.500	Negative log likelihood
All	All (+none)	earth_1_All	4.814	11.496	8.686	Negative log likelihood
All	All (+none)	earth_1_screen.corRank.10	0.462	0.839	0.575	Negative log likelihood
All	All (+none)	earth_1_screen.corRank.25	0.5	0.849	0.593	Negative log likelihood
All	All (+none)	earth_1_screen.corRank.50	0.468	0.872	0.618	Negative log likelihood
All	All (+none)	earth_1_screen.corP.20	2.003	12.015	6.455	Negative log likelihood
All	All (+none)	earth_1_screen.corP.40	4.28	14.587	8.290	Negative log likelihood
All	All (+none)	earth_1_screen.ranger.10	0.456	0.777	0.625	Negative log likelihood
All	All (+none)	earth_1_screen.ranger.25	0.473	0.818	0.661	Negative log likelihood
All	All (+none)	earth_1_screen.glmnet	1.664	2.967	2.230	Negative log likelihood
All	None	SL.glm_All	0.422	0.647	0.520 [0.344, 0.696]	AUC
All	None	SL.ranger_All	0.763	0.895	0.837 [0.737, 0.936]	AUC
All	None	earth_1_All	0.565	0.768	0.684 [0.502, 0.865]	AUC
All	Lasso	SL.glm_screen.glmnet	0.631	0.827	0.743 [0.616, 0.871]	AUC
All	Lasso	SL.ranger_screen.glmnet	0.73	0.897	0.811 [0.703, 0.919]	AUC
All	Lasso	earth_1_screen.glmnet	0.601	0.722	0.689 [0.550, 0.828]	AUC
All	All (-lasso)	SL.glm_screen.corRank.10	0.602	0.814	0.718 [0.552, 0.884]	AUC
All	All (-lasso)	SL.glm_screen.corRank.25	0.65	0.774	0.713 [0.574, 0.851]	AUC
All	All (-lasso)	SL.glm_screen.corRank.50	0.65	0.792	0.731 [0.602, 0.860]	AUC
All	All (-lasso)	SL.glm_screen.corP.20	0.555	0.699	0.620 [0.446, 0.795]	AUC
All	All (-lasso)	SL.glm_screen.corP.40	0.452	0.691	0.608 [0.433, 0.783]	AUC
All	All (-lasso)	SL.glm_screen.ranger.10	0.584	0.83	0.698 [0.562, 0.835]	AUC

Table S13: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	All (-lasso)	SL.glm_screen.ranger.25	0.675	0.807	0.756 [0.631, 0.882]	AUC
All	All (-lasso)	SL.ranger_screen.corRank.10	0.612	0.831	0.718 [0.552, 0.884]	AUC
All	All (-lasso)	SL.ranger_screen.corRank.25	0.674	0.8	0.727 [0.590, 0.865]	AUC
All	All (-lasso)	SL.ranger_screen.corRank.50	0.689	0.815	0.765 [0.645, 0.886]	AUC
All	All (-lasso)	SL.ranger_screen.corP.20	0.772	0.907	0.829 [0.727, 0.931]	AUC
All	All (-lasso)	SL.ranger_screen.corP.40	0.773	0.884	0.826 [0.723, 0.929]	AUC
All	All (-lasso)	SL.ranger_screen.ranger.10	0.652	0.843	0.753 [0.630, 0.876]	AUC
All	All (-lasso)	SL.ranger_screen.ranger.25	0.689	0.888	0.789 [0.674, 0.904]	AUC
All	All (-lasso)	earth_1_screen.corRank.10	0.655	0.817	0.724 [0.553, 0.896]	AUC
All	All (-lasso)	earth_1_screen.corRank.25	0.632	0.763	0.707 [0.542, 0.873]	AUC
All	All (-lasso)	earth_1_screen.corRank.50	0.633	0.821	0.727 [0.591, 0.864]	AUC
All	All (-lasso)	earth_1_screen.corP.20	0.62	0.76	0.680 [0.520, 0.841]	AUC
All	All (-lasso)	earth_1_screen.corP.40	0.565	0.78	0.671 [0.492, 0.850]	AUC
All	All (-lasso)	earth_1_screen.ranger.10	0.605	0.837	0.723 [0.588, 0.859]	AUC
All	All (-lasso)	earth_1_screen.ranger.25	0.647	0.844	0.731 [0.601, 0.862]	AUC
All	All	SL.glm_screen.corRank.10	0.602	0.814	0.718 [0.552, 0.884]	AUC
All	All	SL.glm_screen.corRank.25	0.65	0.774	0.713 [0.574, 0.851]	AUC
All	All	SL.glm_screen.corRank.50	0.65	0.792	0.731 [0.602, 0.860]	AUC
All	All	SL.glm_screen.corP.20	0.555	0.699	0.620 [0.446, 0.795]	AUC
All	All	SL.glm_screen.corP.40	0.452	0.691	0.608 [0.433, 0.783]	AUC
All	All	SL.glm_screen.ranger.10	0.584	0.83	0.698 [0.562, 0.835]	AUC
All	All	SL.glm_screen.ranger.25	0.675	0.807	0.756 [0.631, 0.882]	AUC
All	All	SL.glm_screen.glmnet	0.631	0.827	0.743 [0.616, 0.871]	AUC
All	All	SL.ranger_screen.corRank.10	0.612	0.831	0.718 [0.552, 0.884]	AUC
All	All	SL.ranger_screen.corRank.25	0.674	0.8	0.727 [0.590, 0.865]	AUC
All	All	SL.ranger_screen.corRank.50	0.689	0.815	0.765 [0.645, 0.886]	AUC
All	All	SL.ranger_screen.corP.20	0.772	0.907	0.829 [0.727, 0.931]	AUC
All	All	SL.ranger_screen.corP.40	0.773	0.884	0.826 [0.723, 0.929]	AUC
All	All	SL.ranger_screen.ranger.10	0.652	0.843	0.753 [0.630, 0.876]	AUC
All	All	SL.ranger_screen.ranger.25	0.689	0.888	0.789 [0.674, 0.904]	AUC
All	All	SL.ranger_screen.glmnet	0.73	0.897	0.811 [0.703, 0.919]	AUC
All	All	earth_1_screen.corRank.10	0.655	0.817	0.724 [0.553, 0.896]	AUC
All	All	earth_1_screen.corRank.25	0.632	0.763	0.707 [0.542, 0.873]	AUC
All	All	earth_1_screen.corRank.50	0.633	0.821	0.727 [0.591, 0.864]	AUC
All	All	earth_1_screen.corP.20	0.62	0.76	0.680 [0.520, 0.841]	AUC
All	All	earth_1_screen.corP.40	0.565	0.78	0.671 [0.492, 0.850]	AUC
All	All	earth_1_screen.ranger.10	0.605	0.837	0.723 [0.588, 0.859]	AUC
All	All	earth_1_screen.ranger.25	0.647	0.844	0.731 [0.601, 0.862]	AUC
All	All	earth_1_screen.glmnet	0.601	0.722	0.689 [0.550, 0.828]	AUC
All	All (+none)	SL.glm_All	0.422	0.647	0.520 [0.344, 0.696]	AUC
All	All (+none)	SL.glm_screen.corRank.10	0.602	0.814	0.718 [0.552, 0.884]	AUC
All	All (+none)	SL.glm_screen.corRank.25	0.65	0.774	0.713 [0.574, 0.851]	AUC
All	All (+none)	SL.glm_screen.corRank.50	0.65	0.792	0.731 [0.602, 0.860]	AUC
All	All (+none)	SL.glm_screen.corP.20	0.555	0.699	0.620 [0.446, 0.795]	AUC
All	All (+none)	SL.glm_screen.corP.40	0.452	0.691	0.608 [0.433, 0.783]	AUC
All	All (+none)	SL.glm_screen.ranger.10	0.584	0.83	0.698 [0.562, 0.835]	AUC
All	All (+none)	SL.glm_screen.ranger.25	0.675	0.807	0.756 [0.631, 0.882]	AUC
All	All (+none)	SL.glm_screen.glmnet	0.631	0.827	0.743 [0.616, 0.871]	AUC
All	All (+none)	SL.ranger_All	0.763	0.895	0.837 [0.737, 0.936]	AUC
All	All (+none)	SL.ranger_screen.corRank.10	0.612	0.831	0.718 [0.552, 0.884]	AUC
All	All (+none)	SL.ranger_screen.corRank.25	0.674	0.8	0.727 [0.590, 0.865]	AUC
All	All (+none)	SL.ranger_screen.corRank.50	0.689	0.815	0.765 [0.645, 0.886]	AUC
All	All (+none)	SL.ranger_screen.corP.20	0.772	0.907	0.829 [0.727, 0.931]	AUC
All	All (+none)	SL.ranger_screen.corP.40	0.773	0.884	0.826 [0.723, 0.929]	AUC
All	All (+none)	SL.ranger_screen.ranger.10	0.652	0.843	0.753 [0.630, 0.876]	AUC

Table S13: Estimates of cross-validated prediction performance for all screener-learner pairs within the super learner. *(continued)*

Learners	Screeners	Algorithm	Min	Max	Point estimate [95% CI]	Risk measure
All	All (+none)	SL.ranger_screen.ranger.25	0.689	0.888	0.789 [0.674, 0.904]	AUC
All	All (+none)	SL.ranger_screen.glmnet	0.73	0.897	0.811 [0.703, 0.919]	AUC
All	All (+none)	earth_1_All	0.565	0.768	0.684 [0.502, 0.865]	AUC
All	All (+none)	earth_1_screen.corRank.10	0.655	0.817	0.724 [0.553, 0.896]	AUC
All	All (+none)	earth_1_screen.corRank.25	0.632	0.763	0.707 [0.542, 0.873]	AUC
All	All (+none)	earth_1_screen.corRank.50	0.633	0.821	0.727 [0.591, 0.864]	AUC
All	All (+none)	earth_1_screen.corP.20	0.62	0.76	0.680 [0.520, 0.841]	AUC
All	All (+none)	earth_1_screen.corP.40	0.565	0.78	0.671 [0.492, 0.850]	AUC
All	All (+none)	earth_1_screen.ranger.10	0.605	0.837	0.723 [0.588, 0.859]	AUC
All	All (+none)	earth_1_screen.ranger.25	0.647	0.844	0.731 [0.601, 0.862]	AUC
All	All (+none)	earth_1_screen.glmnet	0.601	0.722	0.689 [0.550, 0.828]	AUC

References

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