Results elastic net on DELCODE data

2022-02-04

Performance - Comparison

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

Models:

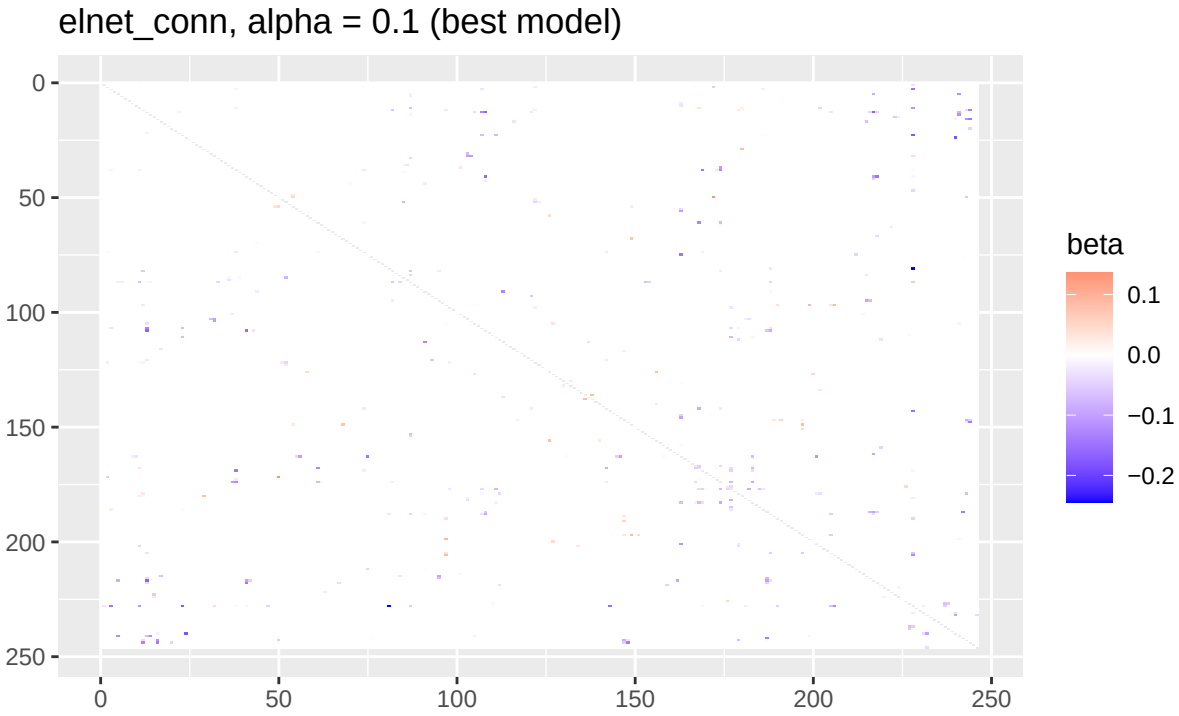
- *conn* = model on connectivity matrix, *abs, squ, quadratic* means fitted on absolute values/squared values/with quadratic functions
- *agg* = model on matrix aggregated by network regions (yeo7), *zero, max, mean* means percentage greater than zero/maximum/mean in region
- *gm* = model on graph metrics,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

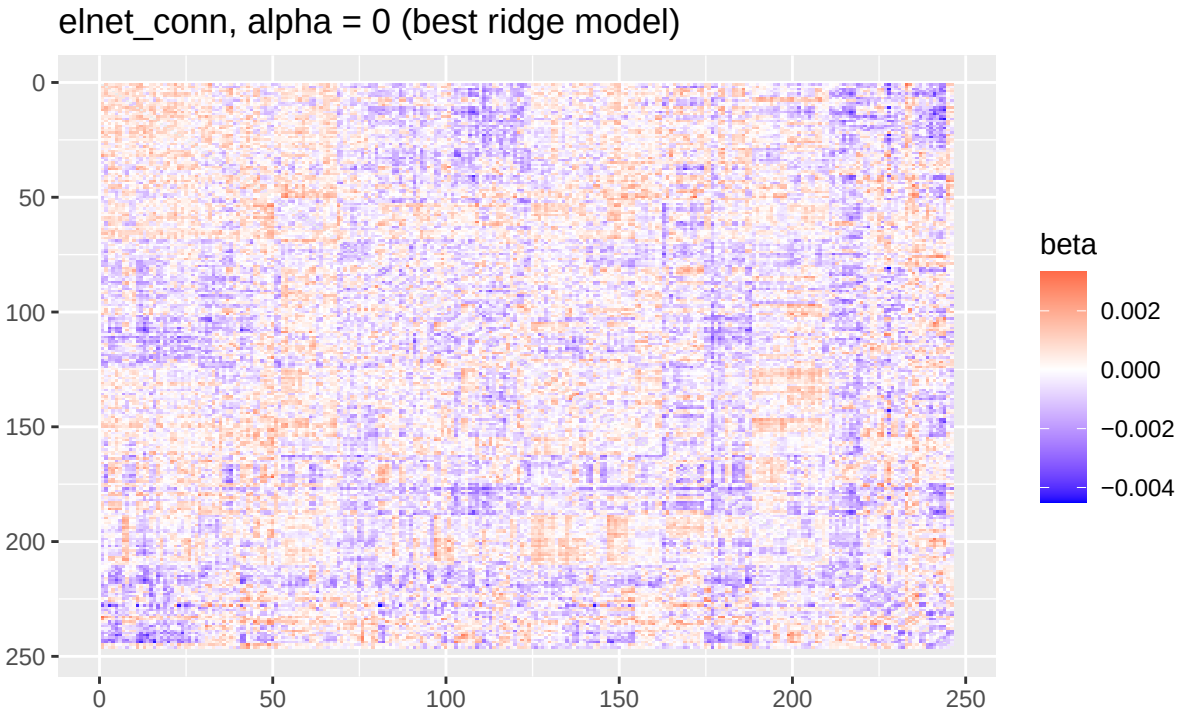
model	accuracy_test	alpha_accuracy	auc_test	alpha_auc	accuracy_train	n_params
elnet_conn	77.6	0.1	83.8	0.1	89.6	30138
elnet_conn_abs	77.6	0.0	80.7	0.0	100.0	30138
elnet_conn_squ	80.0	0.0	80.0	0.0	100.0	30138
elnet_conn_quadratic	76.5	0.0	83.7	0.0	91.4	60275
elnet_agg_zero	76.5	0.4	80.6	0.0	75.3	39
elnet_agg_max	71.8	0.3	71.7	0.0	64.2	39
elnet_agg_mean	75.3	0.0	79.1	0.1	77.9	39
elnet_gm_only	71.8	0.2	73.6	1.0	90.4	1239
elnet_gm_conn	77.6	0.1	83.8	0.1	89.9	31374
elnet_agg_zero_inter	75.3	0.3	82.1	0.0	84.2	819
elnet_agg_max_inter	72.9	0.1	75.5	0.1	68.6	819
elnet_agg_mean_inter	75.3	0.1	81.9	0.7	94.0	819

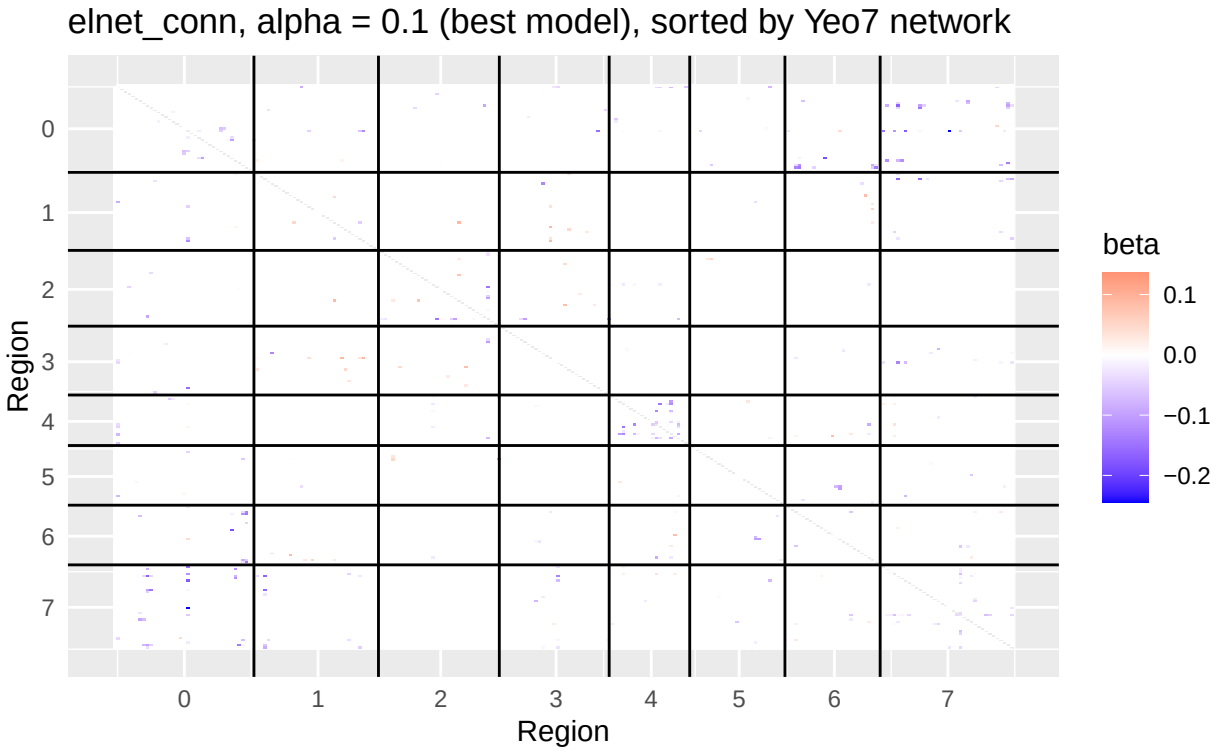
Detailed Evaluation & Visualisation

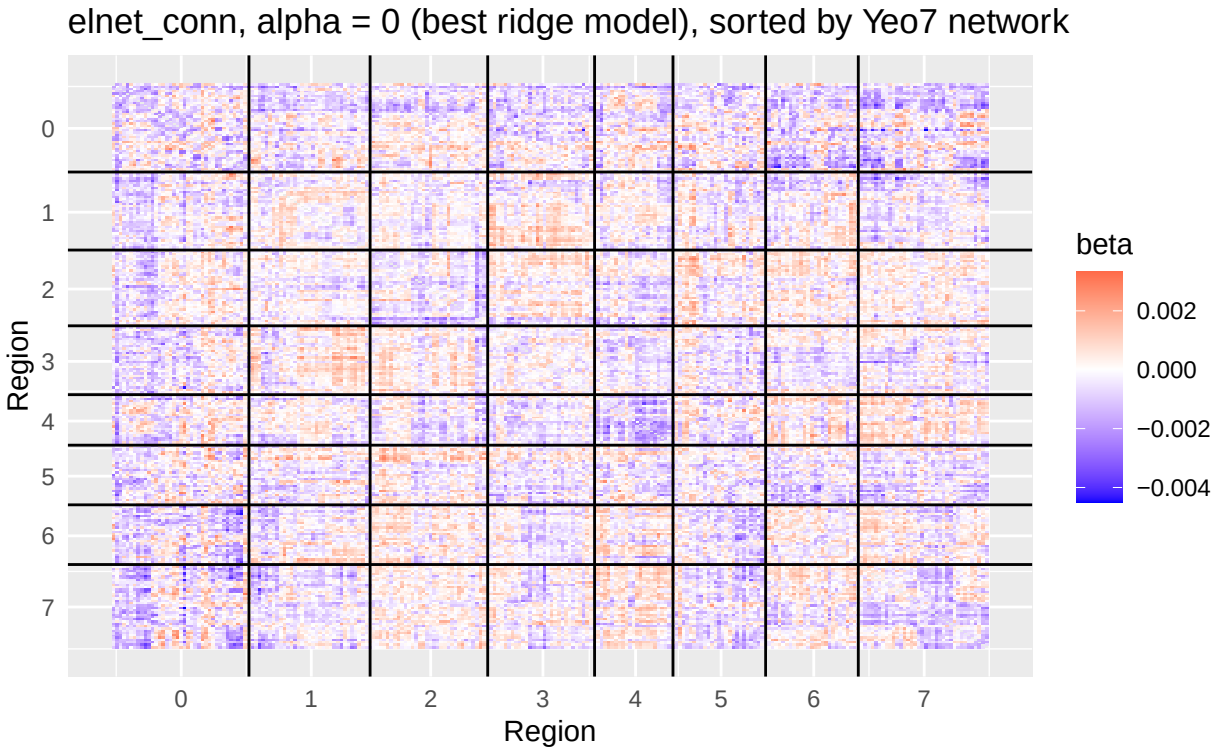
Visualisation

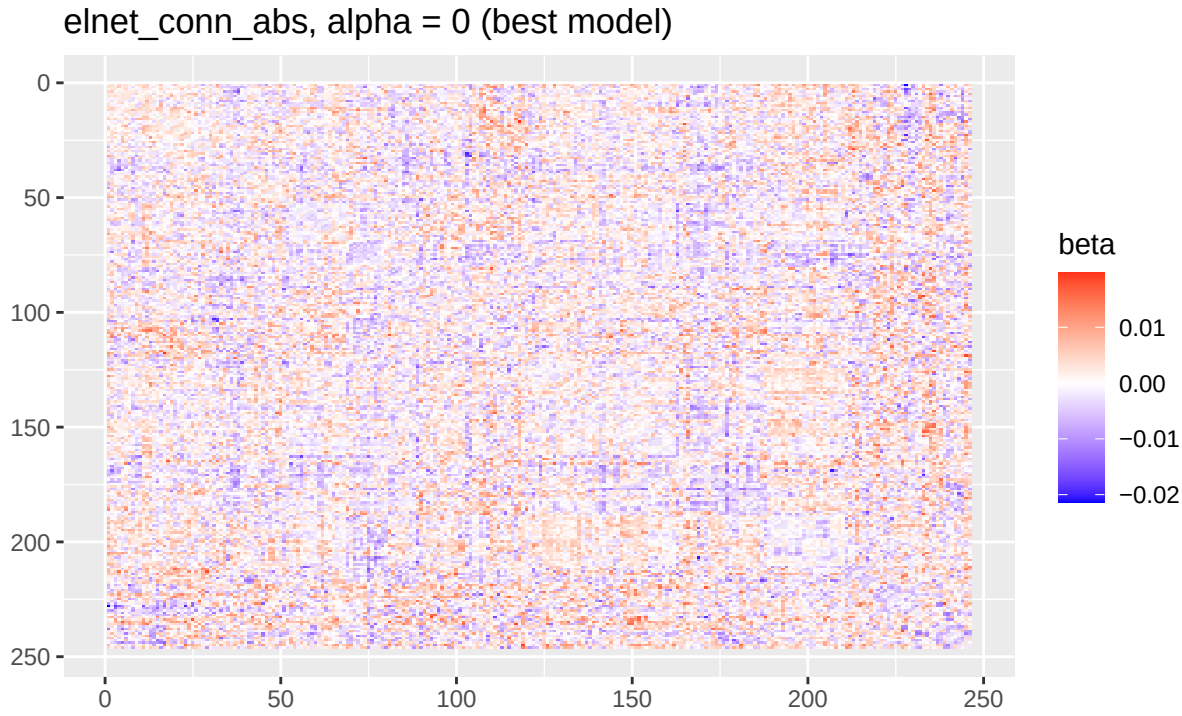
Plotted coefficients for some models (models on connectivity data and on data aggregated by regions, without interactions or squared functions). Shows best beta coefficient, best beta coefficient with alpha = 0 (Ridge-model, all coefficients != zero) and beta sorted by Yeo7-netword (for models on connectivity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

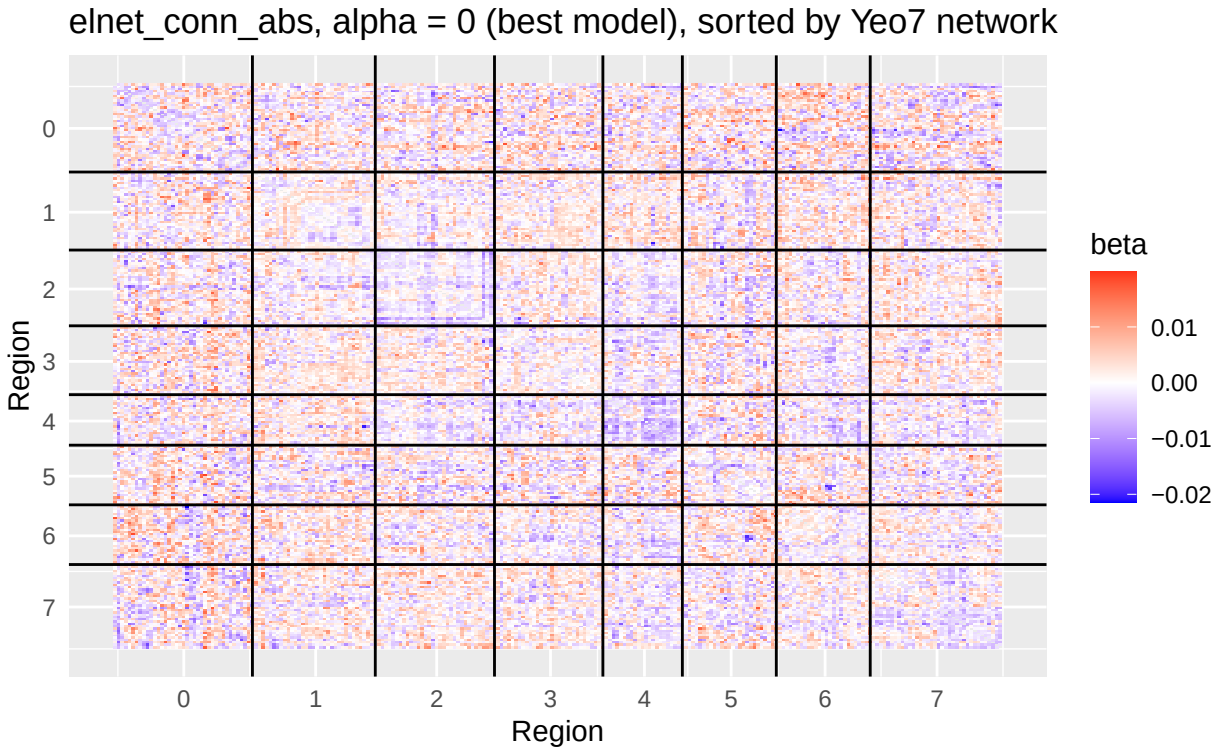

elnet_conn, alpha = 0.1 (best model)
0
50
100
150
200
250
beta
0.1
0.0
−0.1
−0.2

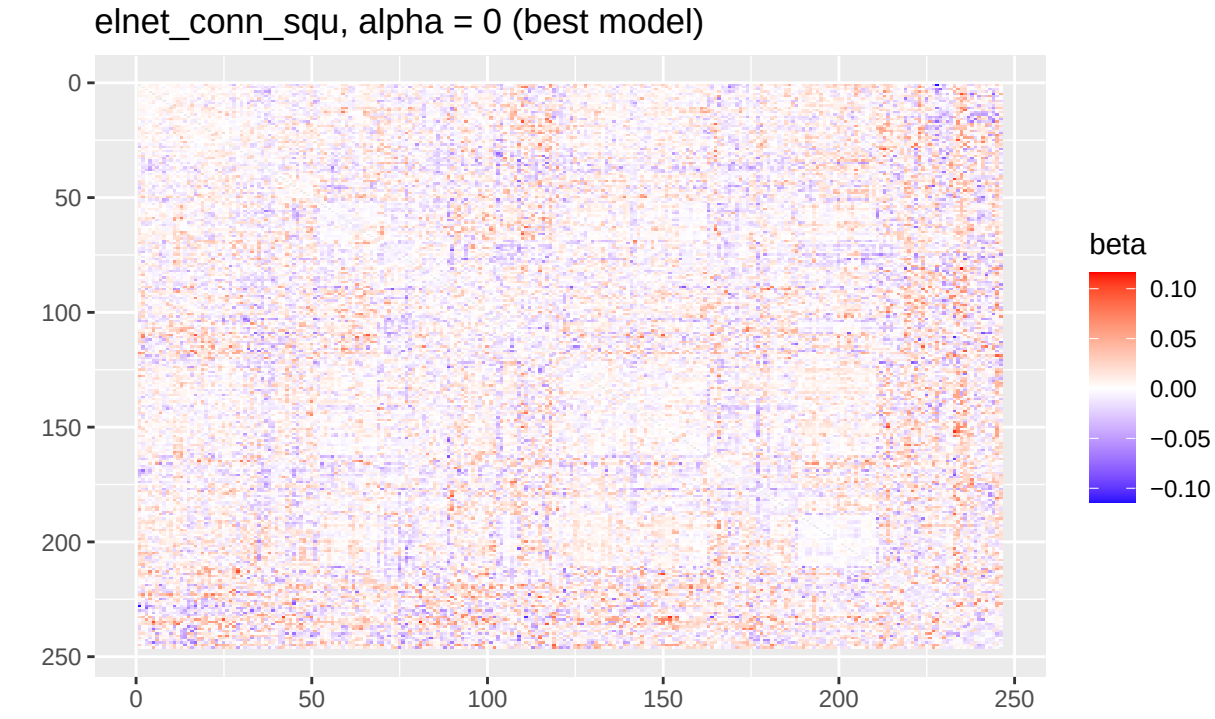

elnet_conn, alpha = 0 (best ridge model)
0
50
100
150
200
250
beta
0.002
0.000
−0.002
−0.004

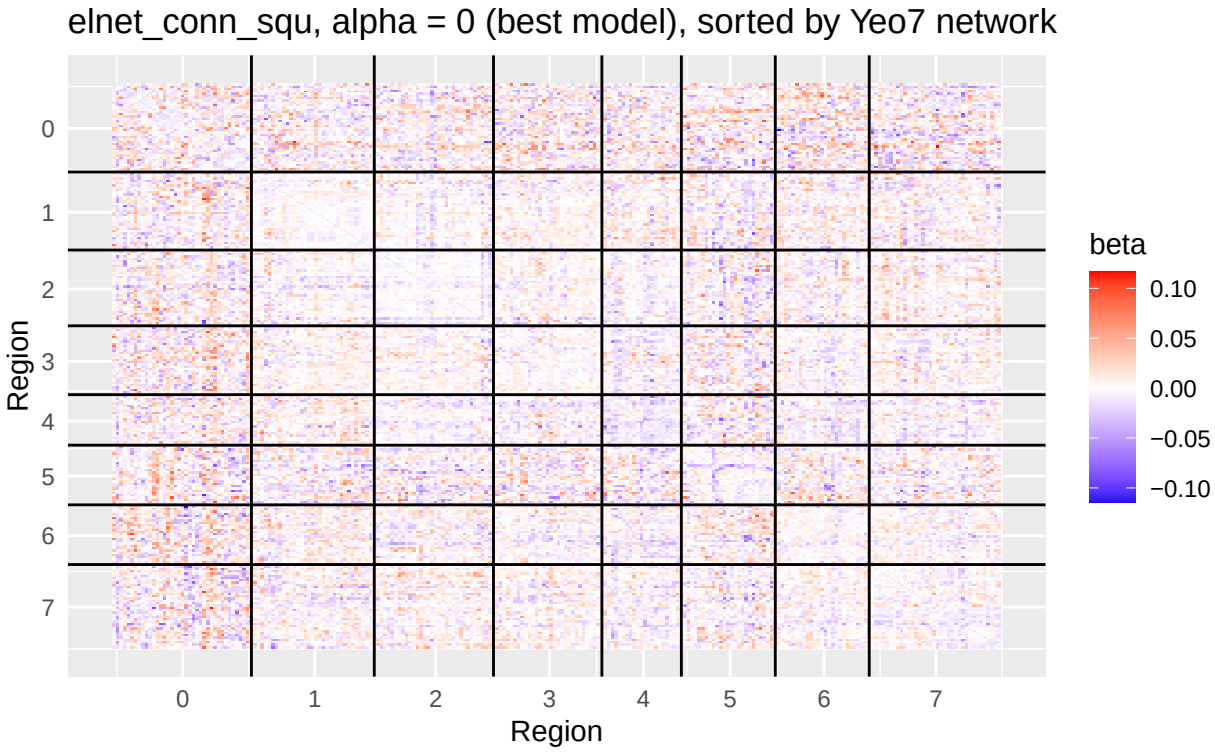

elnet_conn, alpha = 0.1 (best model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
beta
0.1
0.0
−0.1
−0.2

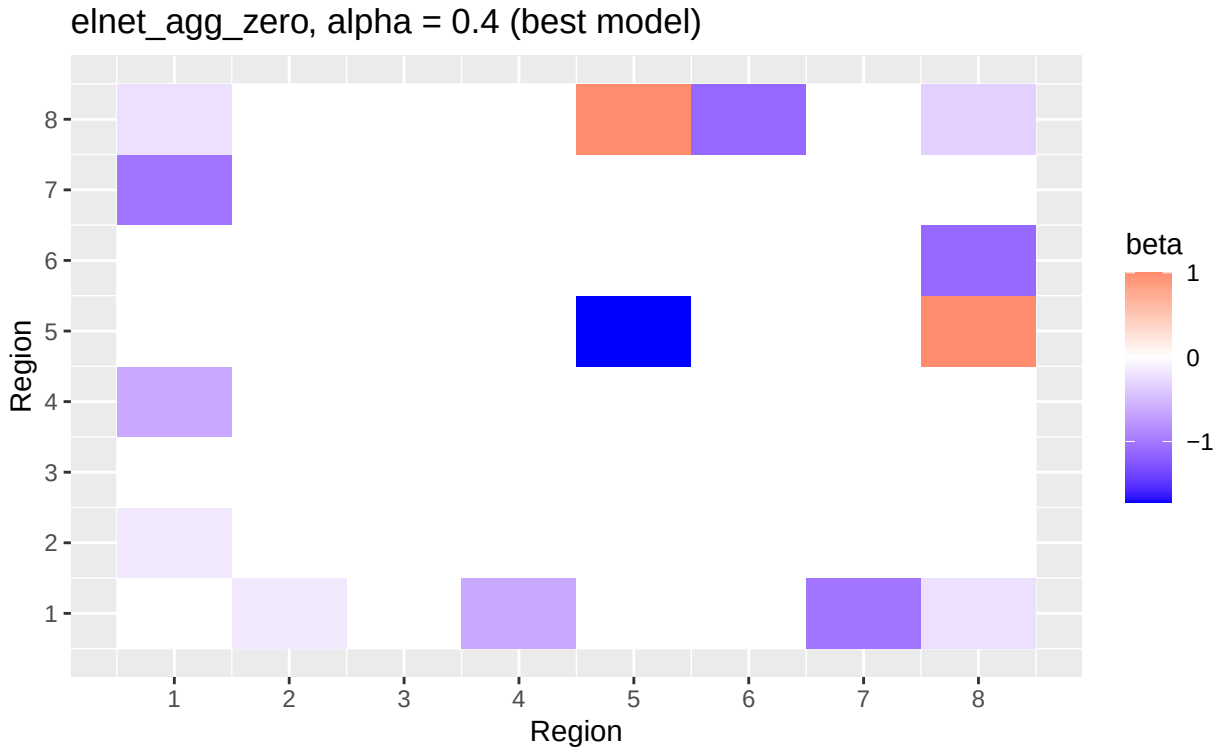

elnet_conn, alpha = 0 (best ridge model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
Region
beta
0.002
0.000
−0.002
−0.004

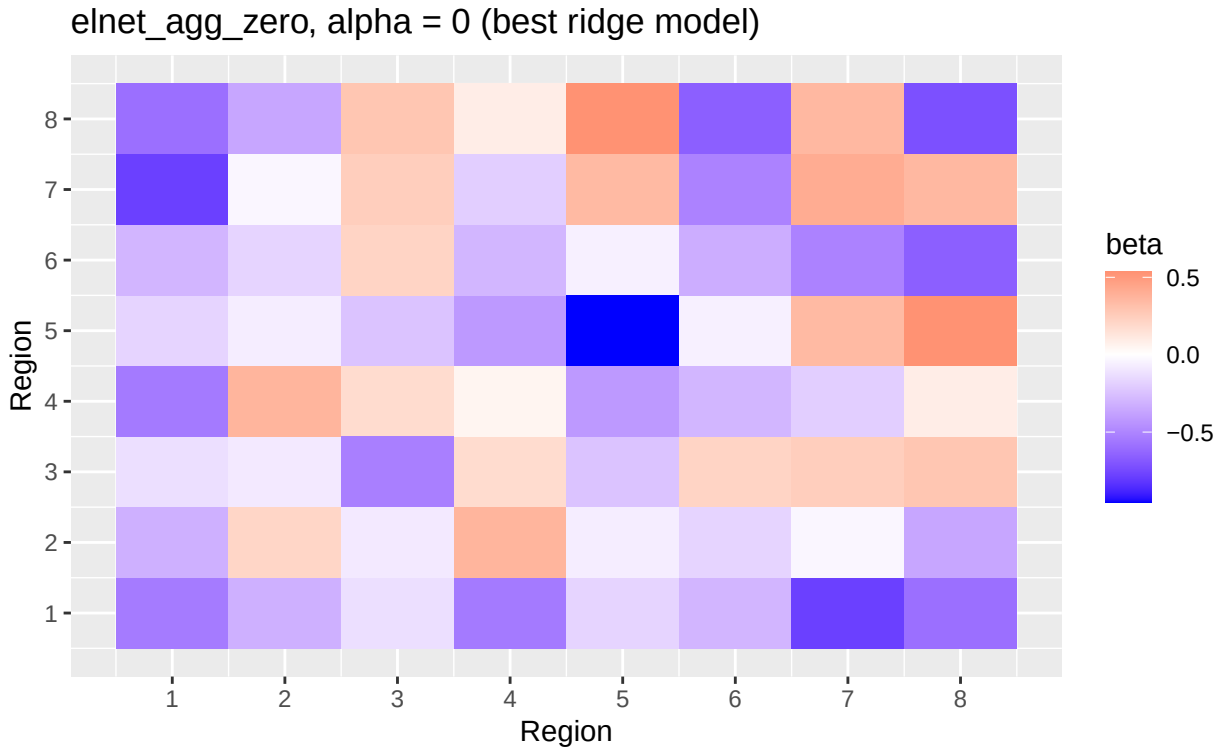

elnet_conn_abs, alpha = 0 (best model)
0
50
100
150
200
250
beta
0.01
0.00
−0.01
−0.02

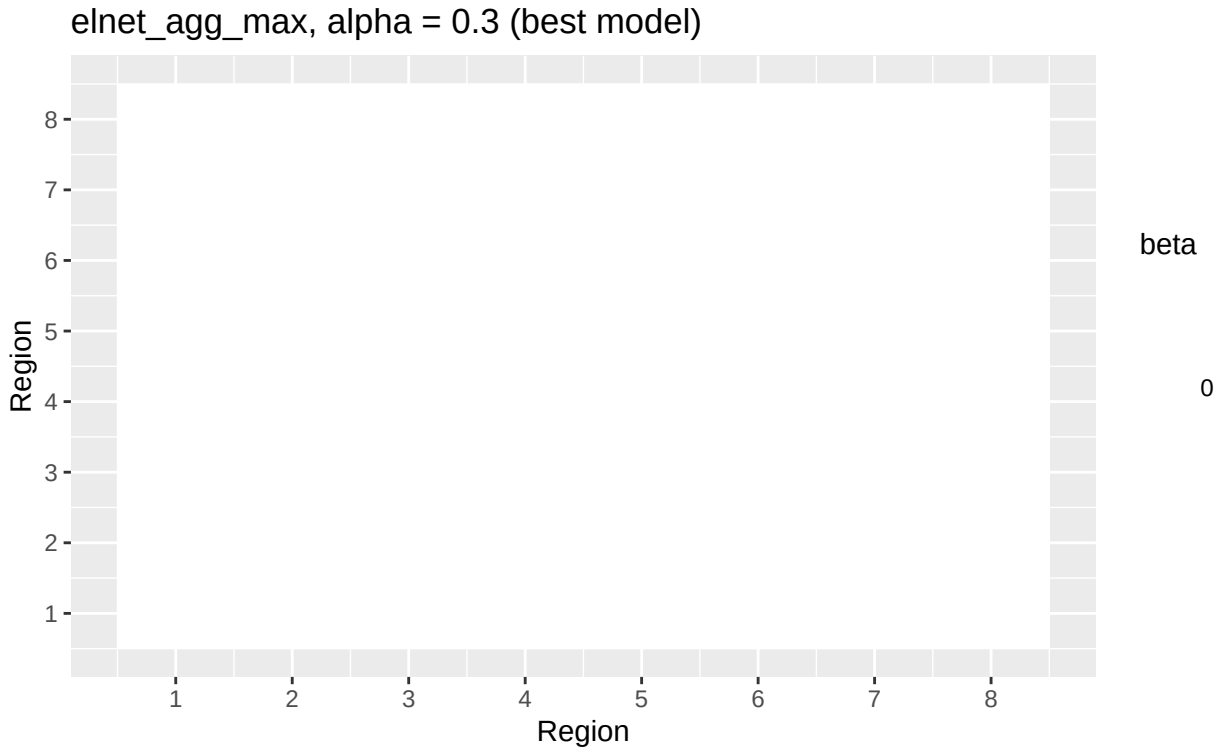

elnet_conn_abs, alpha = 0 (best model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
beta
0.01
0.00
−0.01
−0.02

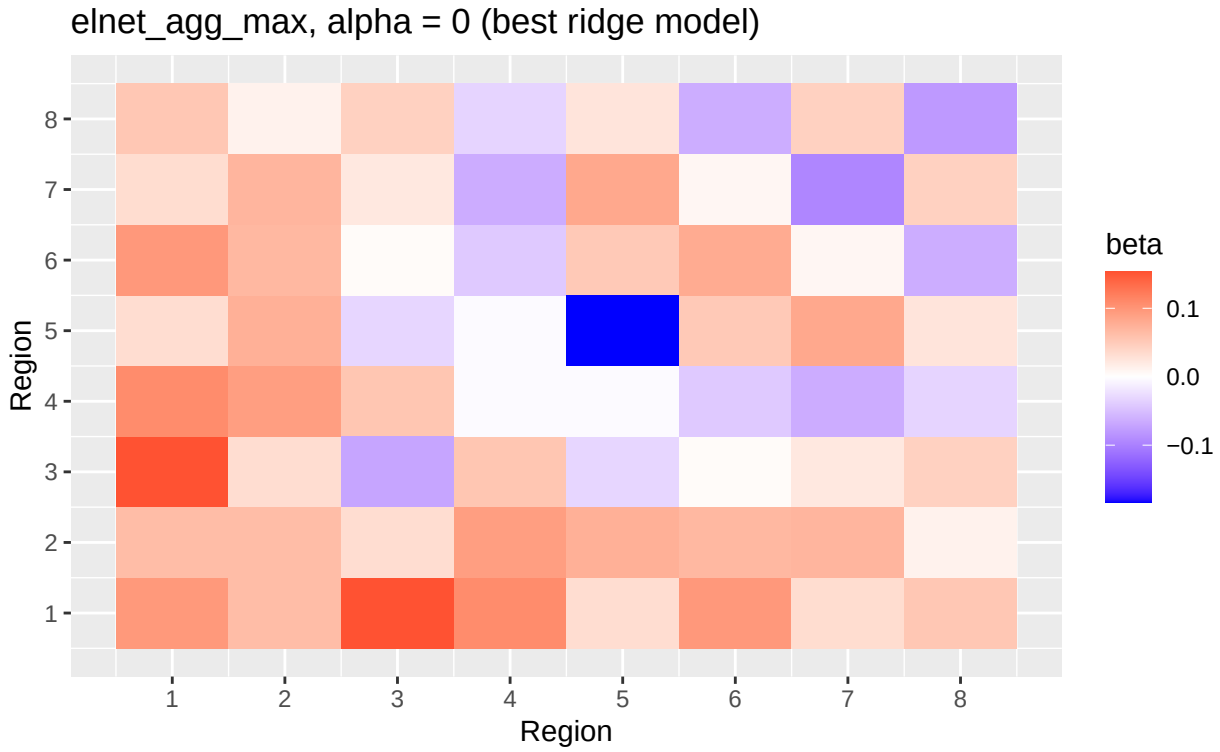

elnet_conn_squ, alpha = 0 (best model)
0
50
100
150
200
250
beta
0.10
0.05
0.00
−0.05
−0.10

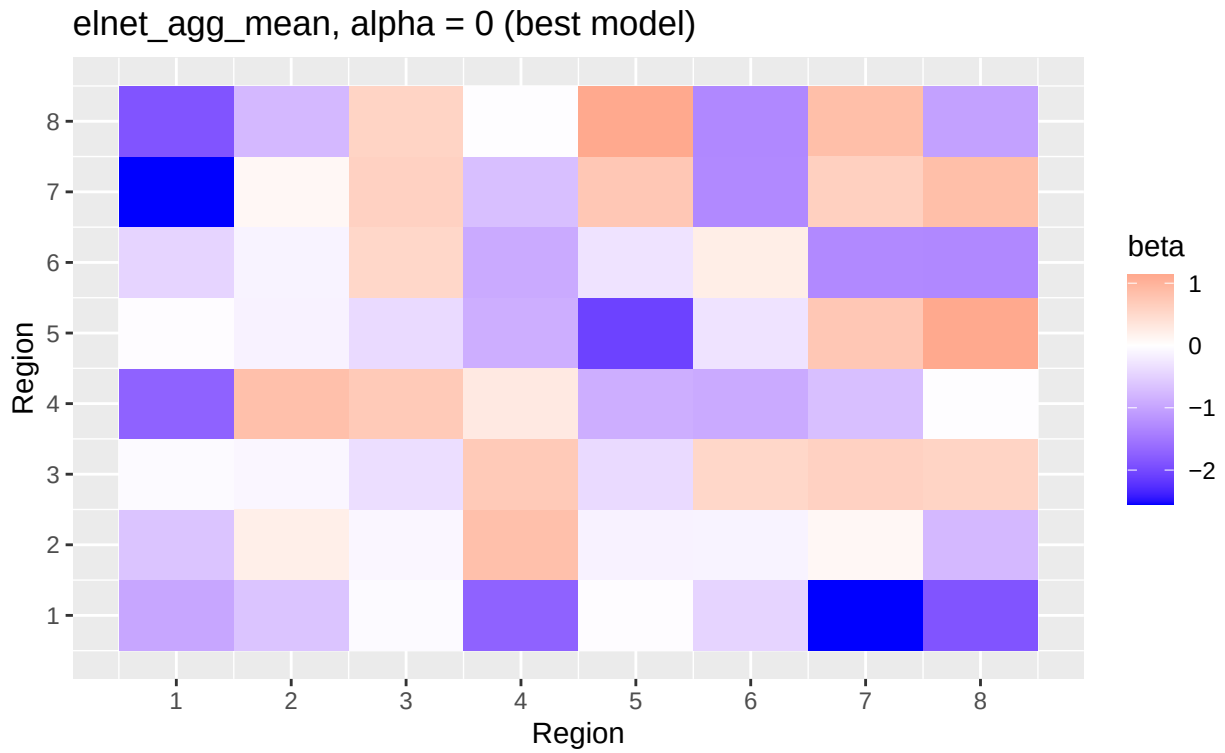

elnet_conn_squ, alpha = 0 (best model), sorted by Yeo7 network
Region
0
1
2
3
4
5
6
7
beta
0.10
0.05
0.00
−0.05
−0.10


elnet_agg_zero, alpha = 0.4 (best model)
Region
Region
beta
1
0
−1
1
2
3
4
5
6
7
8


elnet_agg_zero, alpha = 0 (best ridge model)
Region
Region
beta
0.5
0.0
−0.5
1
2
3
4
5
6
7
8


elnet_agg_max, alpha = 0.3 (best model)
Region
Region
1
2
3
4
5
6
7
8
beta
0


elnet_agg_max, alpha = 0 (best ridge model)
Region
Region
1
2
3
4
5
6
7
8
beta
0.1
0.0
−0.1



For elnet_agg_max, all coffecients of the region-matrix are zero for alpha = 0.3 (best model), only the coefficients of age and sex are unequal to zero.

Confusion Matrices

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

```
## [1] "elnet_conn"
## [1] "alpha:  0.1"
## [1] "lambda:  0.593583313598269"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 25  7
##          1 12 41
##
##                Accuracy : 0.7765
##                  95% CI : (0.6731, 0.8597)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 3.772e-05
##
##                   Kappa : 0.5382
##
##  Mcnemar's Test P-Value : 0.3588
##
##             Sensitivity : 0.8542
##             Specificity : 0.6757
##          Pos Pred Value : 0.7736
##          Neg Pred Value : 0.7812
##              Prevalence : 0.5647
##          Detection Rate : 0.4824
##    Detection Prevalence : 0.6235
##       Balanced Accuracy : 0.7649
##
##        'Positive' Class : 1
##
## [1] "elnet_conn_abs"
## [1] "alpha:  0"
## [1] "lambda:  22.348030737138"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 26  8
##          1 11 40
##
##                Accuracy : 0.7765
##                  95% CI : (0.6731, 0.8597)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 3.772e-05
##
##                   Kappa : 0.5411
##
##  Mcnemar's Test P-Value : 0.6464
##
##             Sensitivity : 0.8333
```

```
##             Specificity : 0.7027
##          Pos Pred Value : 0.7843
##          Neg Pred Value : 0.7647
##              Prevalence : 0.5647
##          Detection Rate : 0.4706
##    Detection Prevalence : 0.6000
##       Balanced Accuracy : 0.7680
##
##        'Positive' Class : 1
##
## [1] "elnet_conn_squ"
## [1] "alpha:  0"
## [1] "lambda:  5.55362663895399"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 28  8
##          1  9 40
##
##                Accuracy : 0.8
##                  95% CI : (0.6992, 0.879)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 4.452e-06
##
##                   Kappa : 0.5919
##
##  Mcnemar's Test P-Value : 1
##
##             Sensitivity : 0.8333
##             Specificity : 0.7568
##          Pos Pred Value : 0.8163
##          Neg Pred Value : 0.7778
##              Prevalence : 0.5647
##          Detection Rate : 0.4706
##    Detection Prevalence : 0.5765
##       Balanced Accuracy : 0.7950
##
##        'Positive' Class : 1
##
## [1] "elnet_conn_quadratic"
## [1] "alpha:  0"
## [1] "lambda:  173.590587529788"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 26  9
##          1 11 39
##
##                Accuracy : 0.7647
##                  95% CI : (0.6603, 0.85)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 9.959e-05
```

```
##
##                  Kappa : 0.5184
##
##  Mcnemar's Test P-Value : 0.8231
##
##             Sensitivity : 0.8125
##             Specificity : 0.7027
##          Pos Pred Value : 0.7800
##          Neg Pred Value : 0.7429
##              Prevalence : 0.5647
##          Detection Rate : 0.4588
##    Detection Prevalence : 0.5882
##       Balanced Accuracy : 0.7576
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_zero"
## [1] "alpha:  0.4"
## [1] "lambda:  0.135212752012306"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 25  8
##          1 12 40
##
##                Accuracy : 0.7647
##                  95% CI : (0.6603, 0.85)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 9.959e-05
##
##                   Kappa : 0.5154
##
##  Mcnemar's Test P-Value : 0.5023
##
##             Sensitivity : 0.8333
##             Specificity : 0.6757
##          Pos Pred Value : 0.7692
##          Neg Pred Value : 0.7576
##              Prevalence : 0.5647
##          Detection Rate : 0.4706
##    Detection Prevalence : 0.6118
##       Balanced Accuracy : 0.7545
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_max"
## [1] "alpha:  0.3"
## [1] "lambda:  0.287062584501627"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 19  6
```

```
##          1 18 42
##
##                Accuracy : 0.7176
##                  95% CI : (0.6096, 0.81)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.002669
##
##                   Kappa : 0.4035
##
##  Mcnemar's Test P-Value : 0.024745
##
##             Sensitivity : 0.8750
##             Specificity : 0.5135
##          Pos Pred Value : 0.7000
##          Neg Pred Value : 0.7600
##              Prevalence : 0.5647
##          Detection Rate : 0.4941
##    Detection Prevalence : 0.7059
##       Balanced Accuracy : 0.6943
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_mean"
## [1] "alpha:  0"
## [1] "lambda:  0.5666040383501"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 26 10
##          1 11 38
##
##                Accuracy : 0.7529
##                  95% CI : (0.6475, 0.8401)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.0002472
##
##                   Kappa : 0.4959
##
##  Mcnemar's Test P-Value : 1.0000000
##
##             Sensitivity : 0.7917
##             Specificity : 0.7027
##          Pos Pred Value : 0.7755
##          Neg Pred Value : 0.7222
##              Prevalence : 0.5647
##          Detection Rate : 0.4471
##    Detection Prevalence : 0.5765
##       Balanced Accuracy : 0.7472
##
##        'Positive' Class : 1
##
## [1] "elnet_gm_only"
## [1] "alpha:  0.2"
```

```
## [1] "lambda:  0.101813466409843"
## 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_gm_conn"
## [1] "alpha:  0.1"
## [1] "lambda:  0.593583313598269"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 25  7
##          1 12 41
##
##                Accuracy : 0.7765
##                  95% CI : (0.6731, 0.8597)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 3.772e-05
##
##                   Kappa : 0.5382
##
##  Mcnemar's Test P-Value : 0.3588
##
##             Sensitivity : 0.8542
##             Specificity : 0.6757
##          Pos Pred Value : 0.7736
##          Neg Pred Value : 0.7812
##              Prevalence : 0.5647
##          Detection Rate : 0.4824
##    Detection Prevalence : 0.6235
```

```
##       Balanced Accuracy : 0.7649
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_zero_inter"
## [1] "alpha:  0.3"
## [1] "lambda:  0.00663151804566908"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 23  7
##          1 14 41
##
##                Accuracy : 0.7529
##                  95% CI : (0.6475, 0.8401)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.0002472
##
##                   Kappa : 0.4863
##
##  Mcnemar's Test P-Value : 0.1904303
##
##             Sensitivity : 0.8542
##             Specificity : 0.6216
##          Pos Pred Value : 0.7455
##          Neg Pred Value : 0.7667
##              Prevalence : 0.5647
##          Detection Rate : 0.4824
##    Detection Prevalence : 0.6471
##       Balanced Accuracy : 0.7379
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_max_inter"
## [1] "alpha:  0.1"
## [1] "lambda:  0.86118775350488"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 17  3
##          1 20 45
##
##                Accuracy : 0.7294
##                  95% CI : (0.6221, 0.8201)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.0012771
##
##                   Kappa : 0.419
##
##  Mcnemar's Test P-Value : 0.0008492
##
##             Sensitivity : 0.9375
```

```
##             Specificity : 0.4595
##          Pos Pred Value : 0.6923
##          Neg Pred Value : 0.8500
##              Prevalence : 0.5647
##          Detection Rate : 0.5294
##    Detection Prevalence : 0.7647
##       Balanced Accuracy : 0.6985
##
##        'Positive' Class : 1
##
## [1] "elnet_agg_mean_inter"
## [1] "alpha:  0.1"
## [1] "lambda:  0.0245809728145133"
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  0  1
##          0 26 10
##          1 11 38
##
##                Accuracy : 0.7529
##                  95% CI : (0.6475, 0.8401)
##     No Information Rate : 0.5647
##     P-Value [Acc > NIR] : 0.0002472
##
##                   Kappa : 0.4959
##
##  Mcnemar's Test P-Value : 1.0000000
##
##             Sensitivity : 0.7917
##             Specificity : 0.7027
##          Pos Pred Value : 0.7755
##          Neg Pred Value : 0.7222
##              Prevalence : 0.5647
##          Detection Rate : 0.4471
##    Detection Prevalence : 0.5765
##       Balanced Accuracy : 0.7472
##
##        'Positive' Class : 1
##
```