Results elastic net on DELCODE data

2022-02-11

Performance - Comparison

The table includes the best alpha, accuracy on test data, AUC on test data, accuracy on training data, number of parameters.

Models:

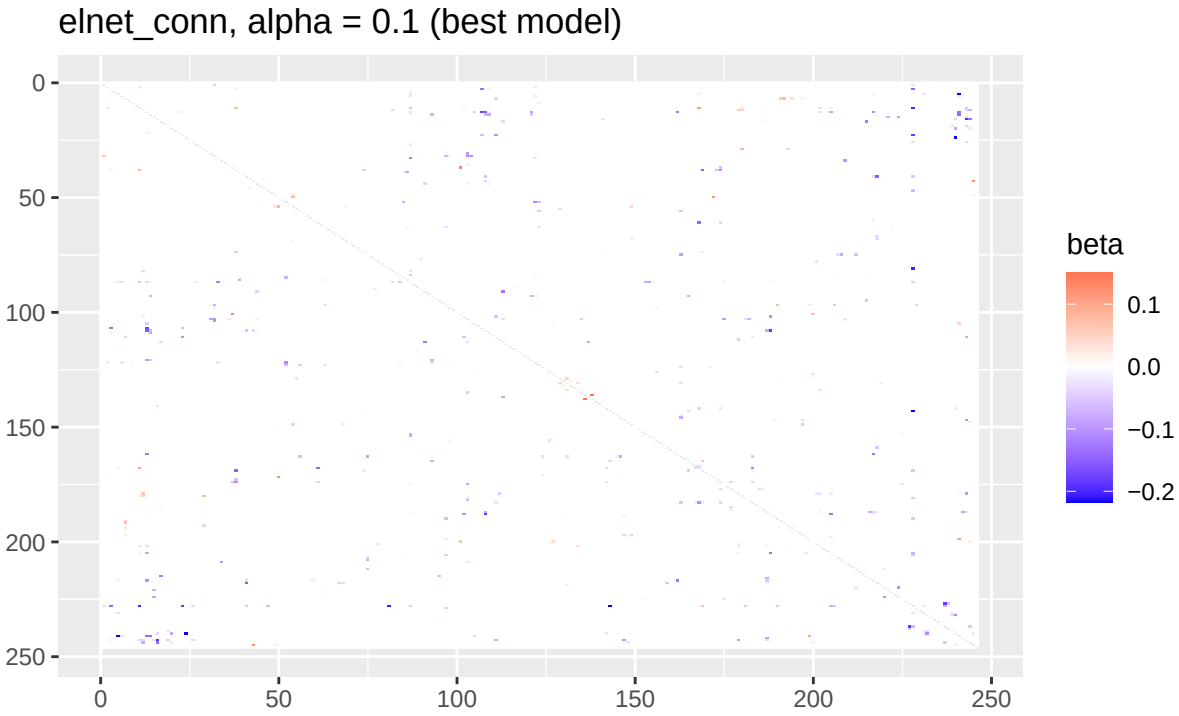
- *conn* = model on connectivity matrix, *abs, squ, quadratic* means fitted on absolute values/squared values/with quadratic functions
- *agg* = model on matrix aggregated by network regions (yeo7), *zero, max, mean* means percentage greater than zero/maximum/mean in region
- *gm* = model on graph metrics, *only* means only on graph metrics, *conn* means model on graph metrics and connectivity matrix
- *inter* means that all two-way interactions are included

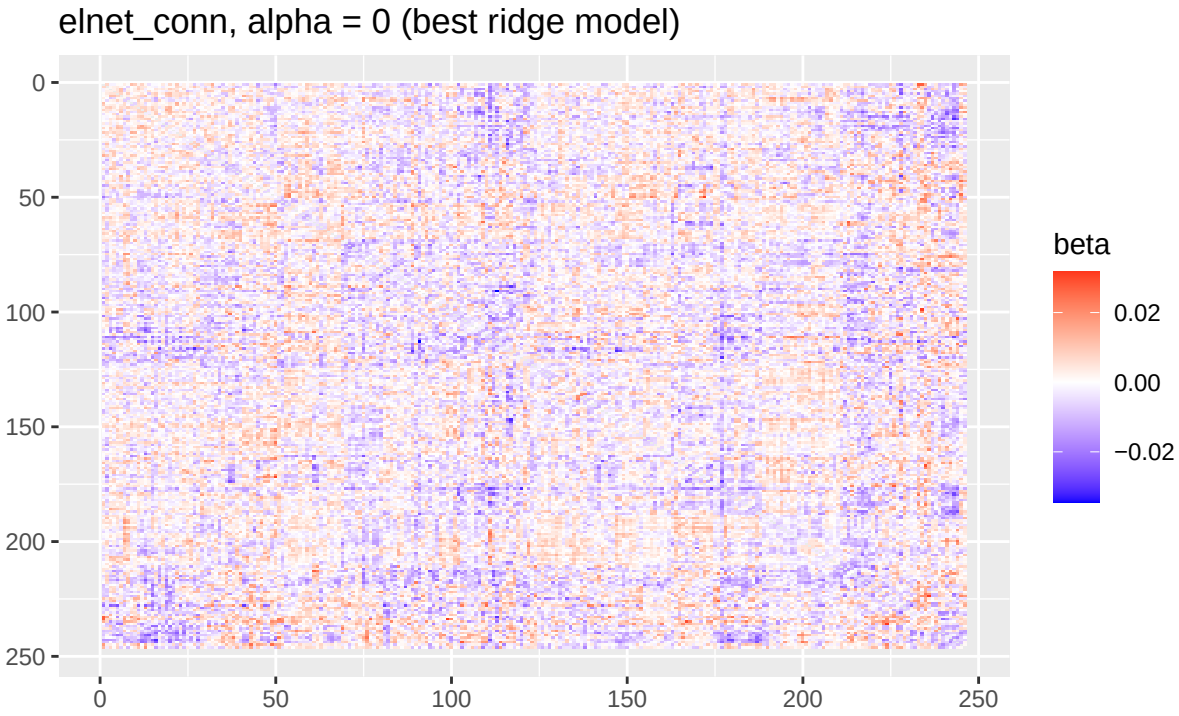
model	alpha	accuracy_test	auc_test	accuracy_train	n_params
elnet_conn	0.1	72.9	79.2	90.9	30138
elnet_conn_abs	0.6	69.4	72.6	89.9	30138
elnet_conn_squ	0.1	71.8	78.9	95.8	30138
elnet_conn_quadratic	0.2	67.1	78.3	96.4	60275
elnet_agg_zero	0.0	71.8	78.1	73.2	39
elnet_agg_max	0.0	64.7	70.1	73.8	39
elnet_agg_mean	0.6	71.8	74.2	75.1	39
elnet_gm_only	0.3	63.5	67.7	68.3	1239
elnet_gm_conn	0.2	70.6	76.7	96.4	31374
elnet_agg_zero_inter	0.5	70.6	80.3	80.0	819
elnet_agg_max_inter	0.4	69.4	73.6	72.2	819
elnet_agg_mean_inter	1.0	68.2	75.0	78.2	819

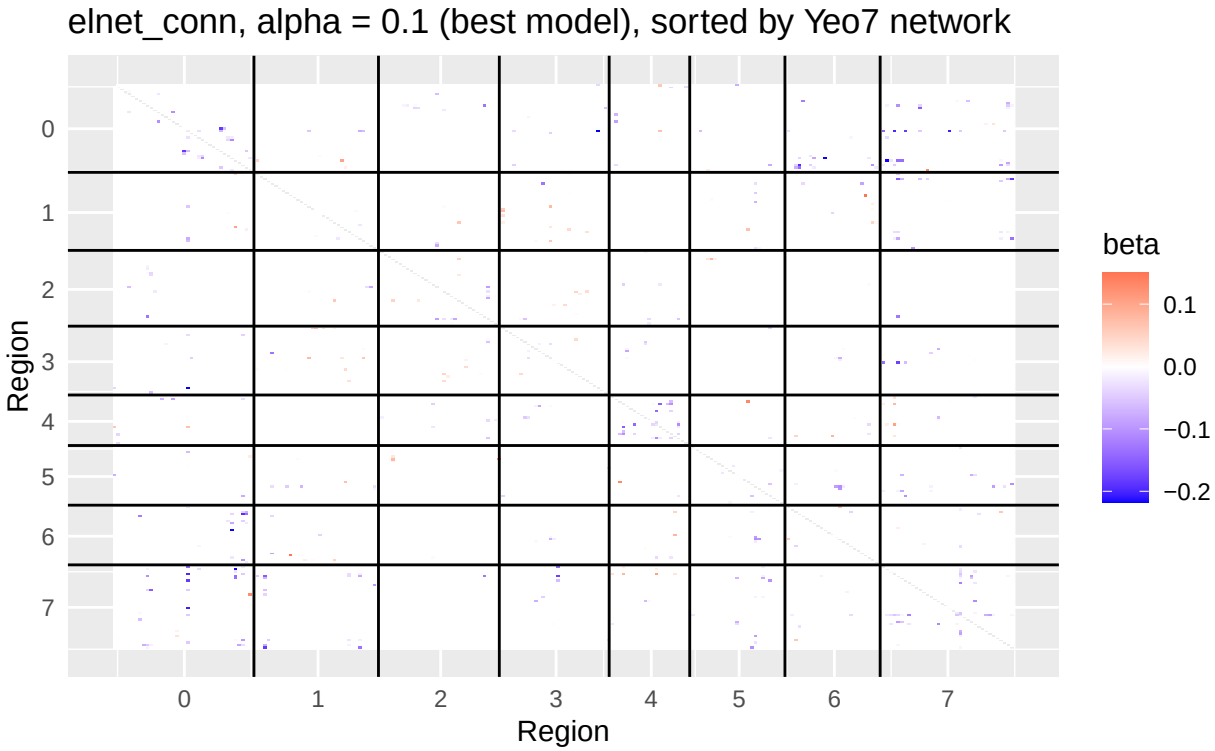
Detailed Evaluation & Visualisation

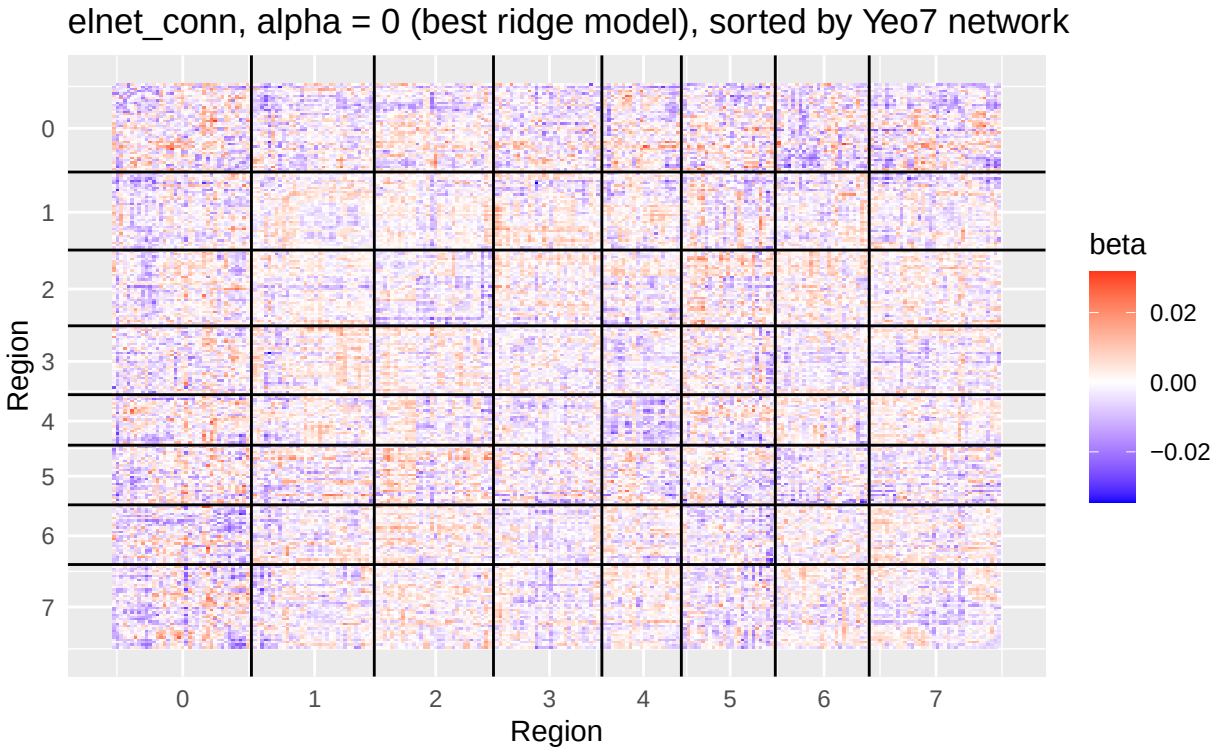
Visualisation

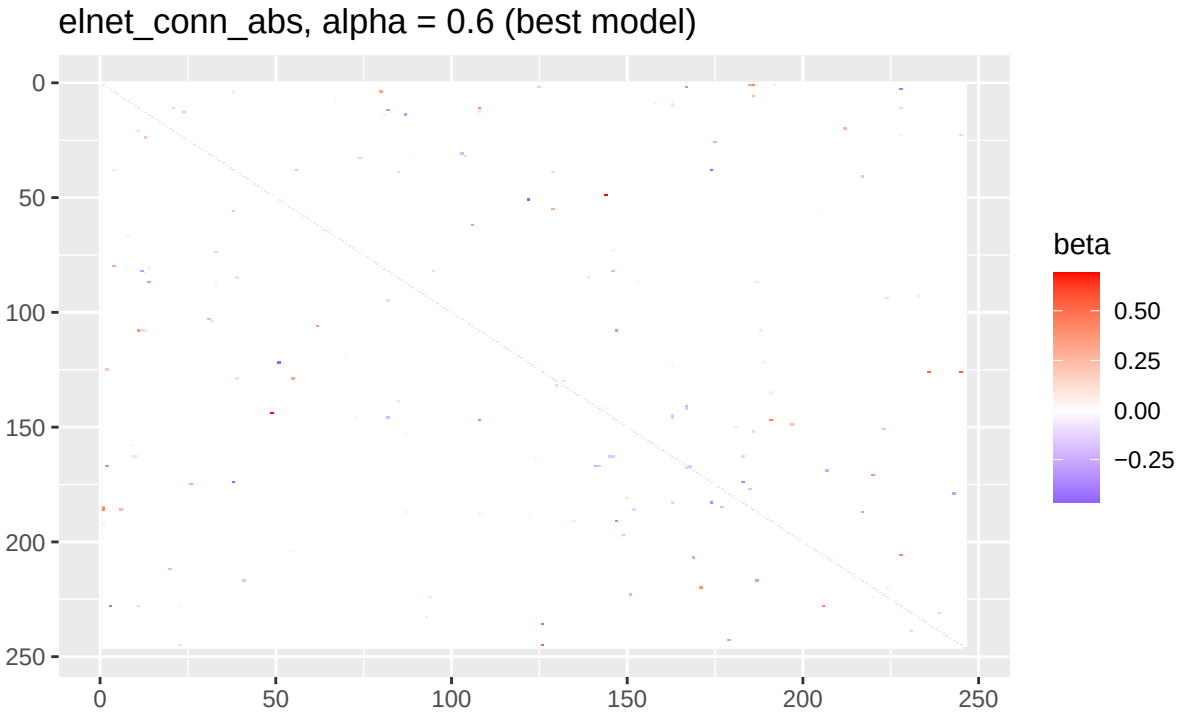
Plotted coefficients for some models (models on connectivity data and on data aggregated by regions, without interactions or squared functions). Shows best beta coefficient, best beta coefficient with alpha = 0 (Ridge-model, all coefficients != zero) and beta sorted by Yeo7-netword (for models on connectivity data).

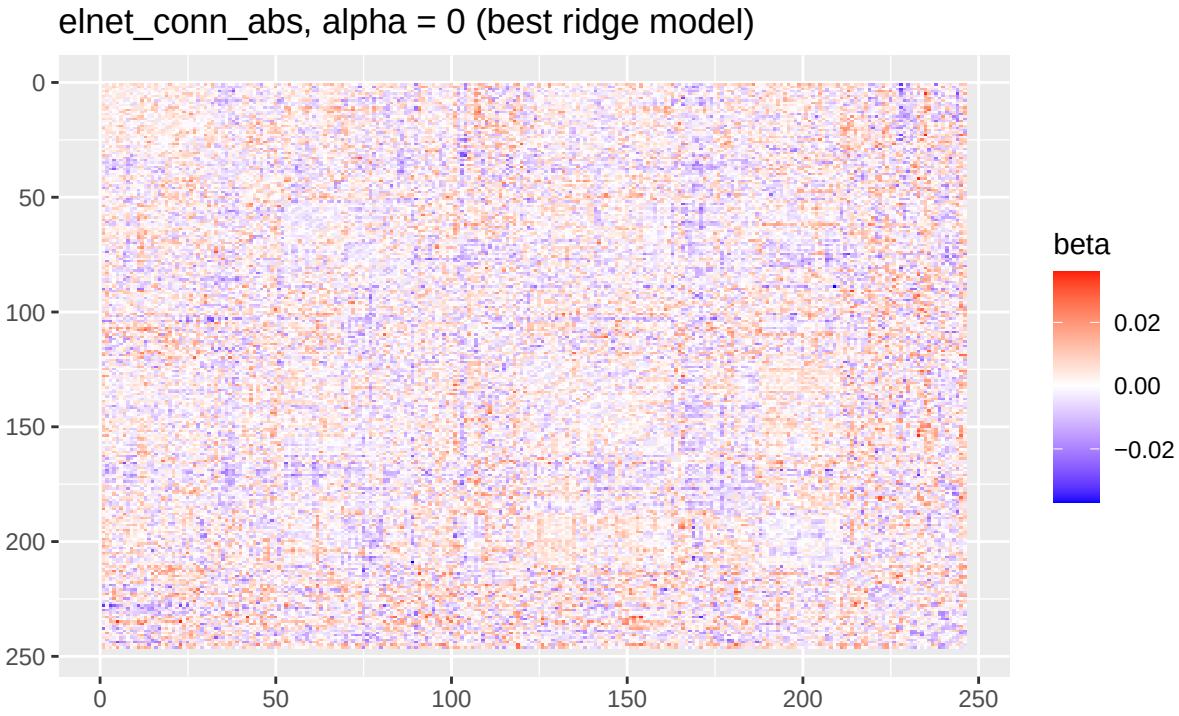

elnet_conn, alpha = 0.1 (best model)
0
50
100
150
200
250
beta
0.1
0.0
−0.1
−0.2

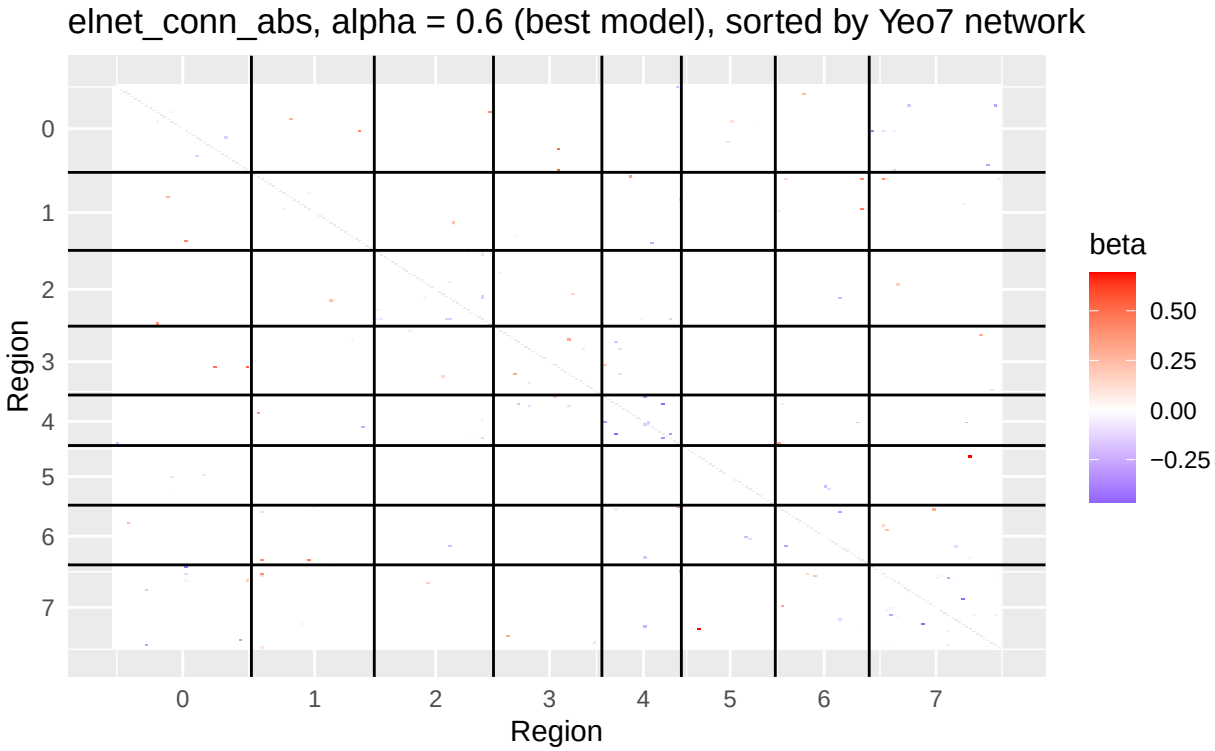

elnet_conn, alpha = 0 (best ridge model)
0
50
100
150
200
250
beta
0.02
0.00
−0.02

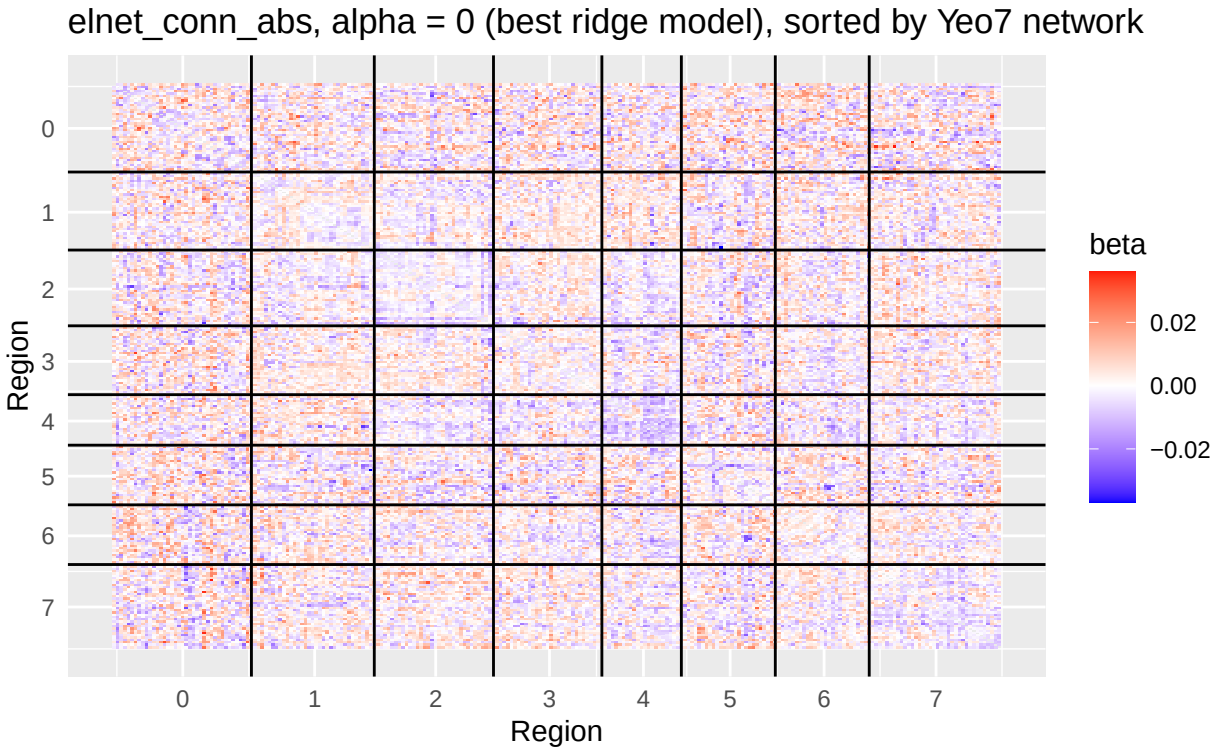

elnet_conn, alpha = 0.1 (best model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
beta
0.1
0.0
−0.1
−0.2

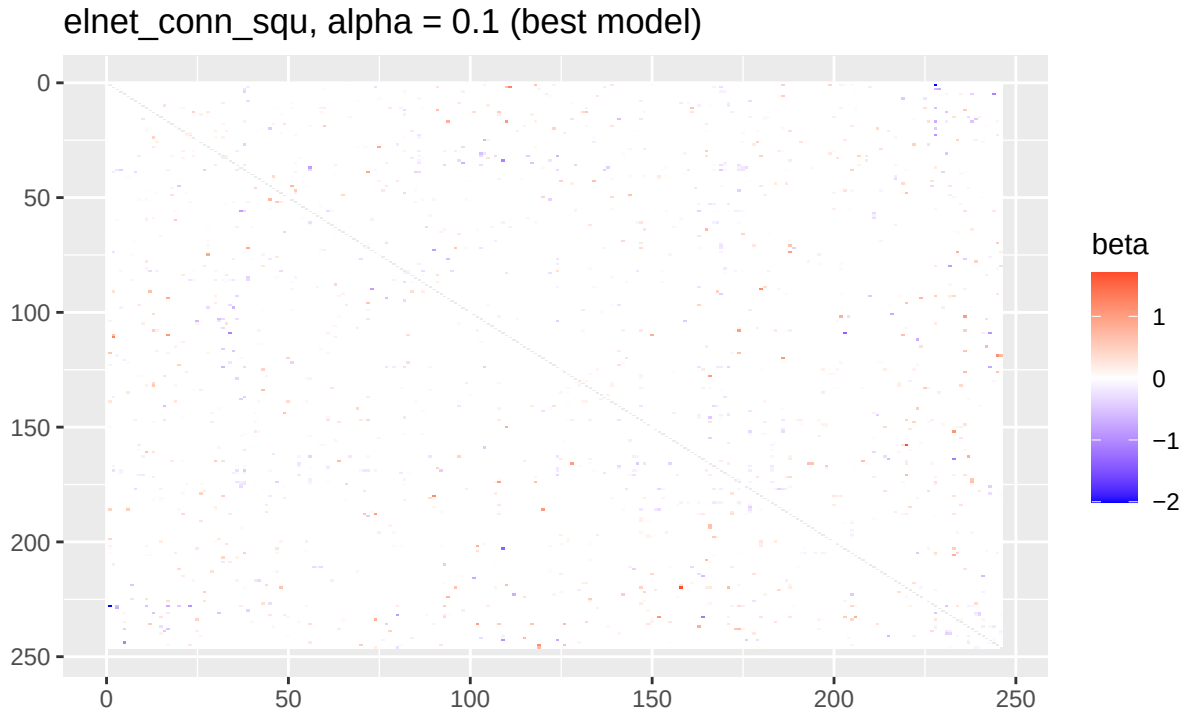

elnet_conn, alpha = 0 (best ridge model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
beta
0.02
0.00
−0.02

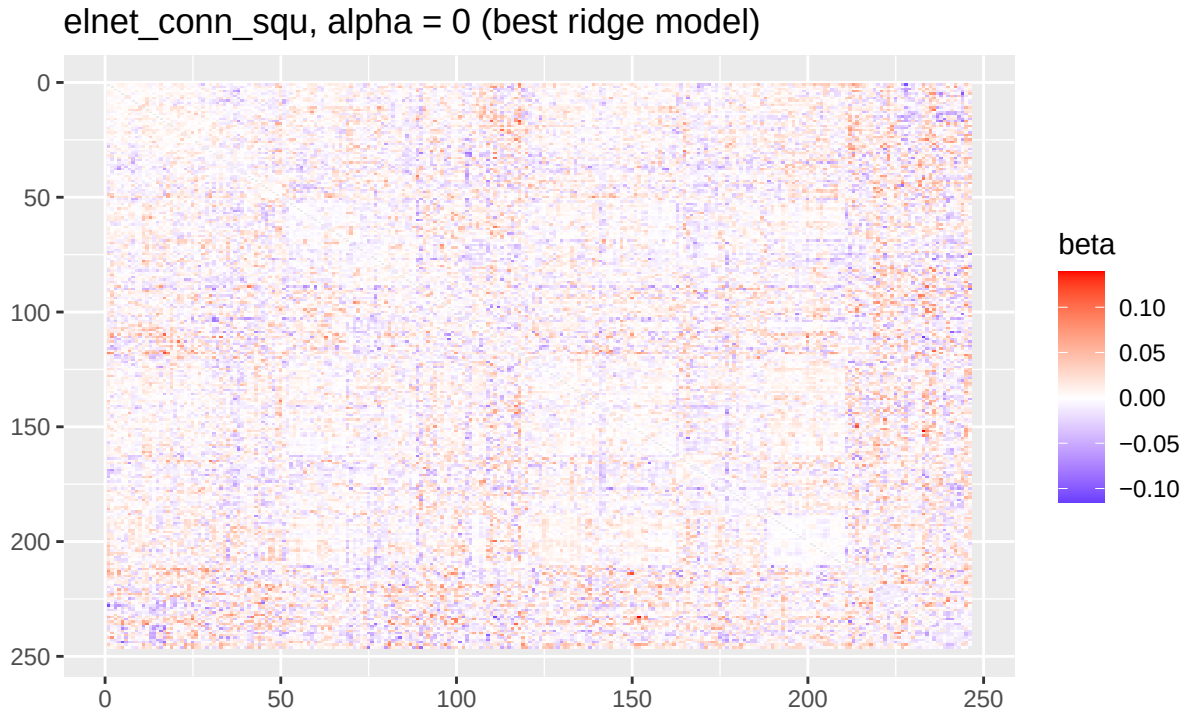

elnet_conn_abs, alpha = 0.6 (best model)
0
50
100
150
200
250
beta
0.50
0.25
0.00
−0.25

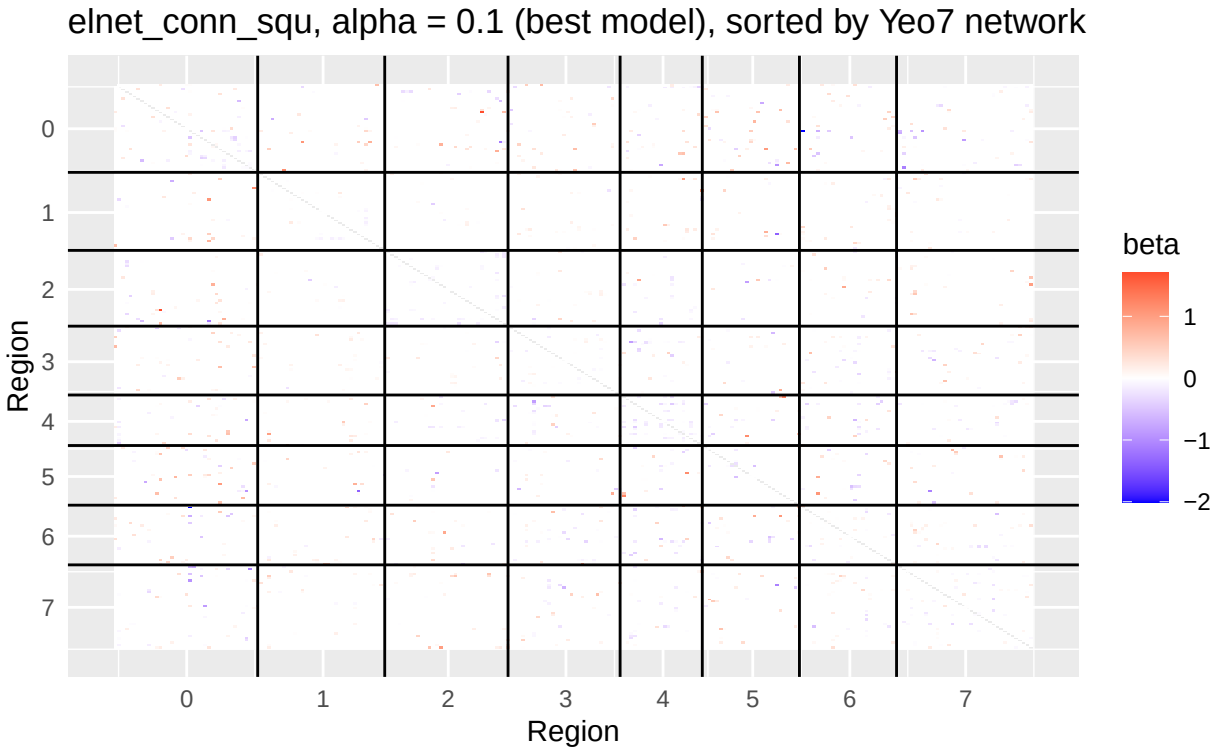

elnet_conn_abs, alpha = 0 (best ridge model)
0
50
100
150
200
250
beta
0.02
0.00
−0.02

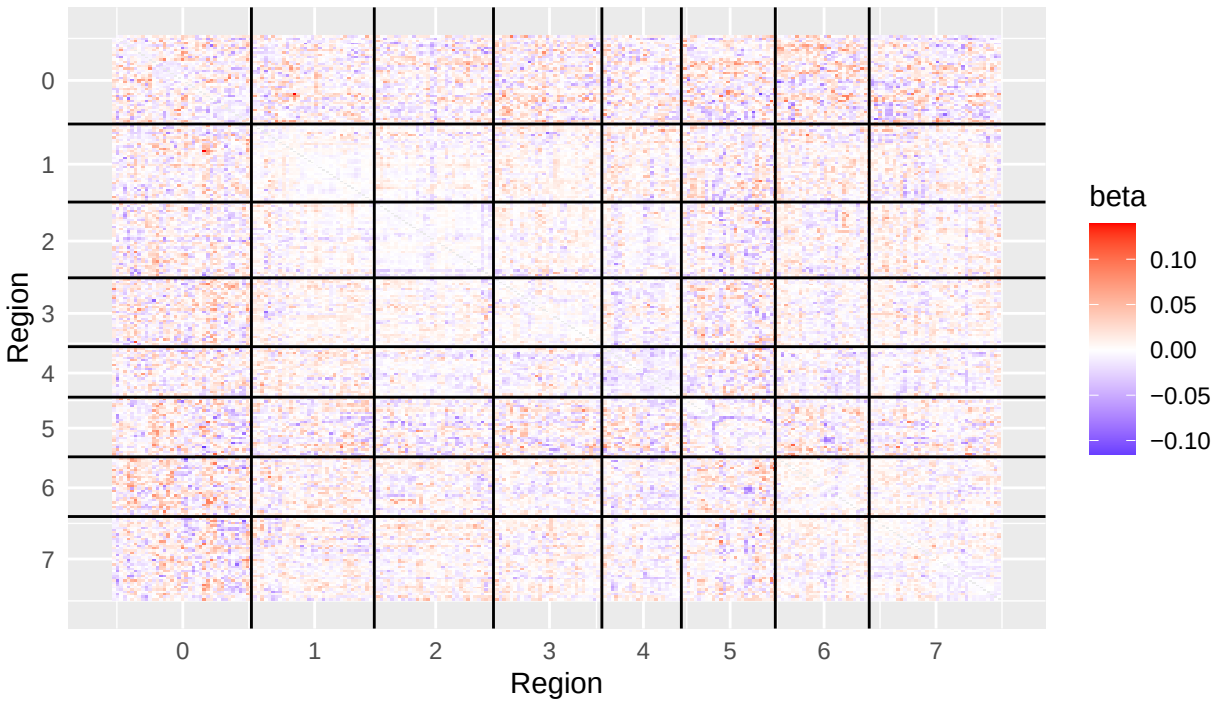

elnet_conn_abs, alpha = 0.6 (best model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
beta
0.50
0.25
0.00
−0.25

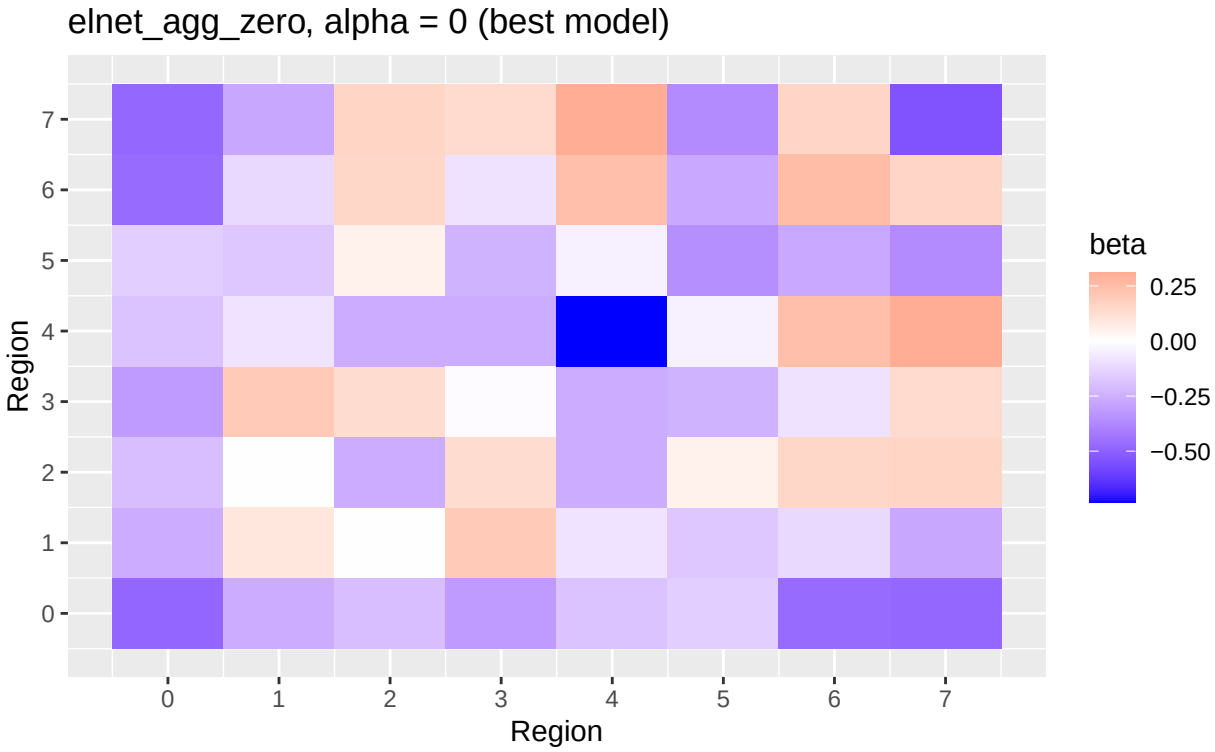

elnet_conn_abs, alpha = 0 (best ridge model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
beta
0.02
0.00
−0.02

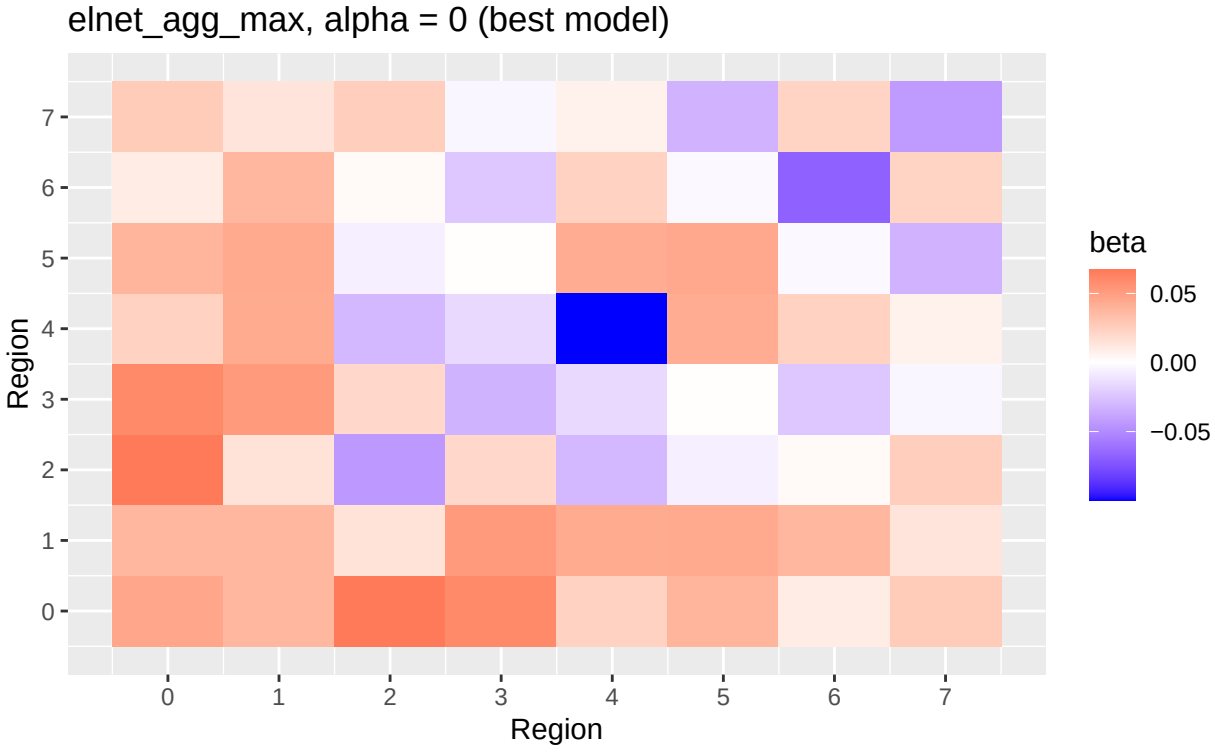

elnet_conn_squ, alpha = 0.1 (best model)
0
50
100
150
200
250
beta
1
0
−1
−2

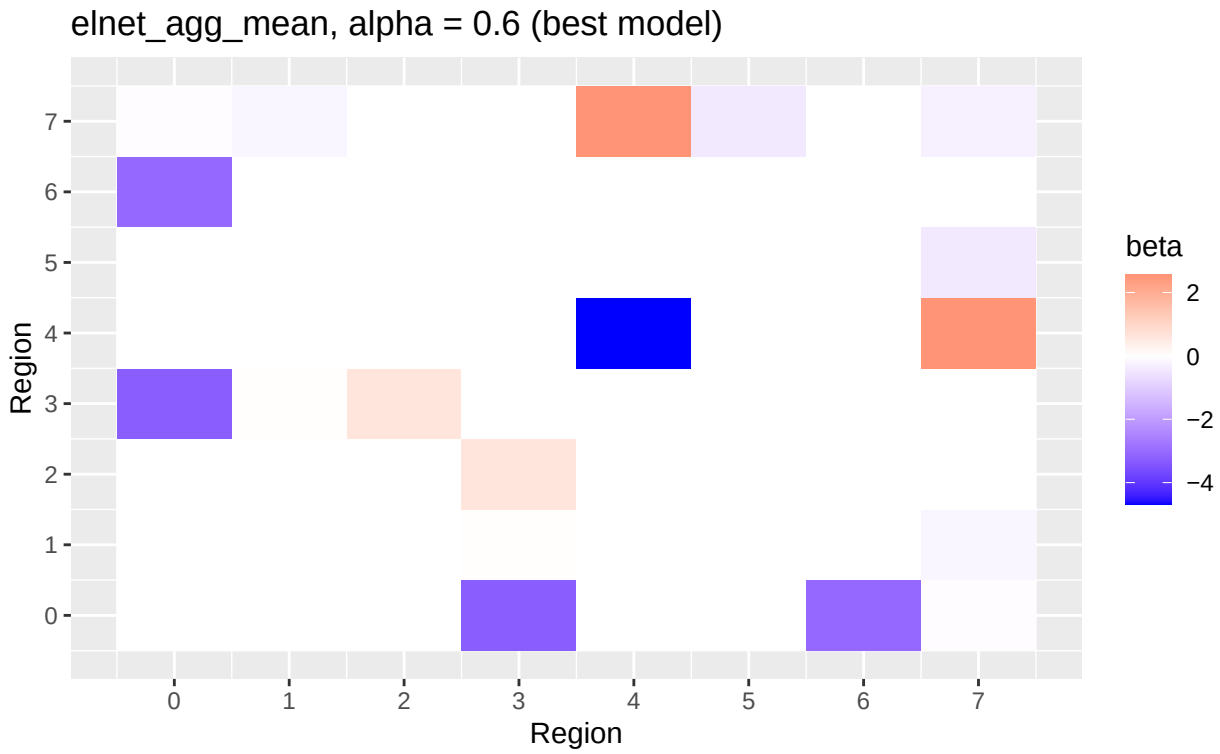

elnet_conn_squ, alpha = 0 (best ridge model)
0
50
100
150
200
250
beta
0.10
0.05
0.00
−0.05
−0.10

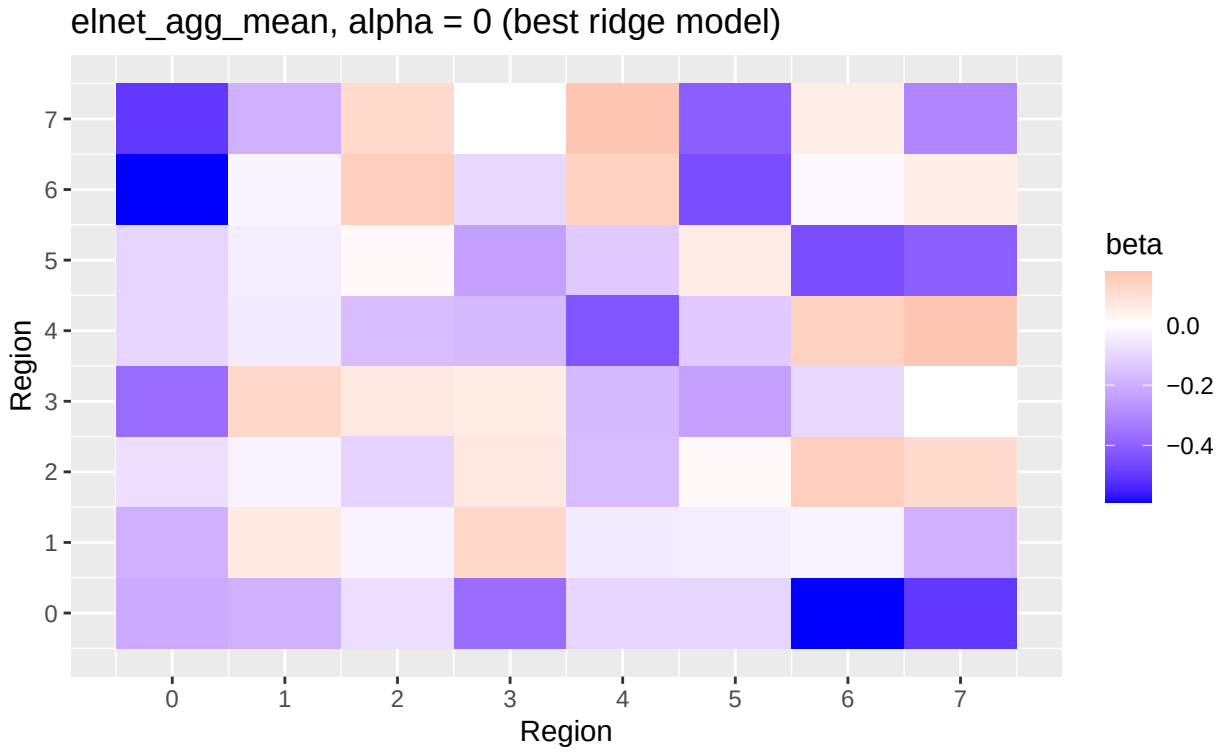

elnet_conn_squ, alpha = 0.1 (best model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
0
1
2
3
4
5
6
7
beta
1
0
−1
−2


elnet_conn_squ, alpha = 0 (best ridge model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
0
1
2
3
4
5
6
7
beta
0.10
0.05
0.00
−0.05
−0.10


elnet_agg_zero, alpha = 0 (best model)
Region
0
1
2
3
4
5
6
7
Region
beta
0.25
0.00
−0.25
−0.50


elnet_agg_max, alpha = 0 (best model)
Region
0
1
2
3
4
5
6
7
Region
beta
0.05
0.00
−0.05


elnet_agg_mean, alpha = 0.6 (best model)
Region
Region
beta
2
0
−2
−4
0
1
2
3
4
5
6
7


elnet_agg_mean, alpha = 0 (best ridge model)
Region
Region
beta
0.0
−0.2
−0.4
0
1
2
3
4
5
6
7

Confusion Matrices

Confusion matrix for every model with best alpha (based on test accuracy).

```
## [1] "elnet_conn"
## [1] "alpha:  0.1"
## [1] "lambda:  0.557377200863924"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 25 11
##          1 12 37
##
##                Accuracy : 0.7294
##                  95% CI : (0.6221, 0.8201)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.001277
##
##                   Kappa : 0.4479
##
##  Mcnemar's Test P-Value : 1.000000
##
##             Sensitivity : 0.7708
##             Specificity : 0.6757
##          Pos Pred Value : 0.7551
##          Neg Pred Value : 0.6944
##              Prevalence : 0.5647
##          Detection Rate : 0.4353
##    Detection Prevalence : 0.5765
##       Balanced Accuracy : 0.7233
##
##        'Positive' Class : 1
##
## [1] "elnet_conn_abs"
## [1] "alpha:  0.6"
## [1] "lambda:  0.106342540093938"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 24 13
##          1 13 35
##
##                Accuracy : 0.6941
##                  95% CI : (0.5847, 0.7895)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.009942
##
##                   Kappa : 0.3778
##
##  Mcnemar's Test P-Value : 1.000000
##
##             Sensitivity : 0.7292
```

```
##             Specificity : 0.6486
##          Pos Pred Value : 0.7292
##          Neg Pred Value : 0.6486
##              Prevalence : 0.5647
##          Detection Rate : 0.4118
##    Detection Prevalence : 0.5647
##       Balanced Accuracy : 0.6889
##
##        'Positive' Class : 1
##
## [1] "elnet_conn_squ"
## [1] "alpha:  0.1"
## [1] "lambda:  0.122964972128965"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 26 13
##          1 11 35
##
##                Accuracy : 0.7176
##                  95% CI : (0.6096, 0.81)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.002669
##
##                   Kappa : 0.4292
##
##  Mcnemar's Test P-Value : 0.838256
##
##             Sensitivity : 0.7292
##             Specificity : 0.7027
##          Pos Pred Value : 0.7609
##          Neg Pred Value : 0.6667
##              Prevalence : 0.5647
##          Detection Rate : 0.4118
##    Detection Prevalence : 0.5412
##       Balanced Accuracy : 0.7159
##
##        'Positive' Class : 1
##
## [1] "elnet_conn_quadratic"
## [1] "alpha:  0.2"
## [1] "lambda:  0.00951944025766332"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 23 14
##          1 14 34
##
##                Accuracy : 0.6706
##                  95% CI : (0.5602, 0.7687)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.03031
```

```
##
##                  Kappa : 0.33
##
##  Mcnemar's Test P-Value : 1.00000
##
##             Sensitivity : 0.7083
##             Specificity : 0.6216
##          Pos Pred Value : 0.7083
##          Neg Pred Value : 0.6216
##              Prevalence : 0.5647
##          Detection Rate : 0.4000
##    Detection Prevalence : 0.5647
##       Balanced Accuracy : 0.6650
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_zero"
## [1] "alpha:  0"
## [1] "lambda:  1.69670789108586"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 20  7
##          1 17 41
##
##                Accuracy : 0.7176
##                  95% CI : (0.6096, 0.81)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.002669
##
##                   Kappa : 0.4073
##
##  Mcnemar's Test P-Value : 0.066193
##
##             Sensitivity : 0.8542
##             Specificity : 0.5405
##          Pos Pred Value : 0.7069
##          Neg Pred Value : 0.7407
##              Prevalence : 0.5647
##          Detection Rate : 0.4824
##    Detection Prevalence : 0.6824
##       Balanced Accuracy : 0.6974
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_max"
## [1] "alpha:  0"
## [1] "lambda:  5.03888605052918"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 15  8
```

```
##          1 22 40
##
##                Accuracy : 0.6471
##                  95% CI : (0.5359, 0.7477)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.07658
##
##                   Kappa : 0.2496
##
##  Mcnemar's Test P-Value : 0.01762
##
##             Sensitivity : 0.8333
##             Specificity : 0.4054
##          Pos Pred Value : 0.6452
##          Neg Pred Value : 0.6522
##              Prevalence : 0.5647
##          Detection Rate : 0.4706
##    Detection Prevalence : 0.7294
##       Balanced Accuracy : 0.6194
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_mean"
## [1] "alpha:  0.6"
## [1] "lambda:  0.0744993861959039"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 28 15
##          1  9 33
##
##                Accuracy : 0.7176
##                  95% CI : (0.6096, 0.81)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.002669
##
##                   Kappa : 0.4362
##
##  Mcnemar's Test P-Value : 0.307434
##
##             Sensitivity : 0.6875
##             Specificity : 0.7568
##          Pos Pred Value : 0.7857
##          Neg Pred Value : 0.6512
##              Prevalence : 0.5647
##          Detection Rate : 0.3882
##    Detection Prevalence : 0.4941
##       Balanced Accuracy : 0.7221
##
##        'Positive' Class : 1
##
## [1] "elnet_gm_only"
## [1] "alpha:  0.3"
```

```
## [1] "lambda:  0.288243140776309"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 12  6
##          1 25 42
##
##                Accuracy : 0.6353
##                  95% CI : (0.5238, 0.7371)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.113919
##
##                   Kappa : 0.2118
##
##  Mcnemar's Test P-Value : 0.001225
##
##             Sensitivity : 0.8750
##             Specificity : 0.3243
##          Pos Pred Value : 0.6269
##          Neg Pred Value : 0.6667
##              Prevalence : 0.5647
##          Detection Rate : 0.4941
##    Detection Prevalence : 0.7882
##       Balanced Accuracy : 0.5997
##
##        'Positive' Class : 1
##
## [1] "elnet_gm_conn"
## [1] "alpha:  0.2"
## [1] "lambda:  0.198138154446053"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 24 12
##          1 13 36
##
##                Accuracy : 0.7059
##                  95% CI : (0.5971, 0.7998)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.005286
##
##                   Kappa : 0.3999
##
##  Mcnemar's Test P-Value : 1.000000
##
##             Sensitivity : 0.7500
##             Specificity : 0.6486
##          Pos Pred Value : 0.7347
##          Neg Pred Value : 0.6667
##              Prevalence : 0.5647
##          Detection Rate : 0.4235
##    Detection Prevalence : 0.5765
```

```
##       Balanced Accuracy : 0.6993
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_zero_inter"
## [1] "alpha:  0.5"
## [1] "lambda:  0.0300888053878411"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 21  9
##          1 16 39
##
##                Accuracy : 0.7059
##                  95% CI : (0.5971, 0.7998)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.005286
##
##                   Kappa : 0.3885
##
##  Mcnemar's Test P-Value : 0.230139
##
##             Sensitivity : 0.8125
##             Specificity : 0.5676
##          Pos Pred Value : 0.7091
##          Neg Pred Value : 0.7000
##              Prevalence : 0.5647
##          Detection Rate : 0.4588
##    Detection Prevalence : 0.6471
##       Balanced Accuracy : 0.6900
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_max_inter"
## [1] "alpha:  0.4"
## [1] "lambda:  0.159423203093747"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 17  6
##          1 20 42
##
##                Accuracy : 0.6941
##                  95% CI : (0.5847, 0.7895)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.009942
##
##                   Kappa : 0.3496
##
##  Mcnemar's Test P-Value : 0.010787
##
##             Sensitivity : 0.8750
```

```
##             Specificity : 0.4595
##          Pos Pred Value : 0.6774
##          Neg Pred Value : 0.7391
##              Prevalence : 0.5647
##          Detection Rate : 0.4941
##    Detection Prevalence : 0.7294
##       Balanced Accuracy : 0.6672
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_mean_inter"
## [1] "alpha:  1"
## [1] "lambda:  0.050359740957724"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 19  9
##          1 18 39
##
##                Accuracy : 0.6824
##                  95% CI : (0.5724, 0.7792)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.01779
##
##                   Kappa : 0.3354
##
##  Mcnemar's Test P-Value : 0.12366
##
##             Sensitivity : 0.8125
##             Specificity : 0.5135
##          Pos Pred Value : 0.6842
##          Neg Pred Value : 0.6786
##              Prevalence : 0.5647
##          Detection Rate : 0.4588
##    Detection Prevalence : 0.6706
##       Balanced Accuracy : 0.6630
##
##        'Positive' Class : 1
##
```