Outputs inspection half CIFAR100

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.0.5
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.0.5
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(tidyr)
```

```
## Warning: package 'tidyr' was built under R version 4.0.5
```

```
library("ggpubr")
```

```
## Warning: package 'ggpubr' was built under R version 4.0.5
```

```
library(LDATS)
```

```
## Warning: package 'LDATS' was built under R version 4.0.5
```

```
library(ggVennDiagram)
```

```
## Warning: package 'ggVennDiagram' was built under R version 4.0.5
```

```
library(stringr)
library(abind)
```

```
## Warning: package 'abind' was built under R version 4.0.3
```

```
source("utils.R")
```

```
## Warning: package 'hash' was built under R version 4.0.5
```

```
## hash-2.2.6.1 provided by Decision Patterns
```

```
## Warning: package 'reticulate' was built under R version 4.0.5
```

```
## Warning: package 'berryFunctions' was built under R version 4.0.5
```

```
##
## Attaching package: 'berryFunctions'
```

```
## The following object is masked from 'package:ggVennDiagram':
##
##     circle
```

```
## The following object is masked from 'package:dplyr':
##
##     between
```

```
## Warning: package 'purrr' was built under R version 4.0.3
```

```
## Warning: package 'reshape2' was built under R version 4.0.3
```

```
##
## Attaching package: 'reshape2'
```

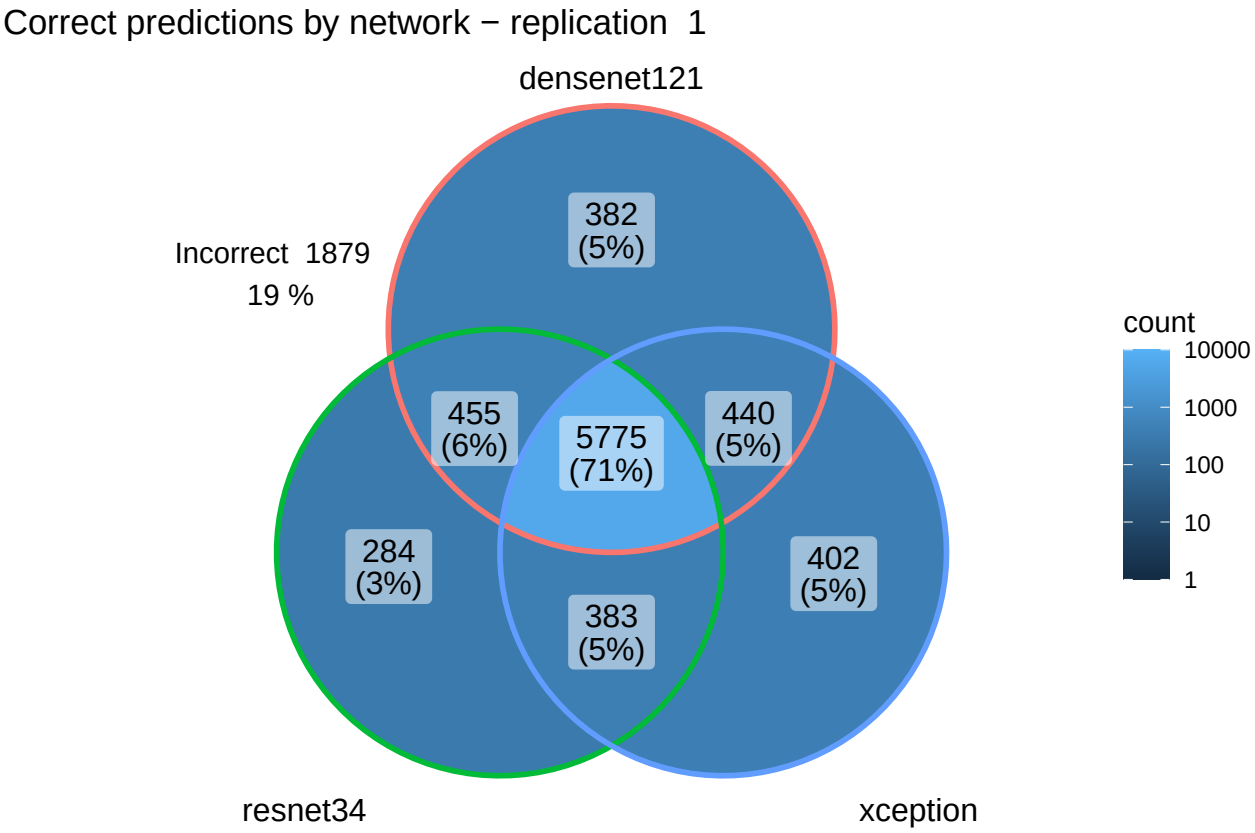
```
## The following object is masked from 'package:tidyr':
##
##     smiths
```

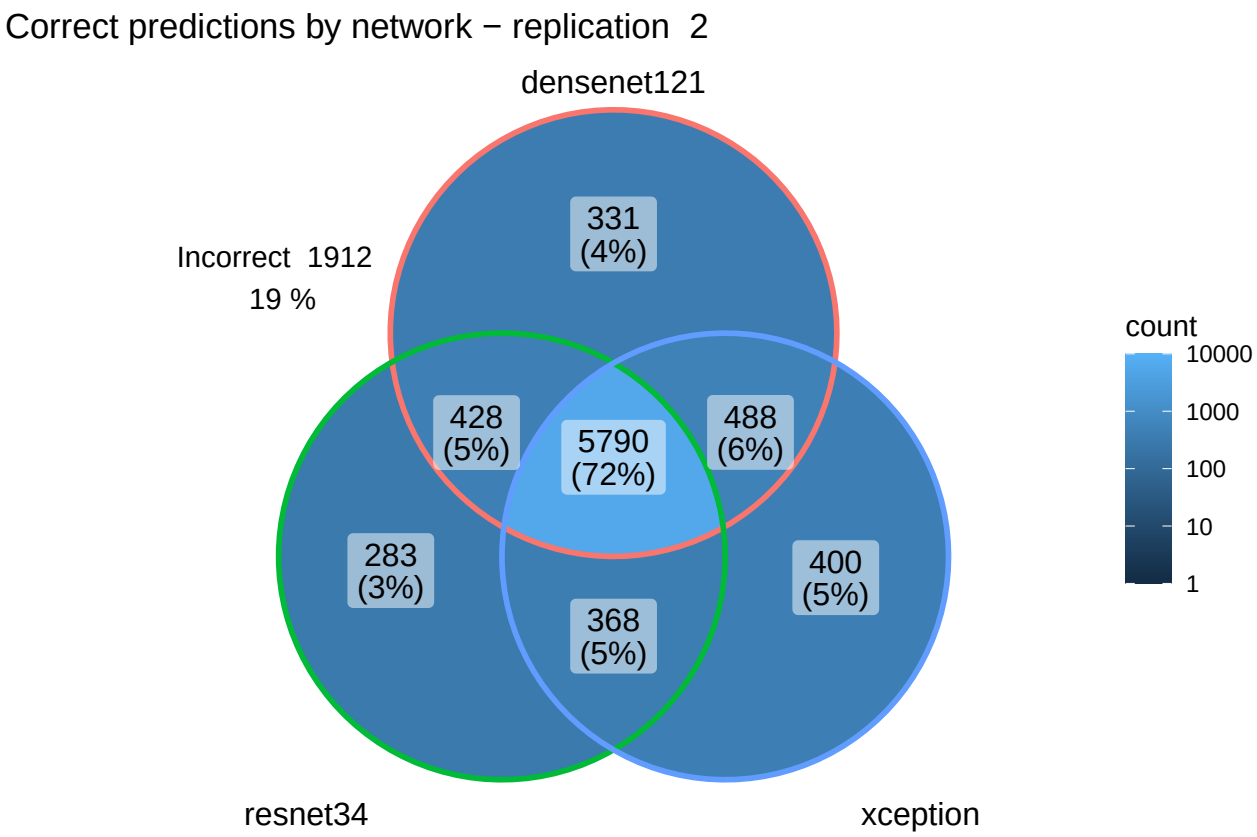
Visualization on CIFAR100. We are using data of three neural networks trained on reduced CIFAR100 training set. Half of the CIFAR100 training set was extracted as a validation set. We then divided both the reduced training set and validation set into 5 disjoint subsets and trained an ensemble on each of them. This was done in 10 replications, each time with random split of the training set into validation and new training set. In this visualization, we are trying to inspect the outputs deeper, mainly to make sense of strange behavior of nll metric for ensemble outputs.

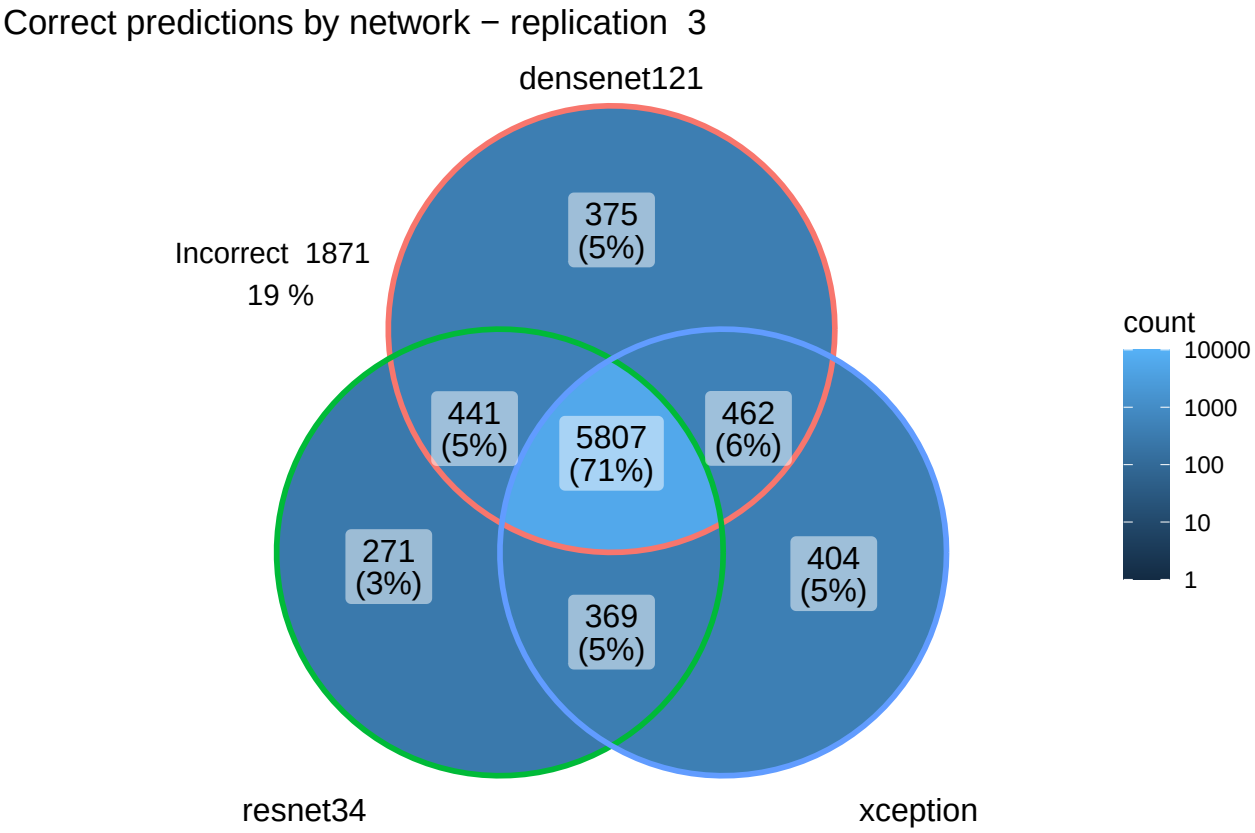
```
base_dir <- "../data/data_train_val_half_c100"
repls <- 0:9
folds <- 0:4
classes <- 100

nets_outputs <- load_network_outputs(base_dir, repls)
ens_outputs_gathered <- load_ensemble_outputs(base_dir, repls, folds, gather=(1 + nets_outputs$test_labe
net_results <- read.csv(file.path(base_dir, "net_accuracies.csv"))
ens_results <- read.csv(file.path(base_dir, "ensemble_accuracies.csv"))
```

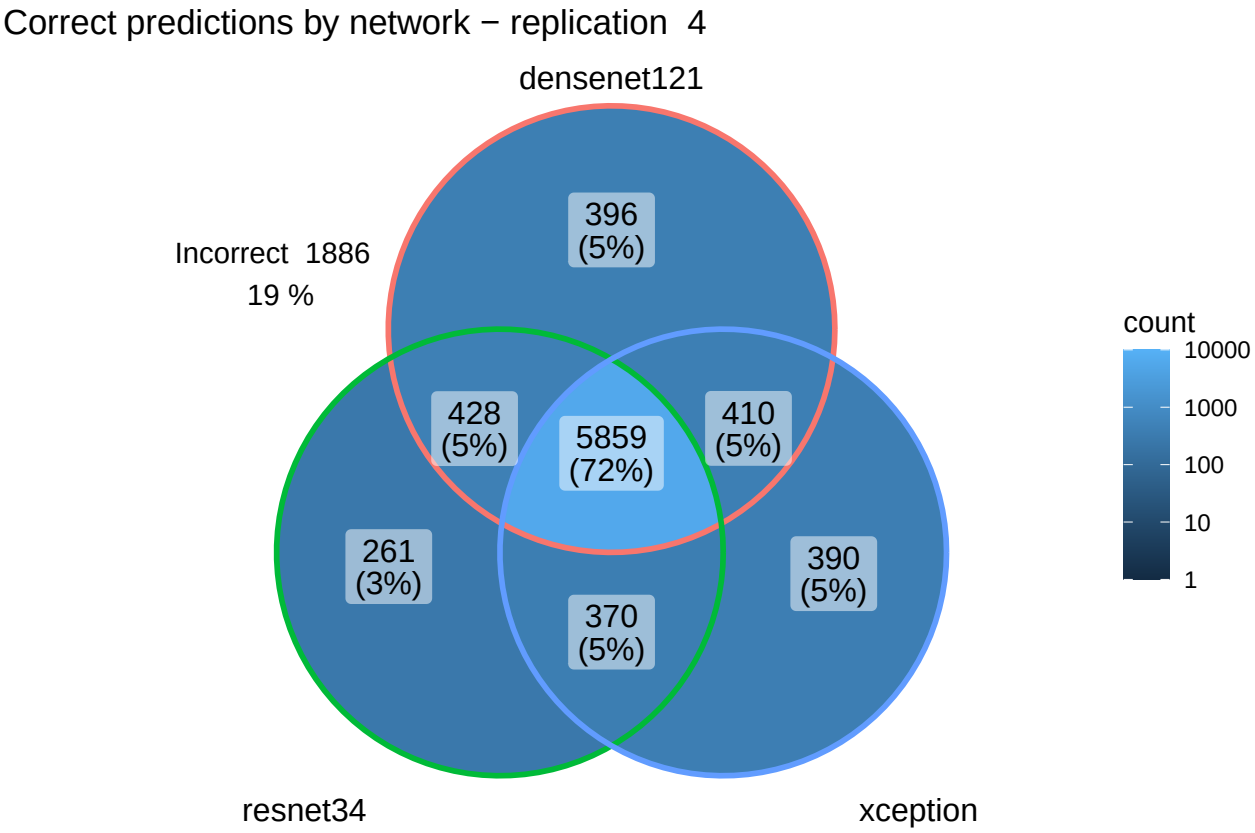
```
sort_ind <- function(lst)
{
  return(sort(lst, index.return=TRUE, decreasing=TRUE)$ix)
}
nets_test_top_indices <- apply(X=nets_outputs$test_outputs, MARGIN=c(1, 2, 3), FUN=sort_ind)[1, , , ]
r_n <- length(repls)
samples_n <- dim(nets_outputs$test_labels)[2]
nets_n <- length(nets_outputs$networks)
test_labs <- nets_outputs$test_labels + 1
dim(test_labs) <- c(r_n, 1, samples_n)
test_labs <- aperm(abind(array(rep(aperm(test_labs, perm=c(2, 1, 3)), nets_n), c(r_n, samples_n, nets_n]
nets_test_cor_preds <- test_labs == nets_test_top_indices
```

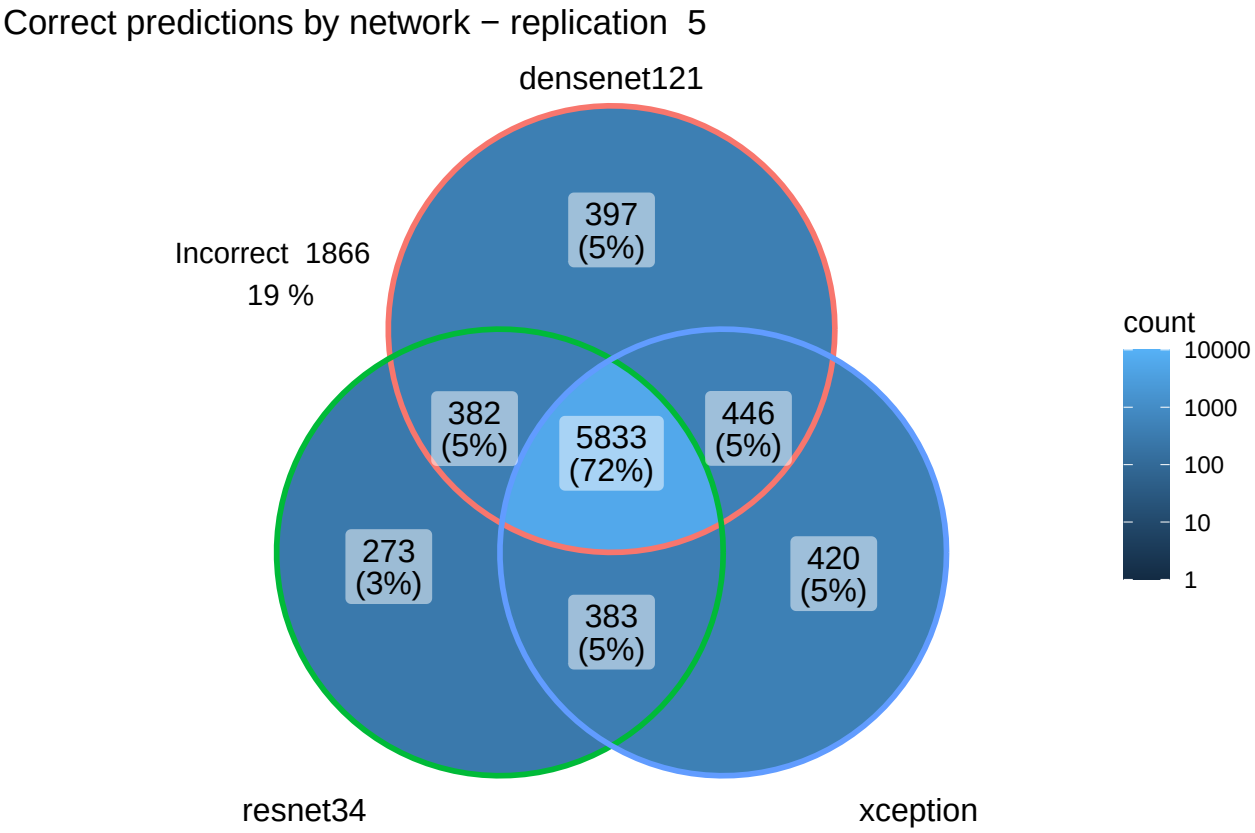
```
for (ri in 1:r_n)
{
  nets_cor_list <- list()
  incor <- 1:samples_n
  for (ni in 1:nets_n)
  {
    cor_list <- which(nets_test_cor_preds[ri, ni, ])
    nets_cor_list[[nets_outputs$networks[ni]]] = cor_list
    incor <- setdiff(incor, cor_list)
  }
  incor_n <- length(incor)
  venn_diag <- ggVennDiagram(nets_cor_list) + scale_fill_gradient(trans="log10", name="count", limits=c
    annotate(geom="text", x=-4, y=5, label=paste("Incorrect ", incor_n, "\n", round(incor_n / samples_n
    ggtitle(paste("Correct predictions by network - replication ", ri)) +
    scale_x_continuous(limits=c(-8, 10))
  print(venn_diag)
}
```

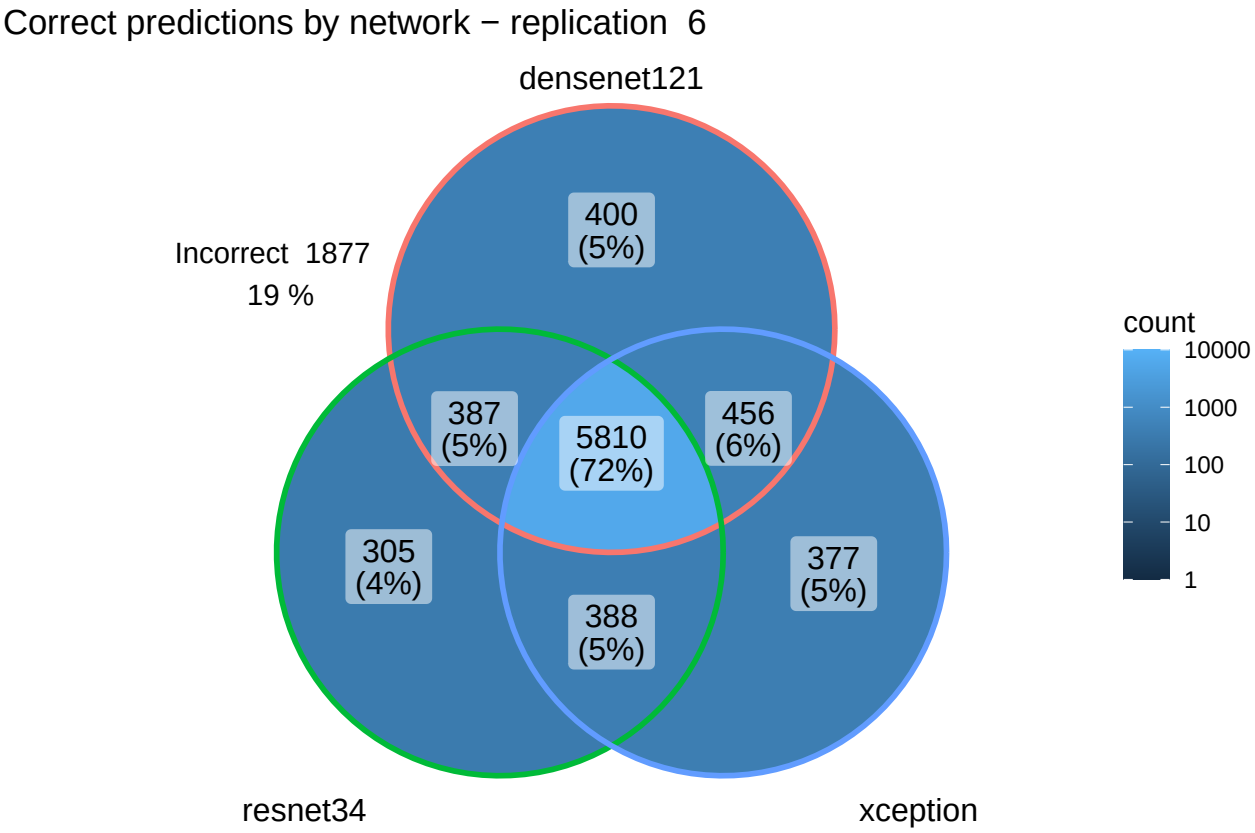

Correct predictions by network − replication 1
densenet121
Incorrect 1879
19 %
382
(5%)
455
(6%)
5775
(71%)
440
(5%)
284
(3%)
383
(5%)
402
(5%)
resnet34
xception
count
10000
1000
100
10
1

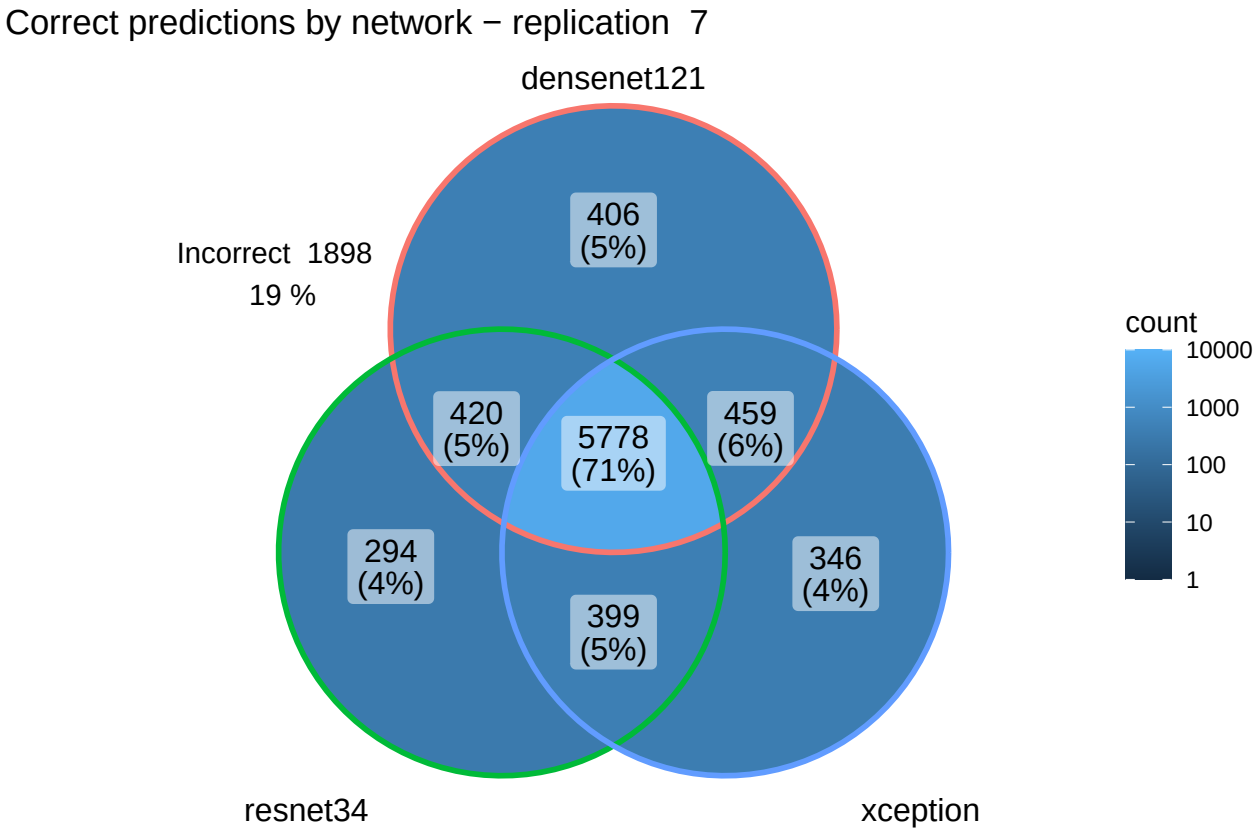

Correct predictions by network − replication 2
densenet121
Incorrect 1912
19 %
331
(4%)
428
(5%)
5790
(72%)
488
(6%)
283
(3%)
400
(5%)
368
(5%)
resnet34
xception
count
10000
1000
100
10
1

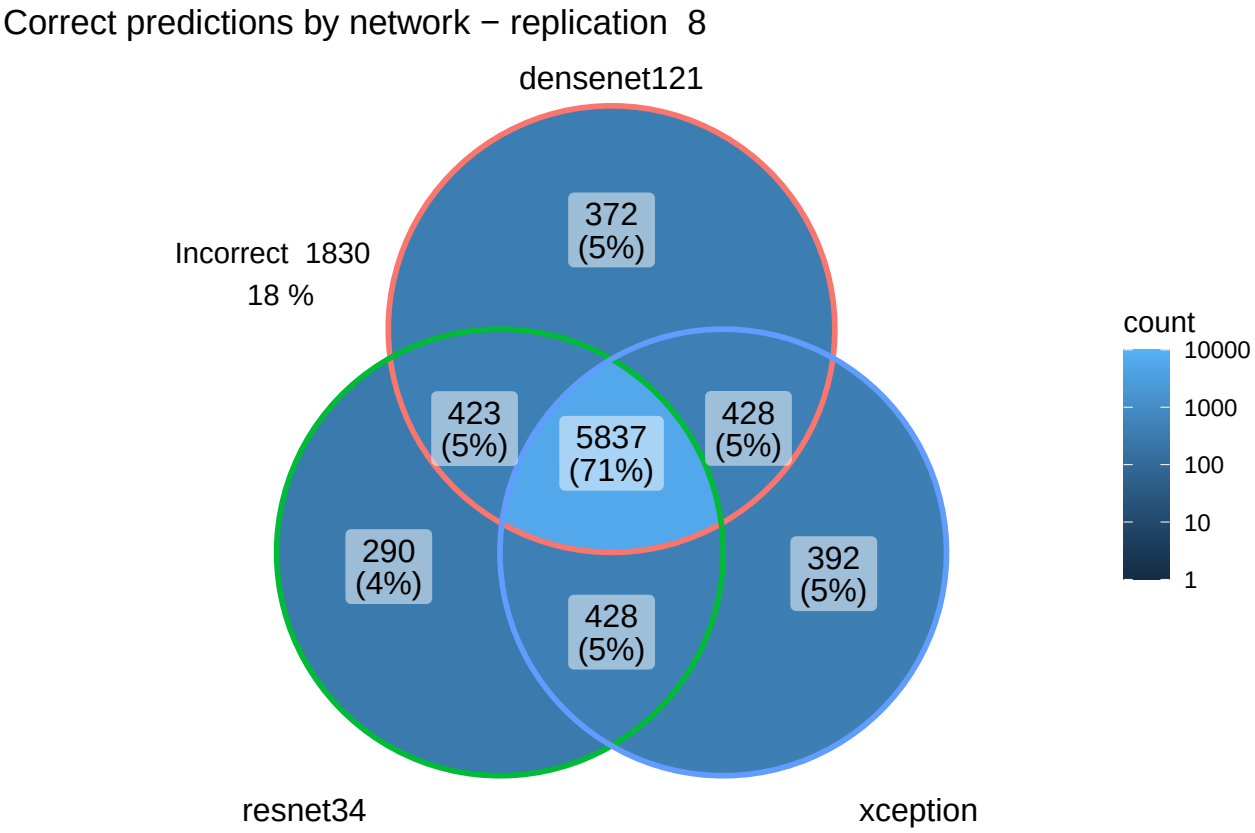

Correct predictions by network − replication 3
densenet121
Incorrect 1871
19 %
375
(5%)
441
(5%)
5807
(71%)
462
(6%)
271
(3%)
404
(5%)
369
(5%)
resnet34
xception
count
10000
1000
100
10
1

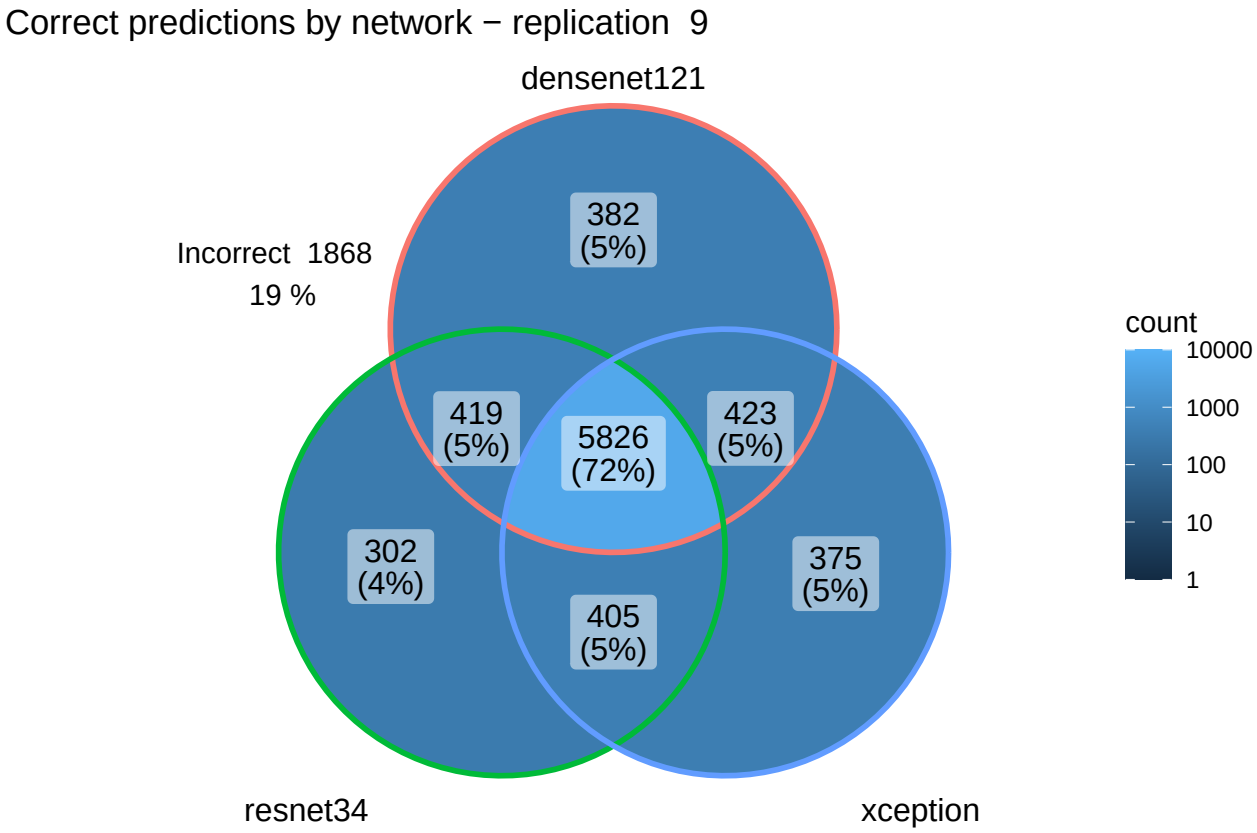

Correct predictions by network − replication 4
densenet121
Incorrect 1886
19 %
396
(5%)
428
(5%)
5859
(72%)
410
(5%)
261
(3%)
370
(5%)
390
(5%)
resnet34
xception
count
10000
1000
100
10
1

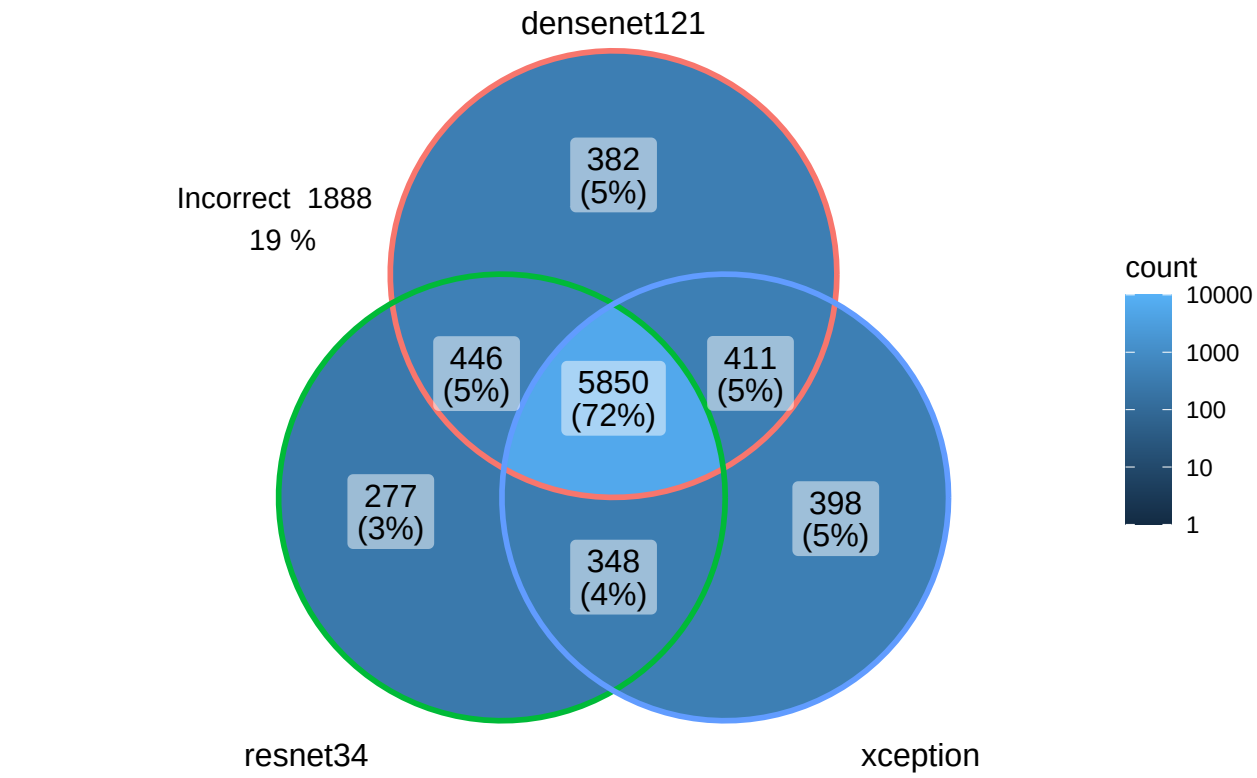

Correct predictions by network − replication 5
densenet121
Incorrect 1866
19 %
397
(5%)
382
(5%)
5833
(72%)
446
(5%)
273
(3%)
383
(5%)
420
(5%)
resnet34
xception
count
10000
1000
100
10
1


Correct predictions by network − replication 6
densenet121
Incorrect 1877
19 %
400
(5%)
387
(5%)
5810
(72%)
456
(6%)
305
(4%)
388
(5%)
377
(5%)
resnet34
xception
count
10000
1000
100
10
1


Correct predictions by network − replication 7
densenet121
Incorrect 1898
19 %
406
(5%)
420
(5%)
5778
(71%)
459
(6%)
294
(4%)
399
(5%)
346
(4%)
resnet34
xception
count
10000
1000
100
10
1


Correct predictions by network − replication 8
densenet121
Incorrect 1830
18 %
372
(5%)
423
(5%)
5837
(71%)
428
(5%)
290
(4%)
428
(5%)
392
(5%)
resnet34
xception
count
10000
1000
100
10
1

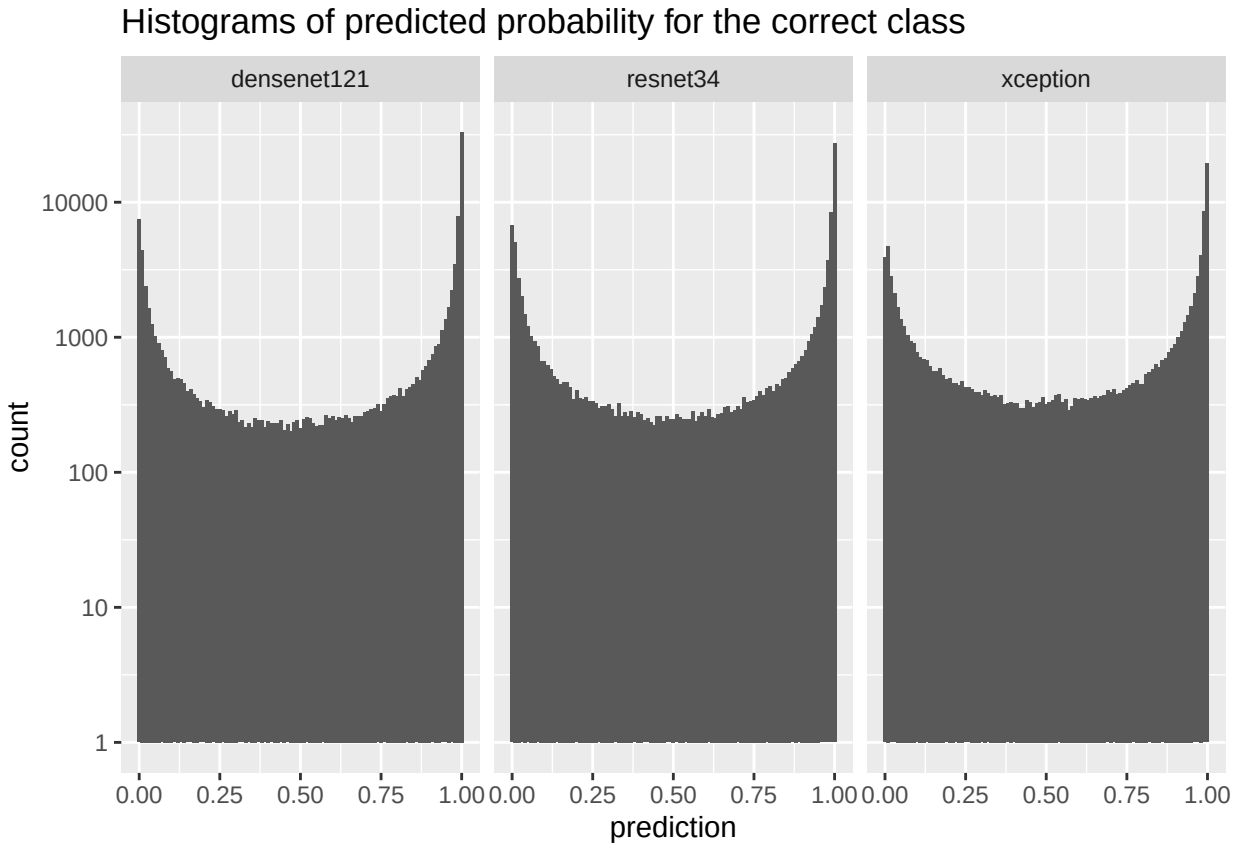

Correct predictions by network − replication 9
densenet121
Incorrect 1868
19 %
382
(5%)
419
(5%)
5826
(72%)
423
(5%)
302
(4%)
405
(5%)
375
(5%)
resnet34
xception
count
10000
1000
100
10
1



Compared to CIFAR10 examples, here are fewer samples correctly classified by all the networks. For one network exclusive correct classifications densenet and xception perform better than resnet. Pairs of network all have similar values with xception, resnet lagging a bit.

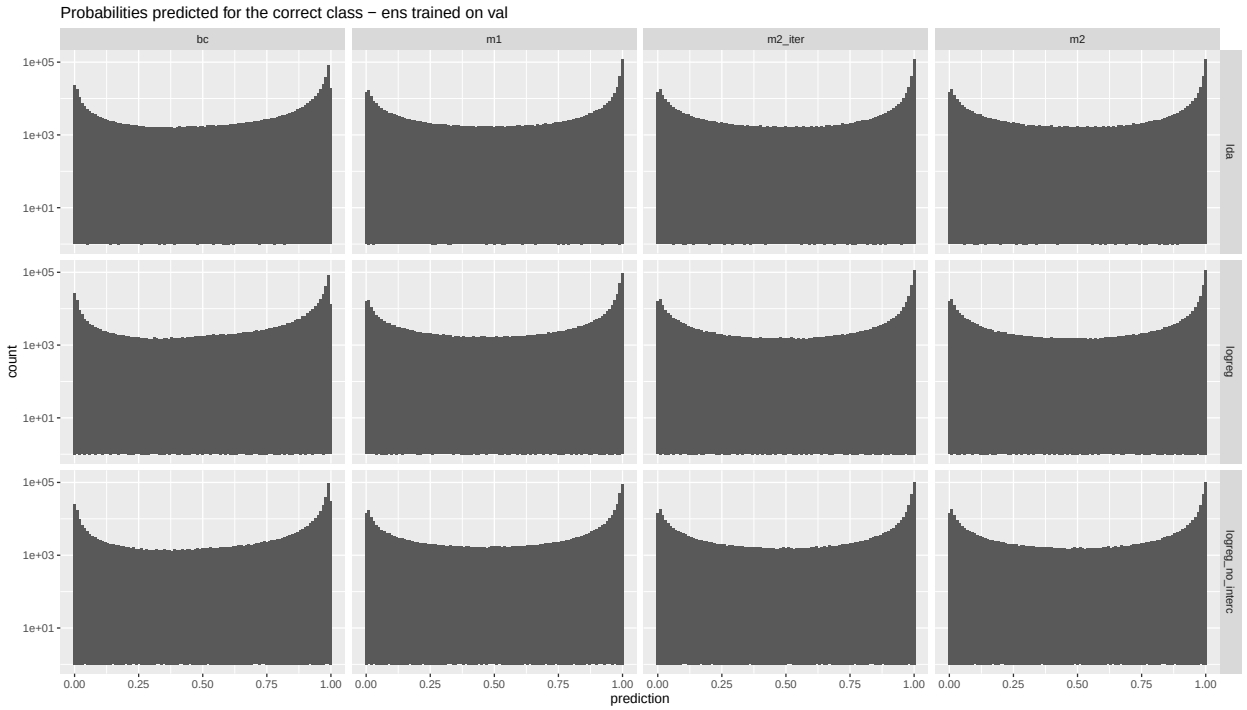
```
preds <- nets_outputs$test_outputs
for (ri in repls + 1)
{
  for (net_i in seq_along(nets_outputs[["networks"]]))
  {
    preds[ri, net_i, ,] <- softmax(preds[ri, net_i, , ])
  }
}
nets_test_cor_probs <- gather(preds, 1 + nets_outputs$test_labels[1, ], 3, 4)
nets_test_cor_probs <- melt(nets_test_cor_probs)
nets_test_cor_probs <- nets_test_cor_probs[, c(-3, -4)]
names(nets_test_cor_probs) <- c("replication", "network", "prediction")
nets_test_cor_probs$network <- as.factor(nets_test_cor_probs$network)
levels(nets_test_cor_probs$network) <- nets_outputs$networks
```

```
nets_cor_preds_histo <- ggplot(data=nets_test_cor_probs) + geom_histogram(mapping=aes(x=prediction), bi
  ggtitle("Histograms of predicted probability for the correct class") + facet_wrap(~network) + scale_y
nets_cor_preds_histo
```




```
val_ens_cor_probs <- melt(ens_outputs_gathered$val_training)
val_ens_cor_probs <- val_ens_cor_probs[, c(-5, -6)]
names(val_ens_cor_probs) <- c("replication", "combining_method", "coupling_method", "fold", "prediction
val_ens_cor_probs[, c("combining_method", "coupling_method")] <- lapply(val_ens_cor_probs[, c("combining
levels(val_ens_cor_probs$combining_method) <- ens_outputs_gathered$combining_methods
levels(val_ens_cor_probs$coupling_method) <- ens_outputs_gathered$coupling_methods
```

```
val_ens_cor_preds_histo <- ggplot(data=val_ens_cor_probs) + geom_histogram(mapping=aes(x=prediction), bi
val_ens_cor_preds_histo
```




```
sum(val_ens_cor_probs$prediction <= 0)
```

```
## [1] 0
```

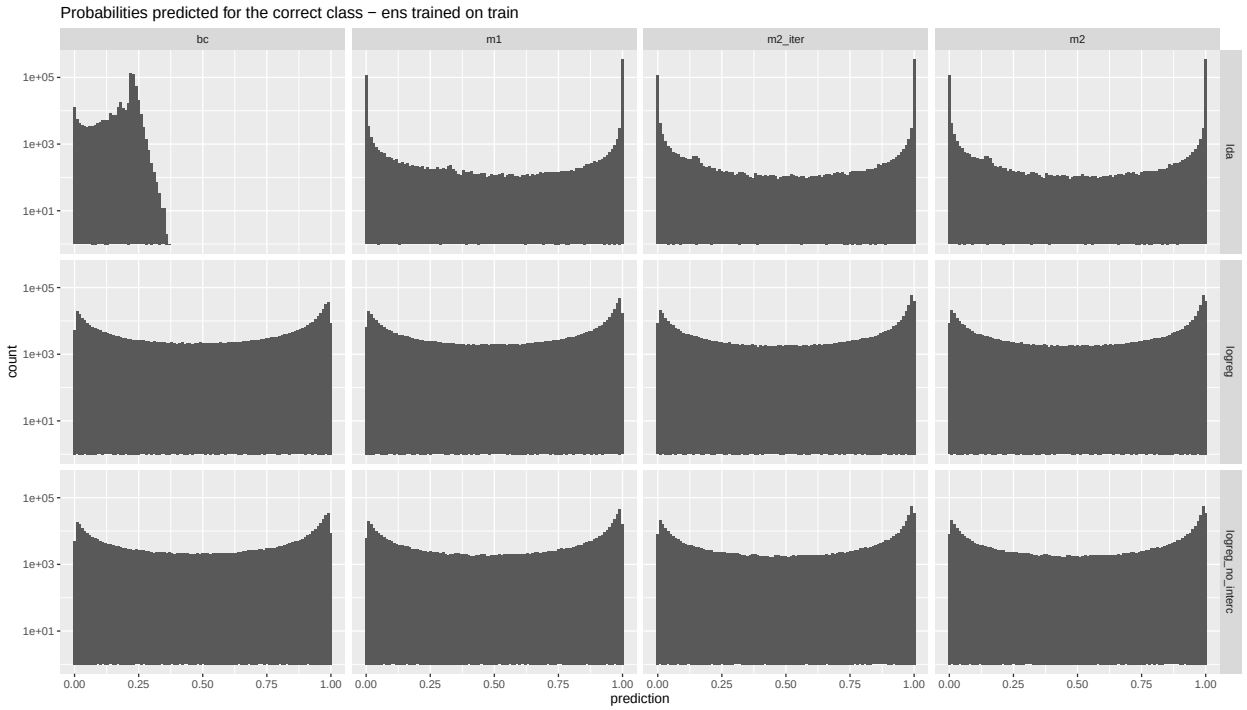
No zero probabilities produced

```
train_ens_cor_probs <- melt(ens_outputs_gathered$train_training)
train_ens_cor_probs <- train_ens_cor_probs[, c(-5, -6)]
names(train_ens_cor_probs) <- c("replication", "combining_method", "coupling_method", "fold", "predicti
train_ens_cor_probs[, c("combining_method", "coupling_method")] <- lapply(train_ens_cor_probs[, c("comb
levels(train_ens_cor_probs$combining_method) <- ens_outputs_gathered$combining_methods
levels(train_ens_cor_probs$coupling_method) <- ens_outputs_gathered$coupling_methods
```

```
train_ens_cor_preds_histo <- ggplot(data=train_ens_cor_probs) + geom_histogram(mapping=aes(x=prediction
train_ens_cor_preds_histo
```

```
## Warning: Transformation introduced infinite values in continuous y-axis
```

```
## Warning: Removed 63 rows containing missing values (geom_bar).
```

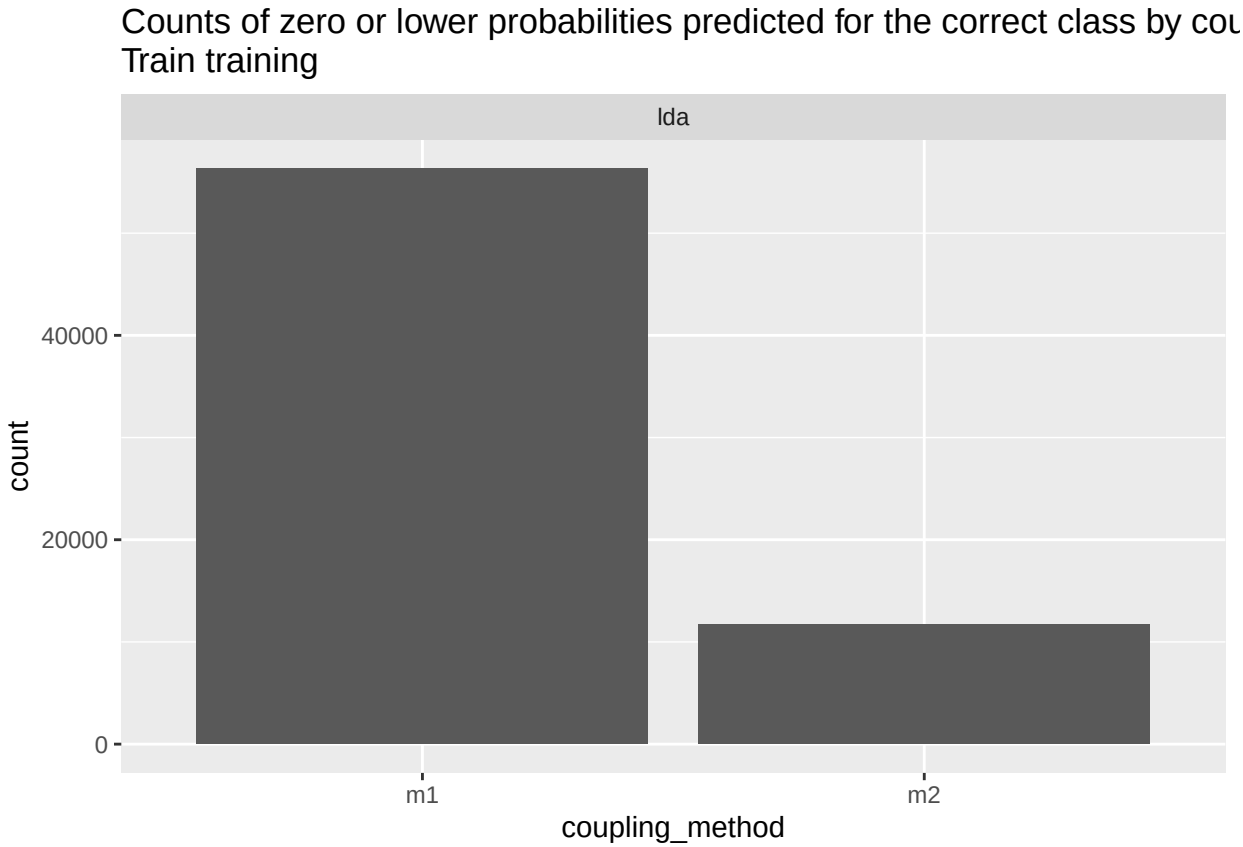


Strange behavior observed for bc coupling method in case of combining method lda is not present for combining methods logreg.

```
train_ens_zero_counts <- ggplot(data=train_ens_cor_probs[train_ens_cor_probs$prediction <= 0, ]) + geom_
```

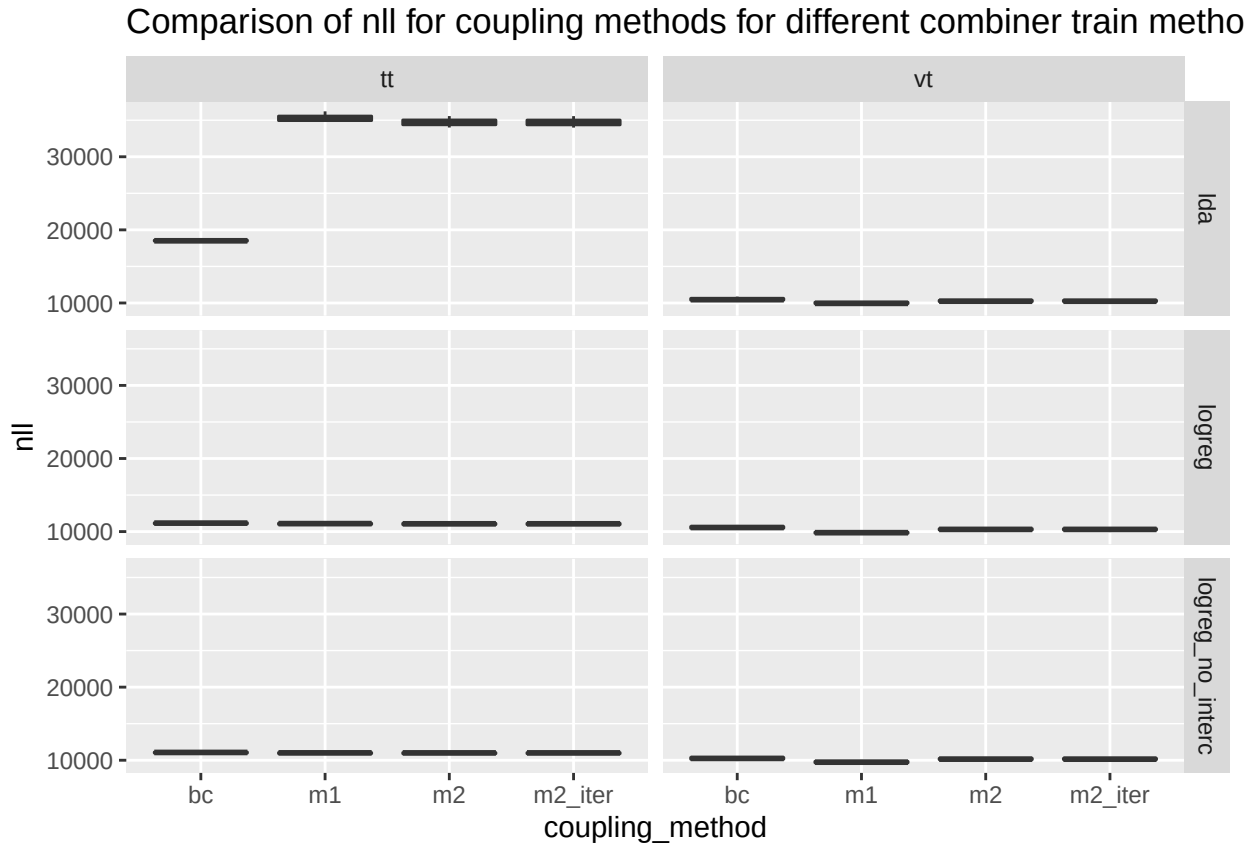
```
## Warning: Ignoring unknown parameters: binwidth, bins, pad
```

```
train_ens_zero_counts
```



m2_iter and bc didn't produce any zero probability outputs. Neither were there any zero probability outputs for combining method logistic regression.

```
val_ens_nll <- ggplot(data=ens_results) + geom_boxplot(mapping=aes(x=coupling_method, y=nll)) + facet_gr
  ggtitle("Comparison of nll for coupling methods for different combiner train methodologies")
val_ens_nll
```

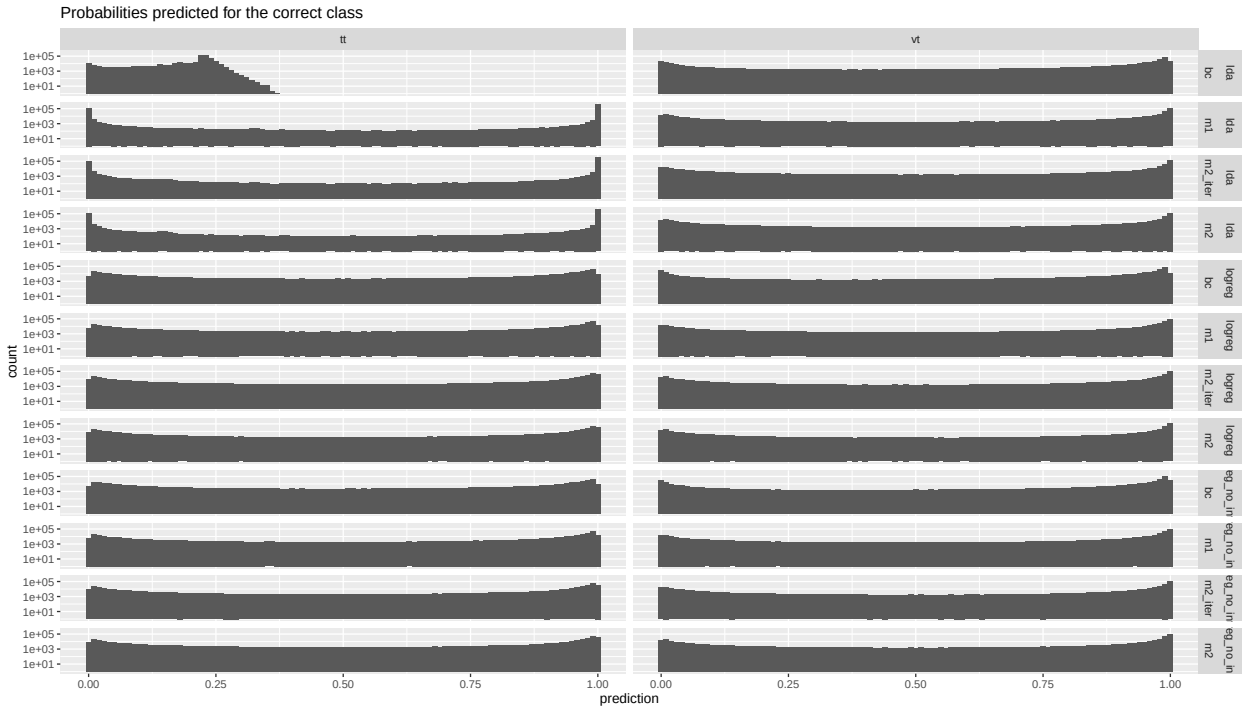



```
val_ens_cor_probs$train_type <- "vt"
train_ens_cor_probs$train_type <- "tt"
ens_cor_probs <- rbind(val_ens_cor_probs, train_ens_cor_probs)
```

```
ens_cor_preds_histo <- ggplot(data=ens_cor_probs) + geom_histogram(mapping=aes(x=prediction), binwidth=
ens_cor_preds_histo
```

```
## Warning: Transformation introduced infinite values in continuous y-axis
```

```
## Warning: Removed 63 rows containing missing values (geom_bar).
```



In case of logreg combining method there are fewer values in the extreme bins than for lda. Also, there are fewer of these extreme values for tt than for vt.

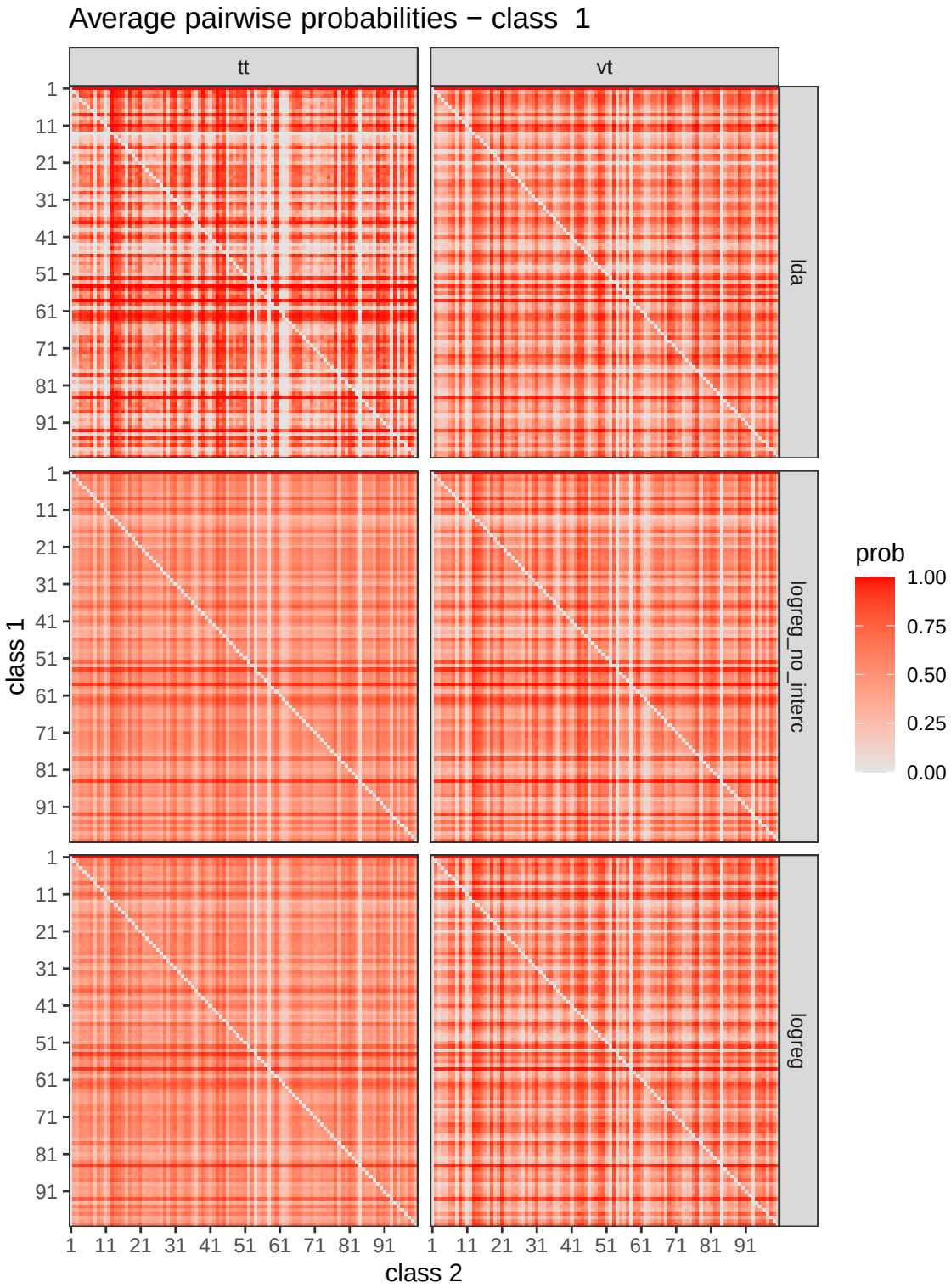
```
df_val_Rs <- melt(np$load(file.path(base_dir, "val_training_class_aggr_R.npy")))
df_train_Rs <- melt(np$load(file.path(base_dir, "train_training_class_aggr_R.npy")))
co_m_R <- read.csv(file.path(base_dir, "R_mat_co_m_names.csv"), header=FALSE)
```

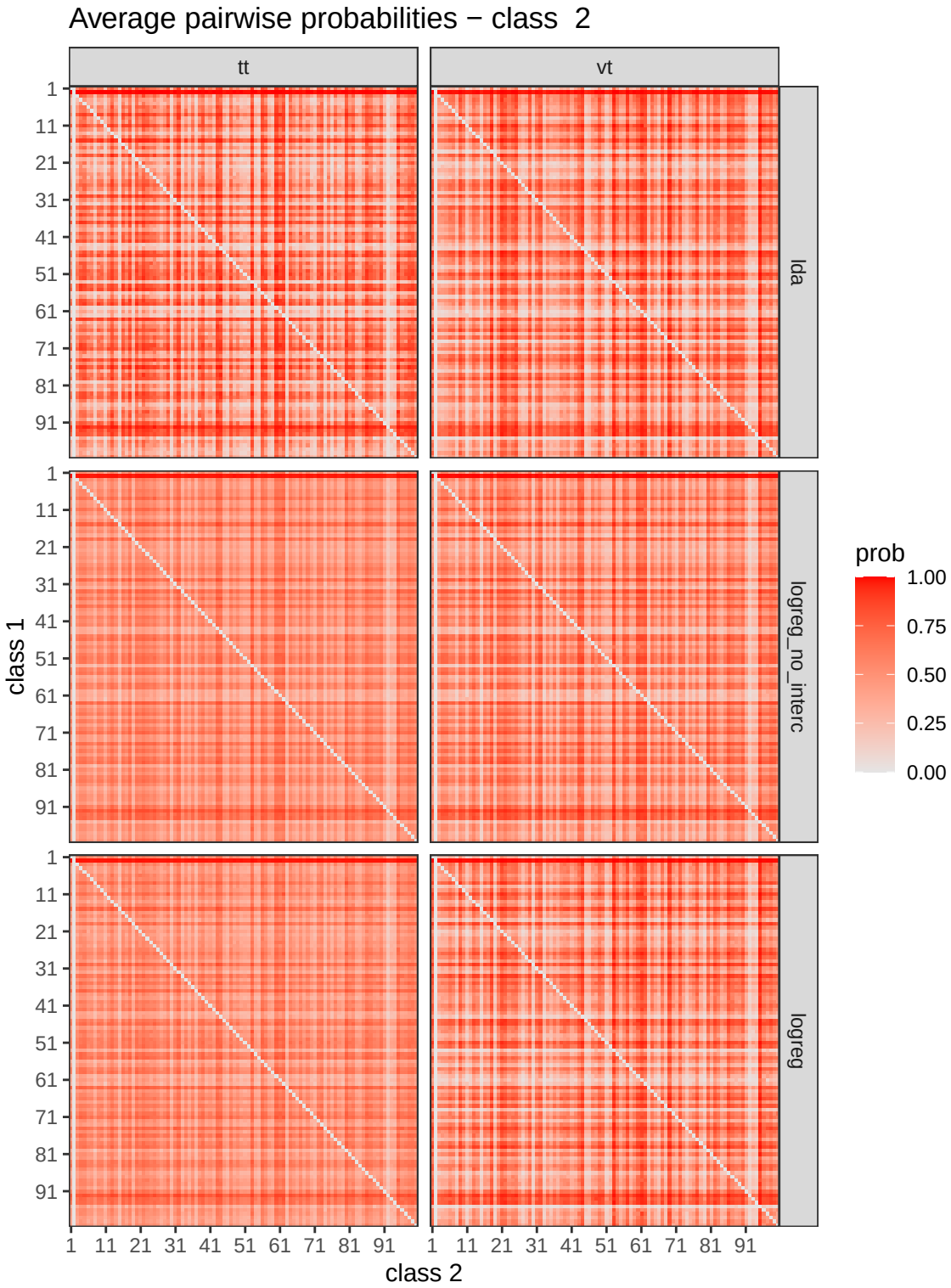
```
names(df_val_Rs) <- c("combining_method", "precision", "class", "class1", "class2", "prob")
names(df_train_Rs) <- c("combining_method", "precision", "class", "class1", "class2", "prob")

df_val_Rs[,c("class", "class1", "class2", "combining_method")] <- lapply(df_val_Rs[,c("class", "class1"
df_train_Rs[,c("class", "class1", "class2", "combining_method")] <- lapply(df_train_Rs[,c("class", "clas

levels(df_val_Rs$combining_method) <- co_m_R$V1
levels(df_train_Rs$combining_method) <- co_m_R$V1
```

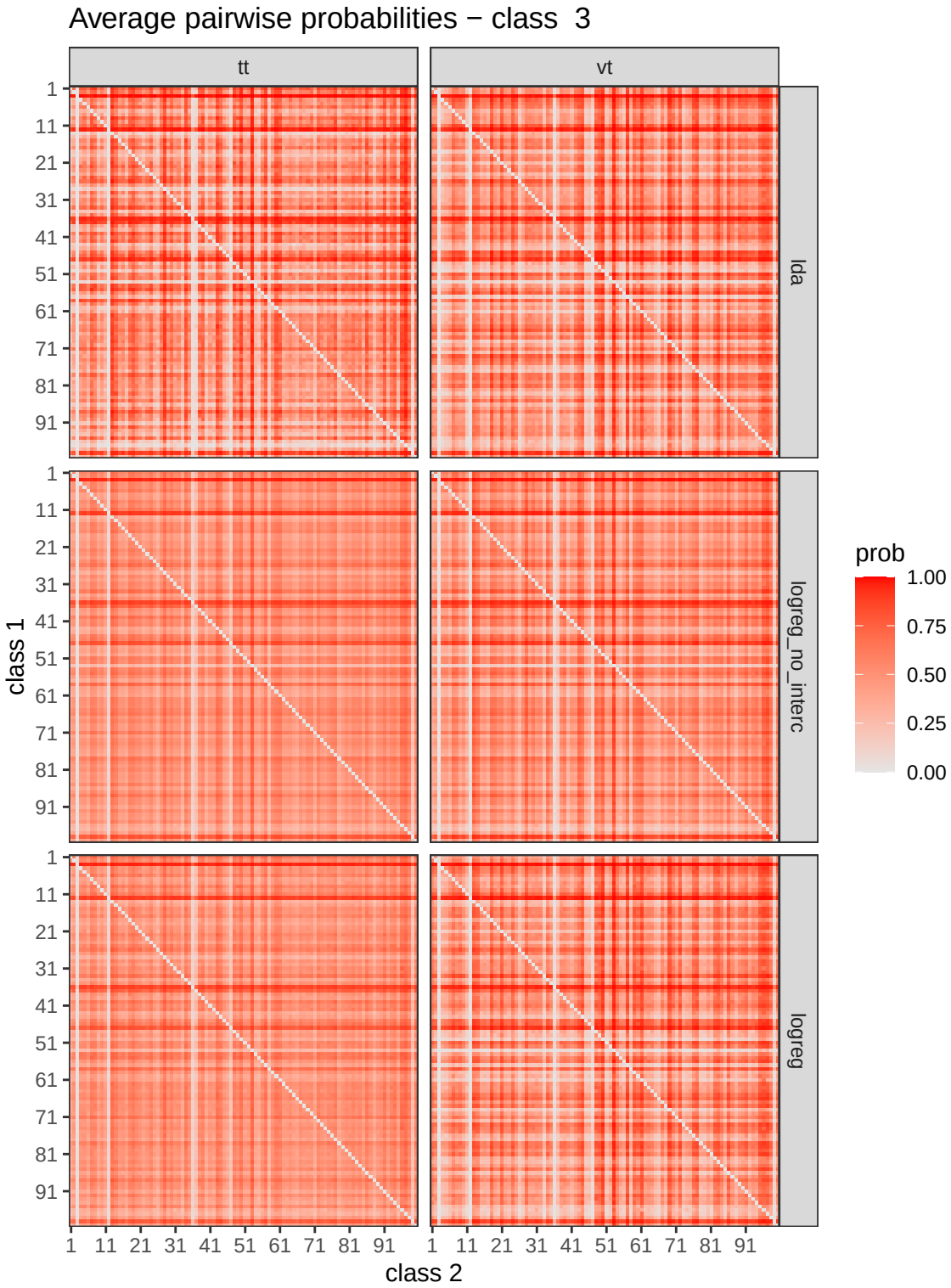
```
df_val_Rs$train_type <- "vt"
df_train_Rs$train_type <- "tt"
class_mean_Rs <- rbind(df_val_Rs, df_train_Rs)

df_aggr_Rs_diff <- class_mean_Rs %>% pivot_wider(names_from = train_type, values_from = prob) %>% mutat
```

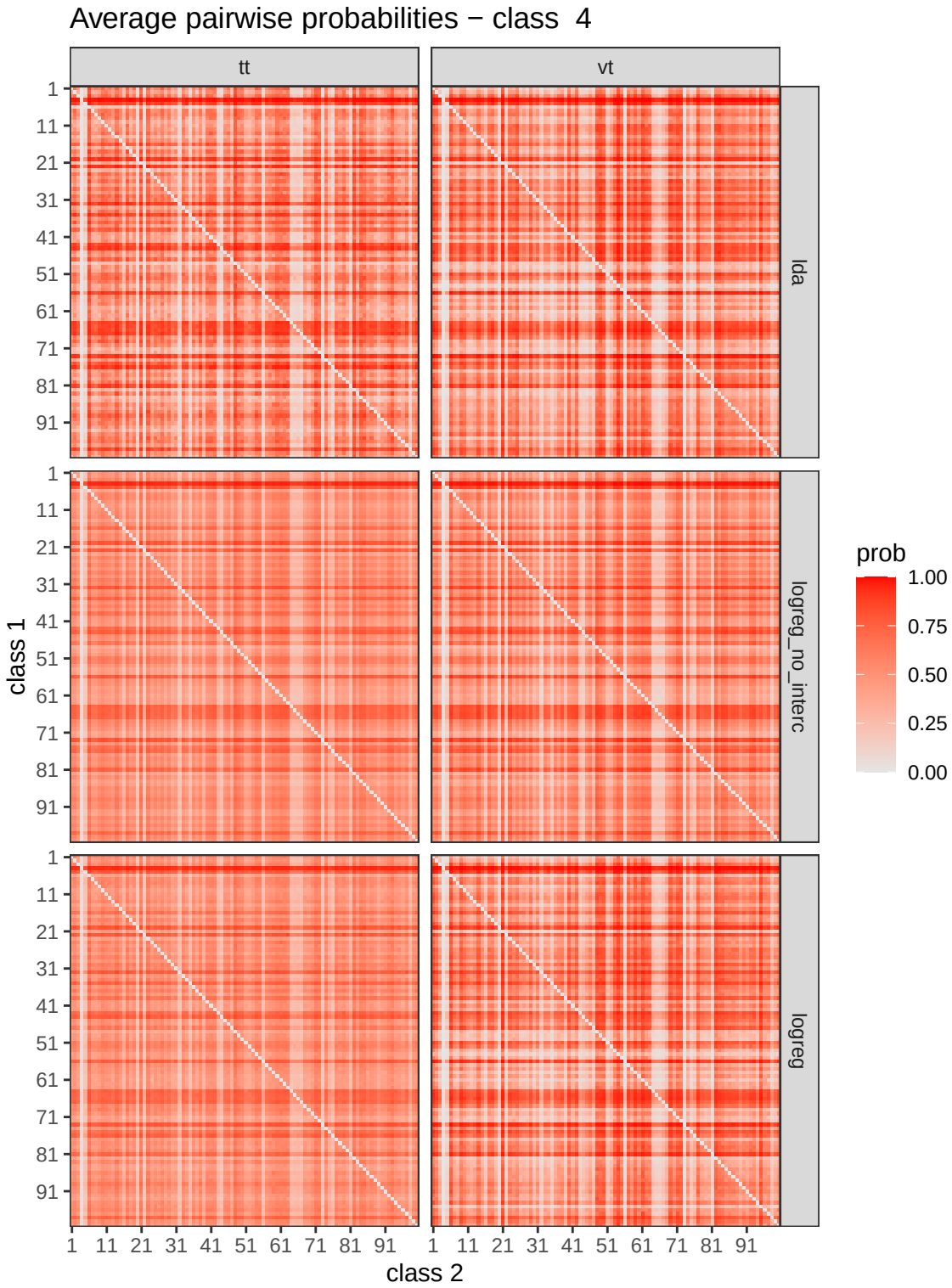
```
for (cls in 1:classes)
{
  cur_class_Rs <- class_mean_Rs %>% filter(class == cls)
  plot_cls <-  ggplot(cur_class_Rs, aes(x = class2, y = class1)) +
    geom_raster(aes(fill=prob)) +
    facet_grid(rows=vars(combining_method), cols=vars(train_type)) +
    scale_fill_gradient(low="grey90", high="red", limits=c(0, 1)) +
    scale_y_discrete(limits=rev, breaks=seq(1, 100, 10)) +
```

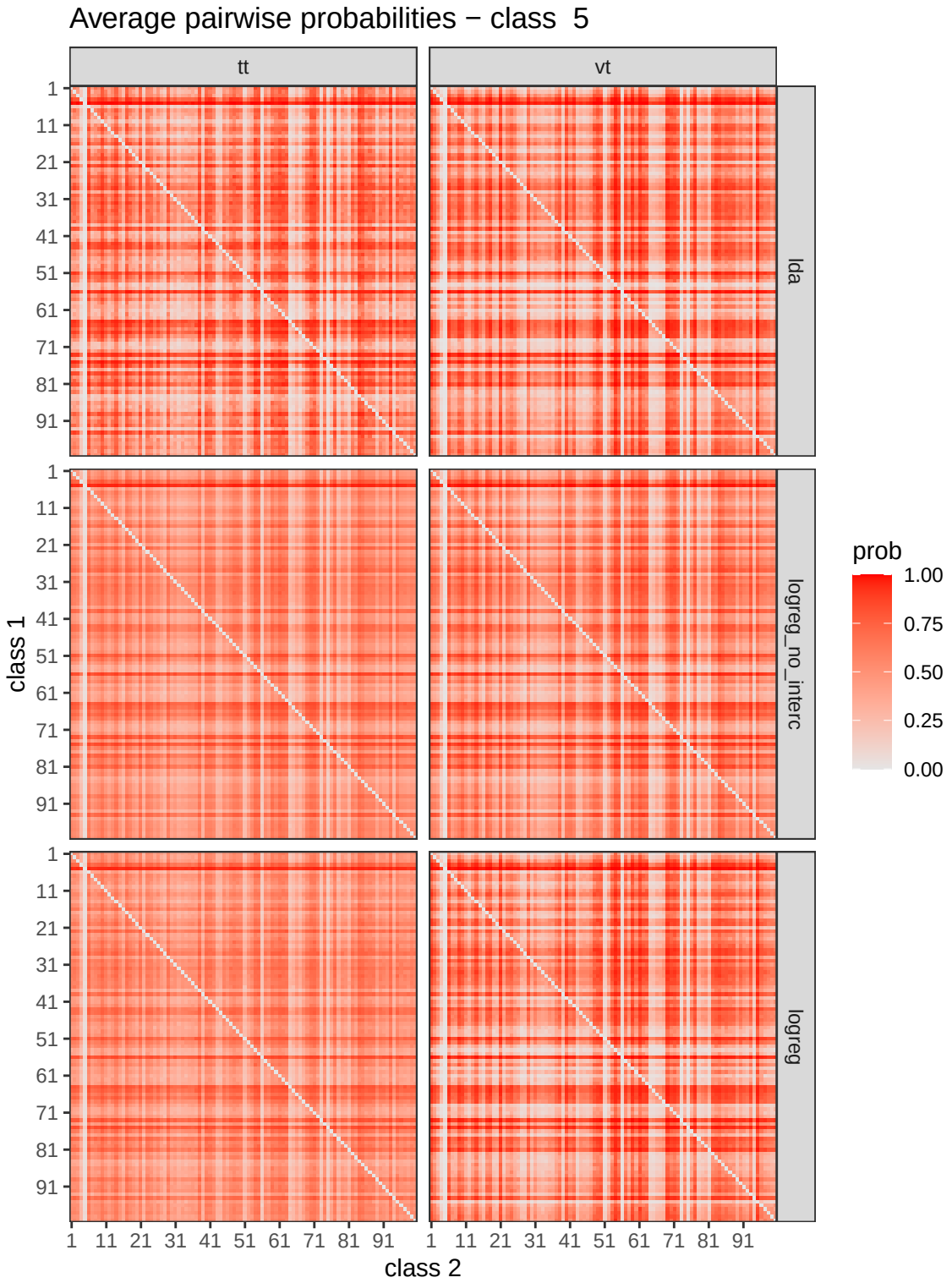
```
    scale_x_discrete(breaks=seq(1, 100, 10)) +
    labs(x="class 2", y="class 1", title=paste("Average pairwise probabilities - class ", cls)) +
    theme_bw()

  print(plot_cls)
}
```

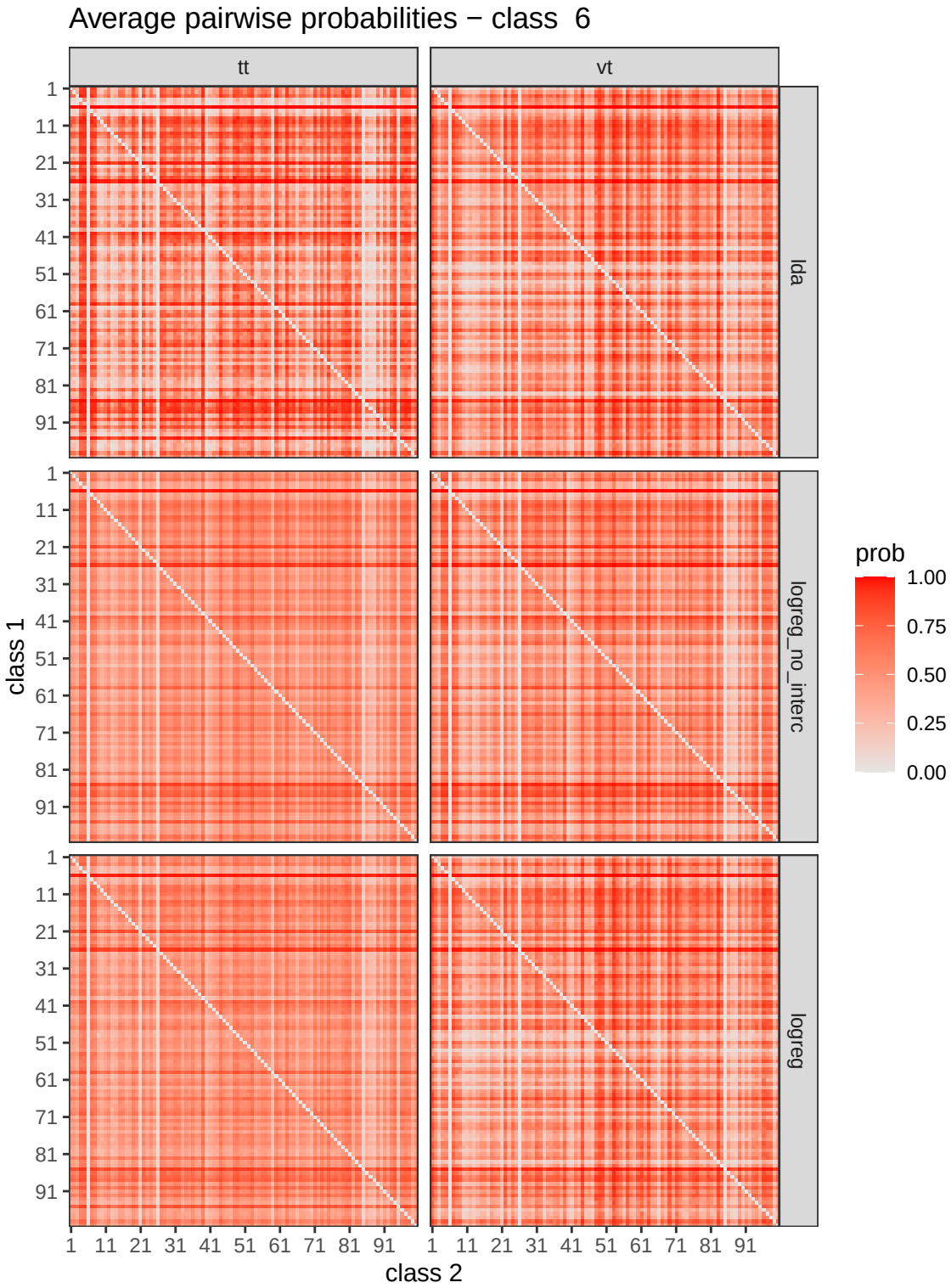

Average pairwise probabilities − class 1
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

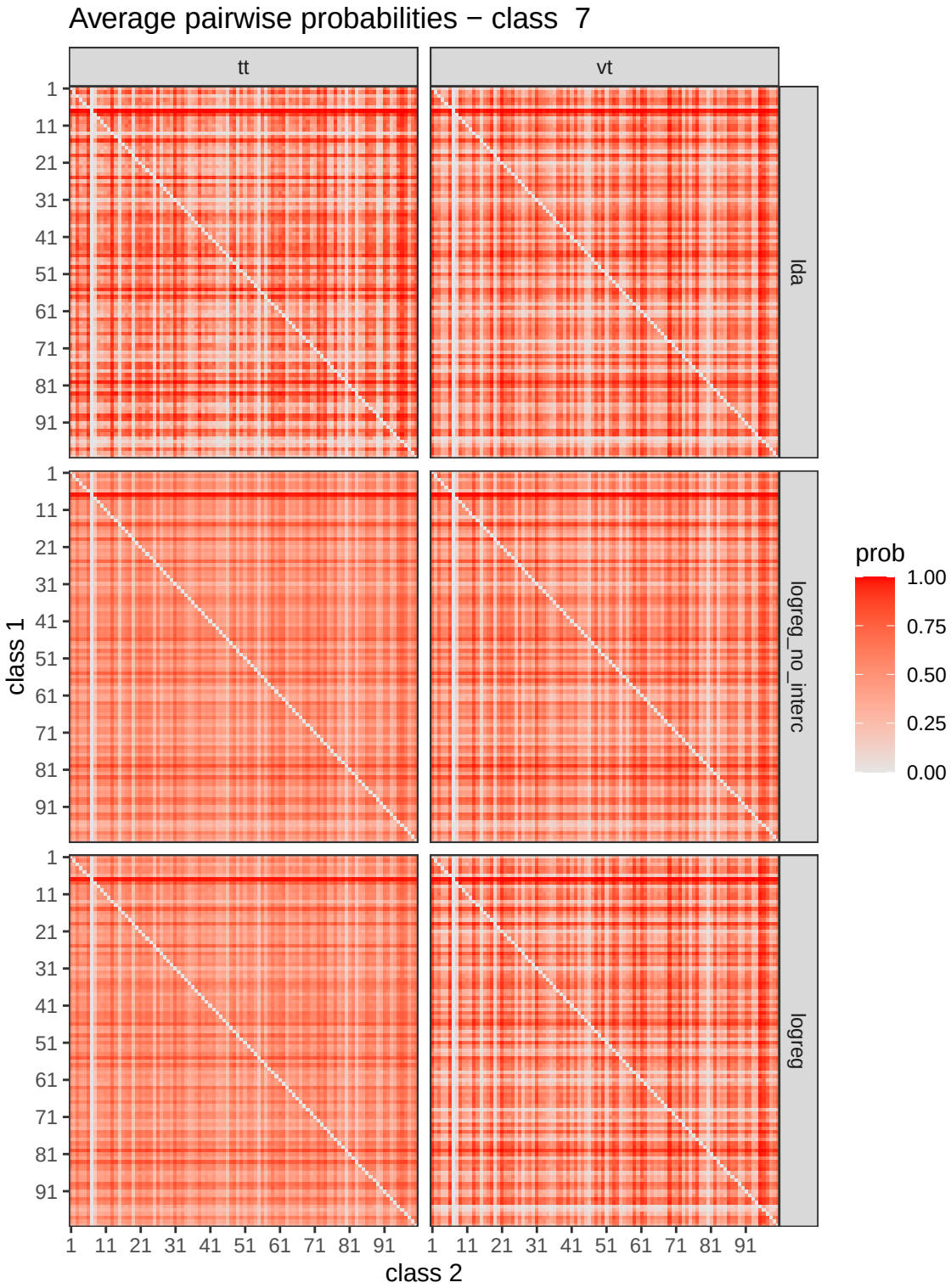

Average pairwise probabilities − class 2
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 3
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 4
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
1
11
21
31
41
51
61
71
81
91
prob
1.00
0.75
0.50
0.25
0.00


Average pairwise probabilities − class 5
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 6
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 7
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
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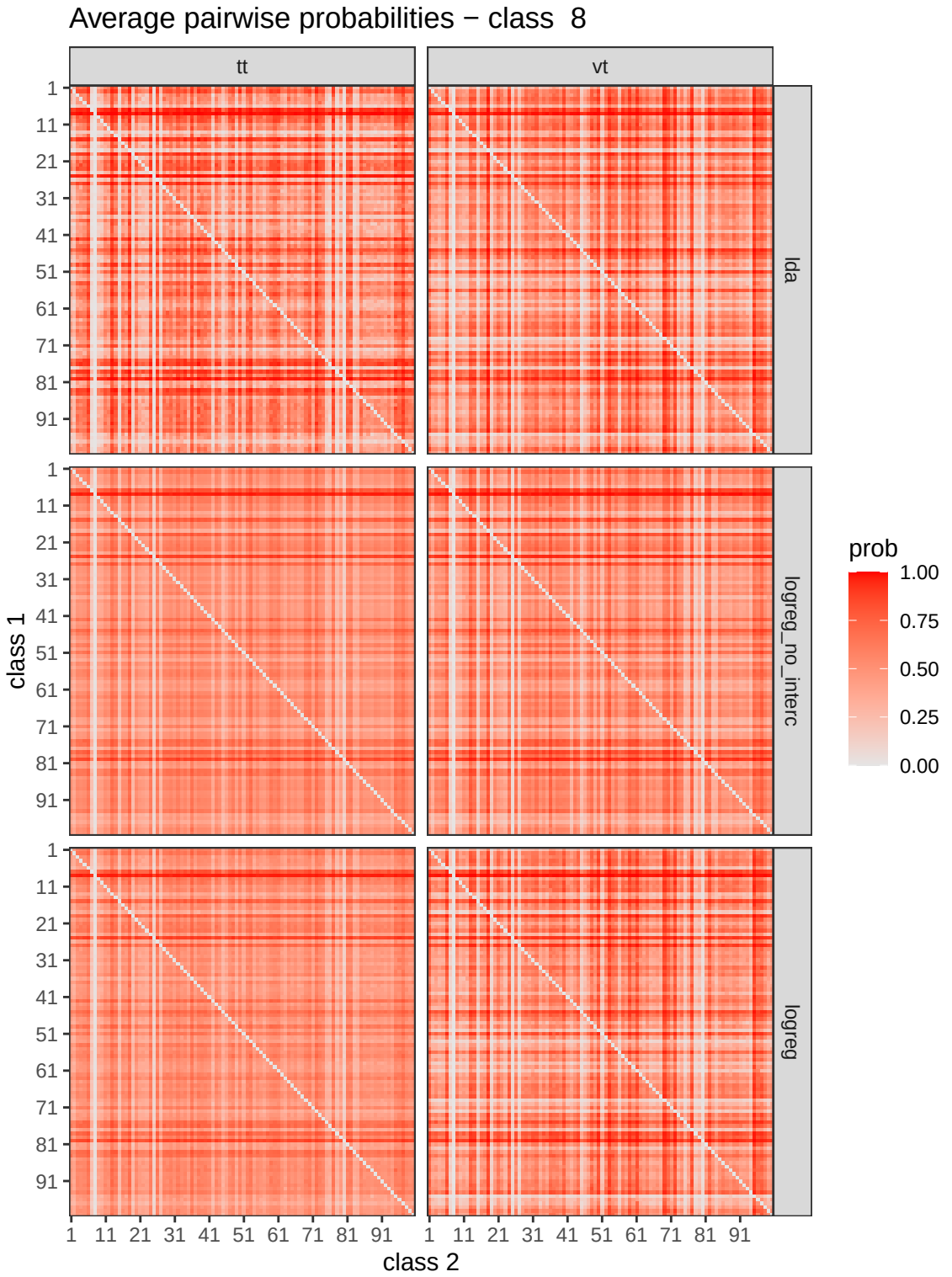
Average pairwise probabilities − class 8
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vt
lda
logreg_no_interc
logreg
class 1
class 2
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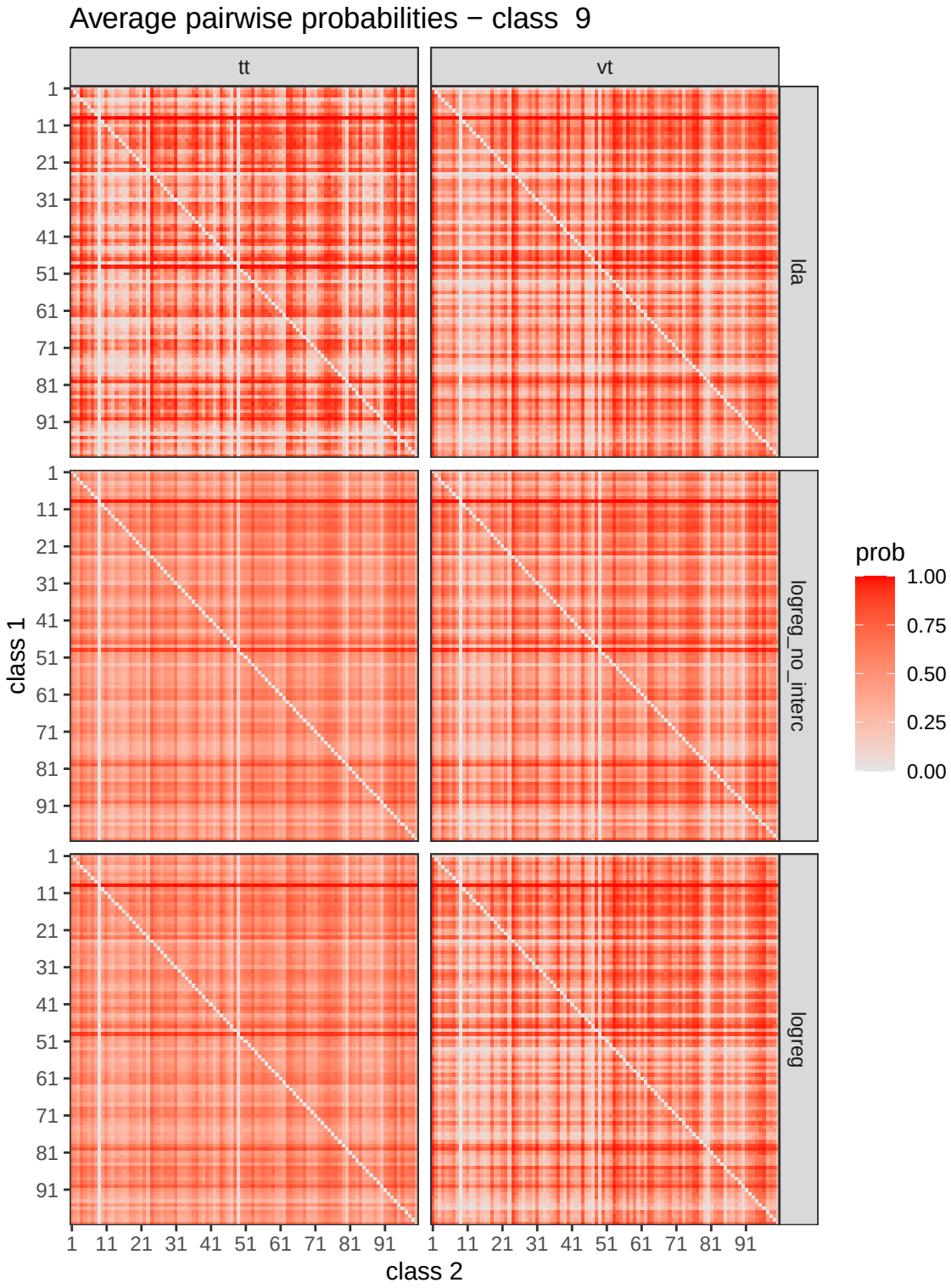
Average pairwise probabilities − class 9
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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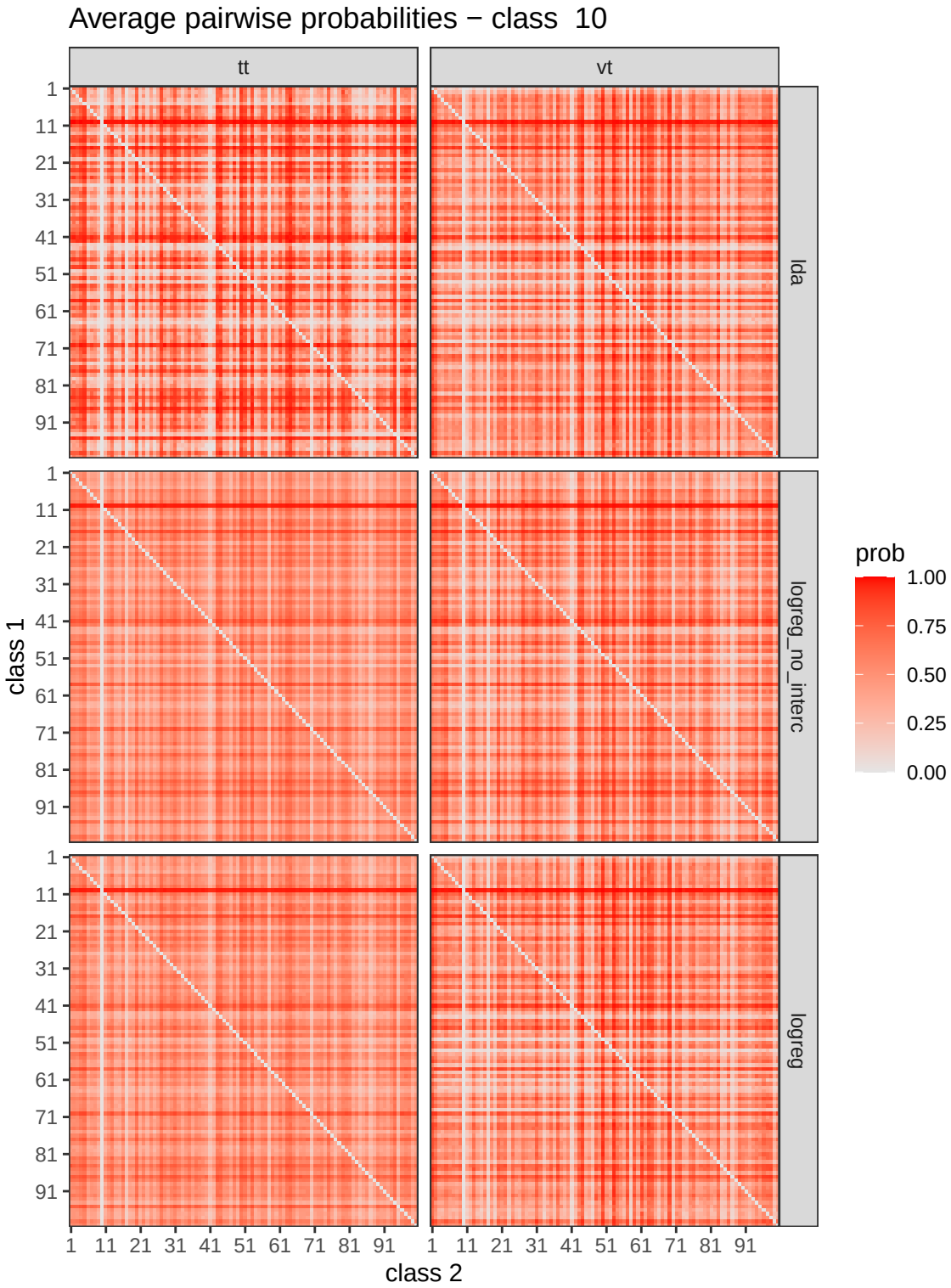
Average pairwise probabilities − class 10
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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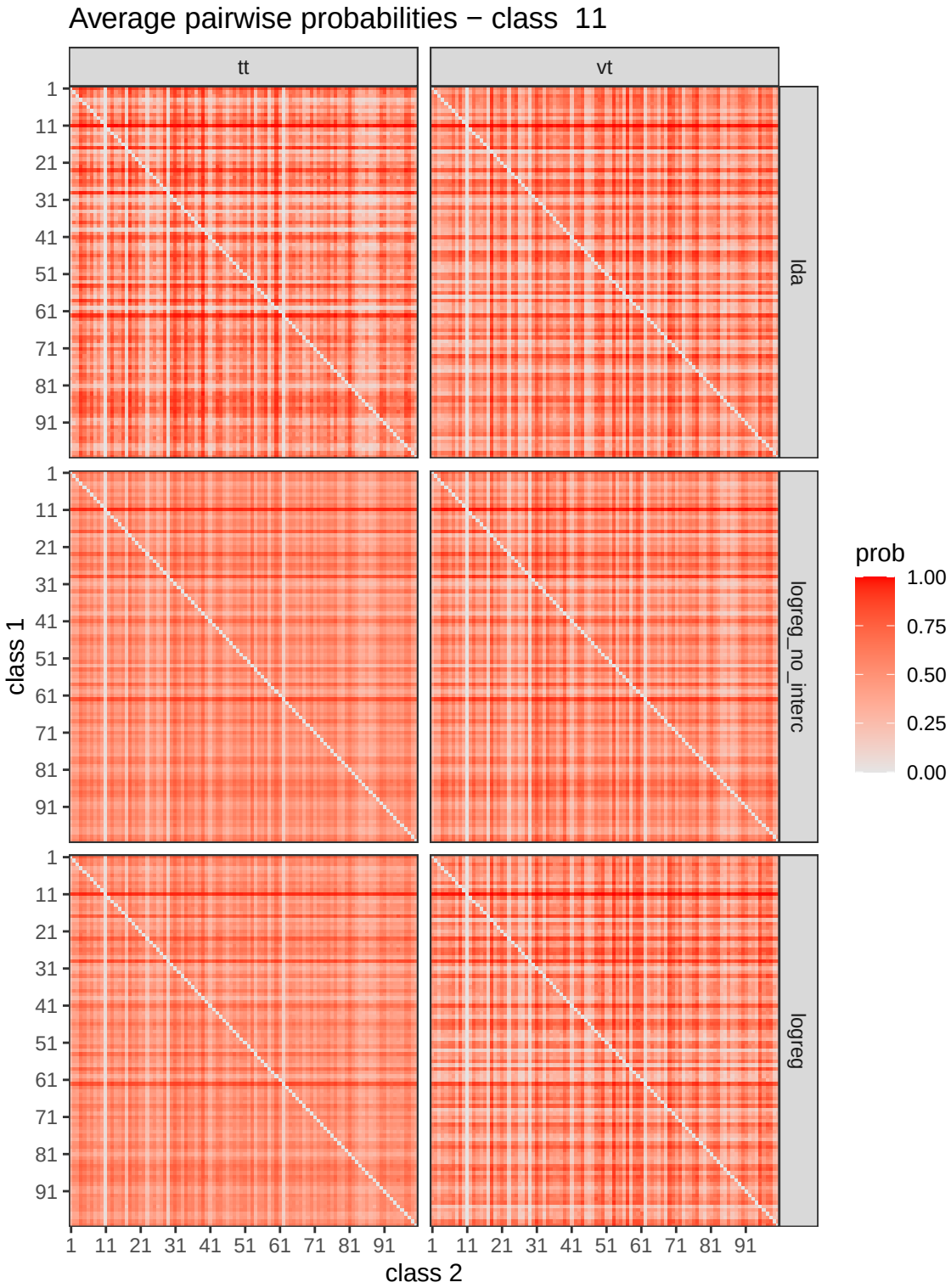
Average pairwise probabilities − class 11
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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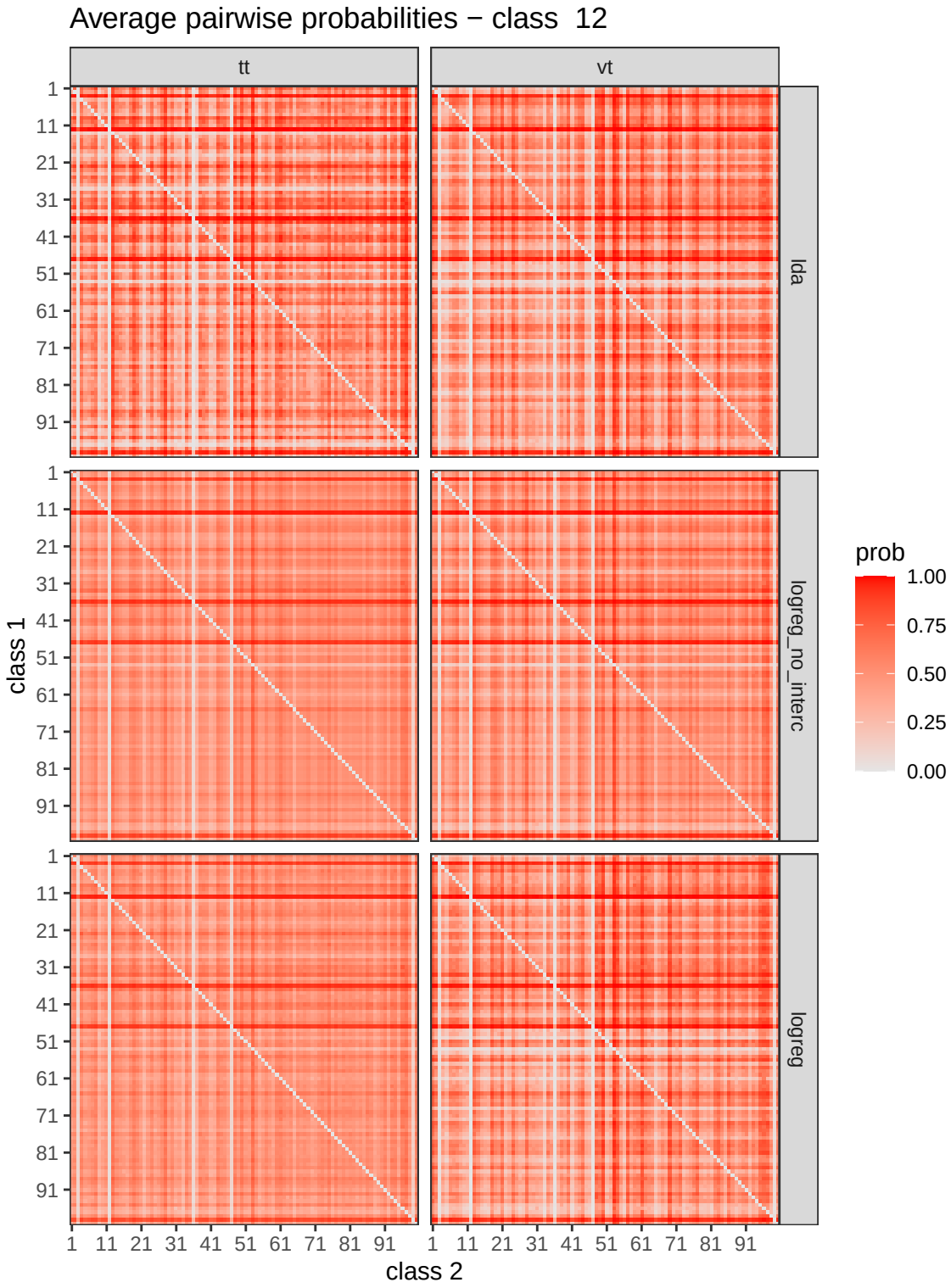
81
91


Average pairwise probabilities − class 12
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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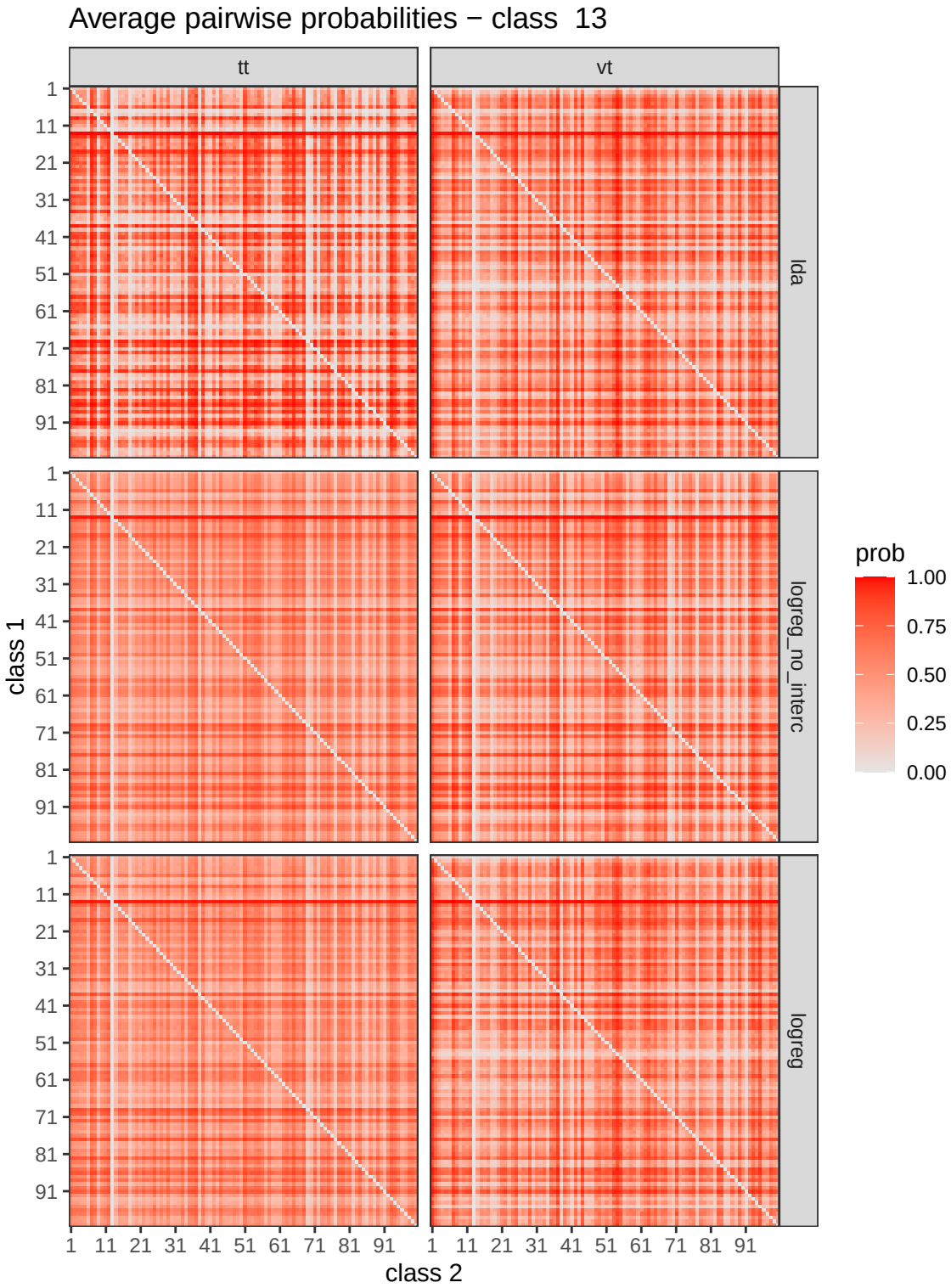
Average pairwise probabilities − class 13
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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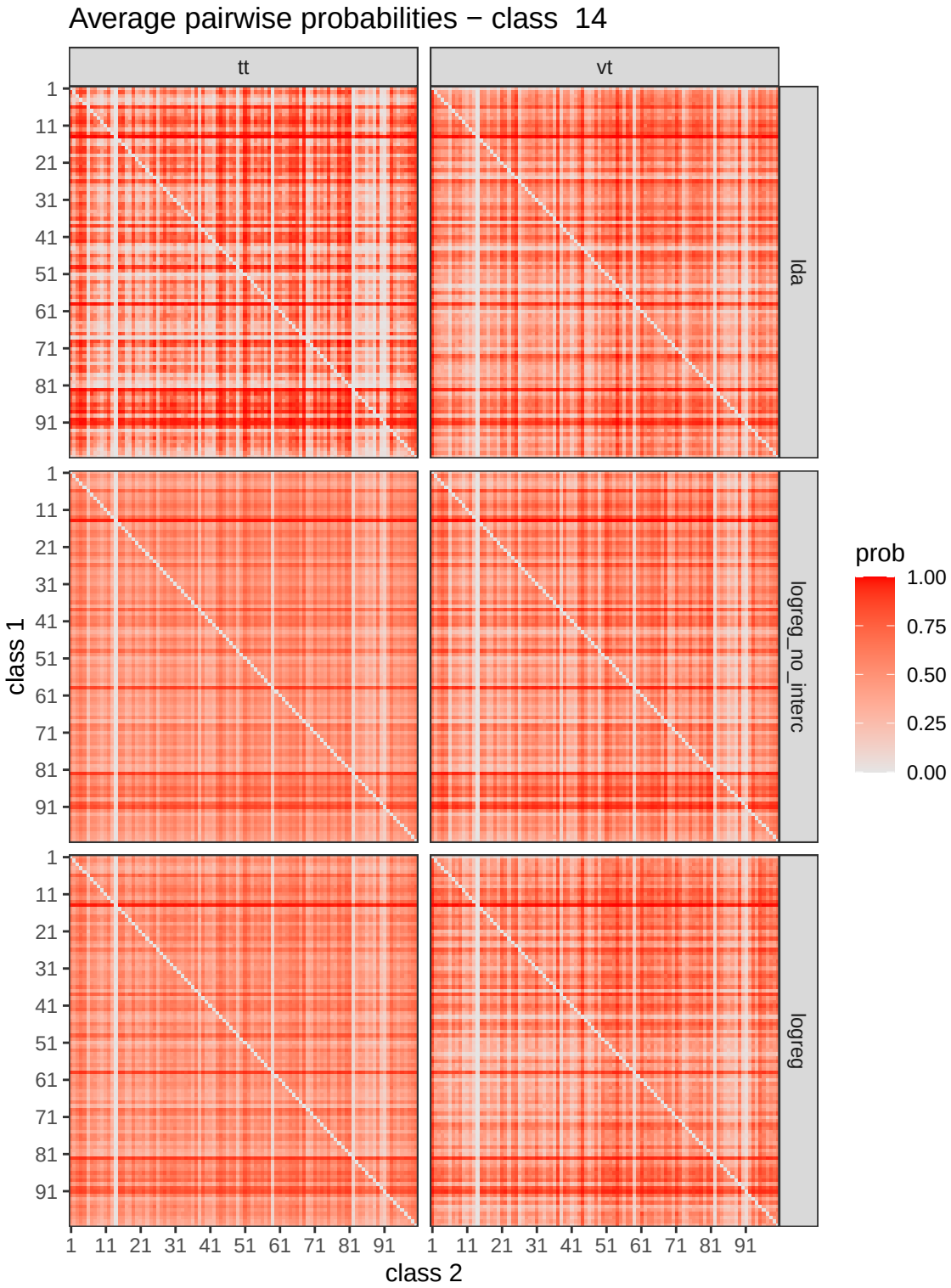
Average pairwise probabilities − class 14
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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11
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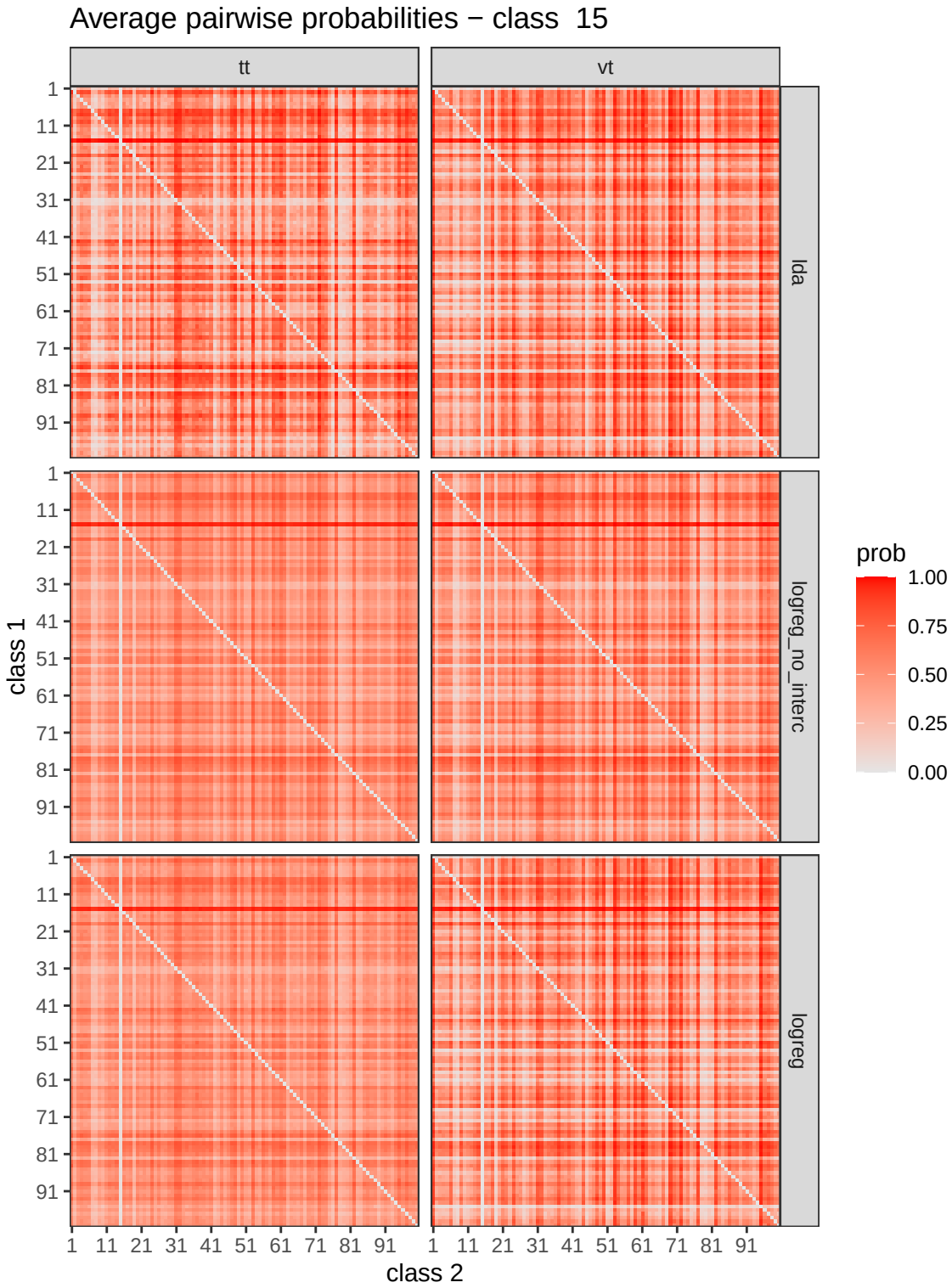
31
41
51
61
71
81
91
prob
1.00
0.75
0.50
0.25
0.00


Average pairwise probabilities − class 15
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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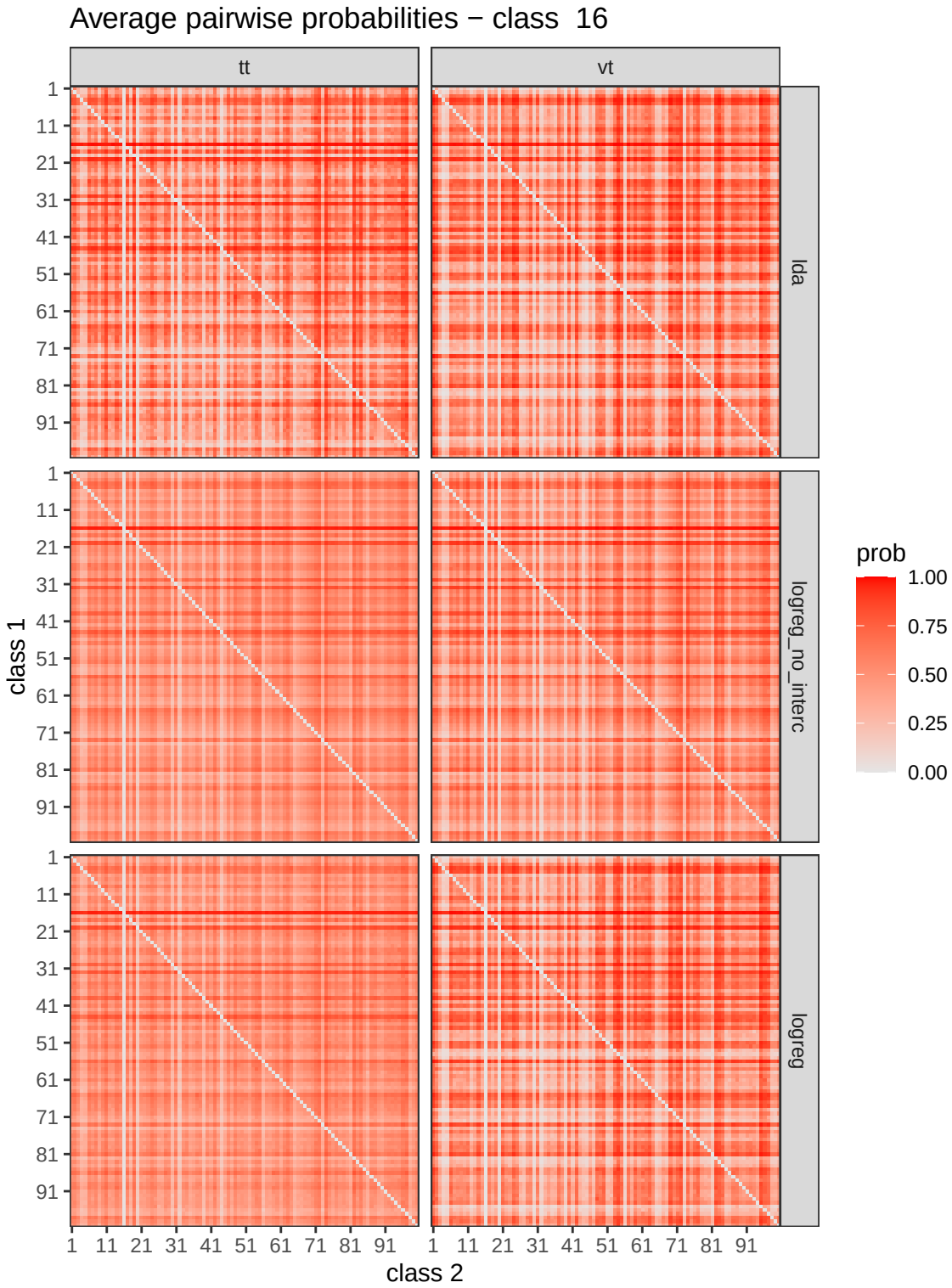
31
41
51
61
71
81
91
prob
1.00
0.75
0.50
0.25
0.00


Average pairwise probabilities − class 16
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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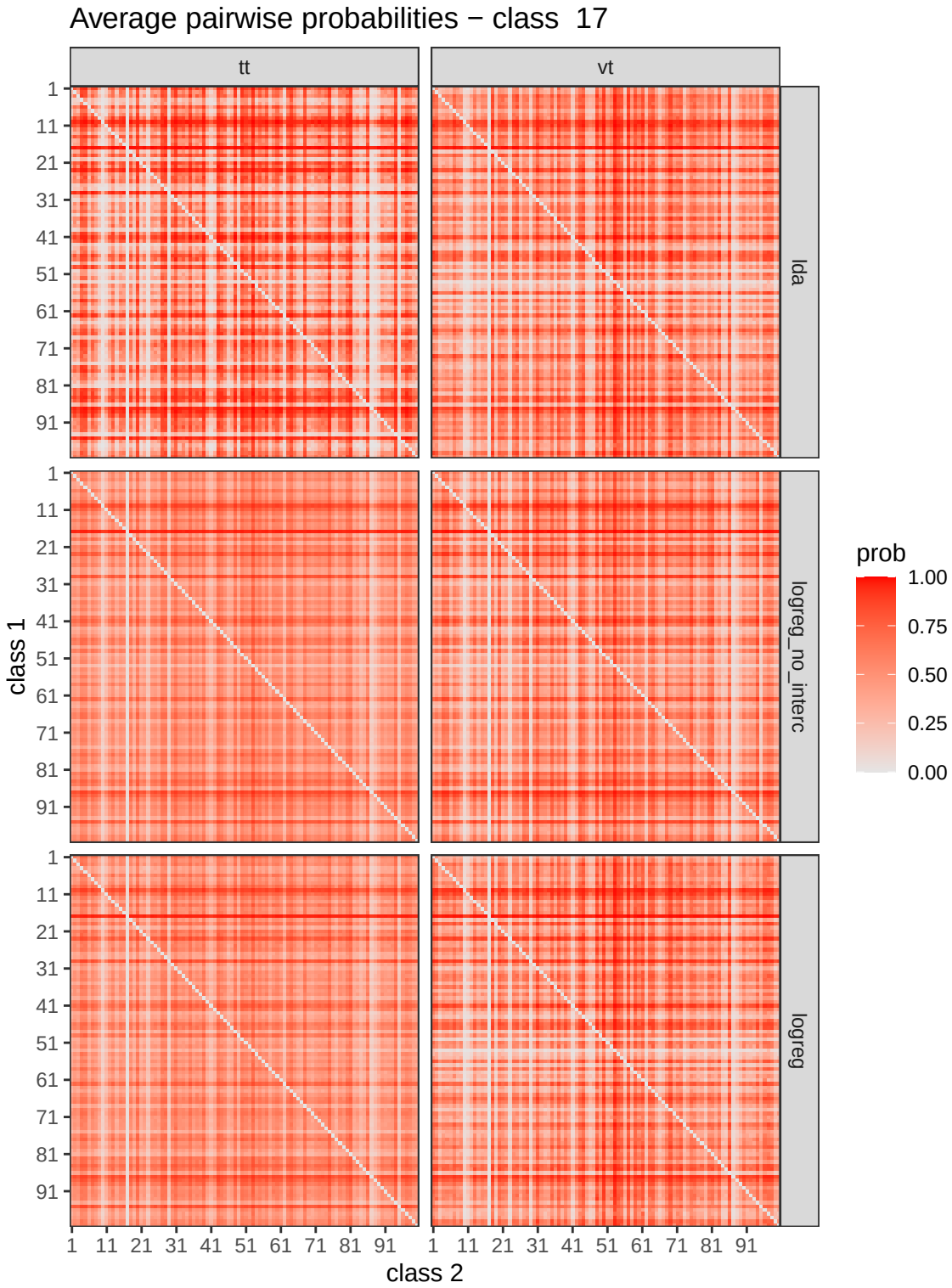
81
91


Average pairwise probabilities − class 17
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
0.00
1
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21
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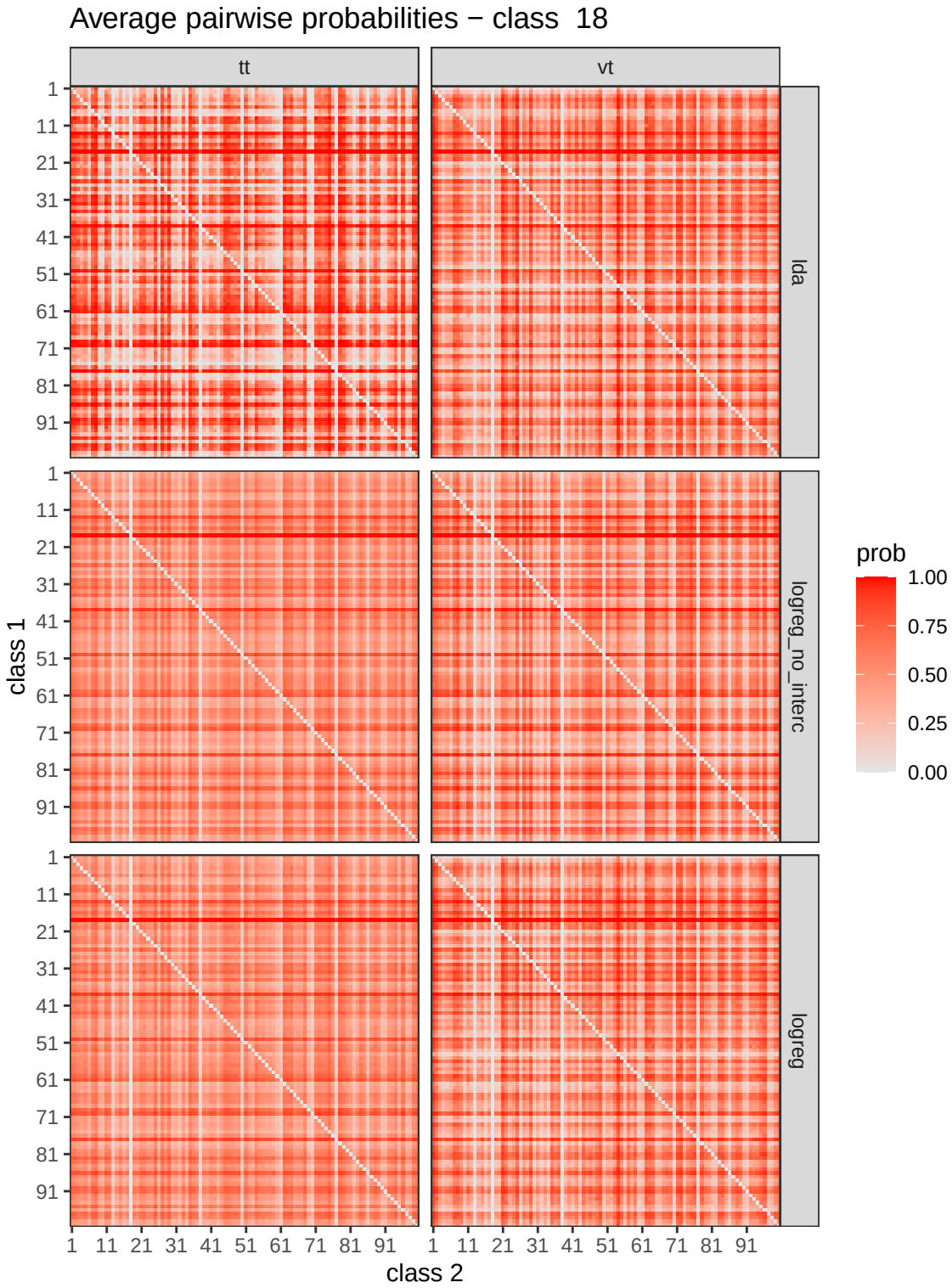
71
81
91


Average pairwise probabilities − class 18
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
0.00
1
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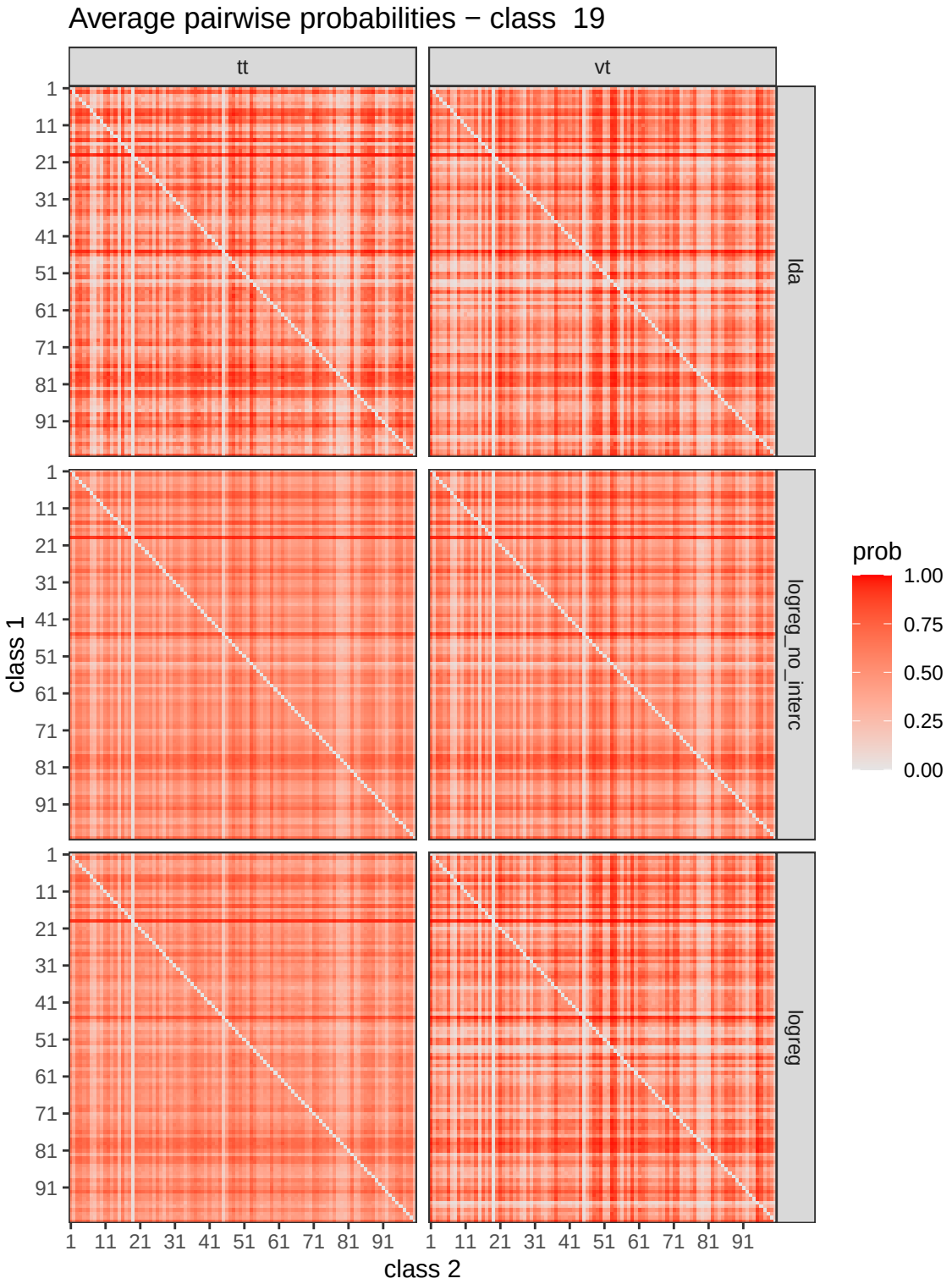
91


Average pairwise probabilities − class 19
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.75
0.50
0.25
0.00
1
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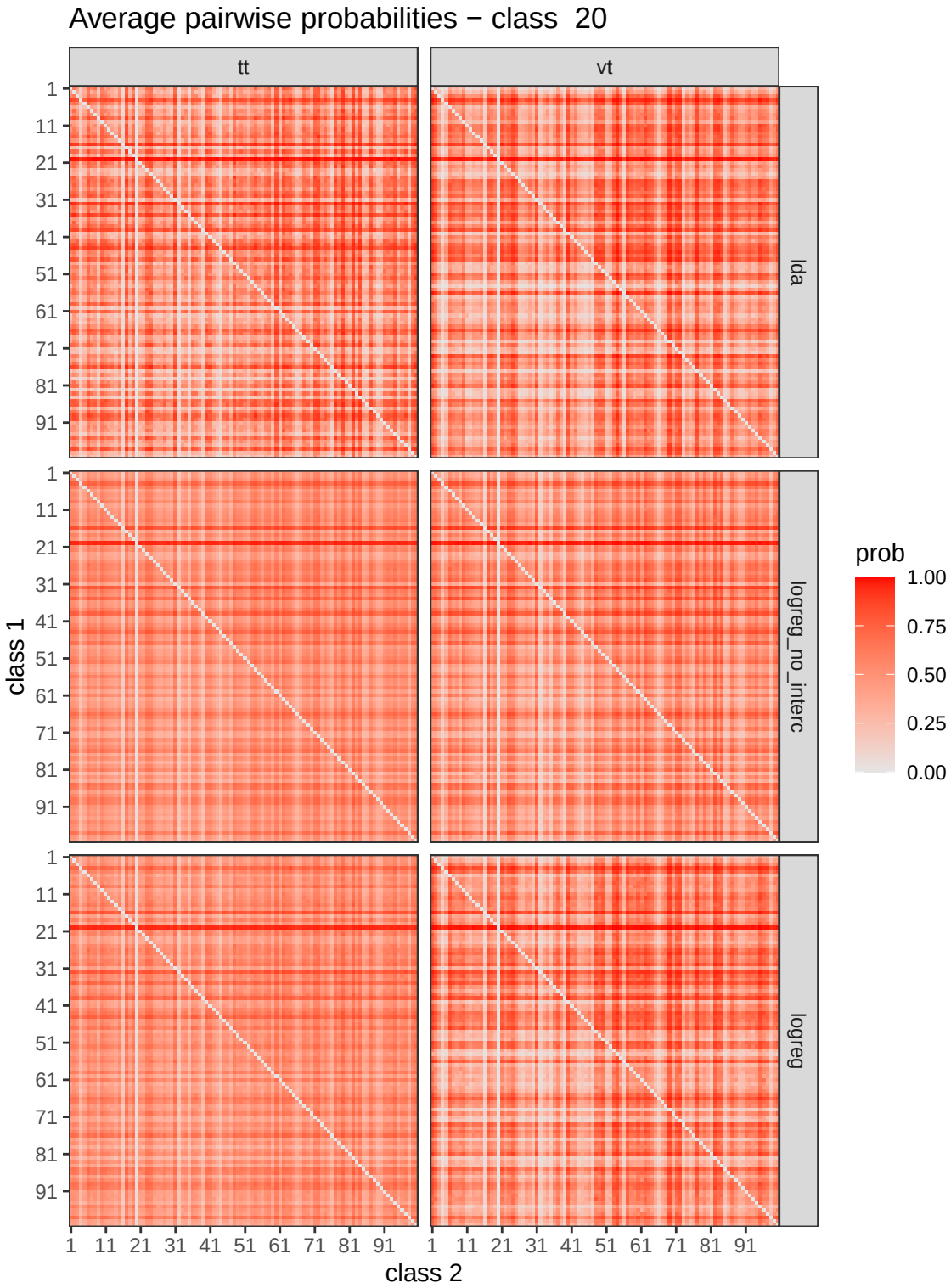
71
81
91


Average pairwise probabilities − class 20
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.75
0.50
0.25
0.00
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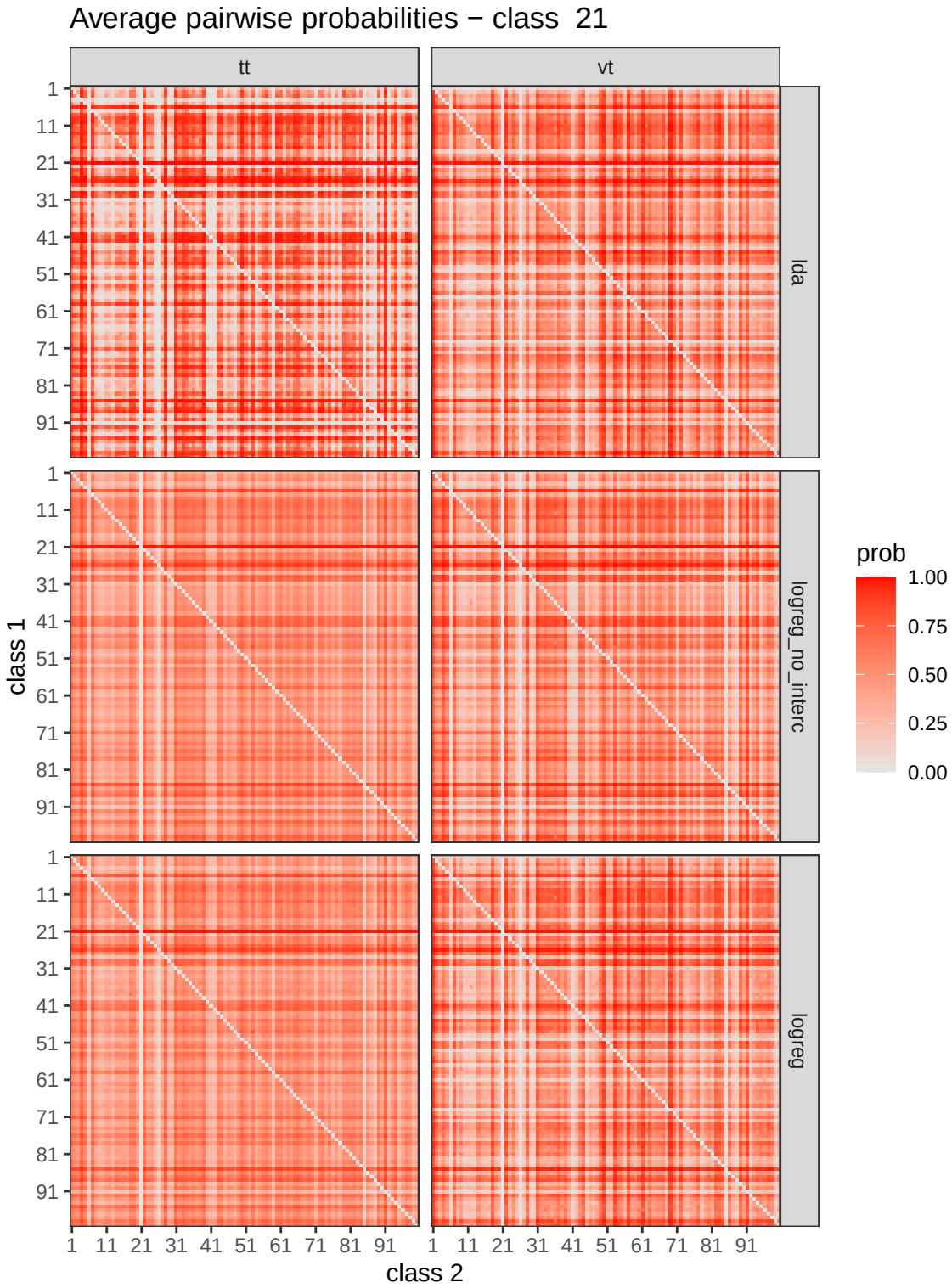
81
91


Average pairwise probabilities − class 21
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
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21
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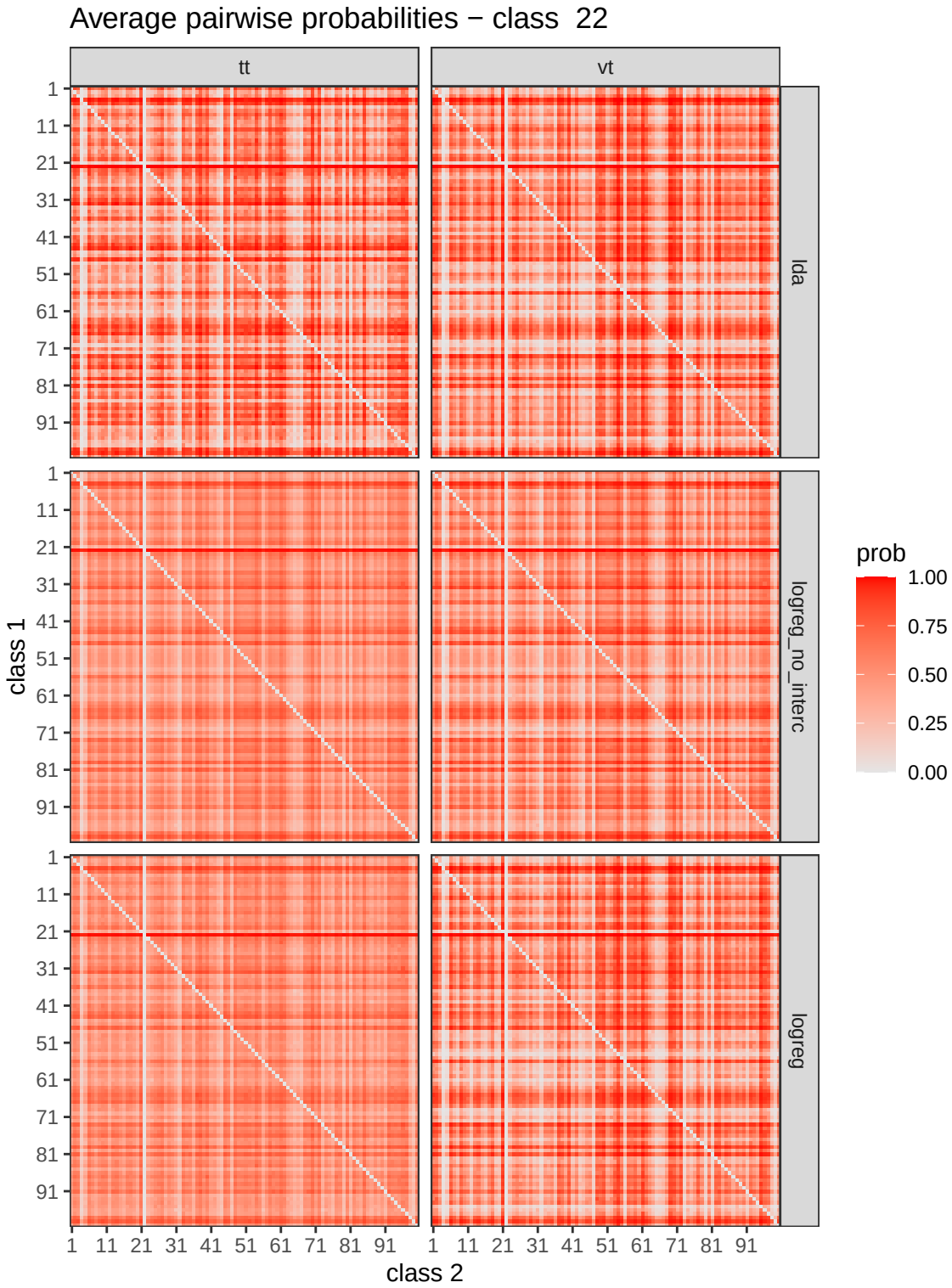
71
81
91


Average pairwise probabilities − class 22
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.75
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0.00
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21
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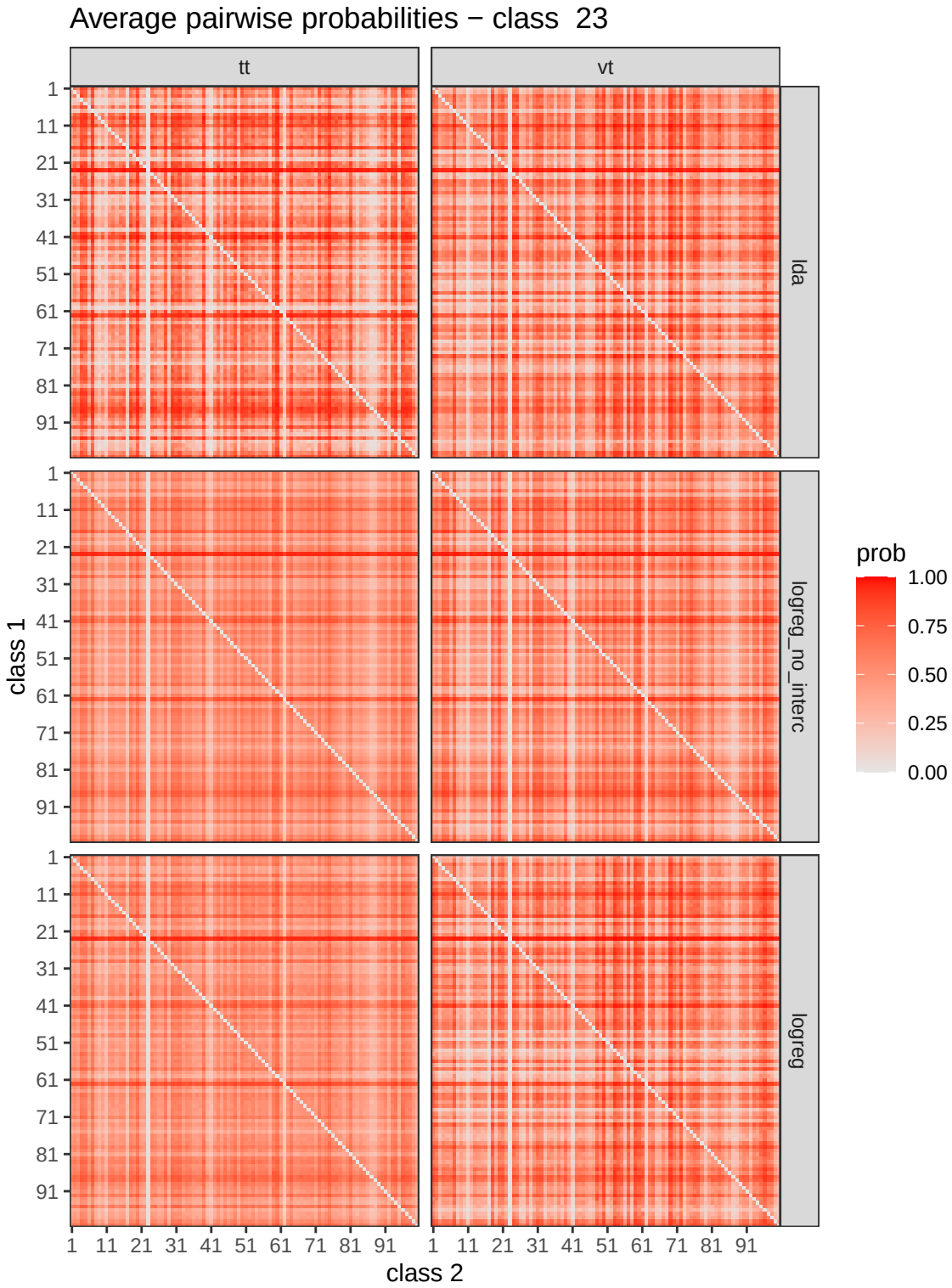
81
91


Average pairwise probabilities − class 23
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.25
0.00
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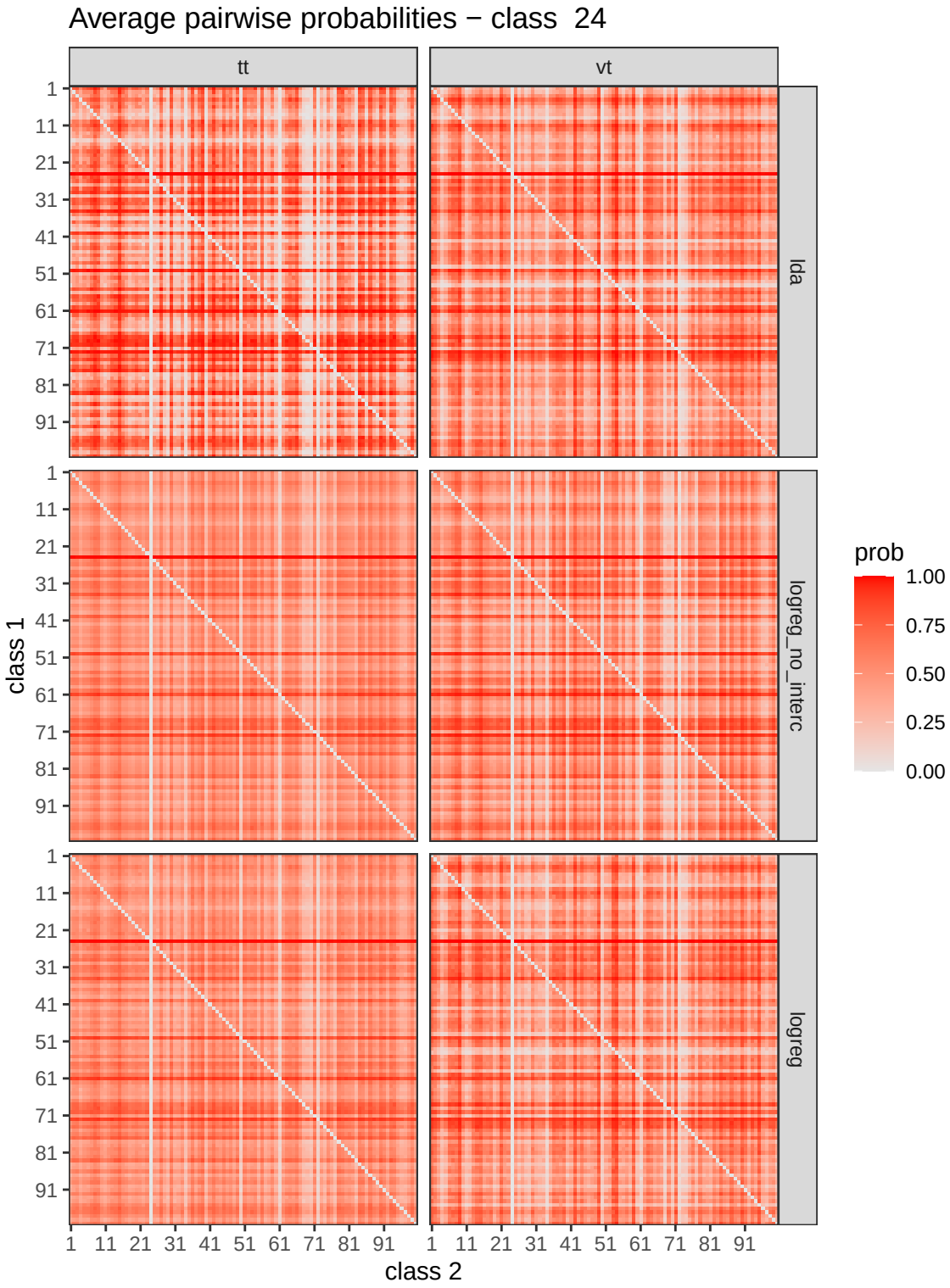
81
91


Average pairwise probabilities − class 24
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
0.00
1
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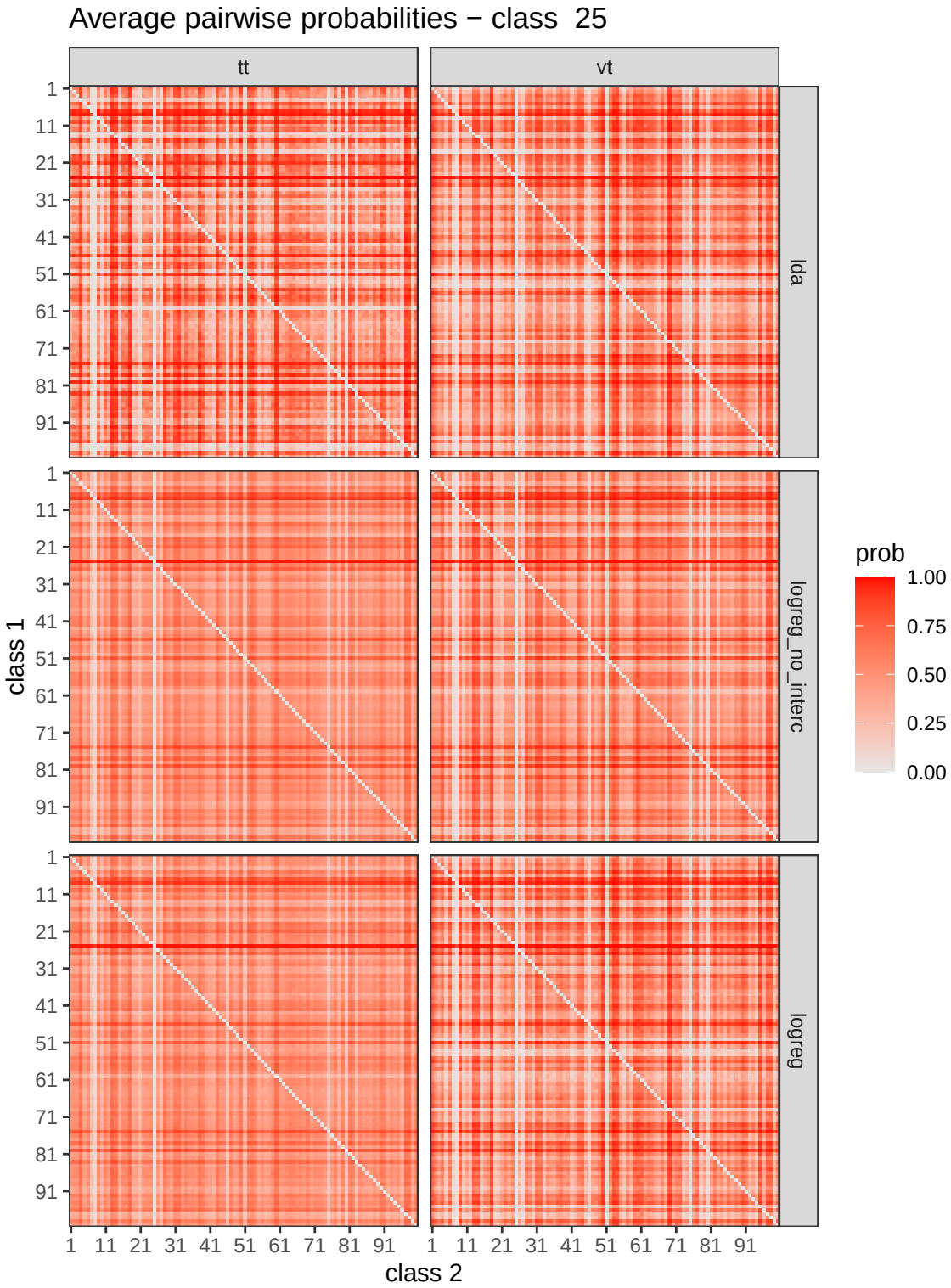
81
91


Average pairwise probabilities − class 25
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.75
0.50
0.25
0.00
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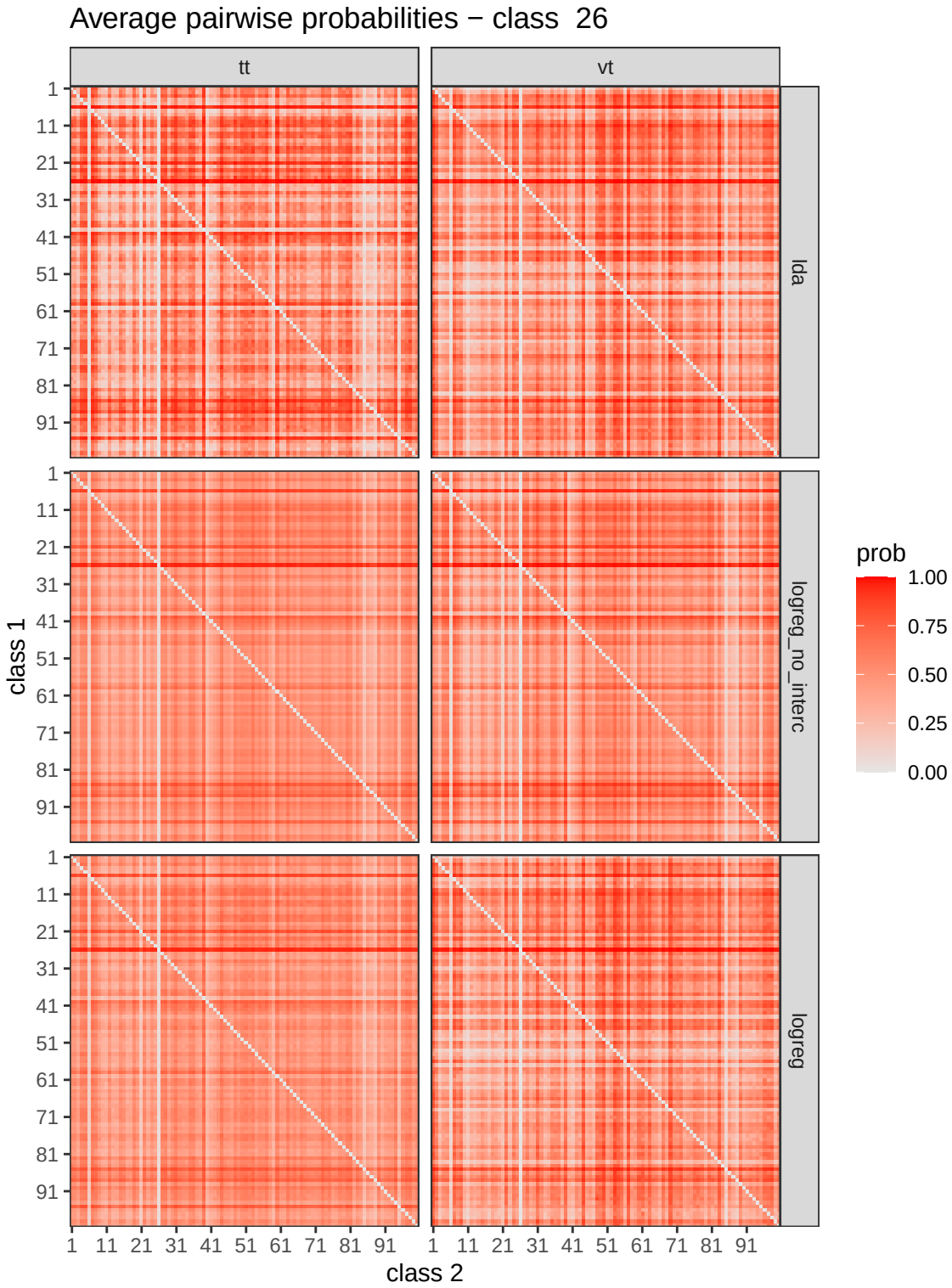
81
91


Average pairwise probabilities − class 26
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
0.00
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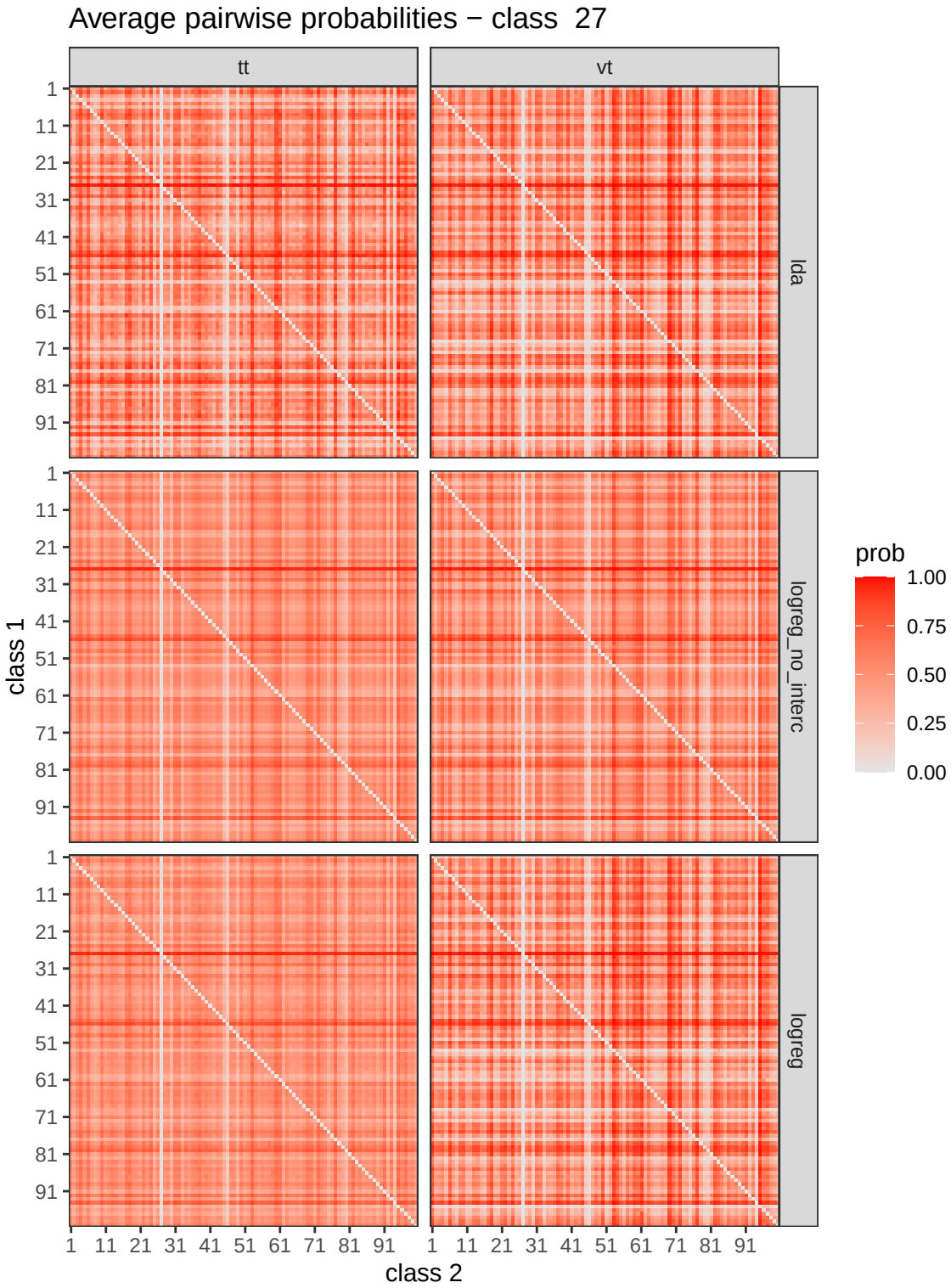
81
91


Average pairwise probabilities − class 27
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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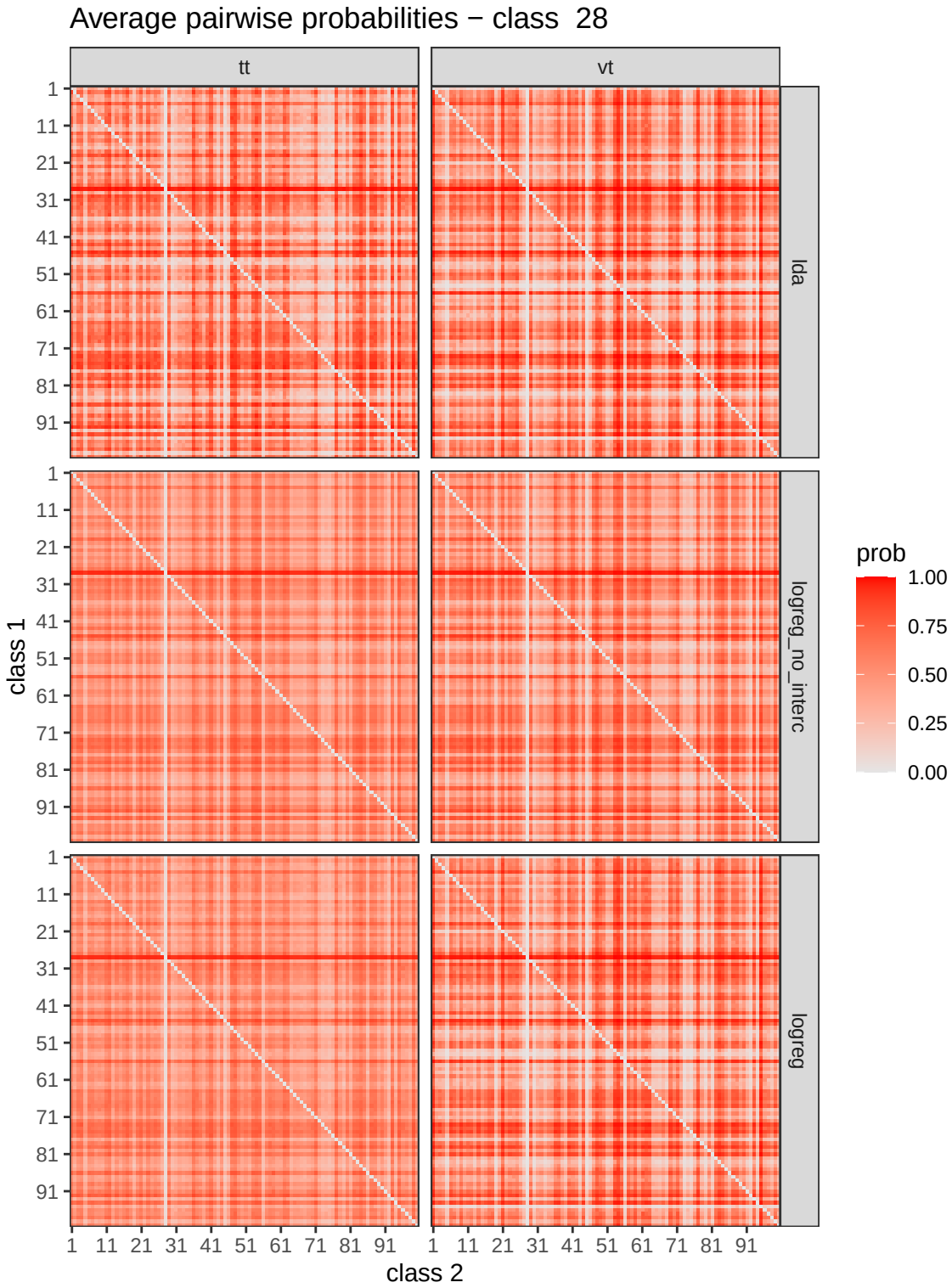
71
81
91
prob
1.00
0.75
0.50
0.25
0.00


Average pairwise probabilities − class 28
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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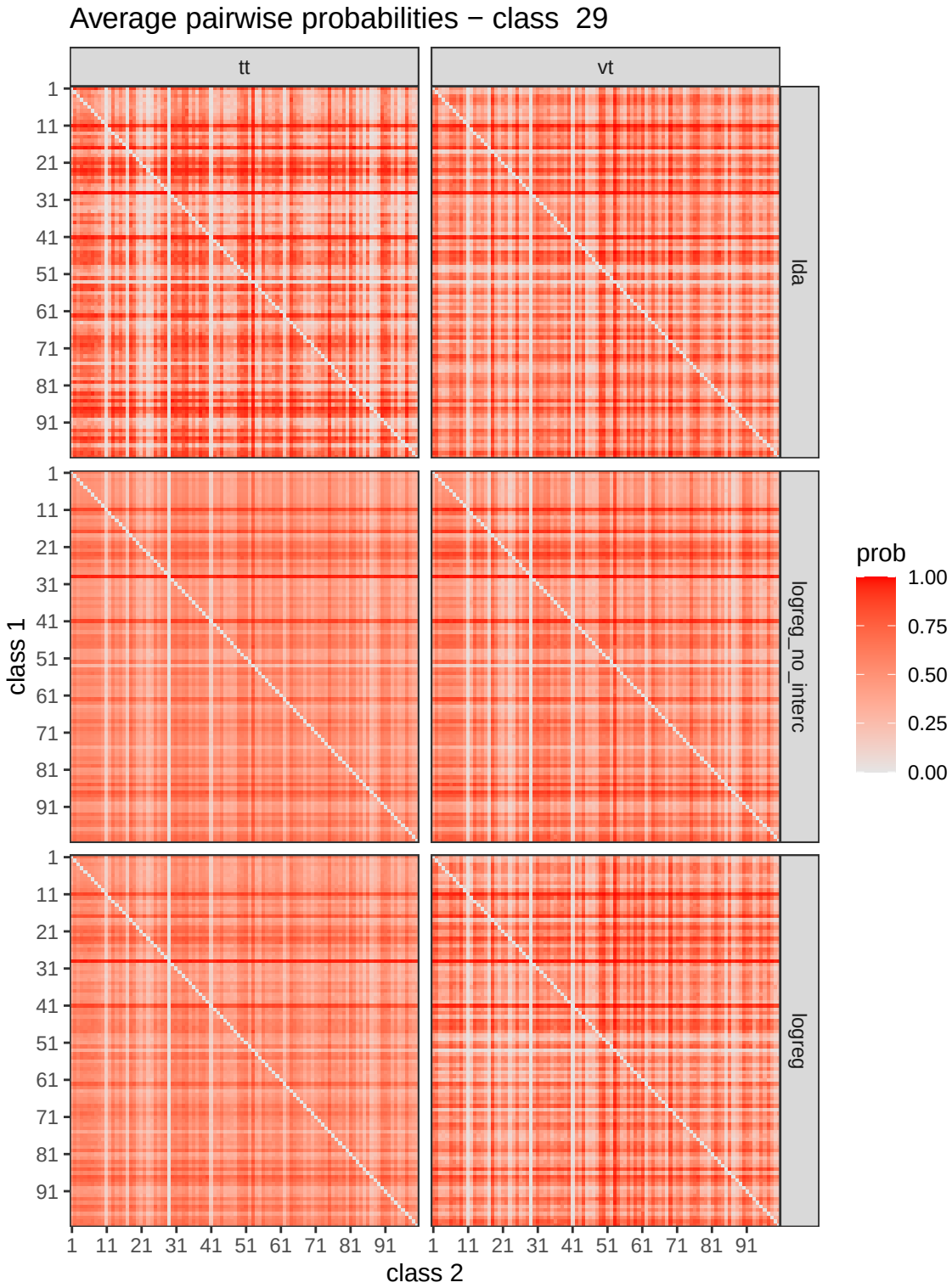
71
81
91
prob
1.00
0.75
0.50
0.25
0.00


Average pairwise probabilities − class 29
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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31
41
51
61
71
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91
prob
1.00
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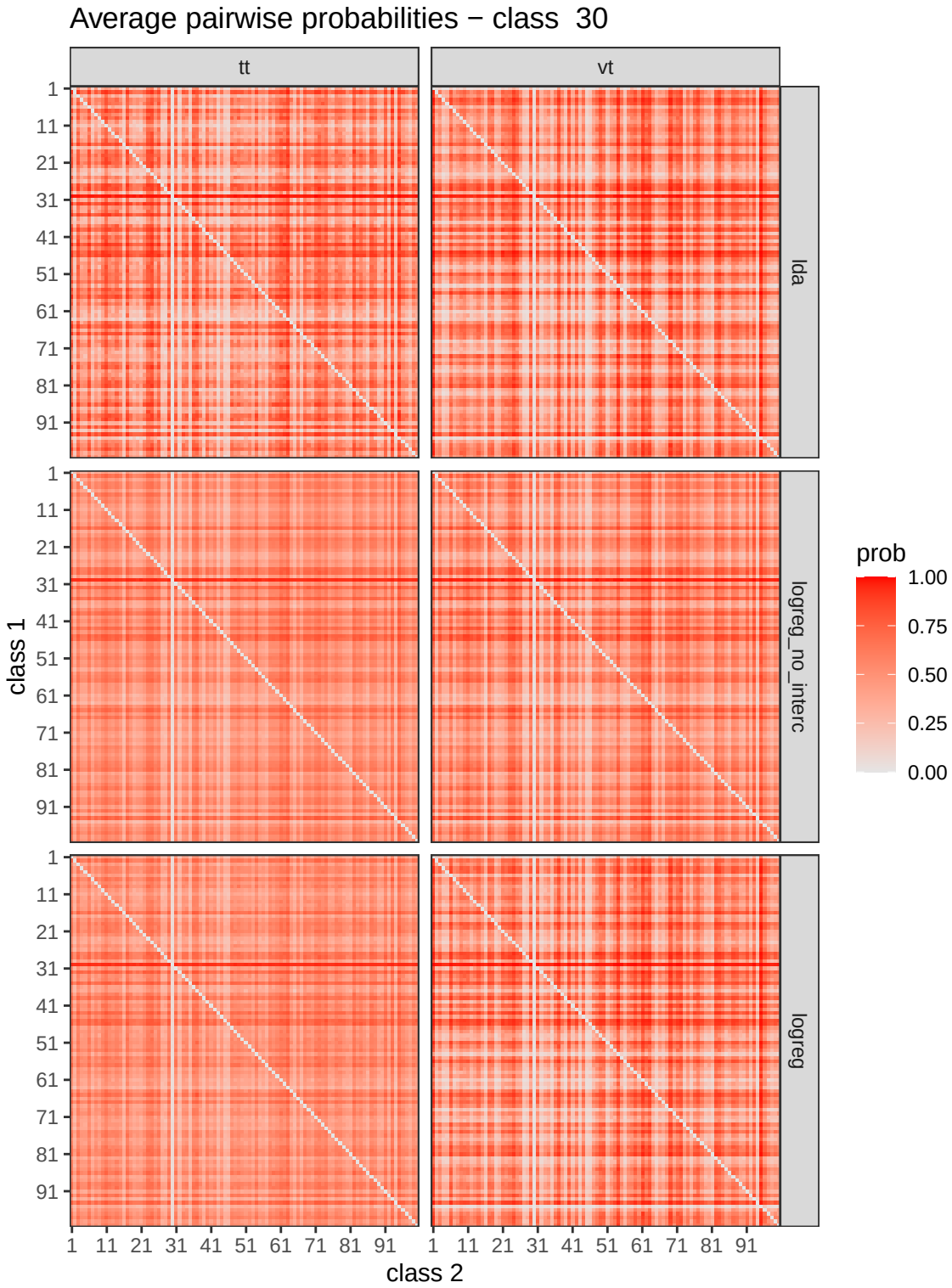
0.50
0.25
0.00


Average pairwise probabilities − class 30
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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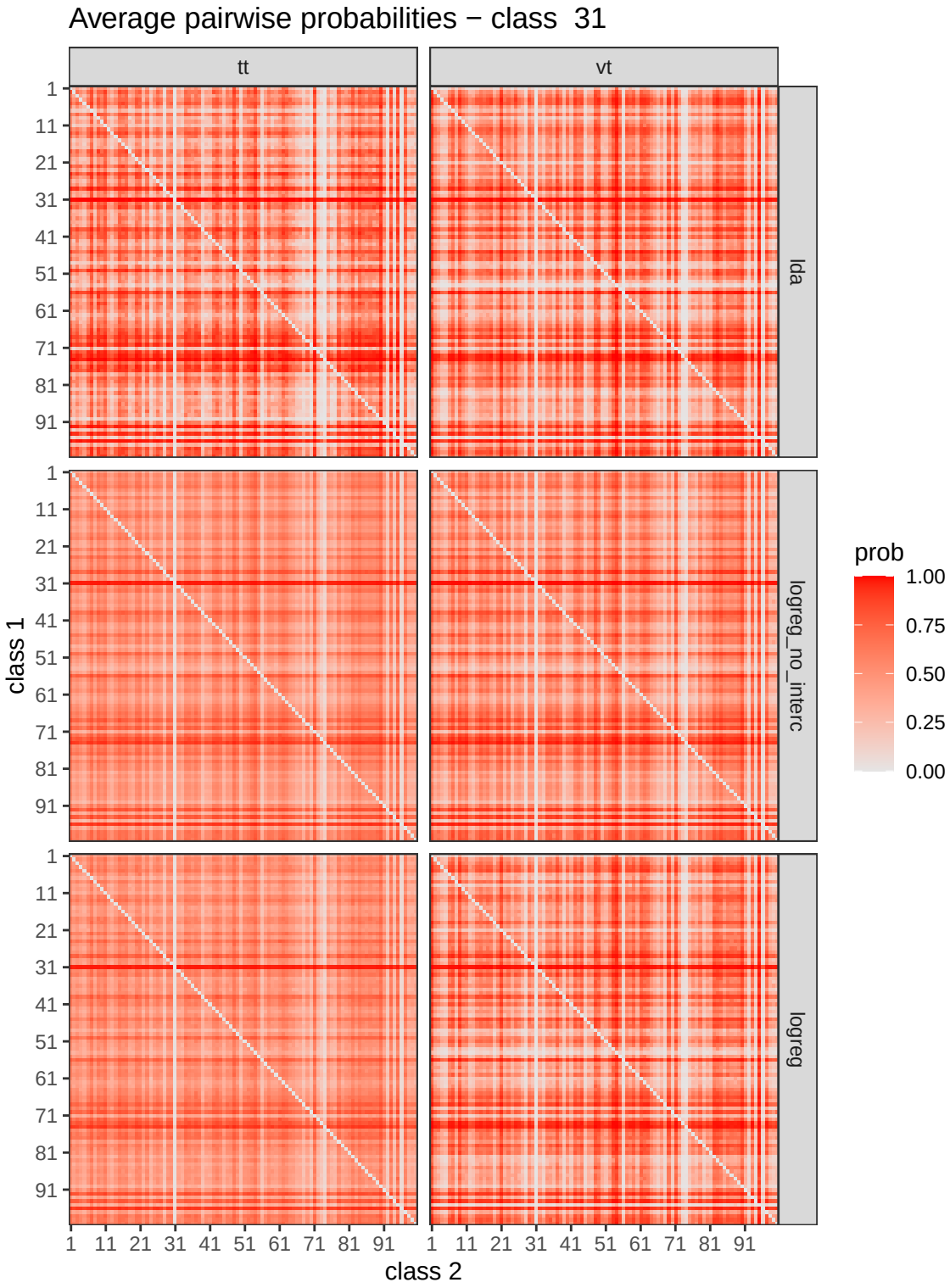
Average pairwise probabilities − class 31
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
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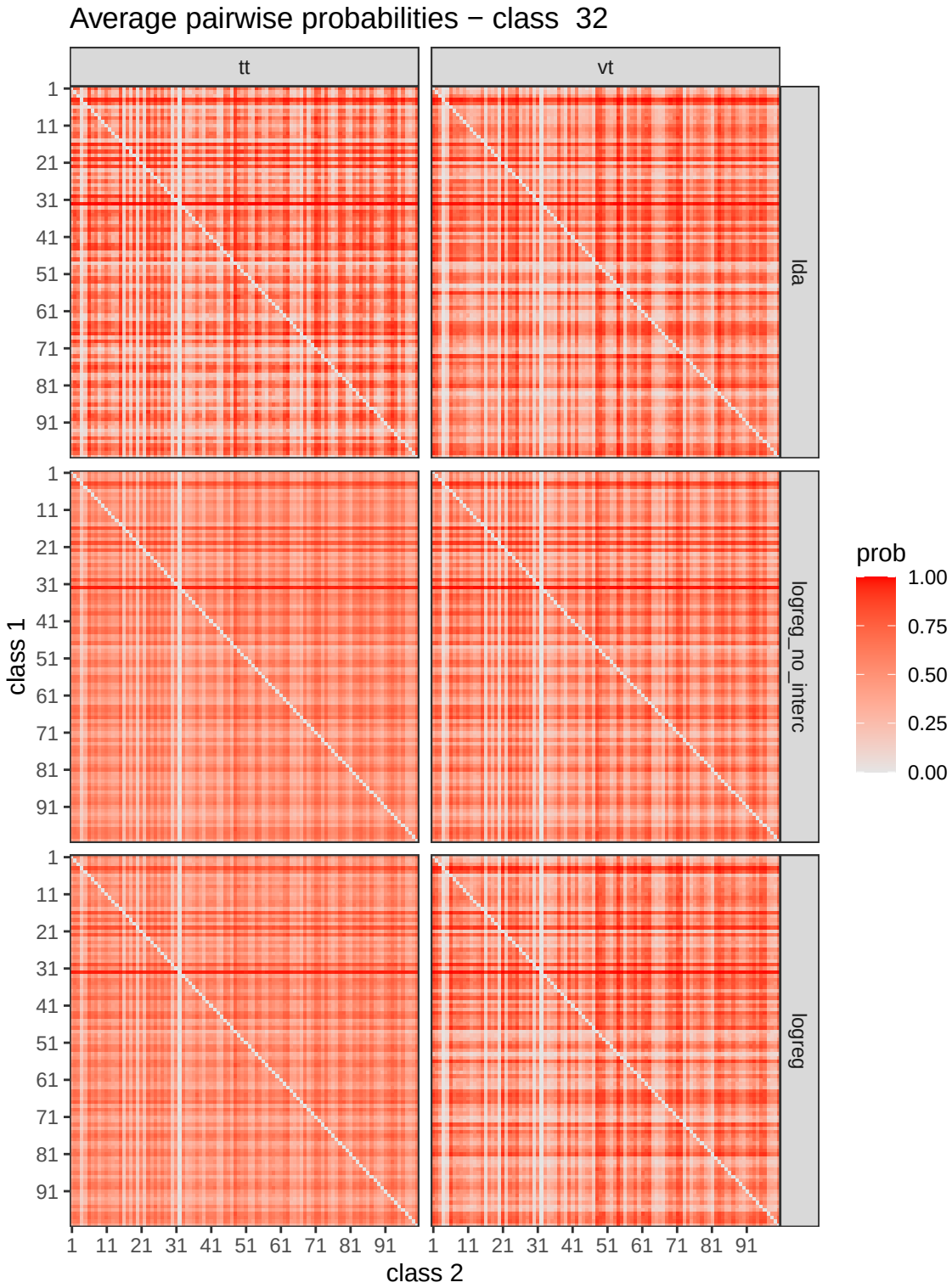
Average pairwise probabilities − class 32
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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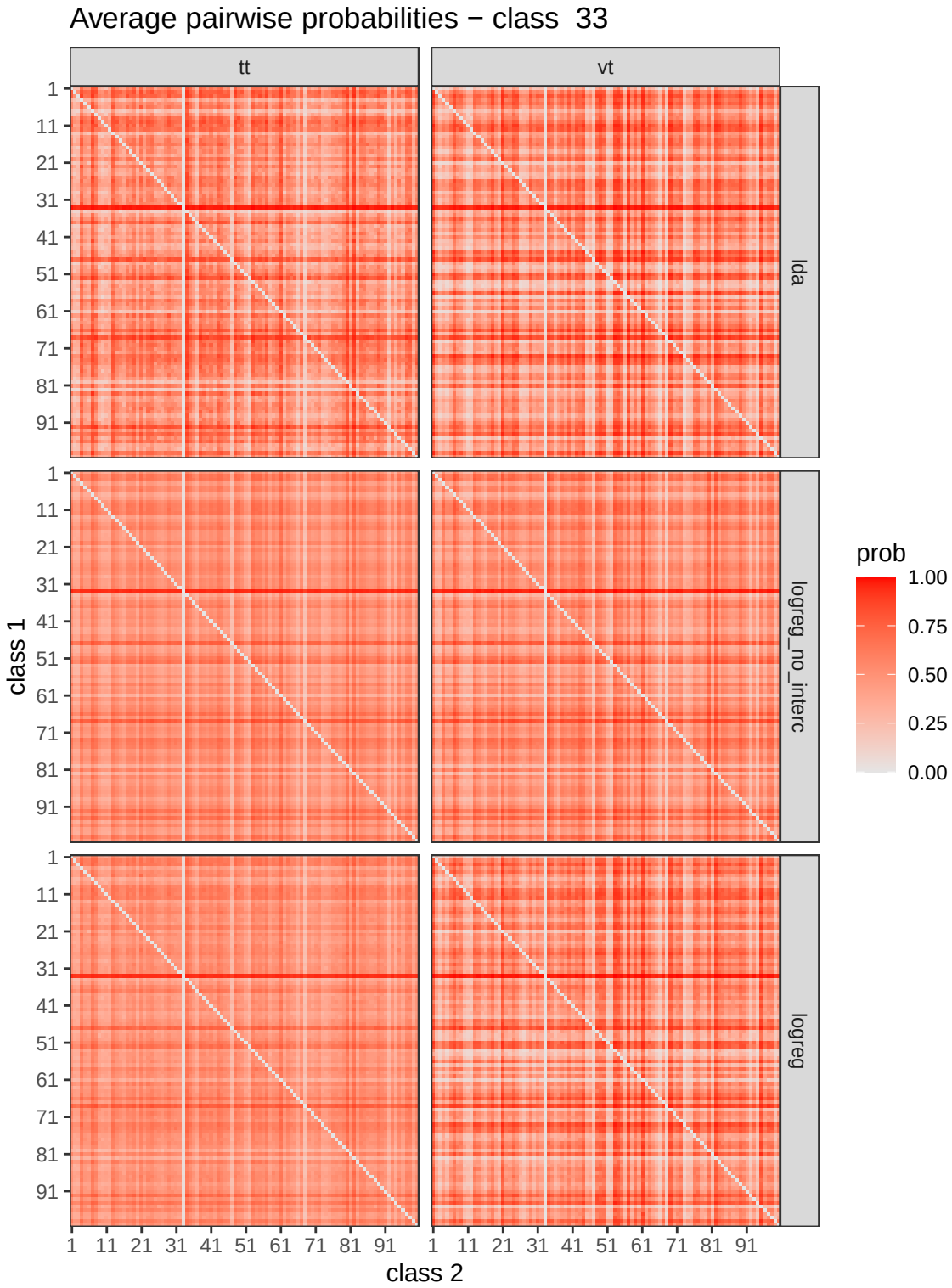
Average pairwise probabilities − class 33
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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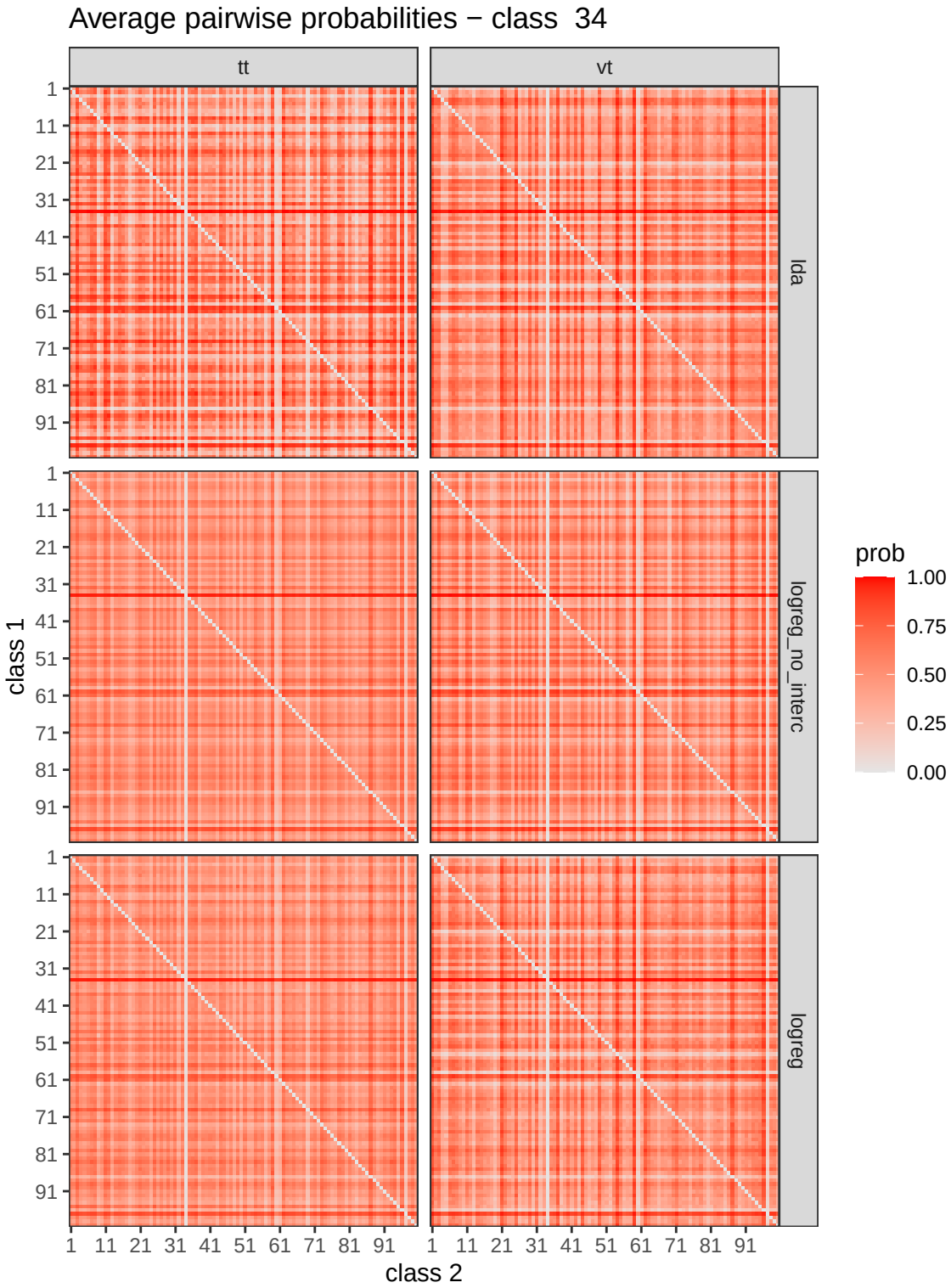
Average pairwise probabilities − class 34
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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51
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71
81
91
prob
1.00
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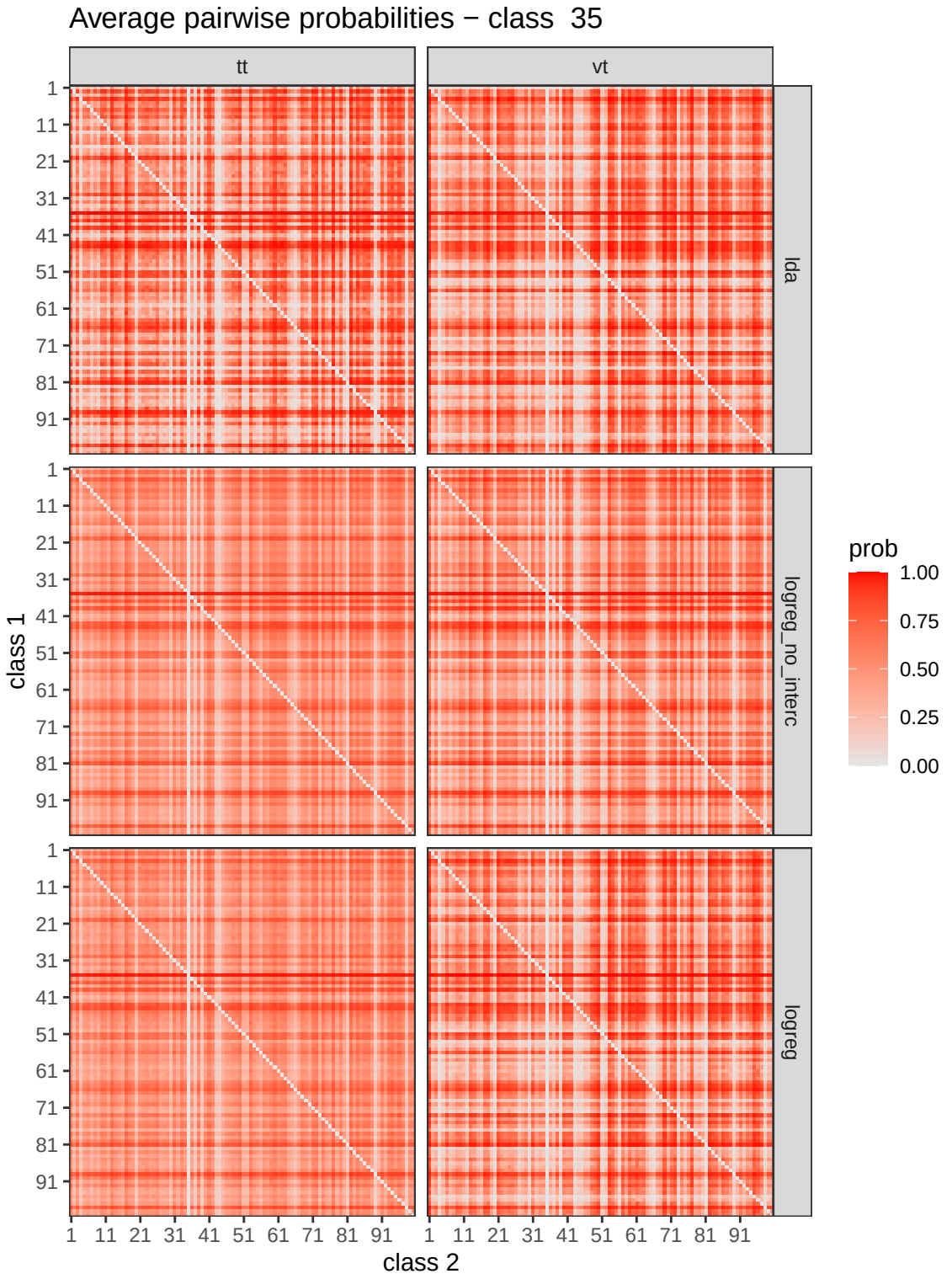
0.50
0.25
0.00


Average pairwise probabilities − class 35
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
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0.00
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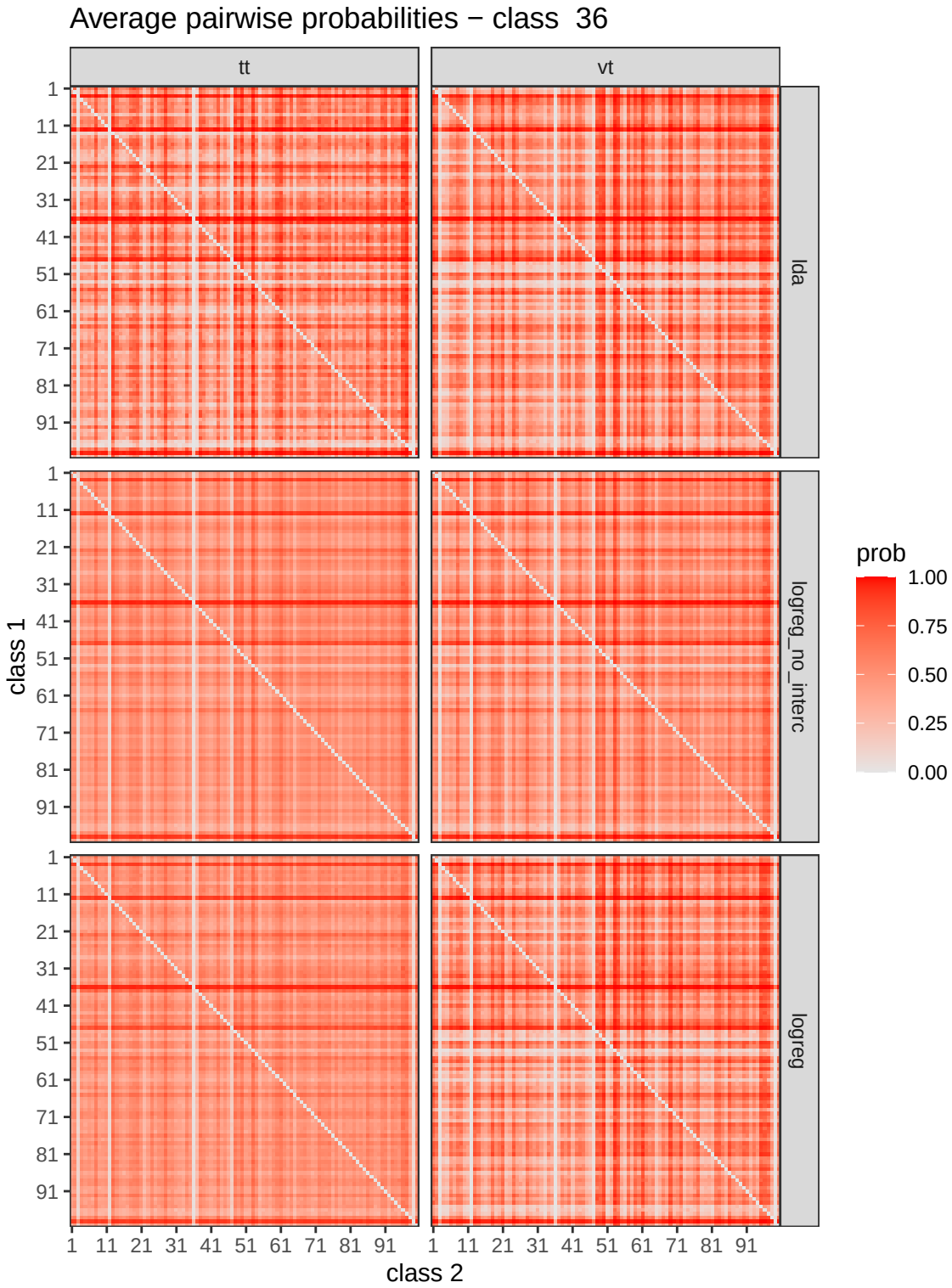
Average pairwise probabilities − class 36
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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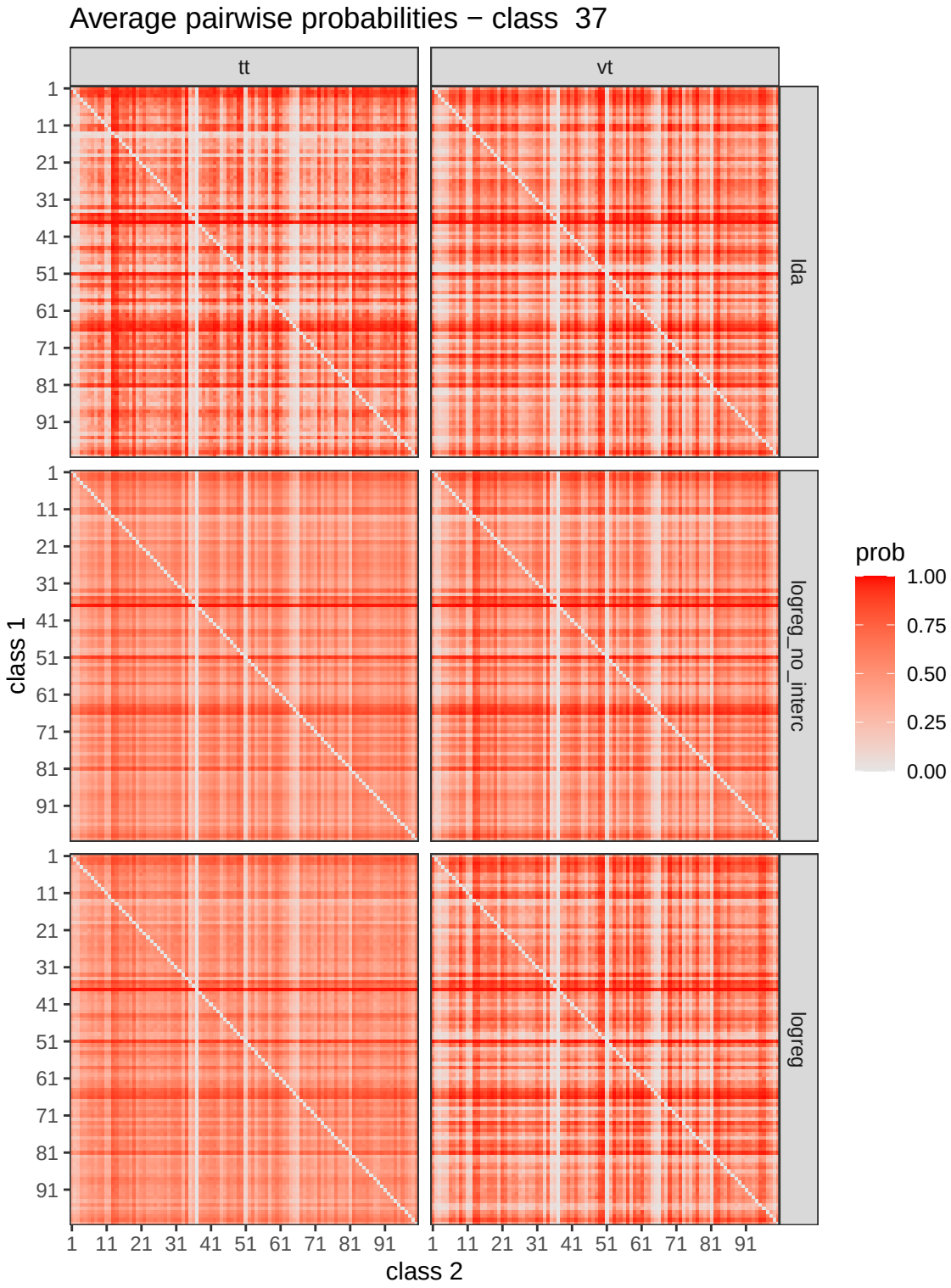
Average pairwise probabilities − class 37
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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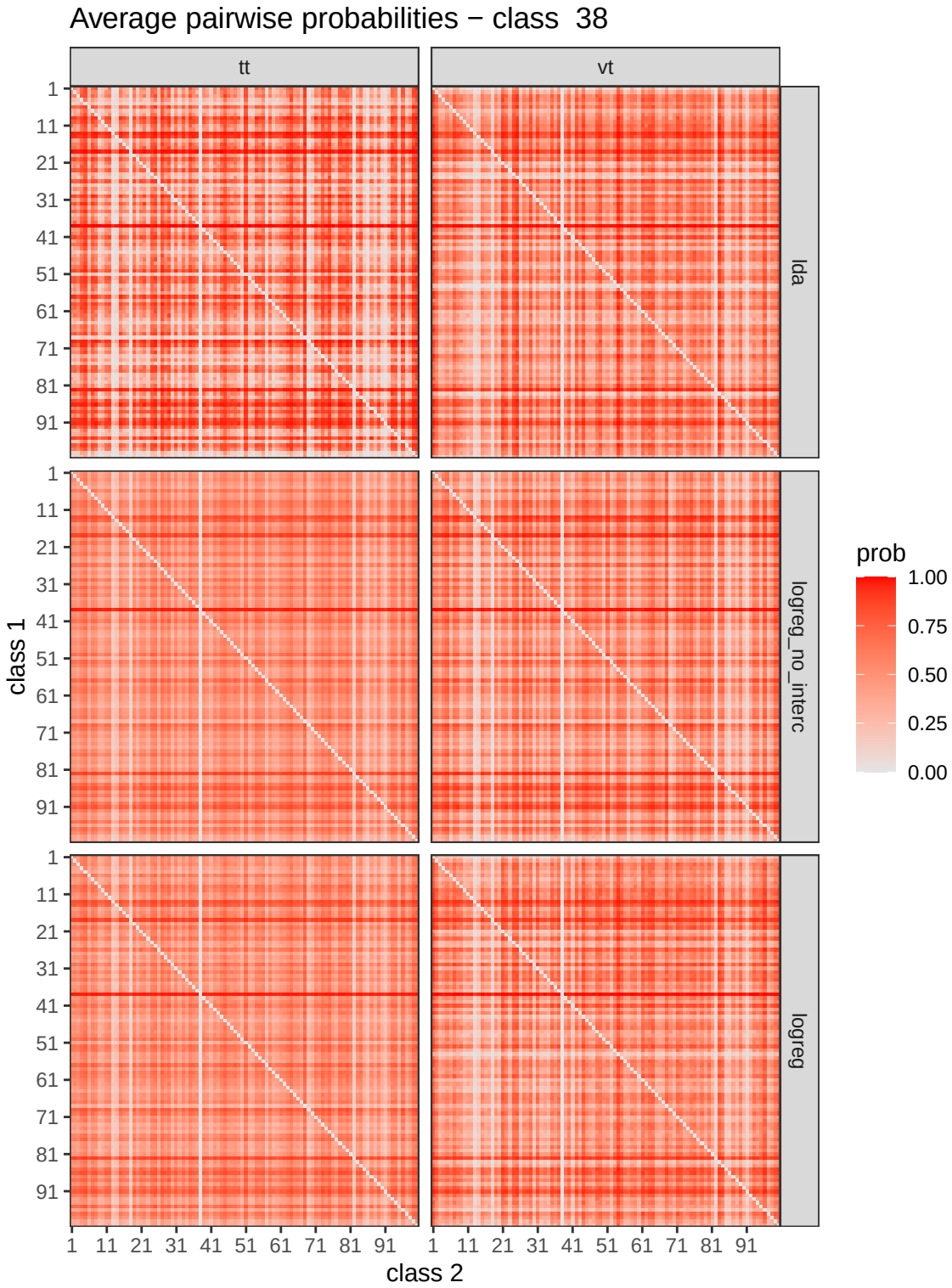
Average pairwise probabilities − class 38
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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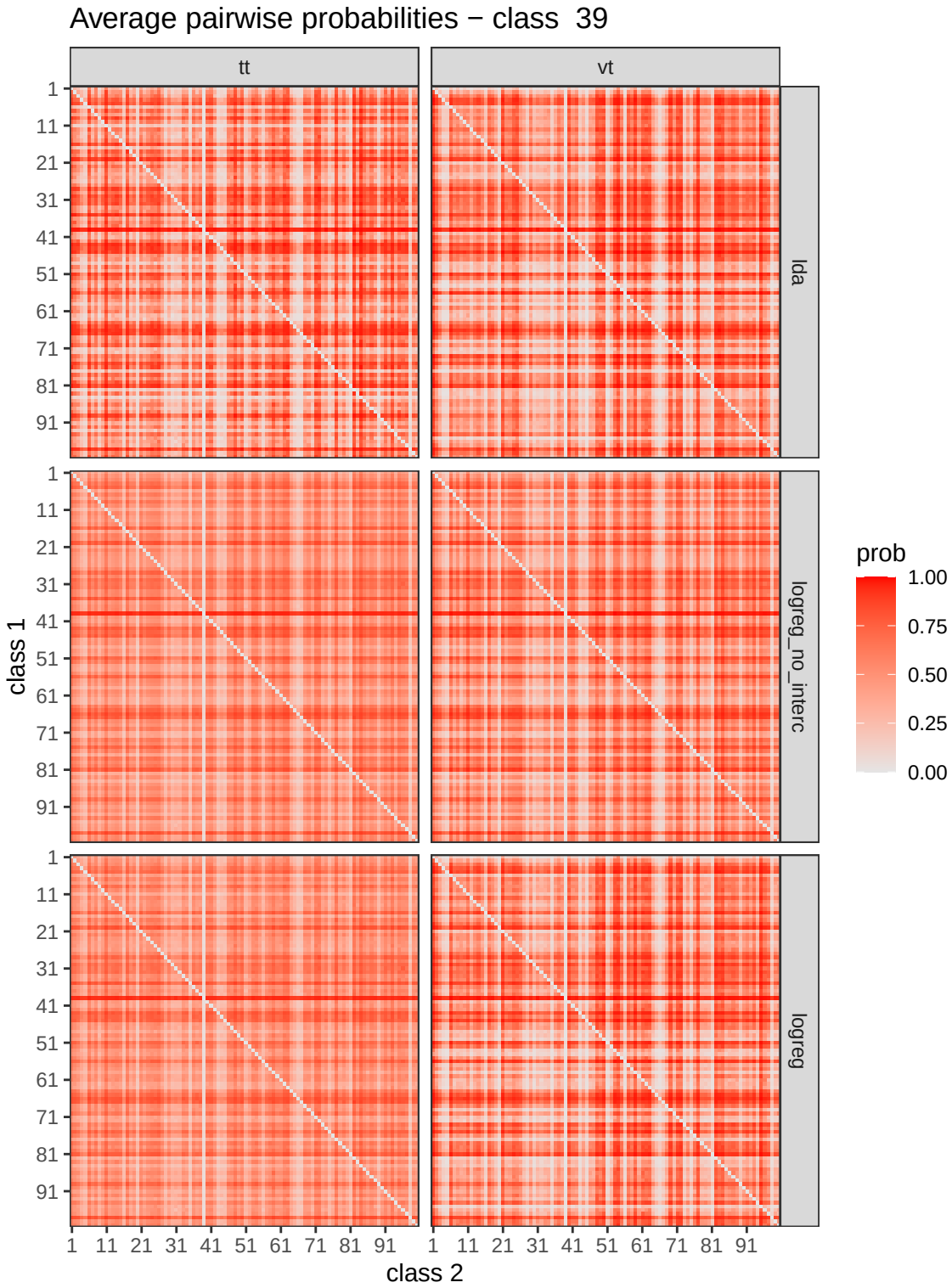
Average pairwise probabilities − class 39
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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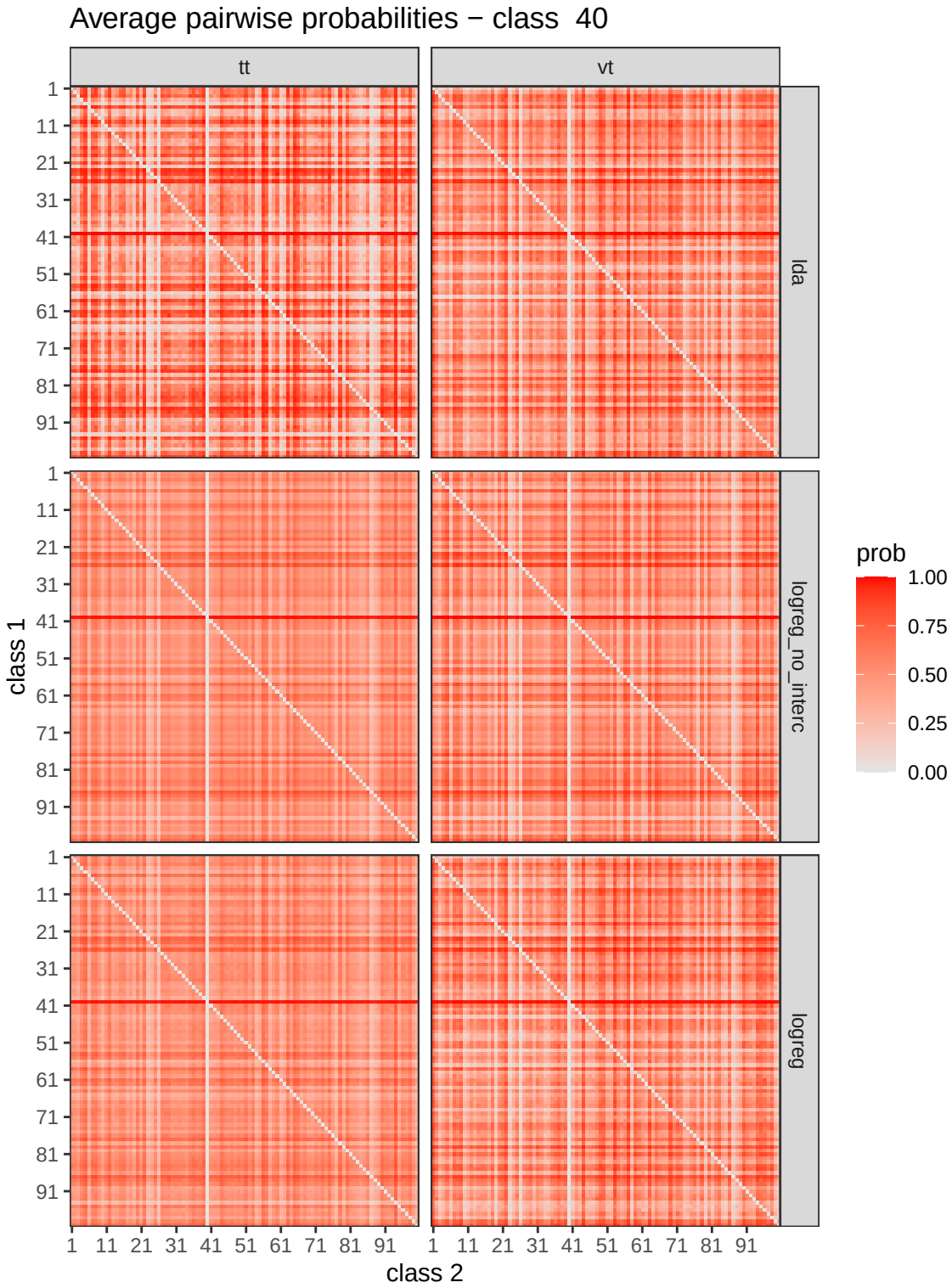
Average pairwise probabilities − class 40
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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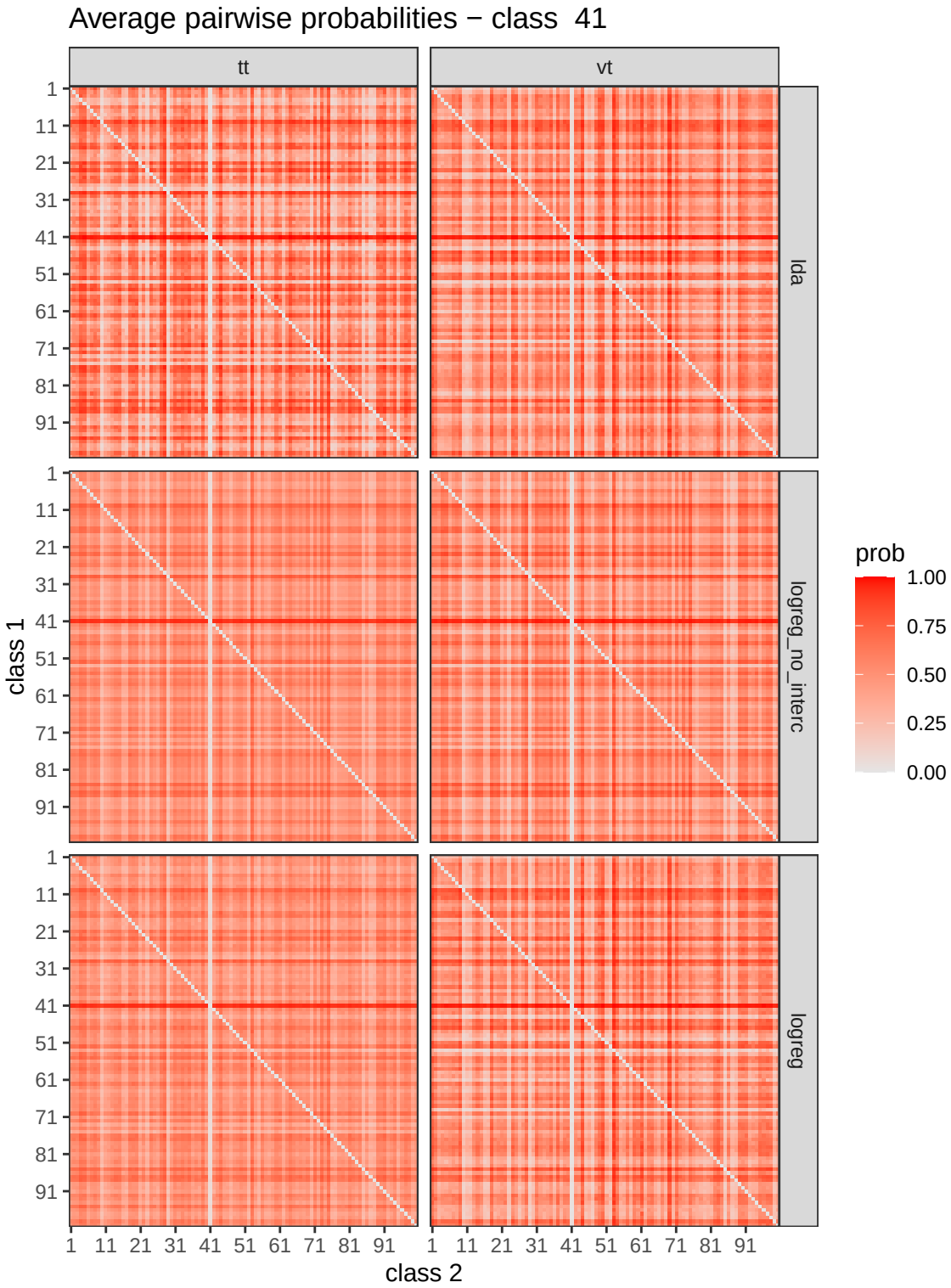
Average pairwise probabilities − class 41
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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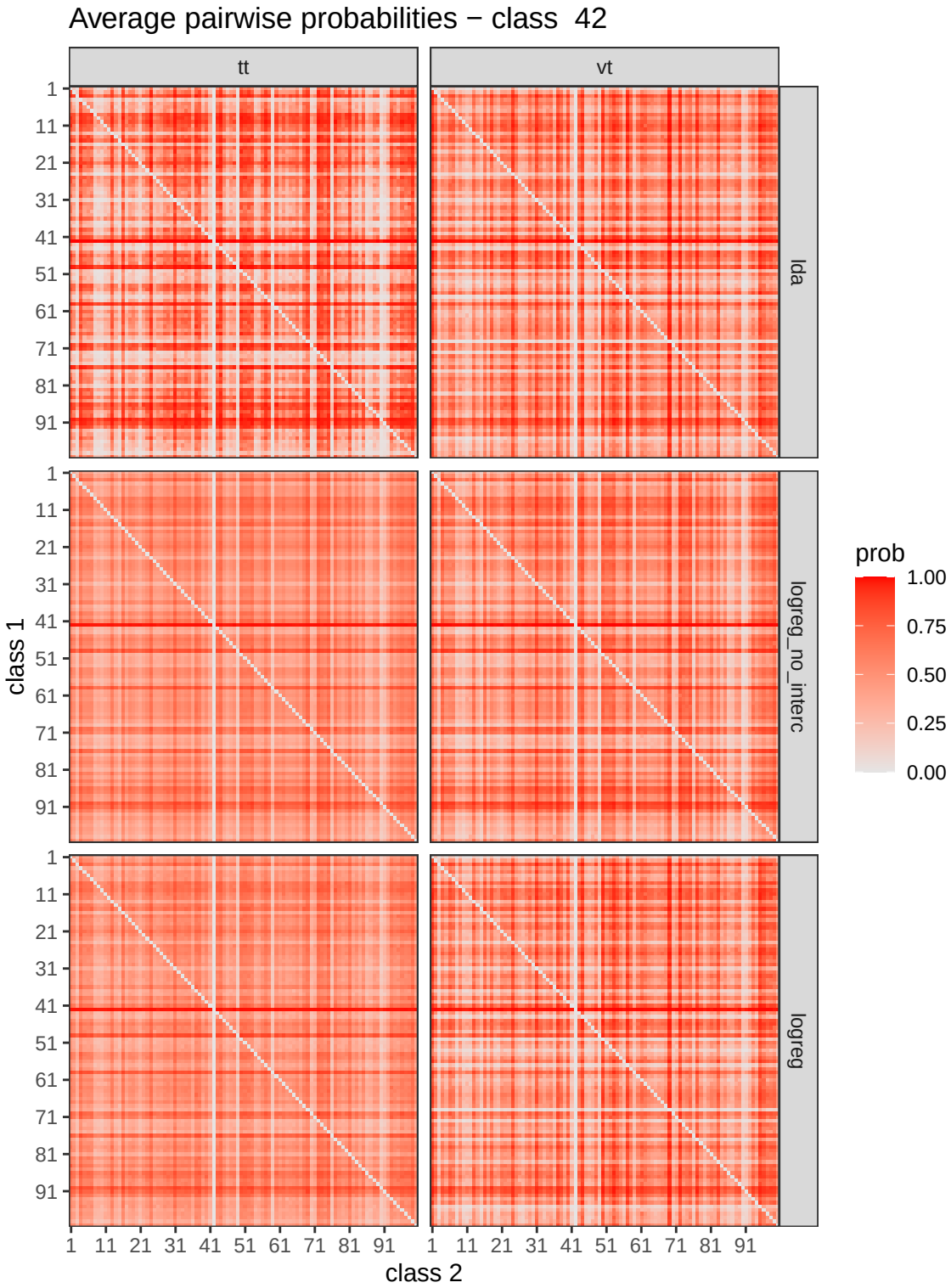
Average pairwise probabilities − class 42
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.75
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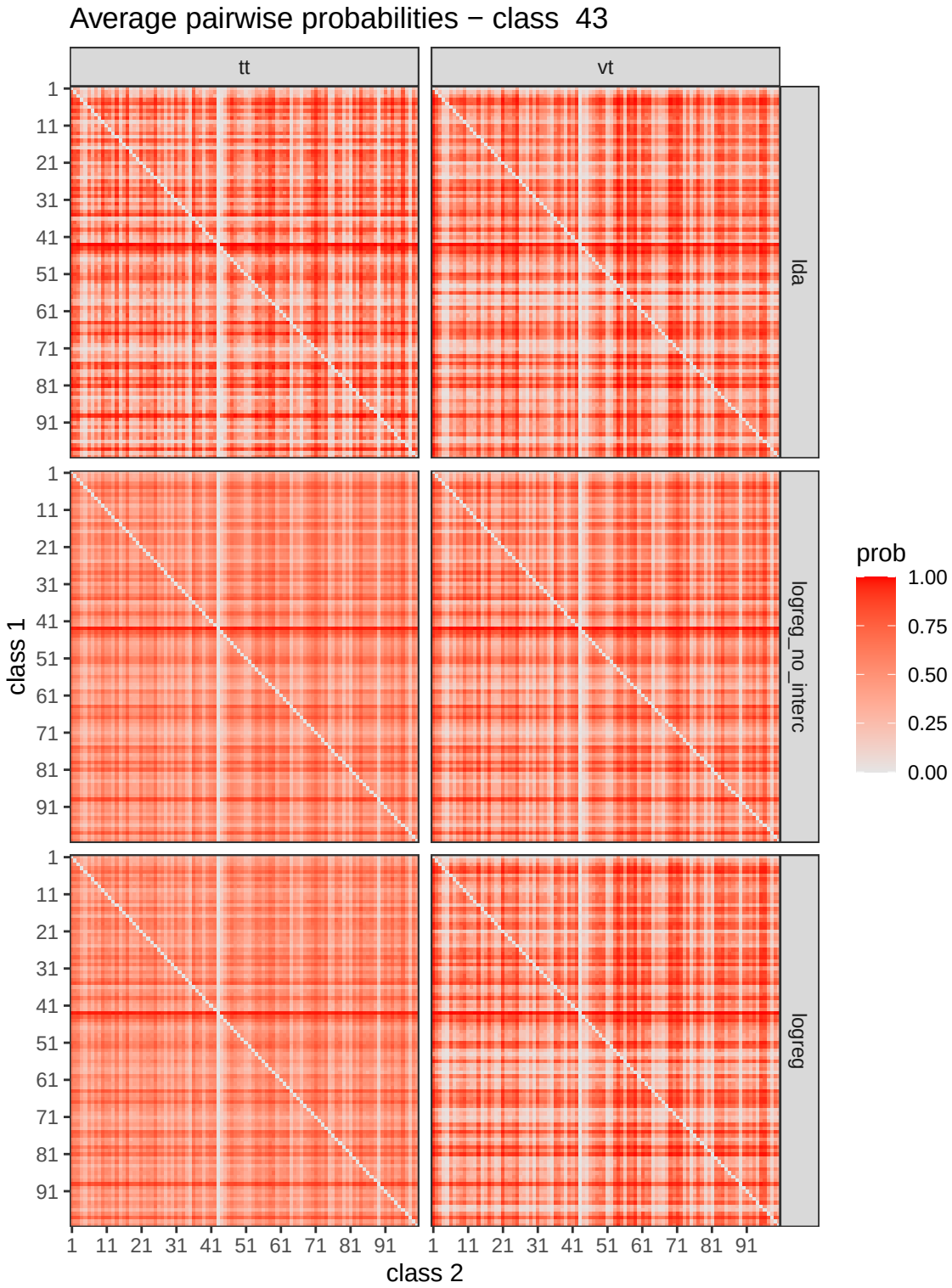
Average pairwise probabilities − class 43
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
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81
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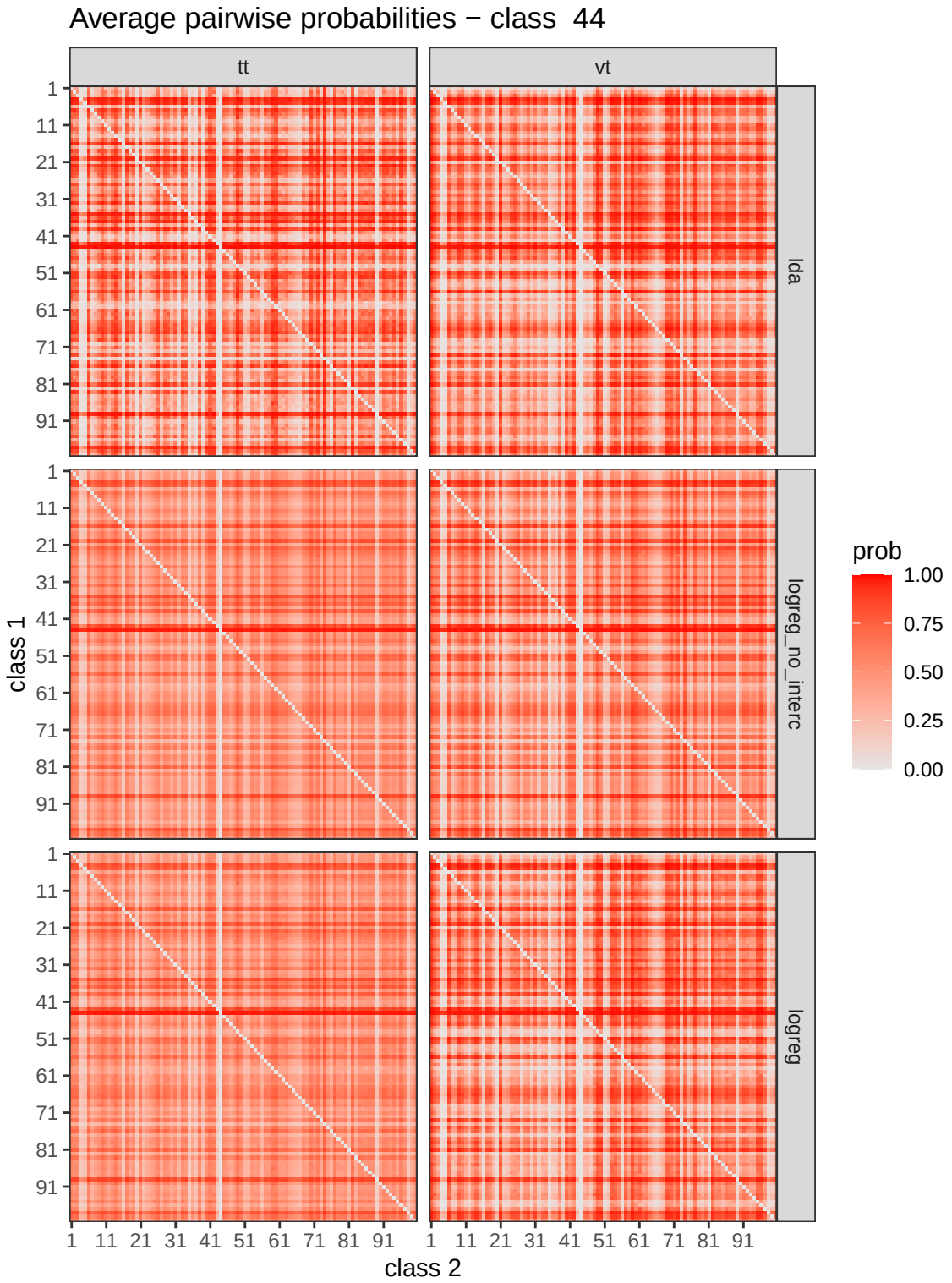
Average pairwise probabilities − class 44
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
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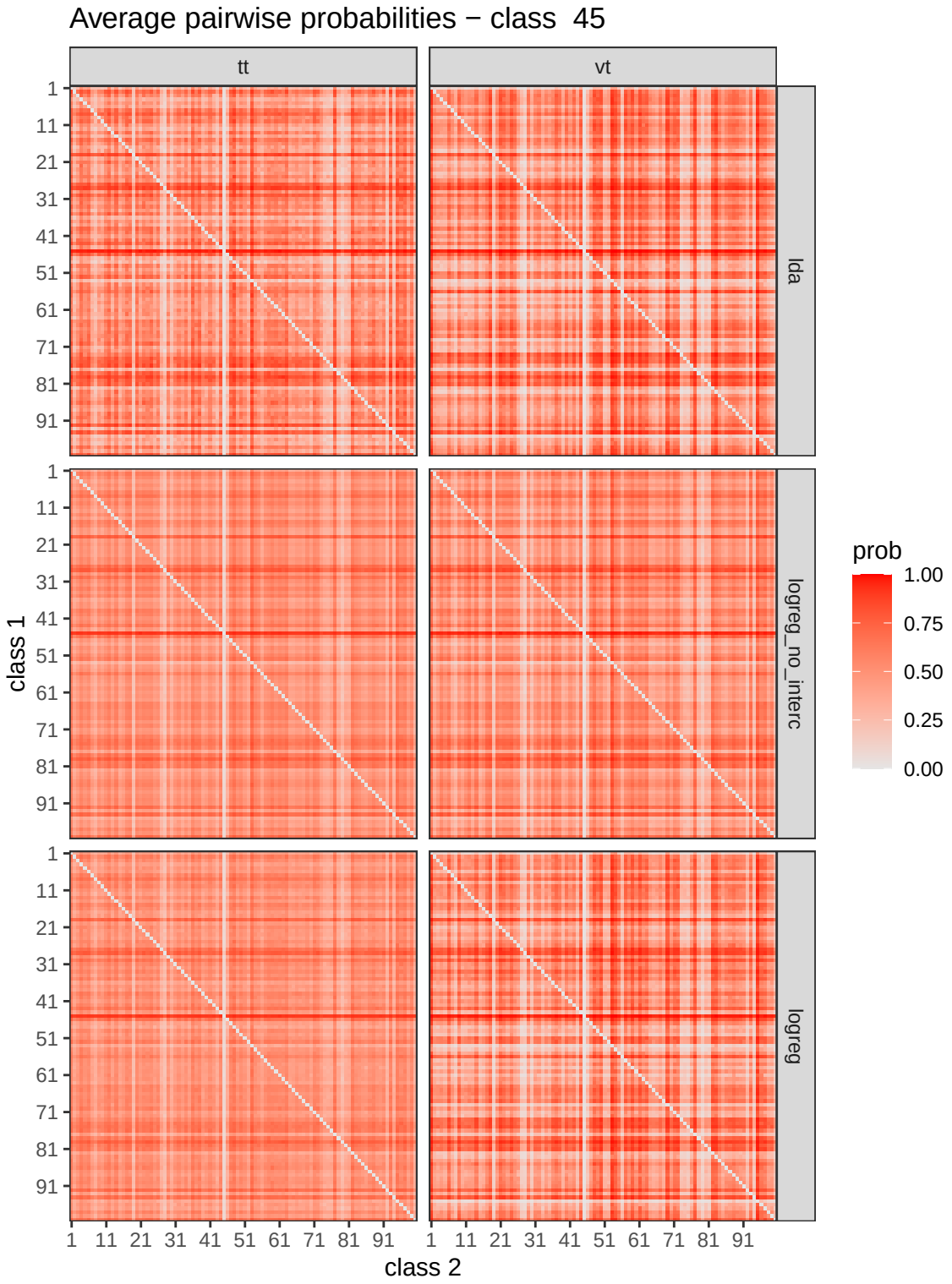
Average pairwise probabilities − class 45
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vt
lda
logreg_no_interc
logreg
class 1
class 2
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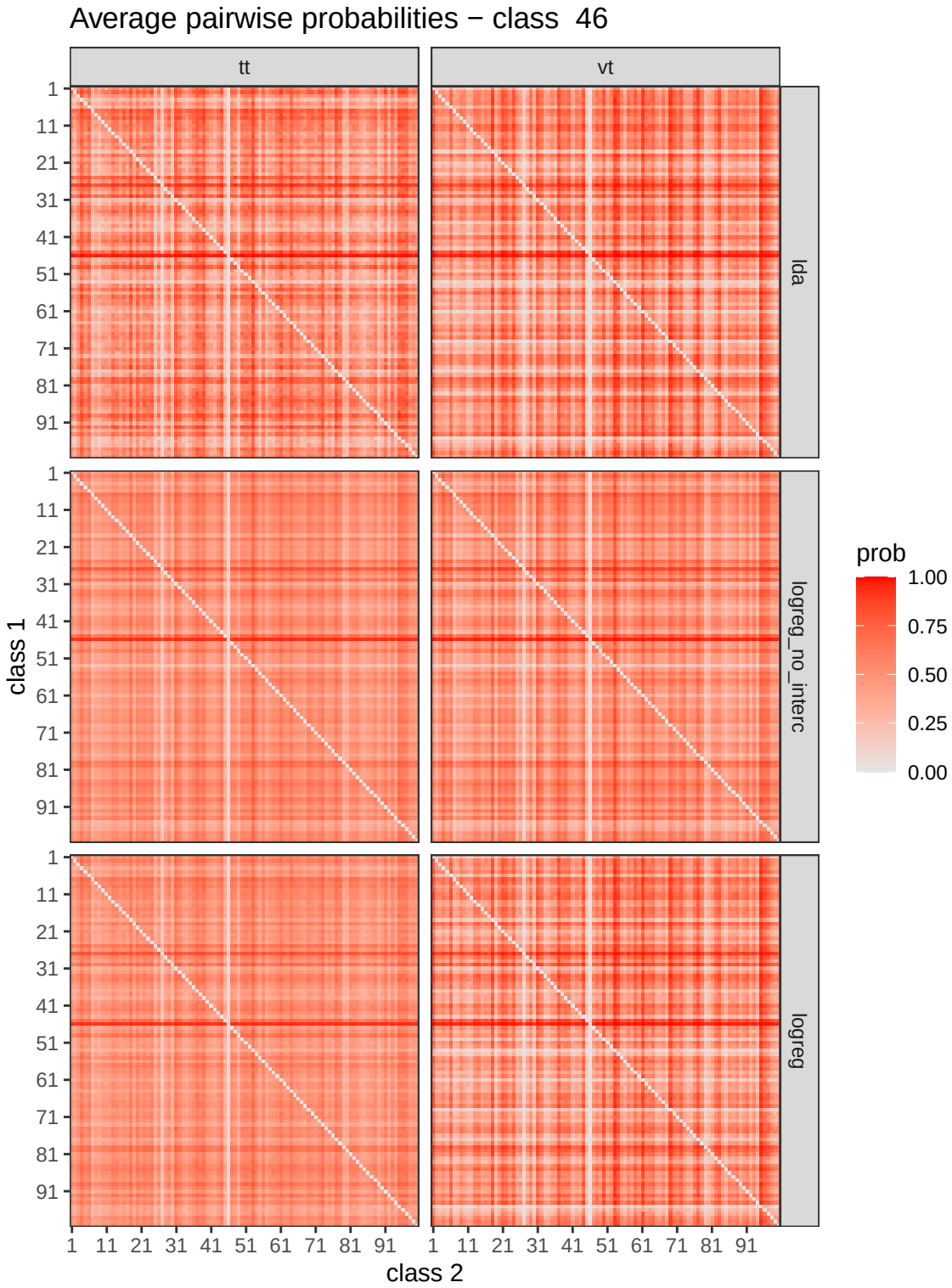
Average pairwise probabilities − class 46
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lda
logreg_no_interc
logreg
class 1
class 2
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71
81
91
prob
1.00
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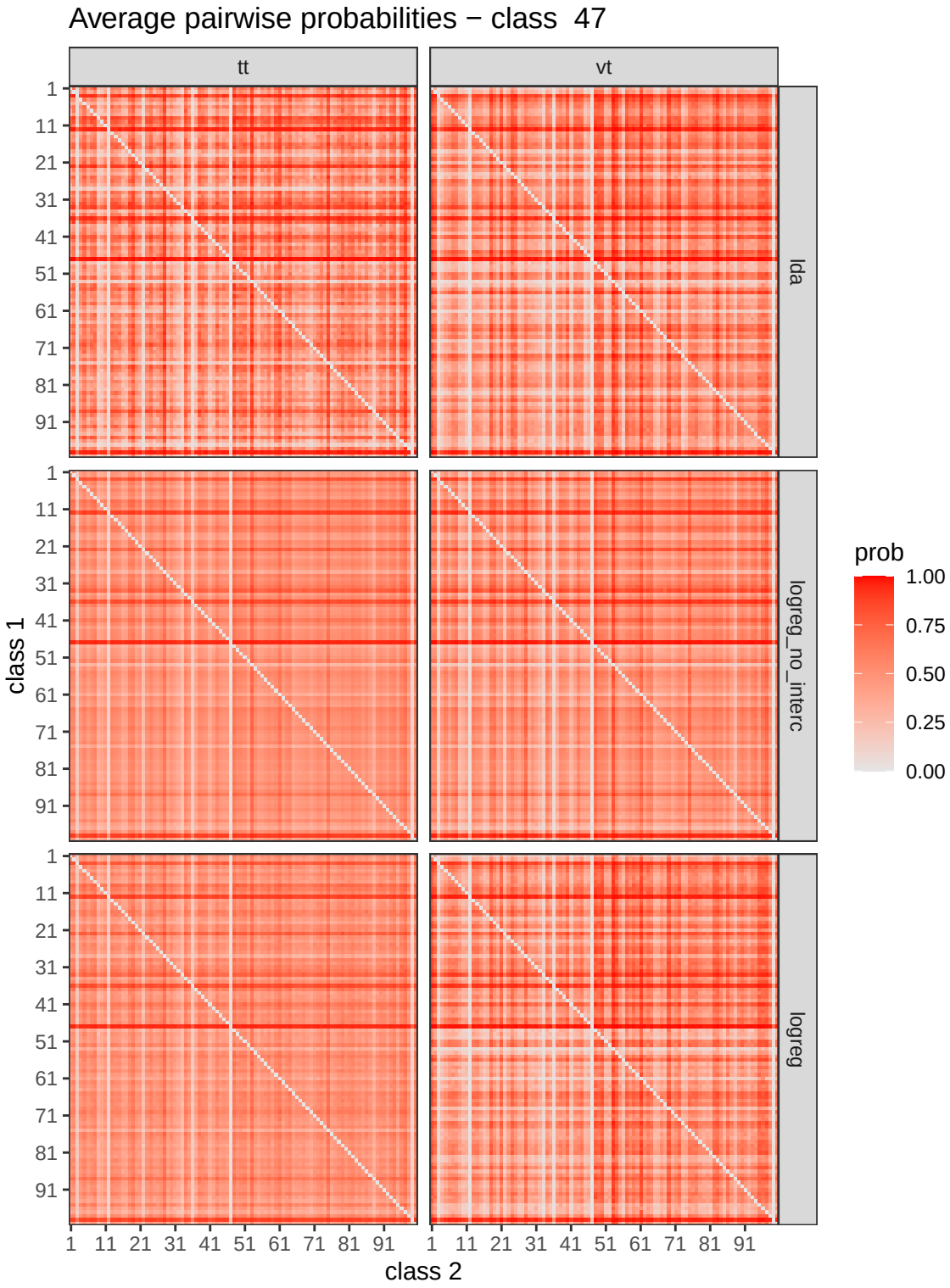
0.25
0.00


Average pairwise probabilities − class 47
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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1
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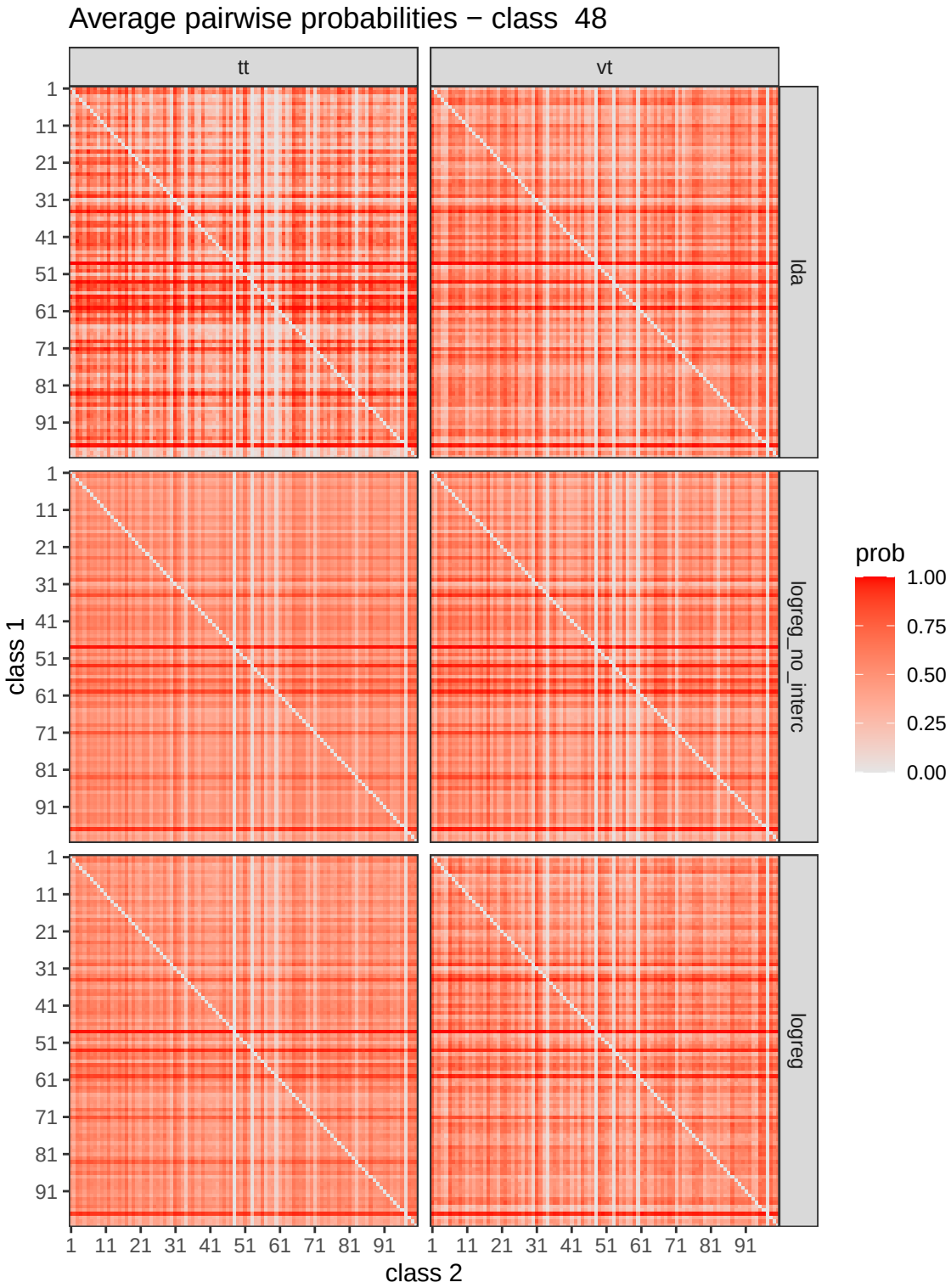
Average pairwise probabilities − class 48
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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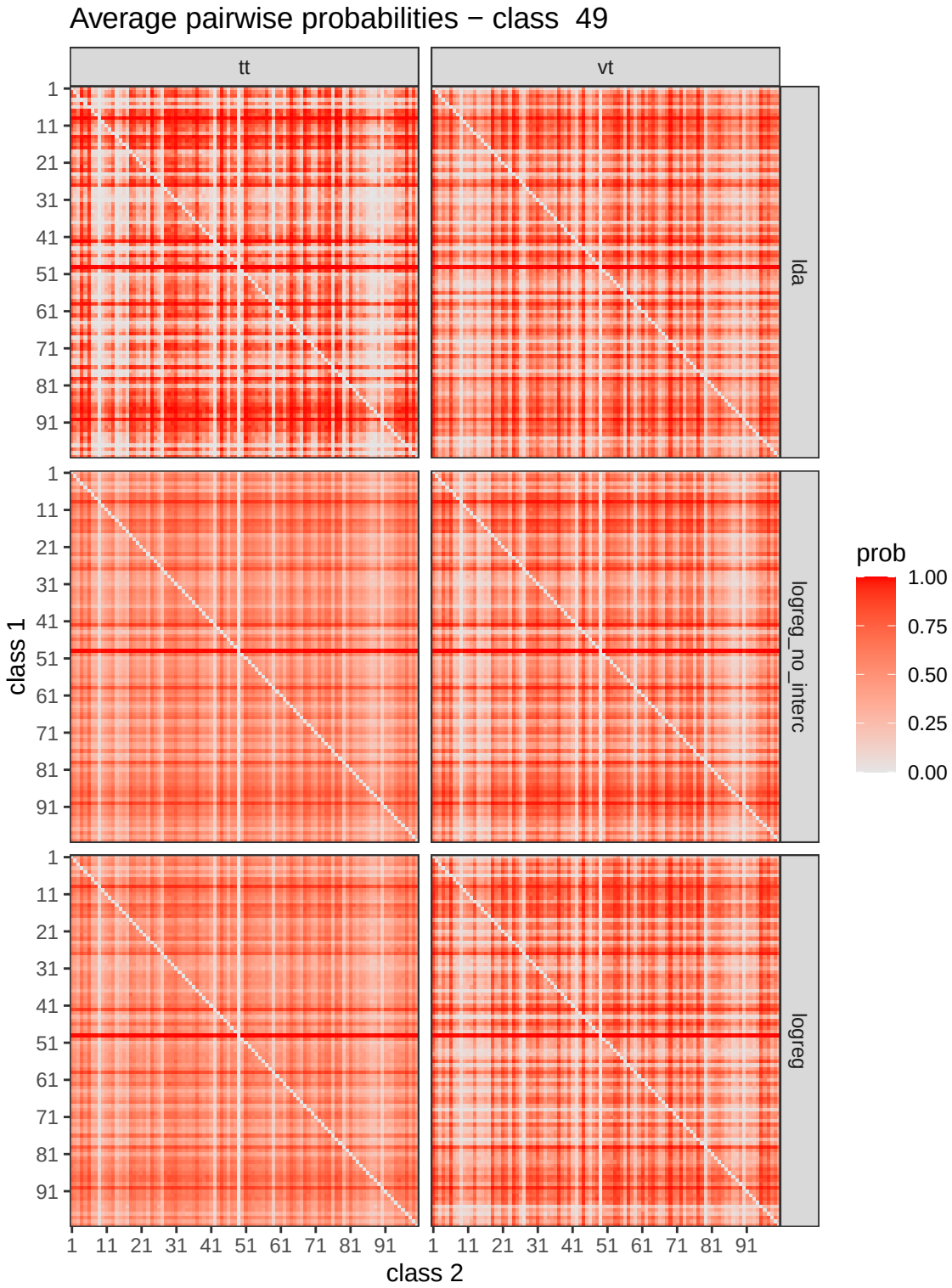
Average pairwise probabilities − class 49
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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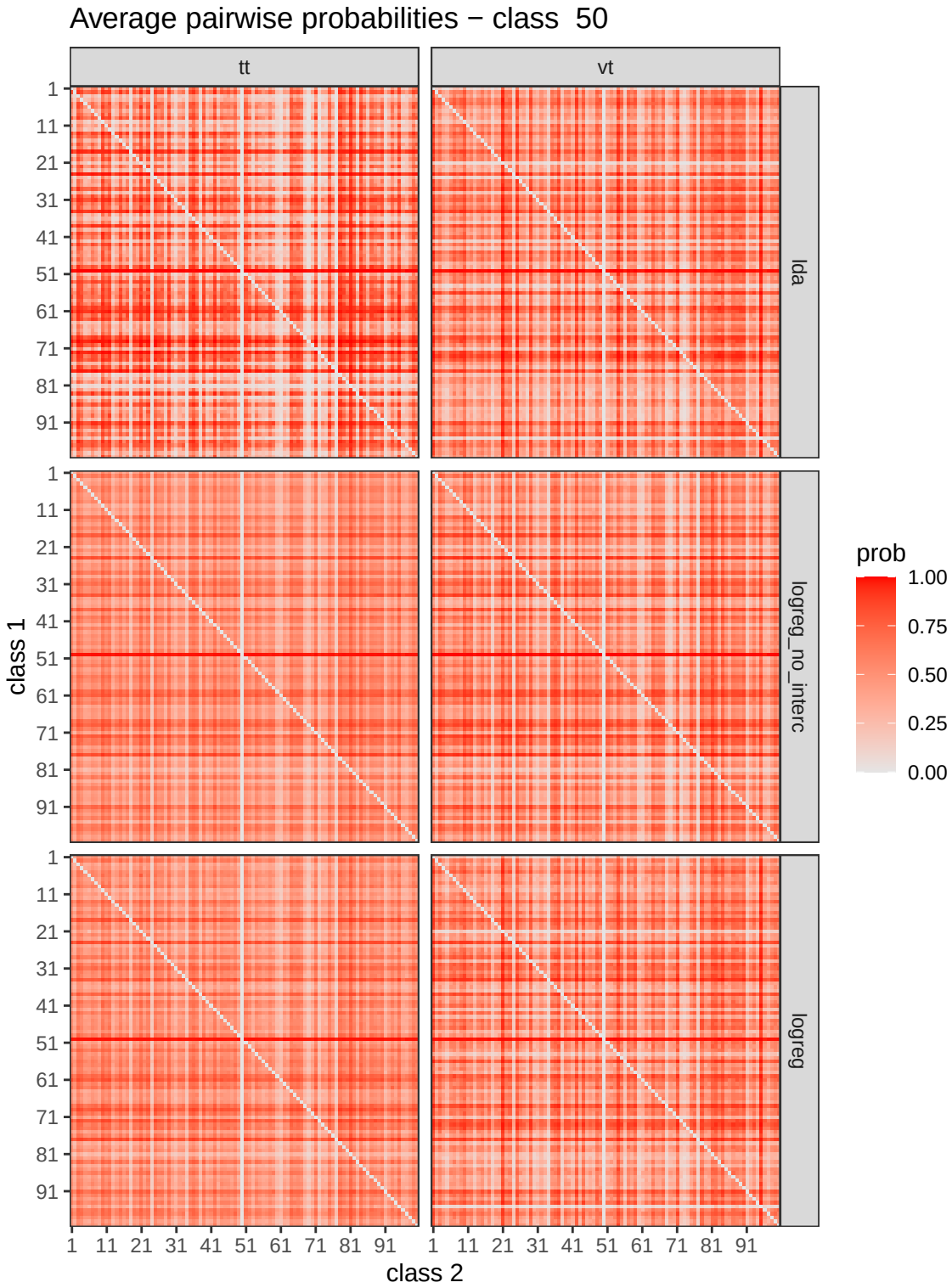
Average pairwise probabilities − class 50
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
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81
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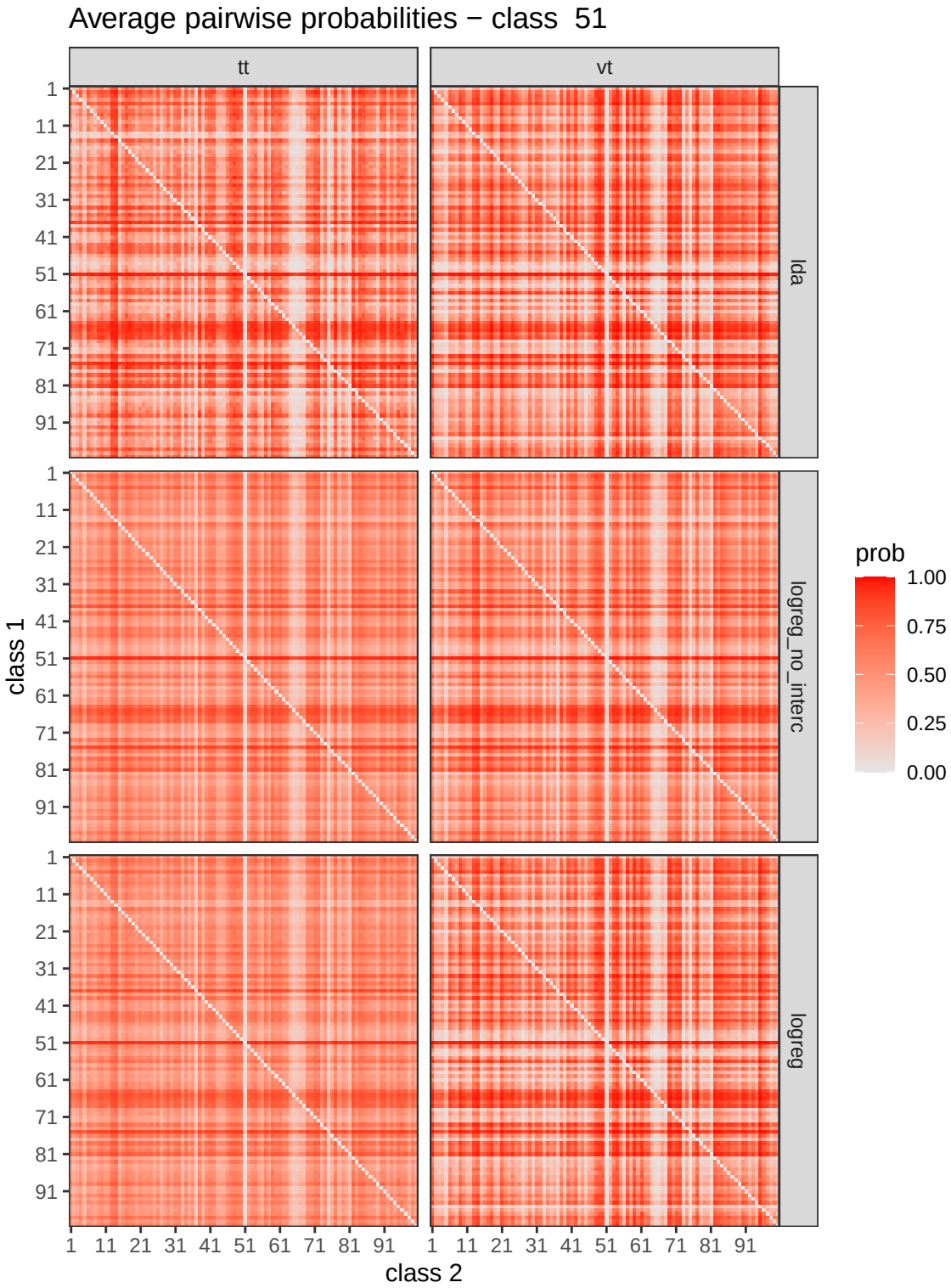
Average pairwise probabilities − class 51
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
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81
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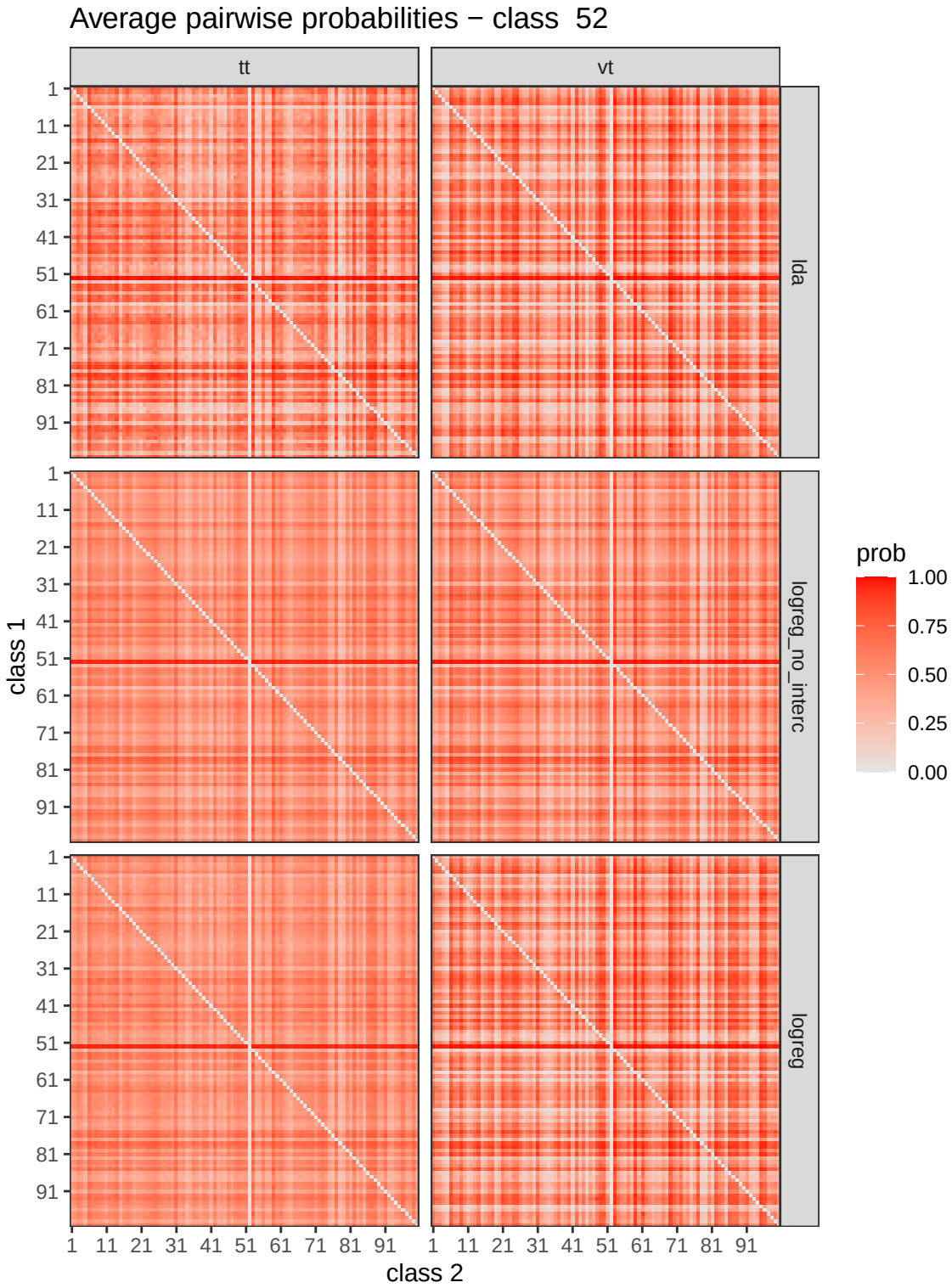
Average pairwise probabilities − class 52
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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81
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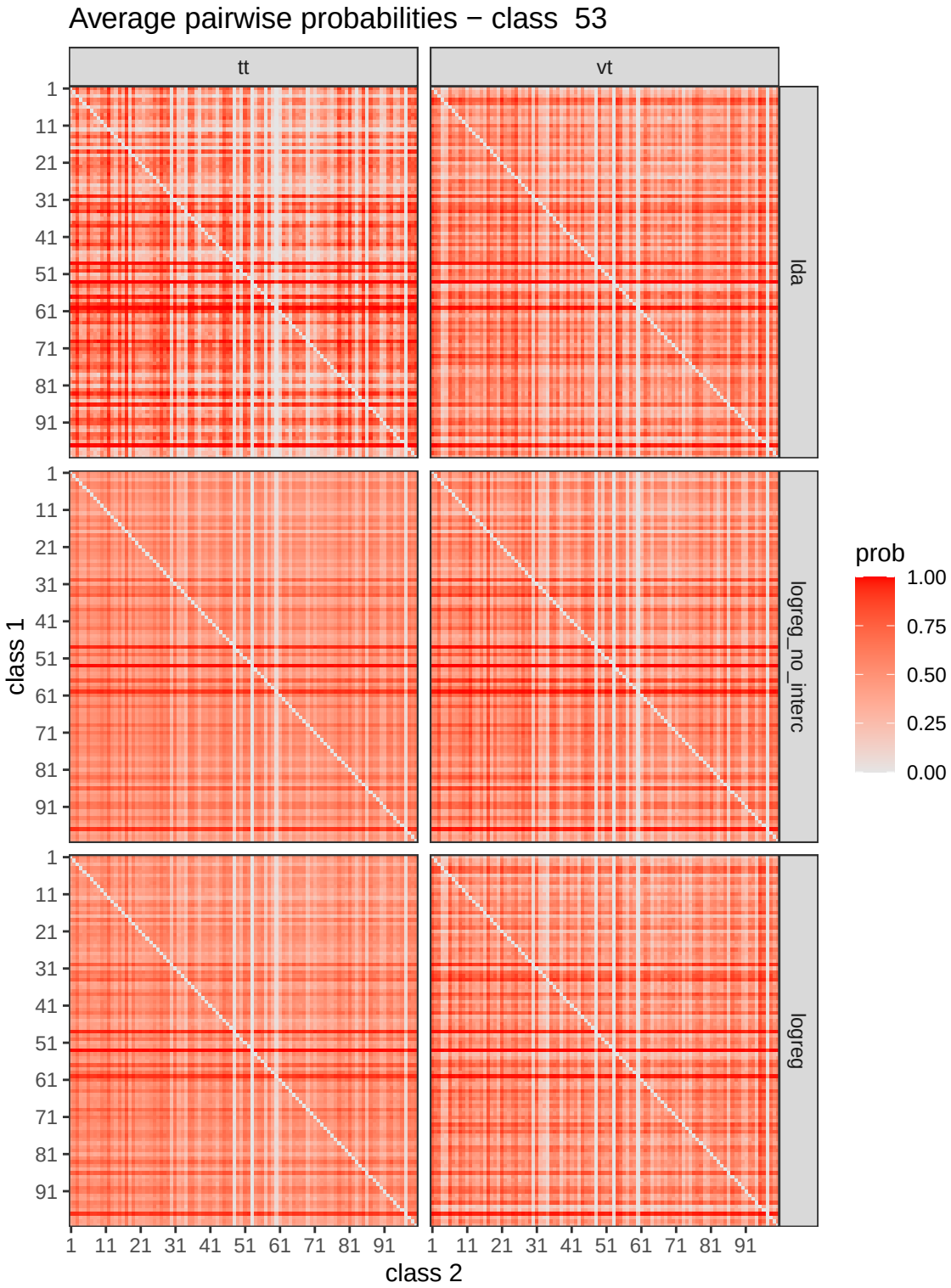
Average pairwise probabilities − class 53
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
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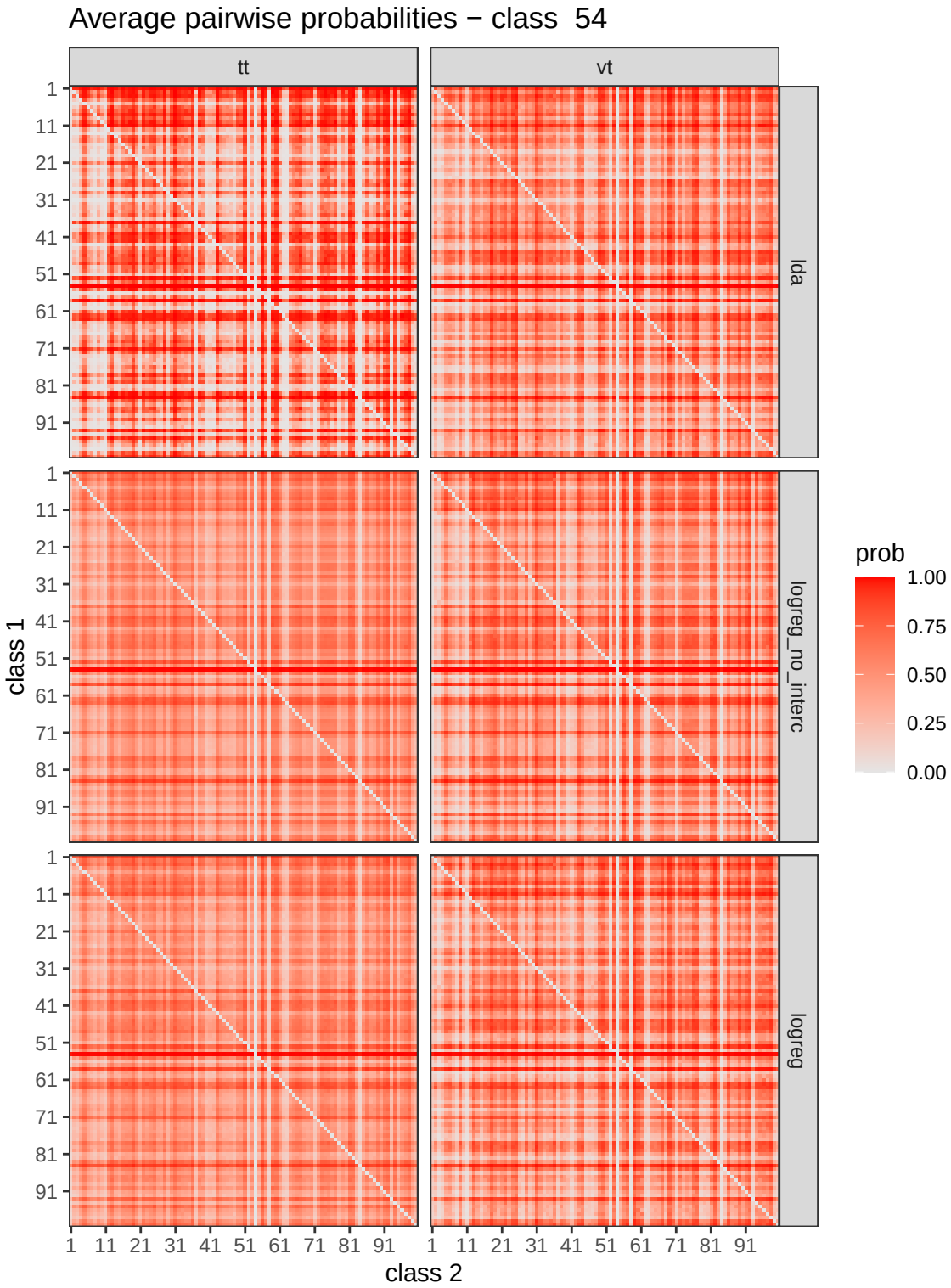
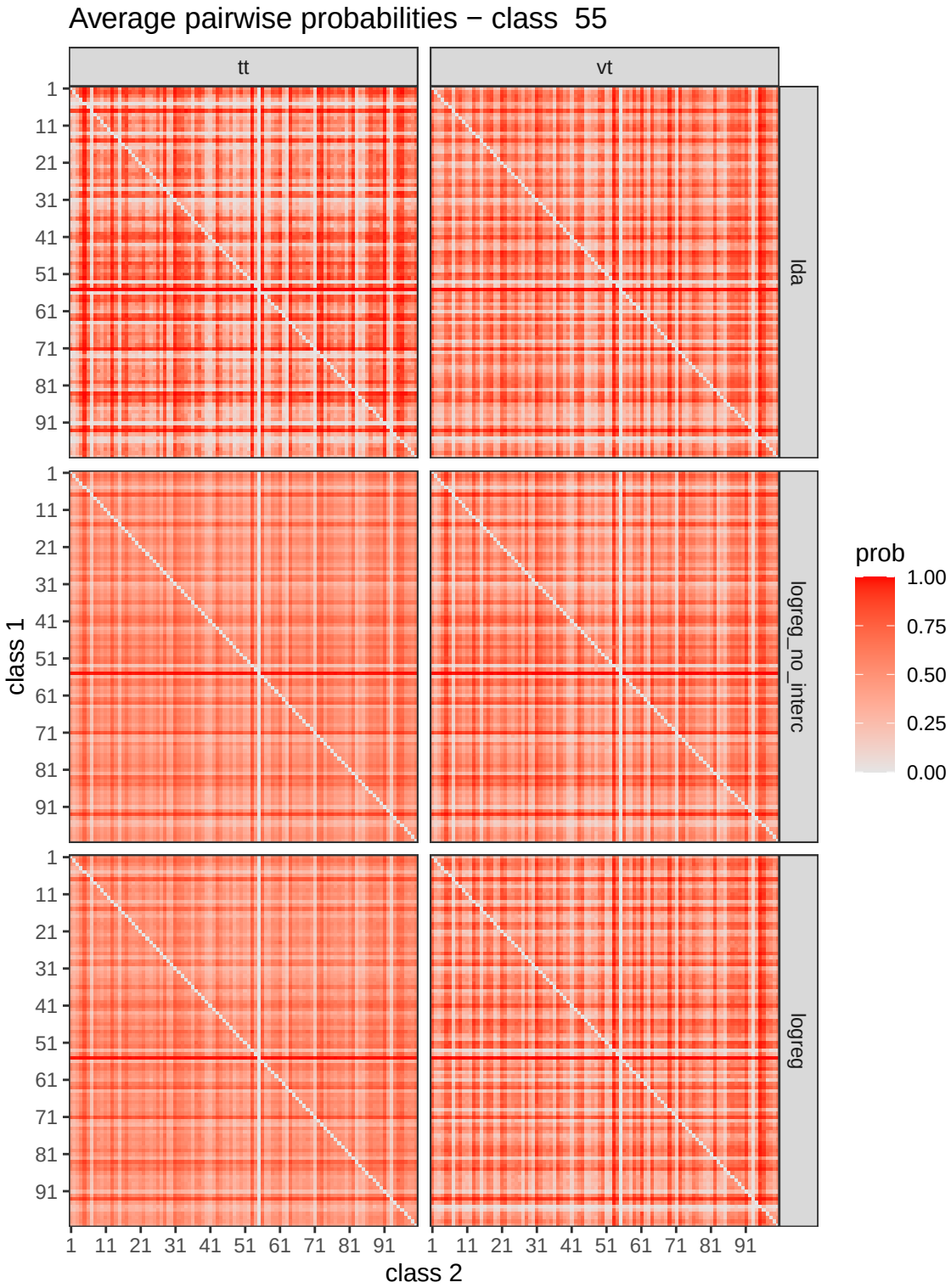
81
91


Average pairwise probabilities − class 54
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1 11 21 31 41 51 61 71 81 91


Average pairwise probabilities − class 55
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
0.00
1
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21
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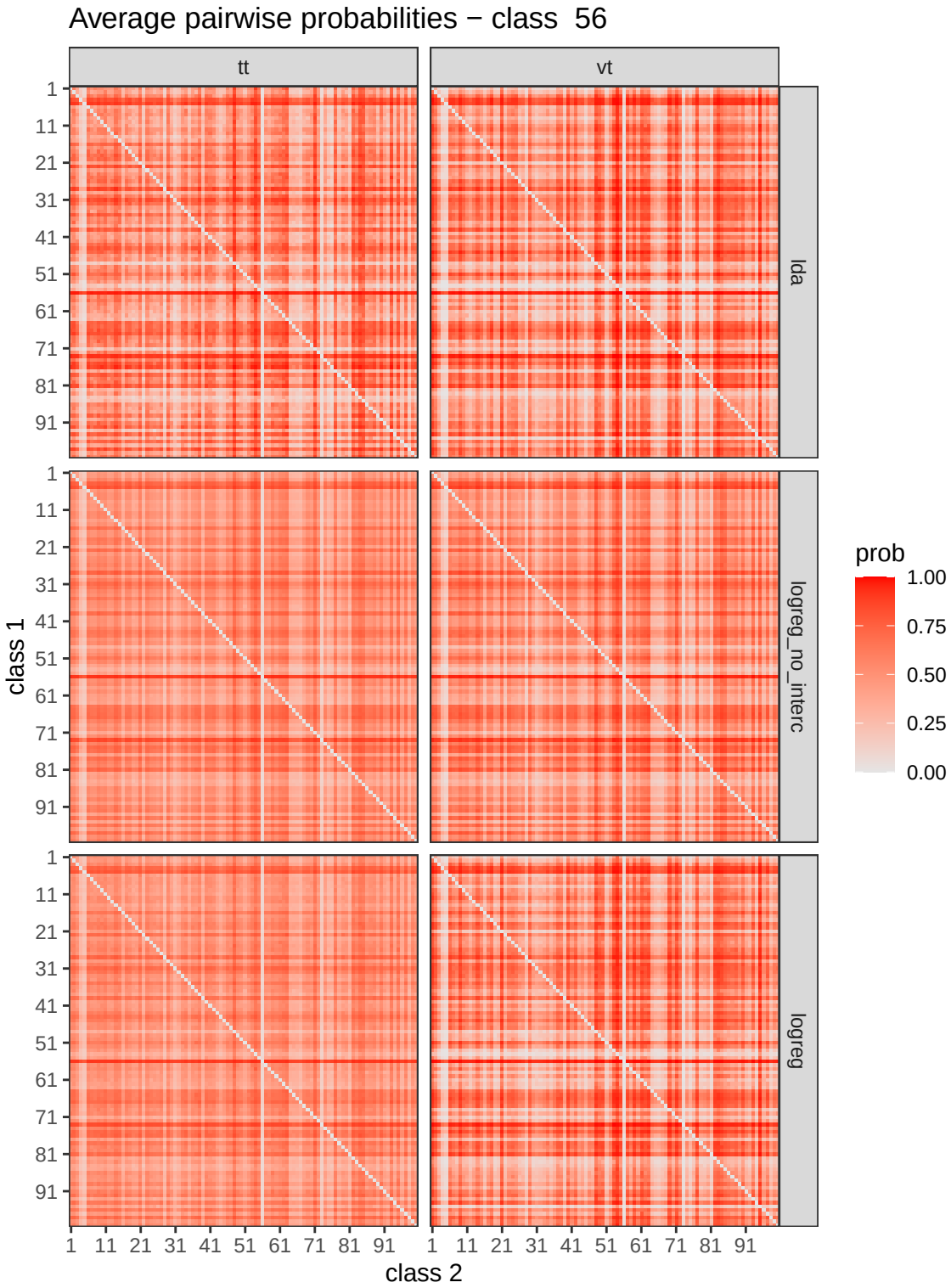
61
71
81
91


Average pairwise probabilities − class 56
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vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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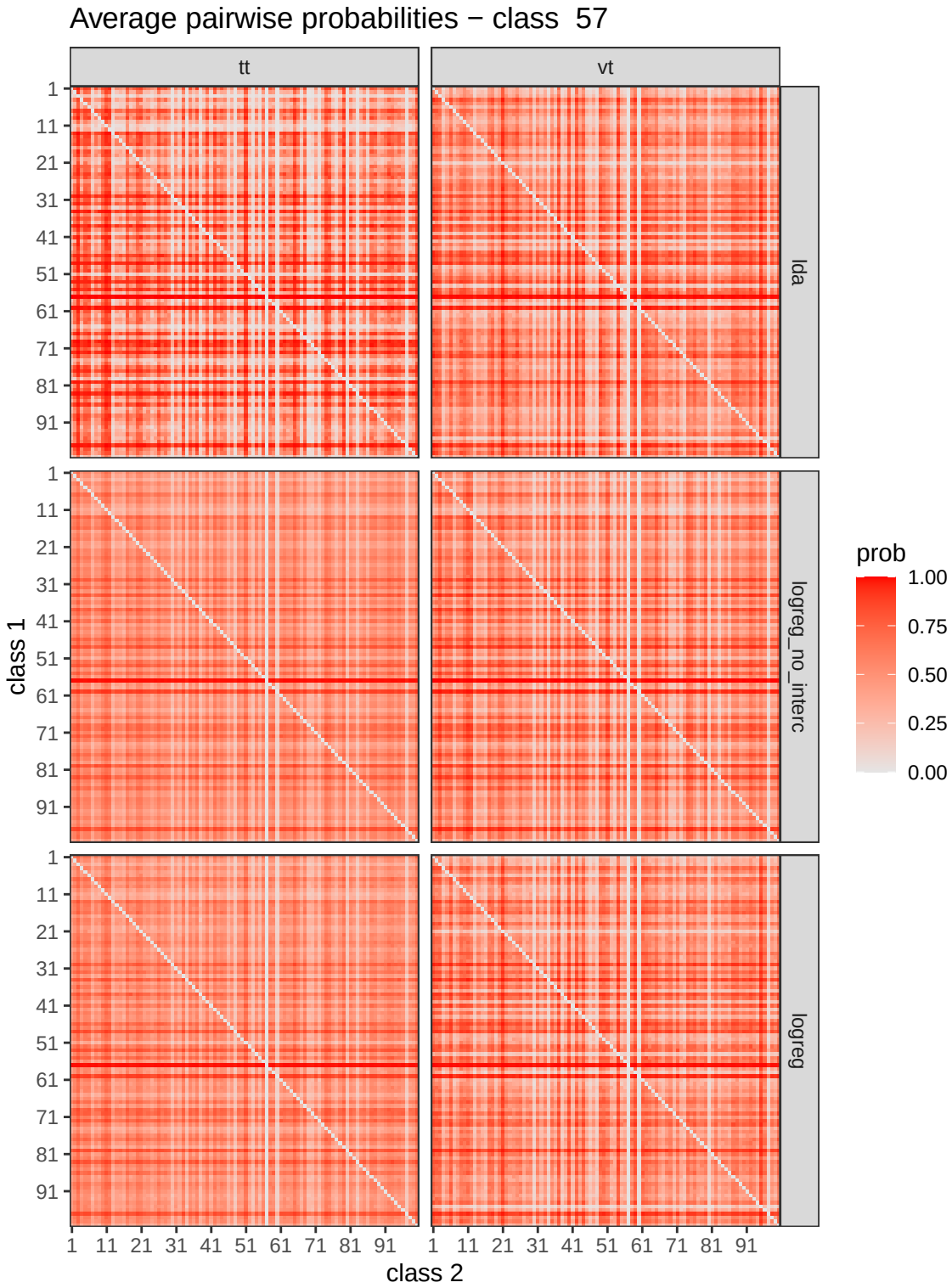
81
91


Average pairwise probabilities − class 57
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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0.50
0.25
0.00
1
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81
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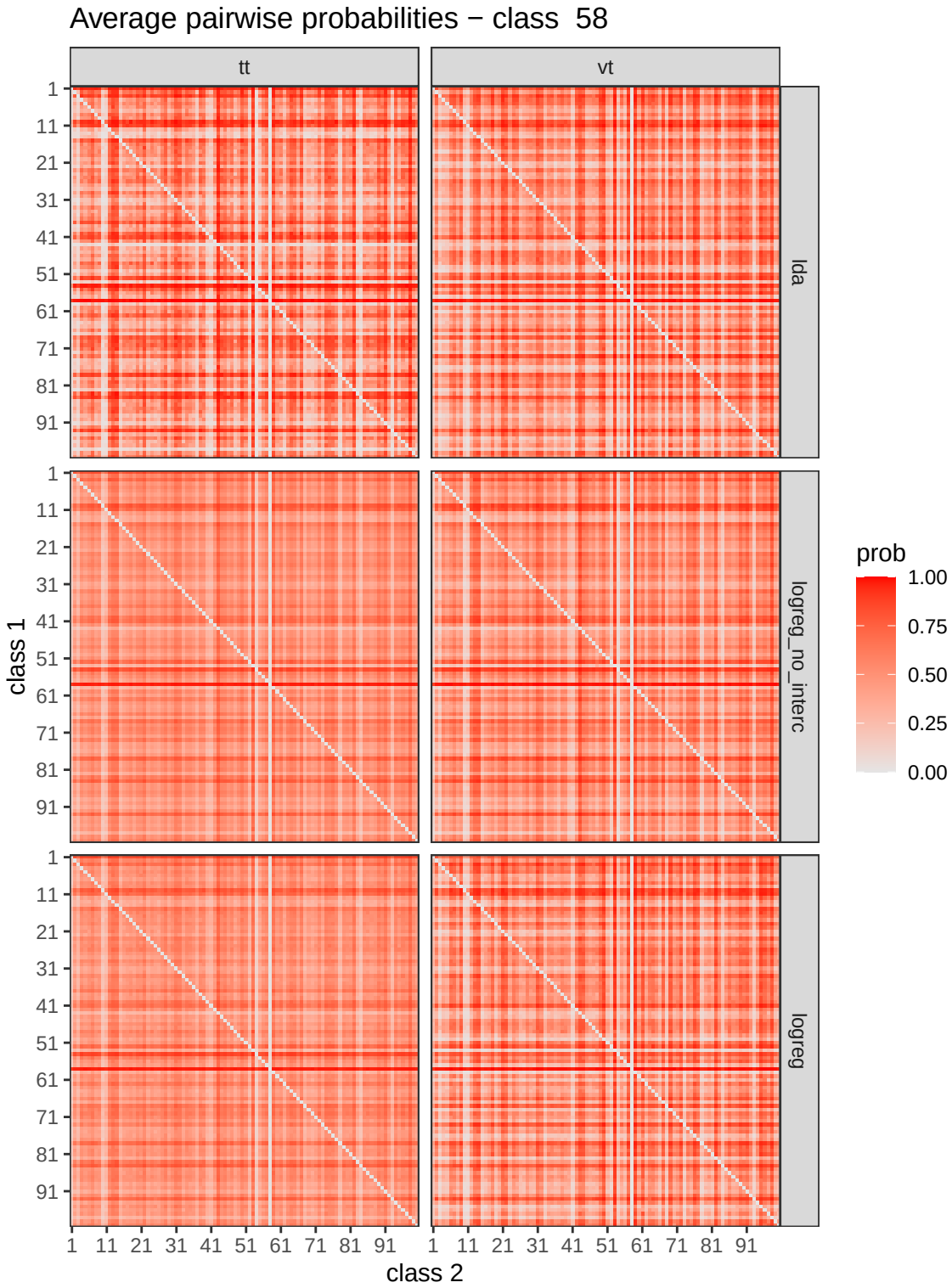
Average pairwise probabilities − class 58
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
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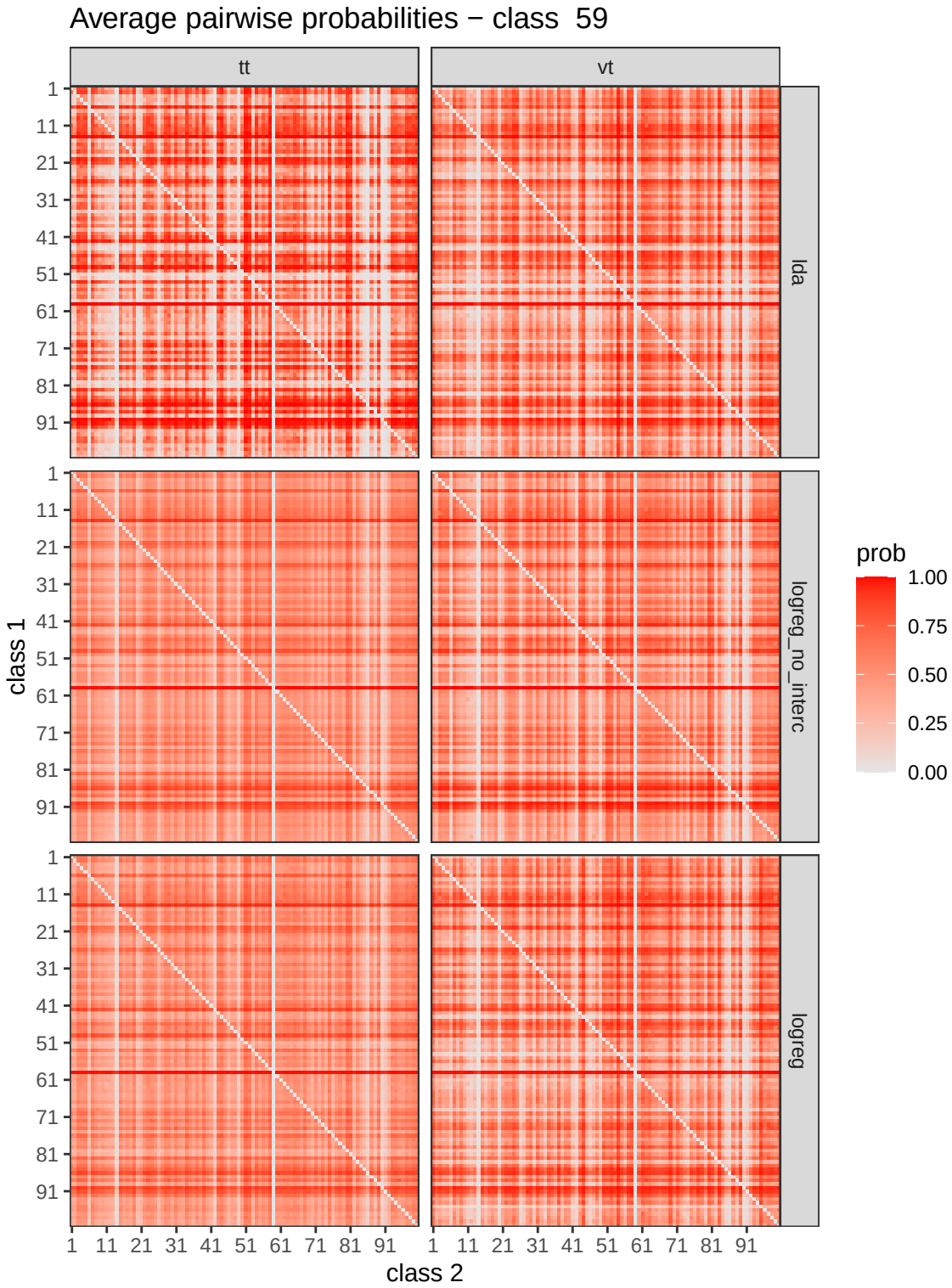
Average pairwise probabilities − class 59
tt
vt
lda
logreg_no_interc
logreg
class 1
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prob
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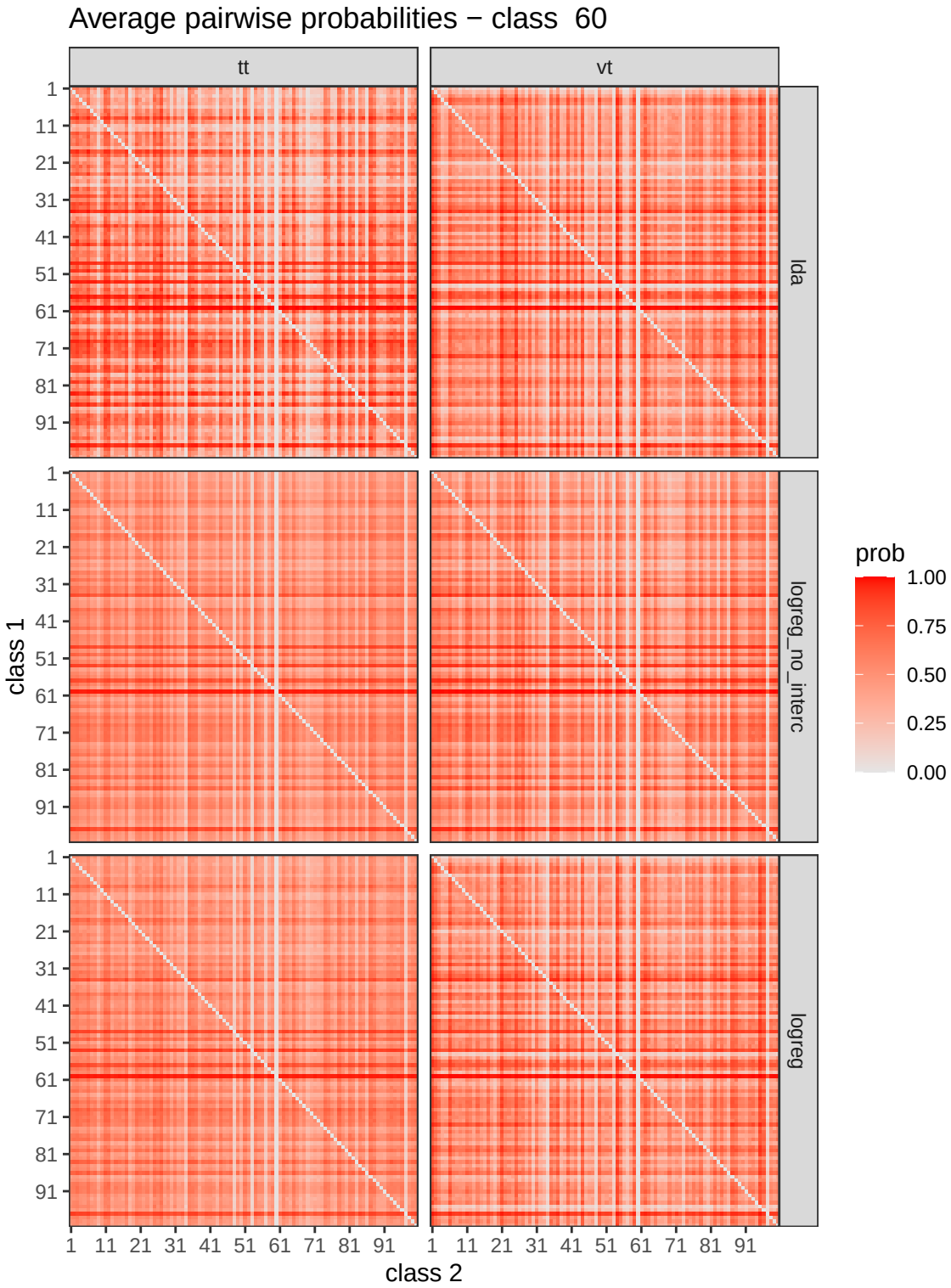
Average pairwise probabilities − class 60
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lda
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logreg
class 1
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prob
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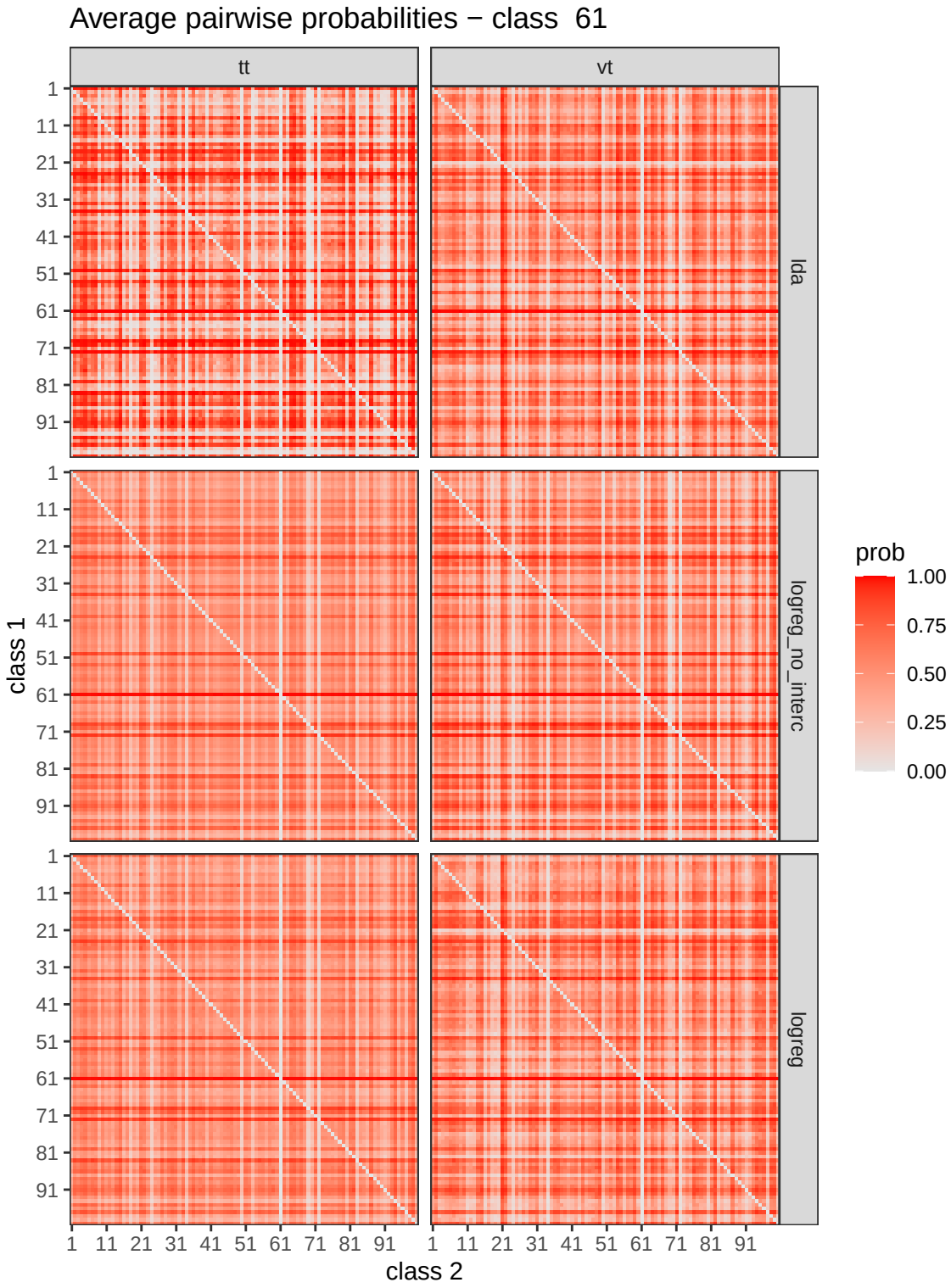
Average pairwise probabilities − class 61
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logreg
class 1
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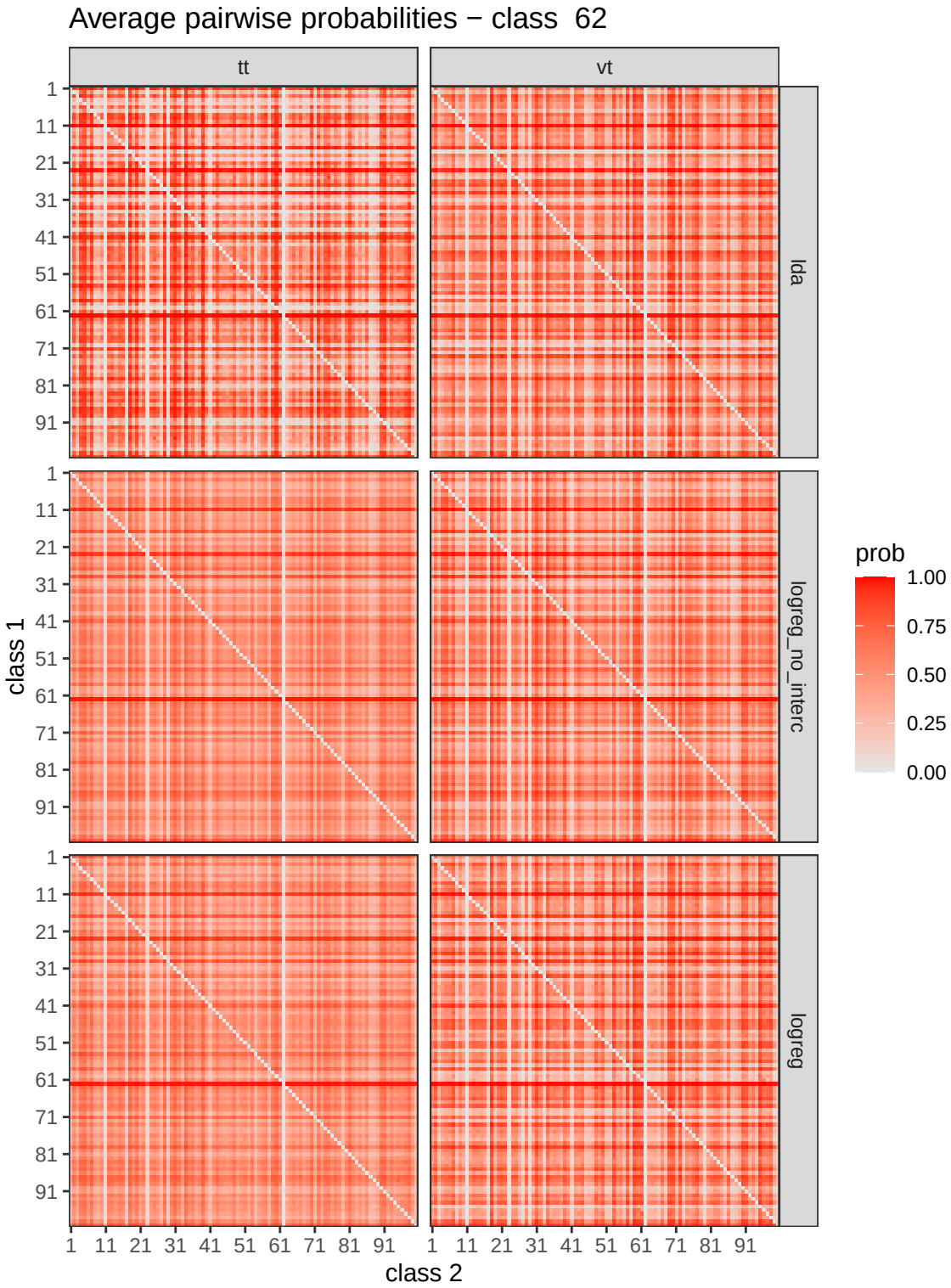
Average pairwise probabilities − class 62
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logreg_no_interc
logreg
class 1
class 2
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71
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91
prob
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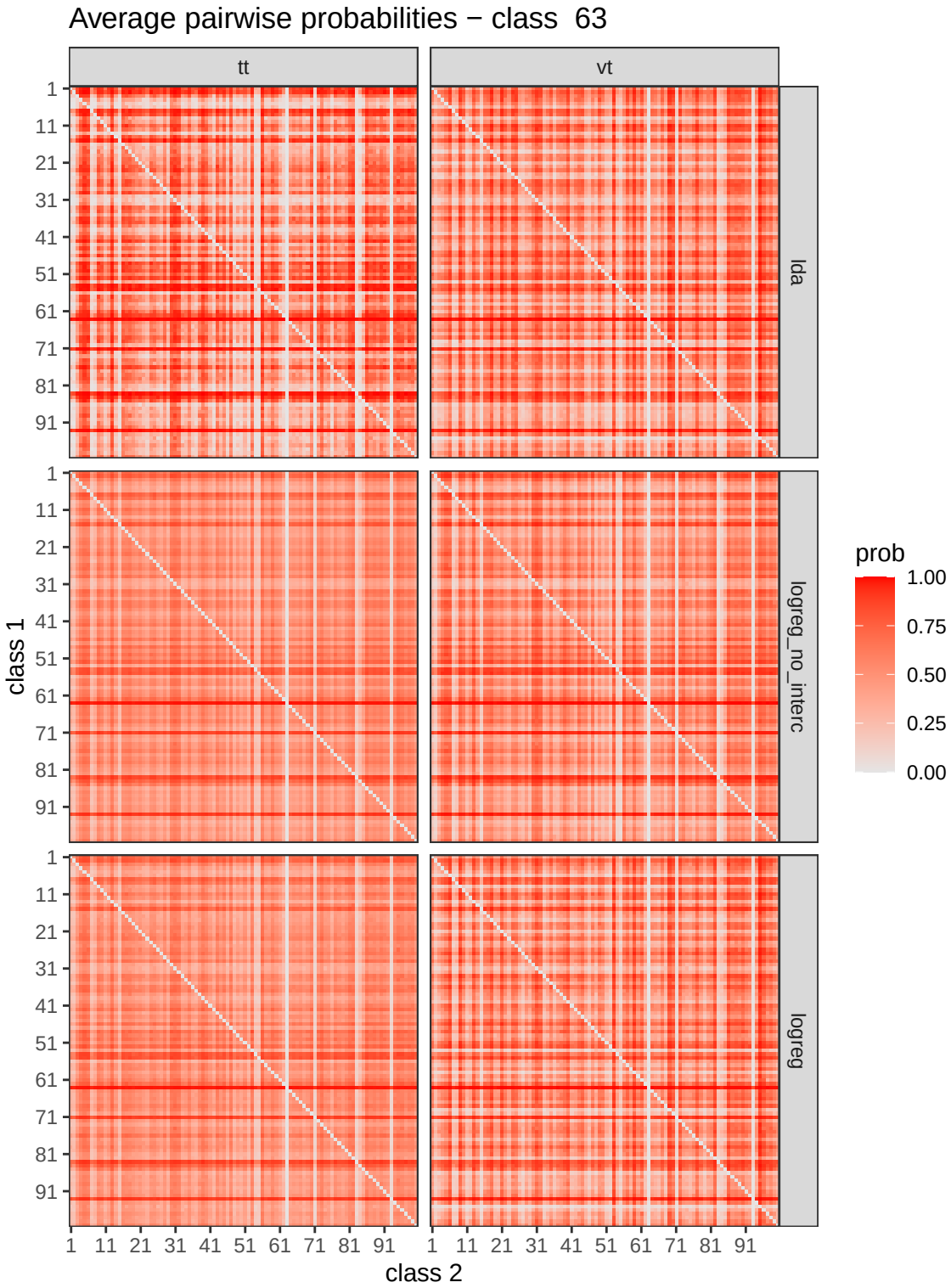
0.25
0.00


Average pairwise probabilities − class 63
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logreg_no_interc
logreg
class 1
class 2
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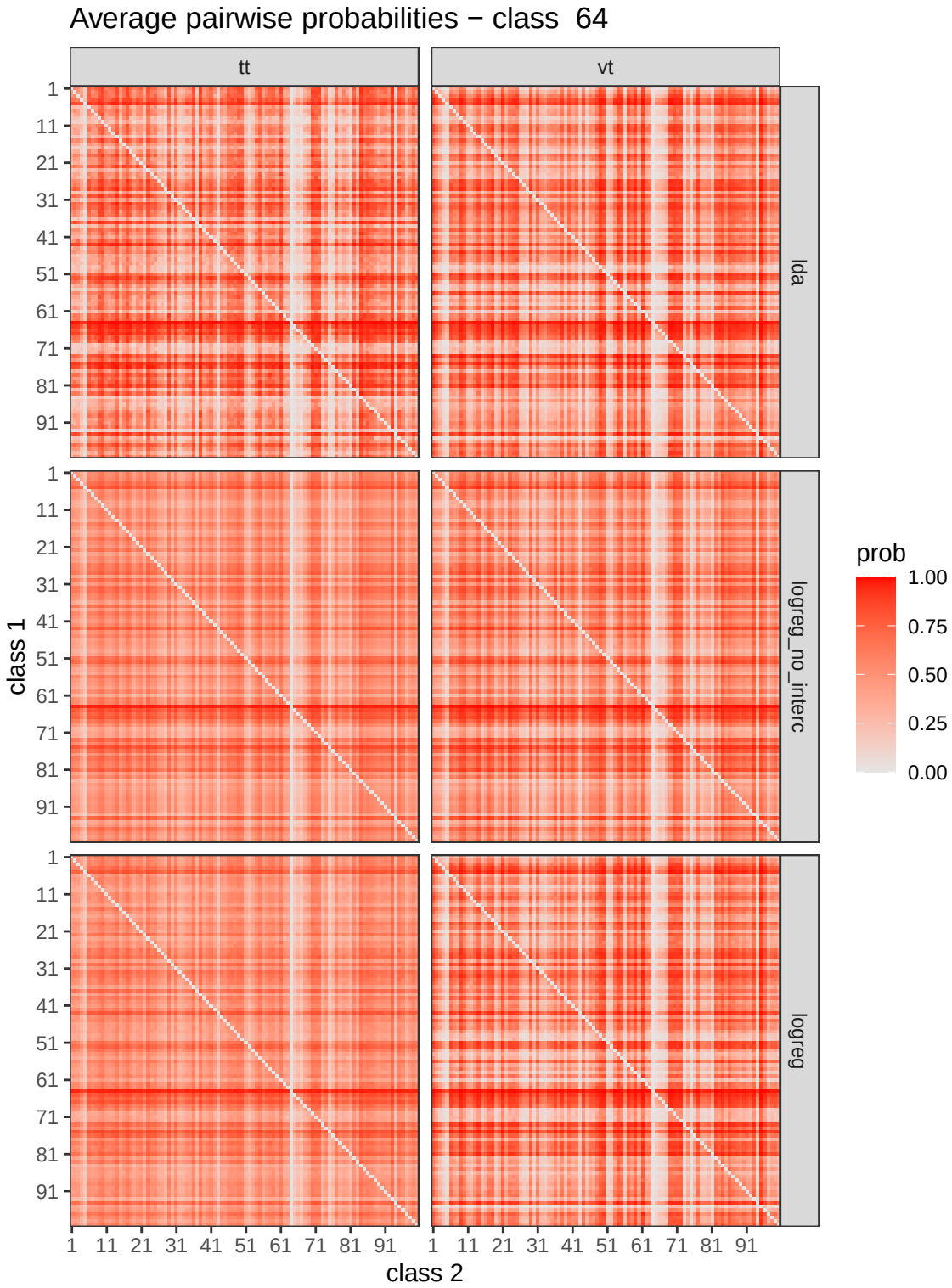
Average pairwise probabilities − class 64
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logreg
class 1
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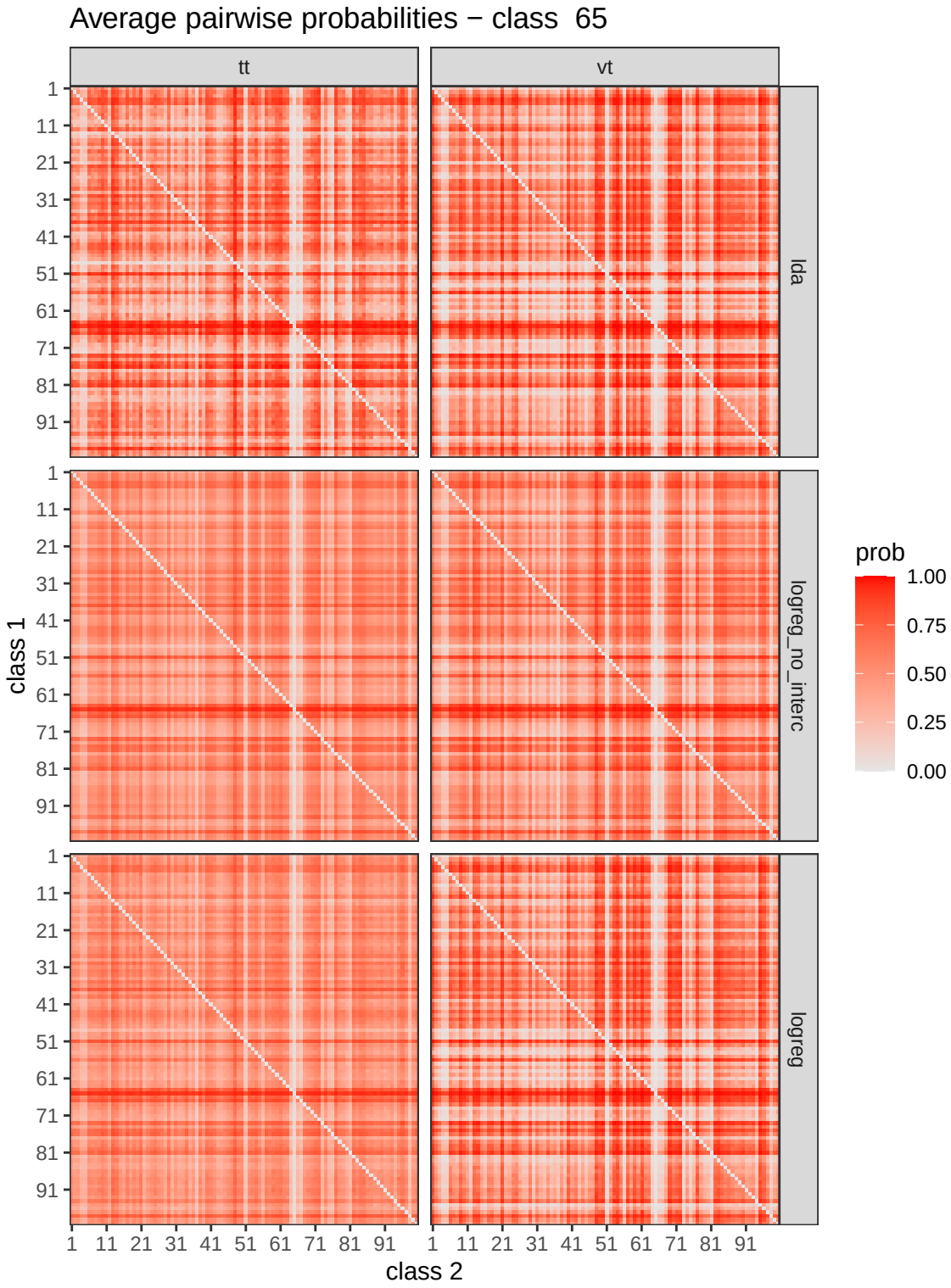
Average pairwise probabilities − class 65
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logreg
class 1
class 2
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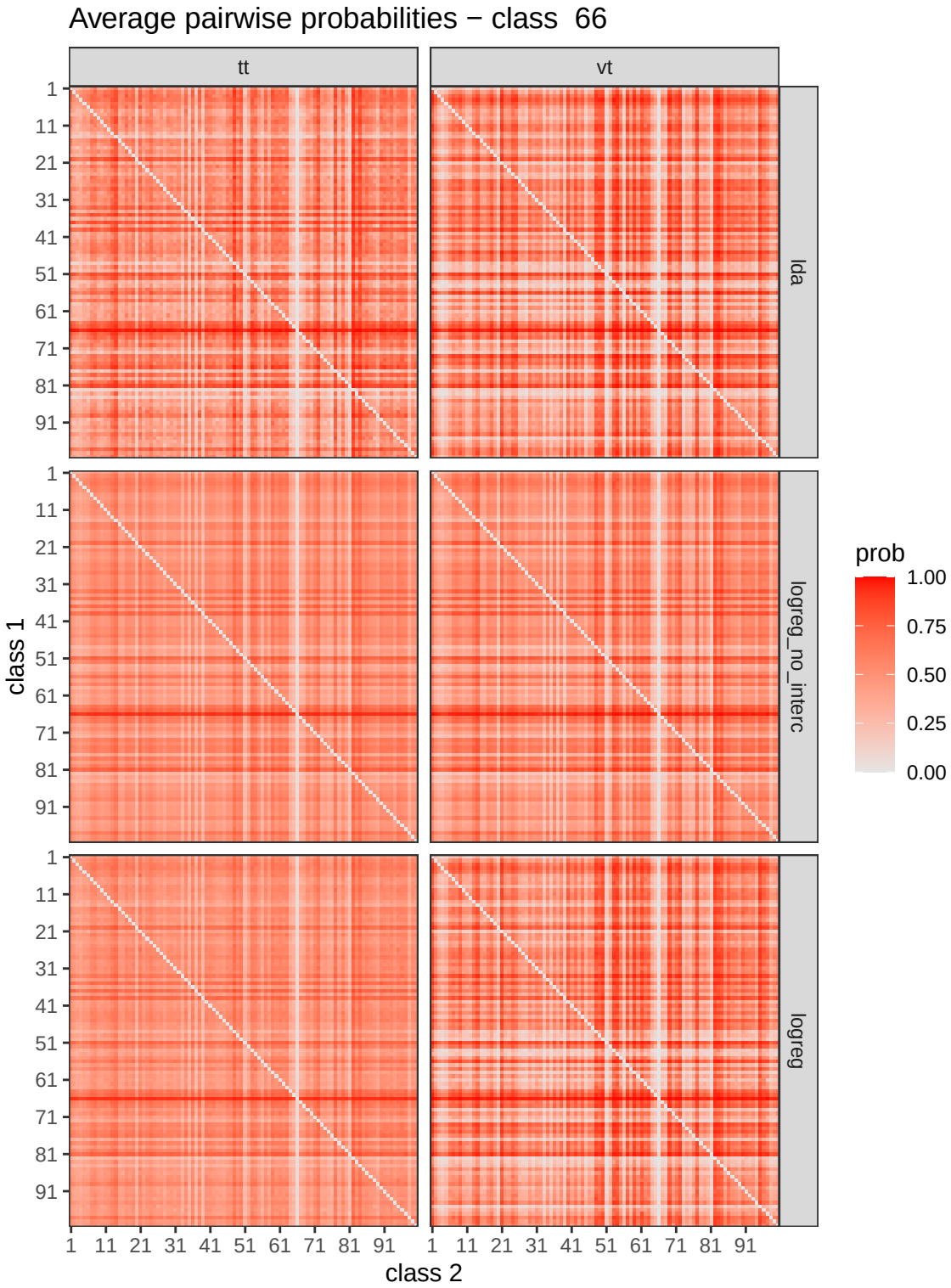
Average pairwise probabilities − class 66
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logreg
class 1
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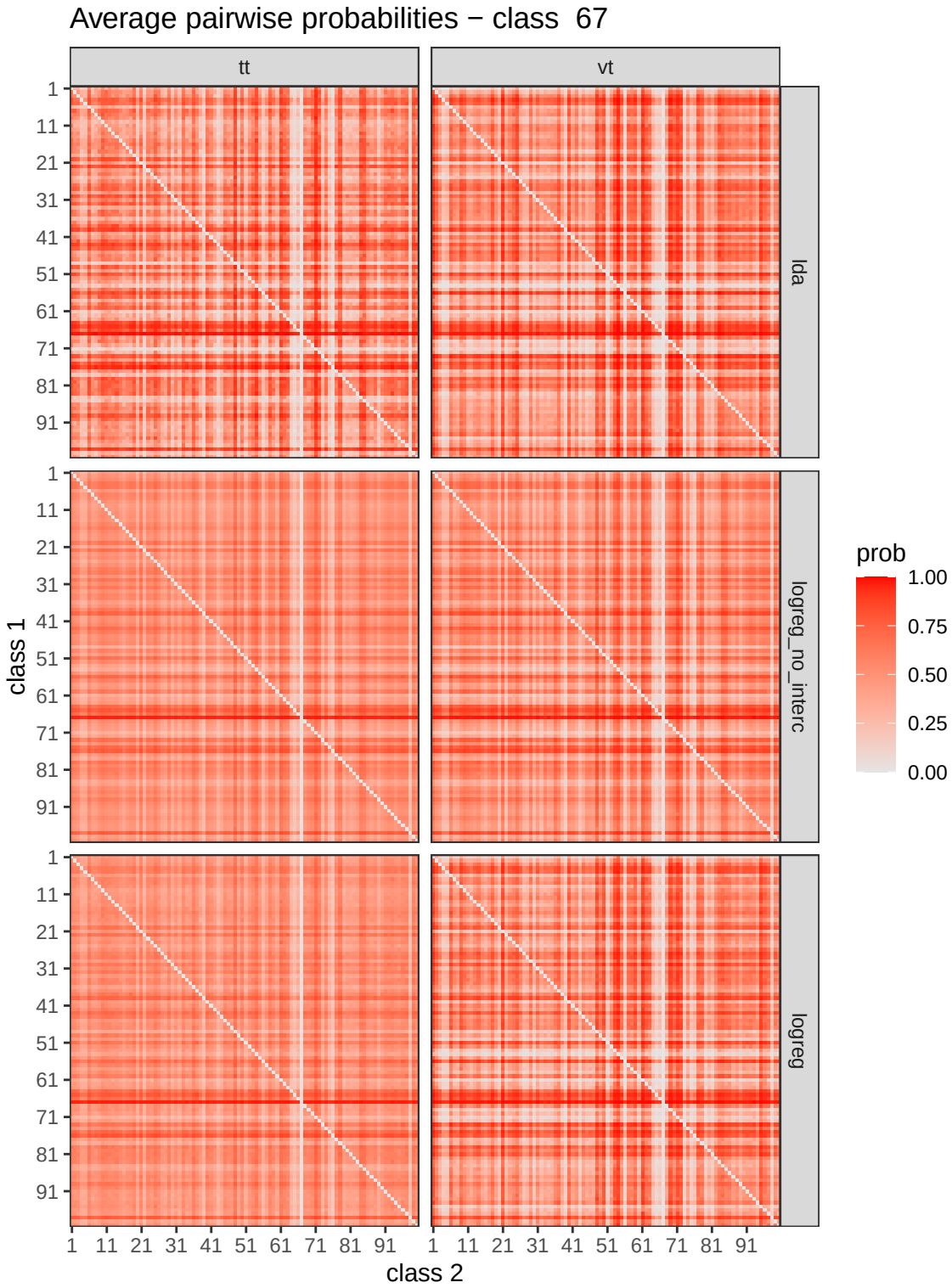
Average pairwise probabilities − class 67
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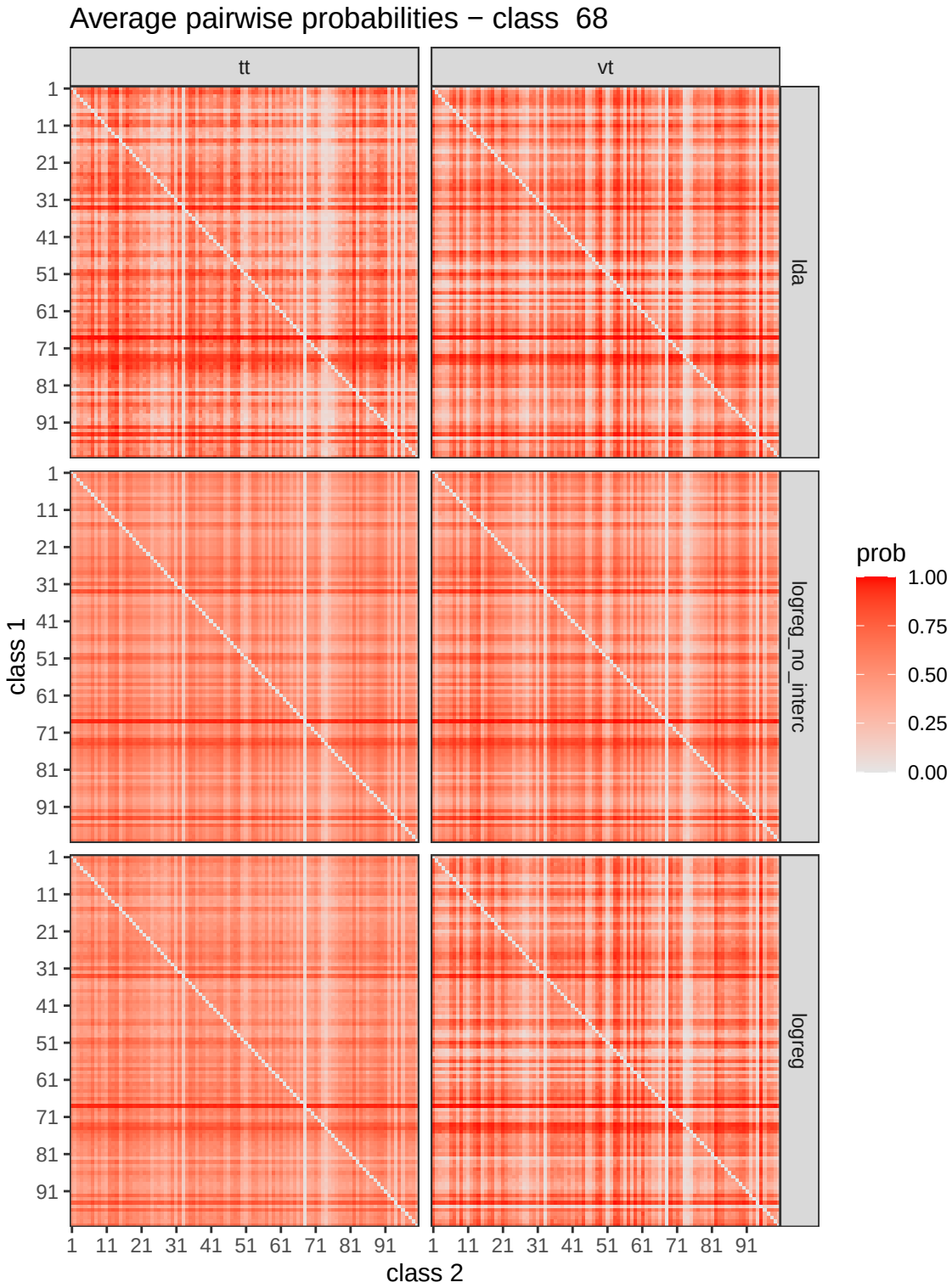
Average pairwise probabilities − class 68
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logreg
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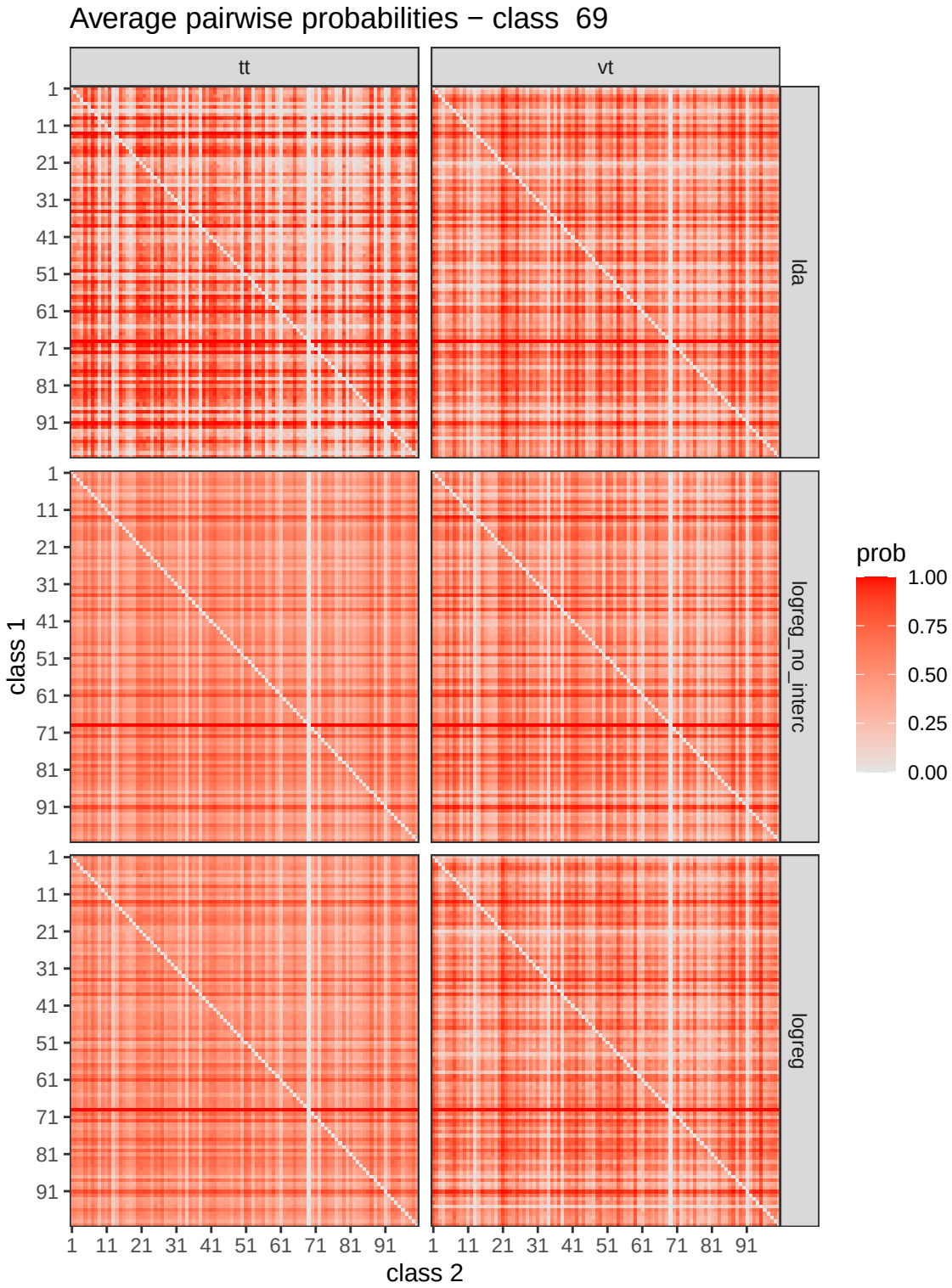
Average pairwise probabilities − class 69
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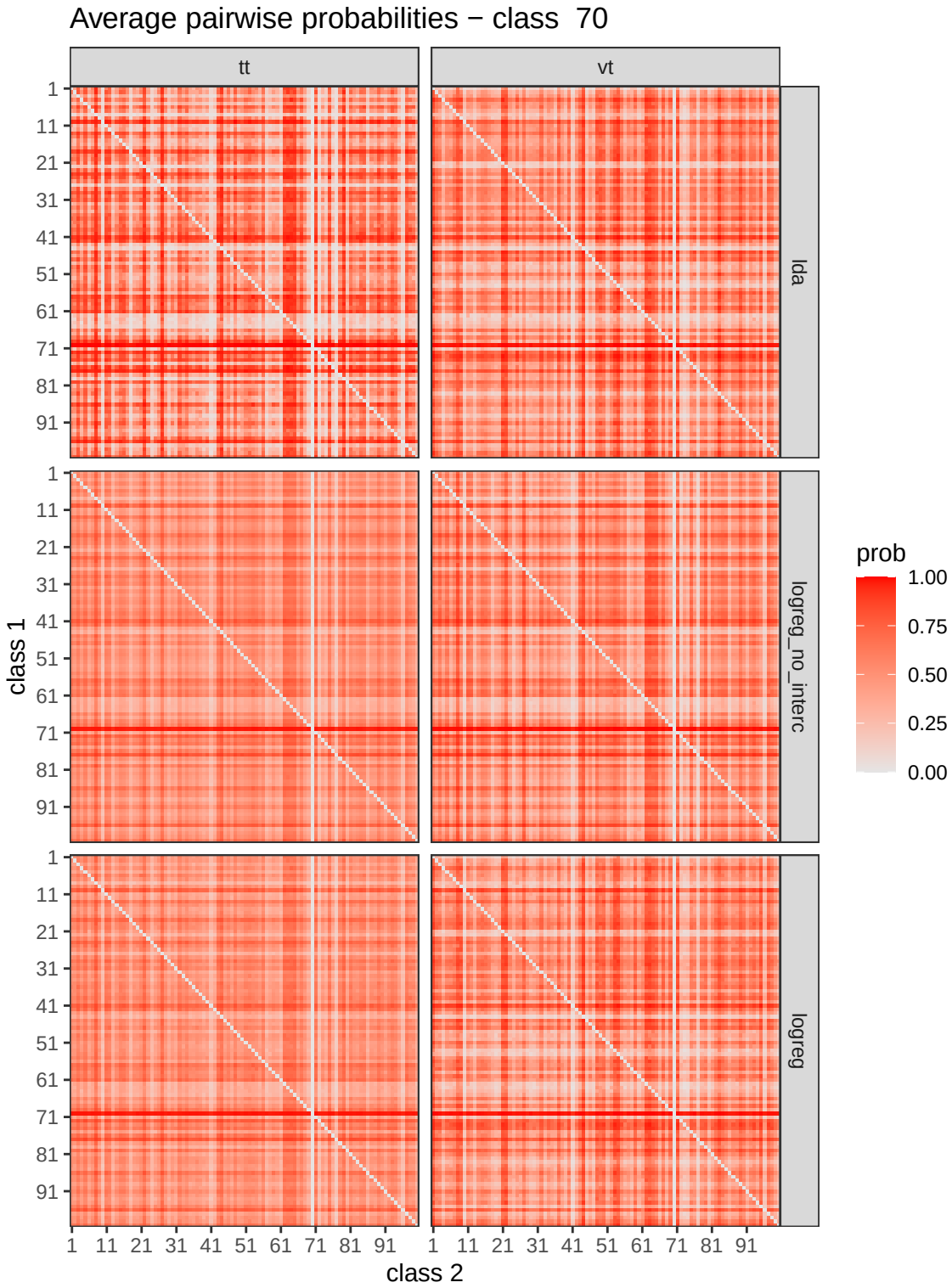
Average pairwise probabilities − class 70
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logreg
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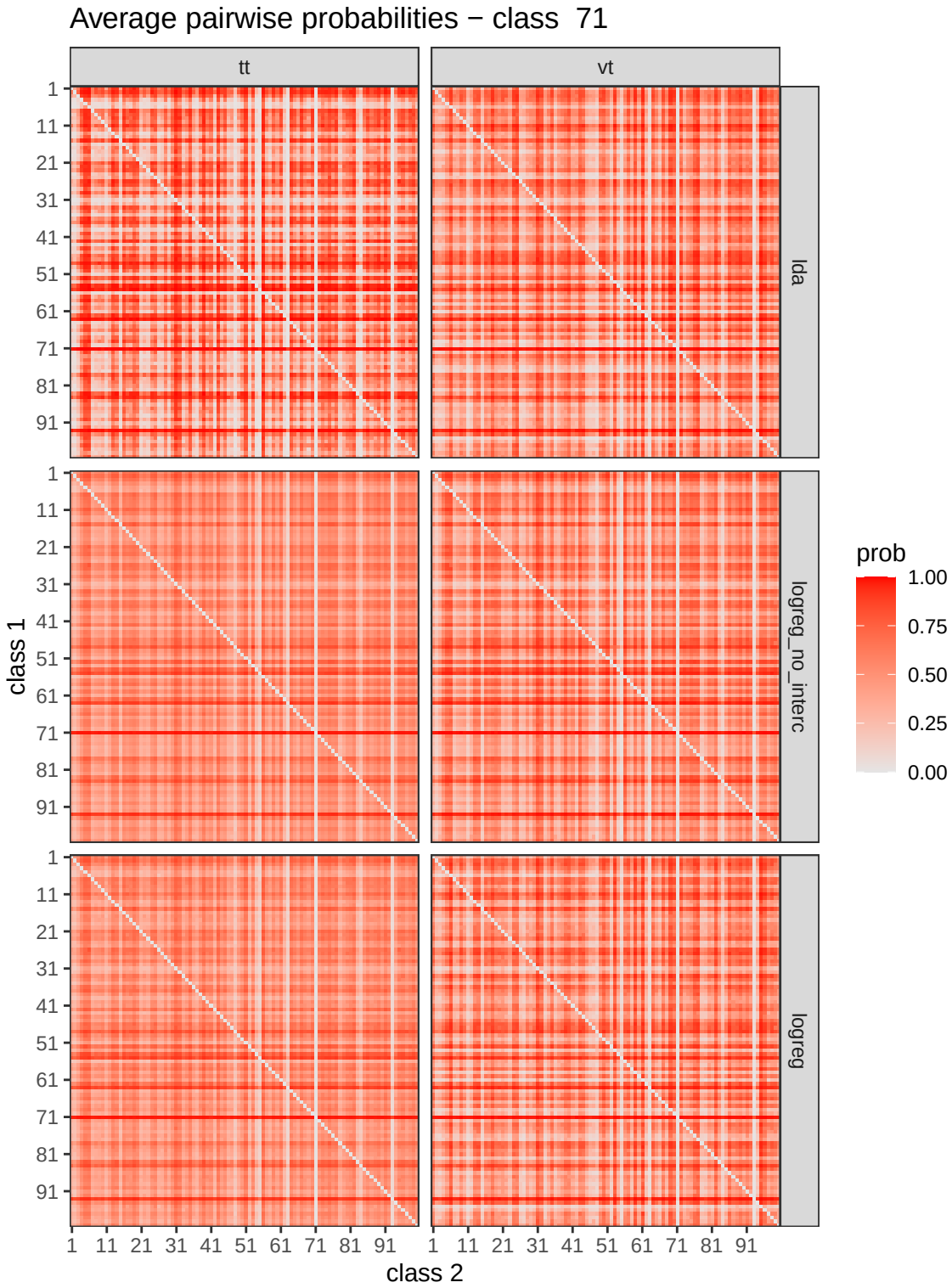
Average pairwise probabilities − class 71
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logreg
class 1
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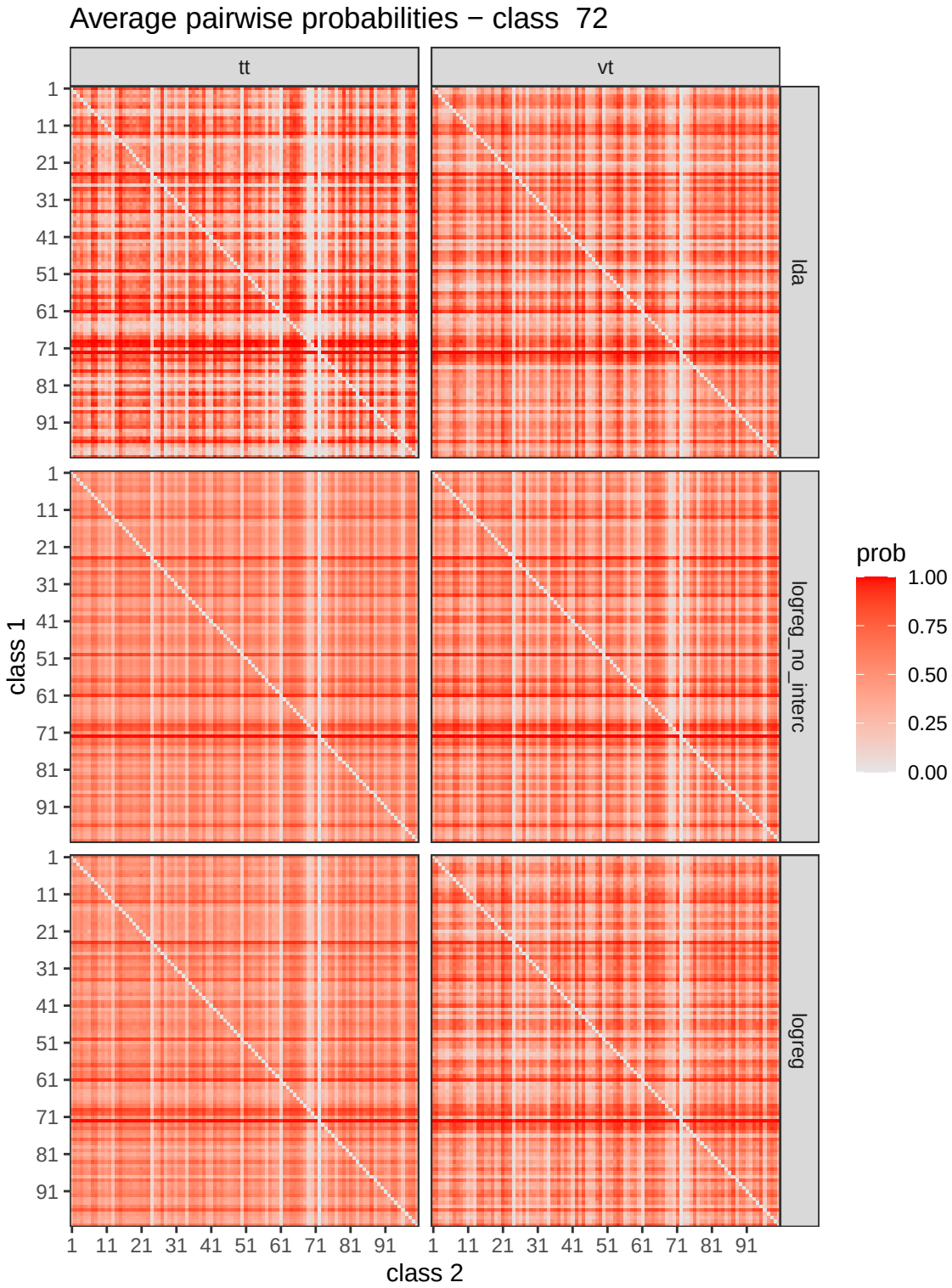
Average pairwise probabilities − class 72
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logreg
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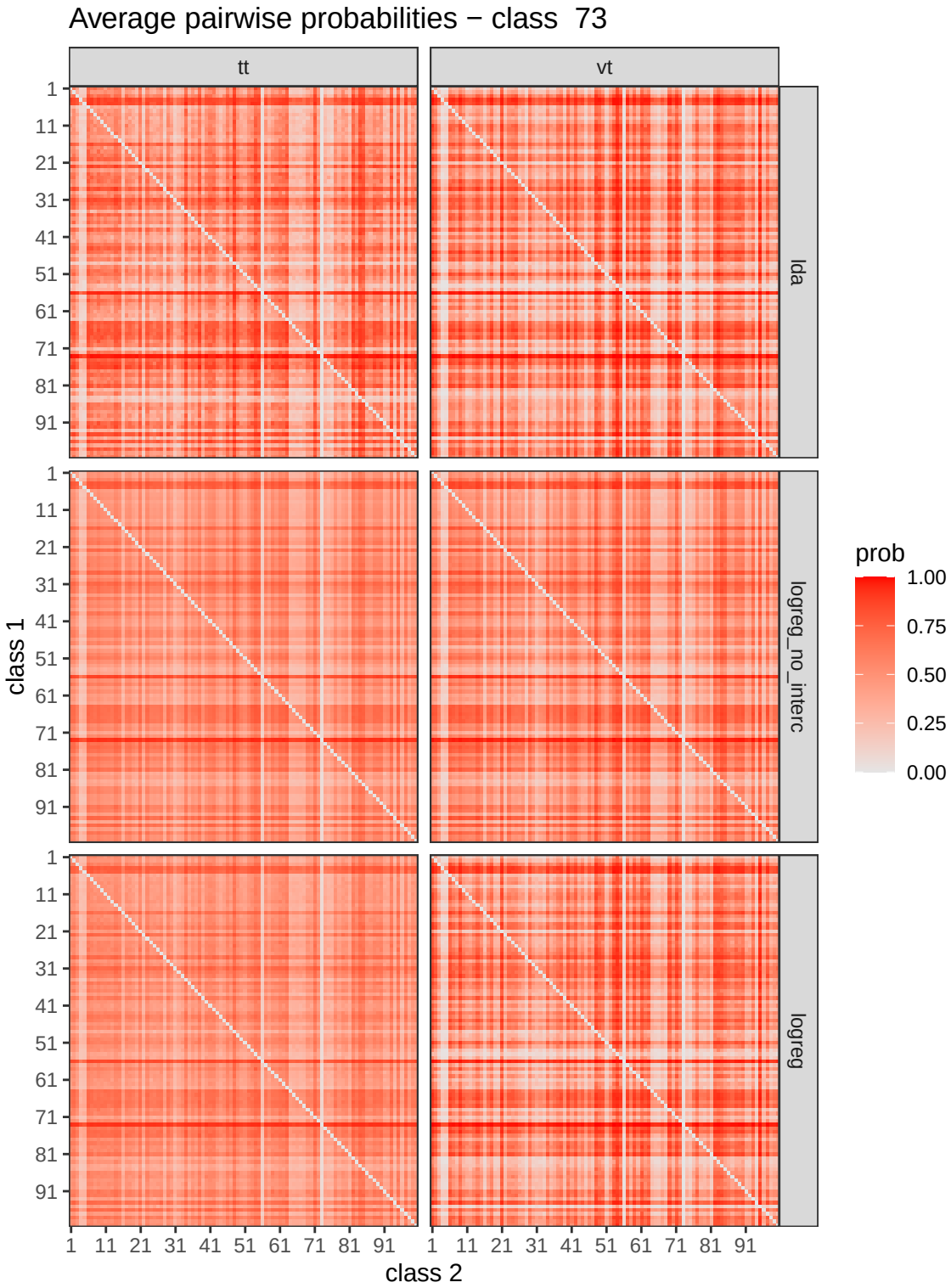
Average pairwise probabilities − class 73
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logreg
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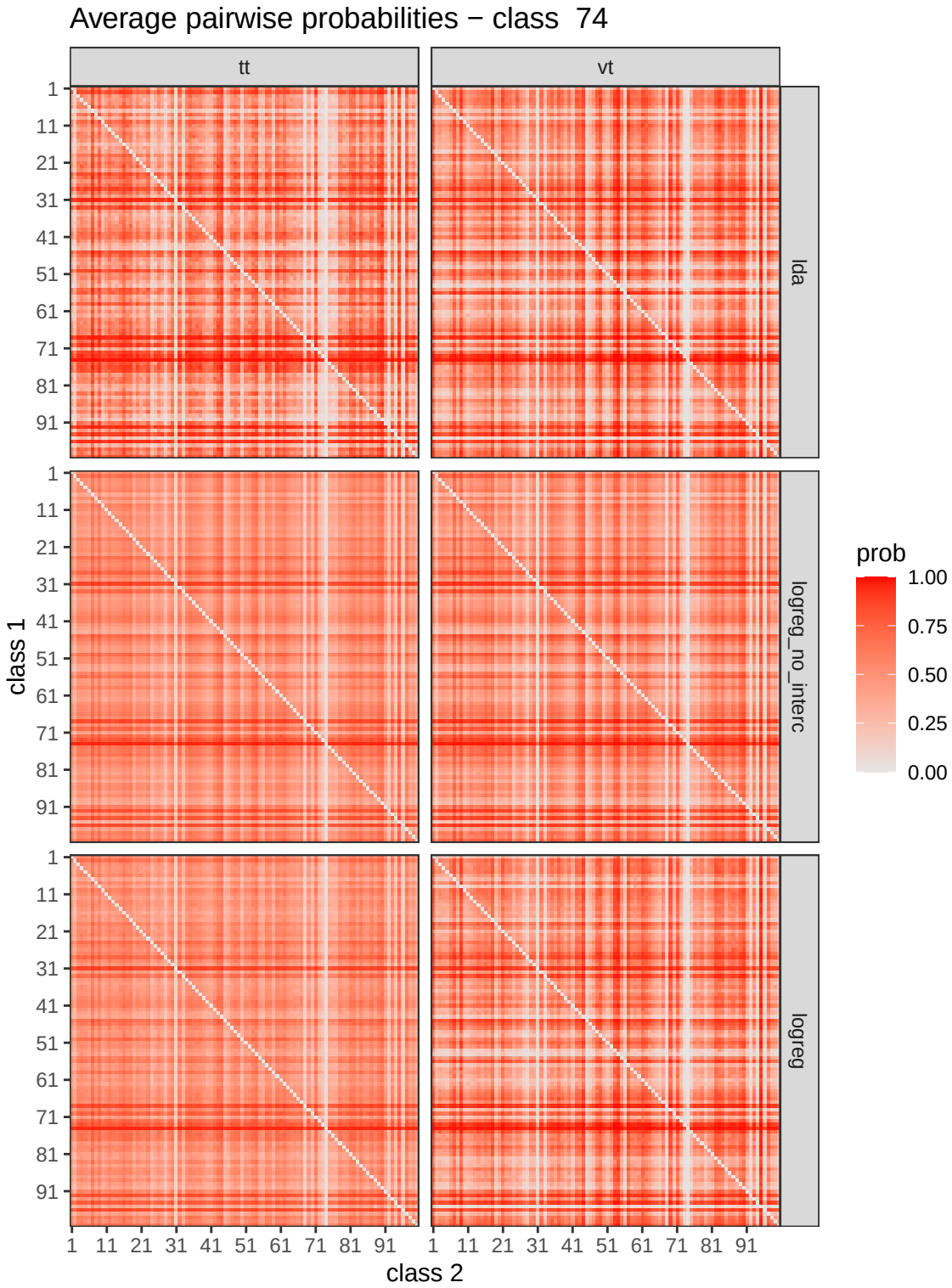
Average pairwise probabilities − class 74
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lda
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logreg
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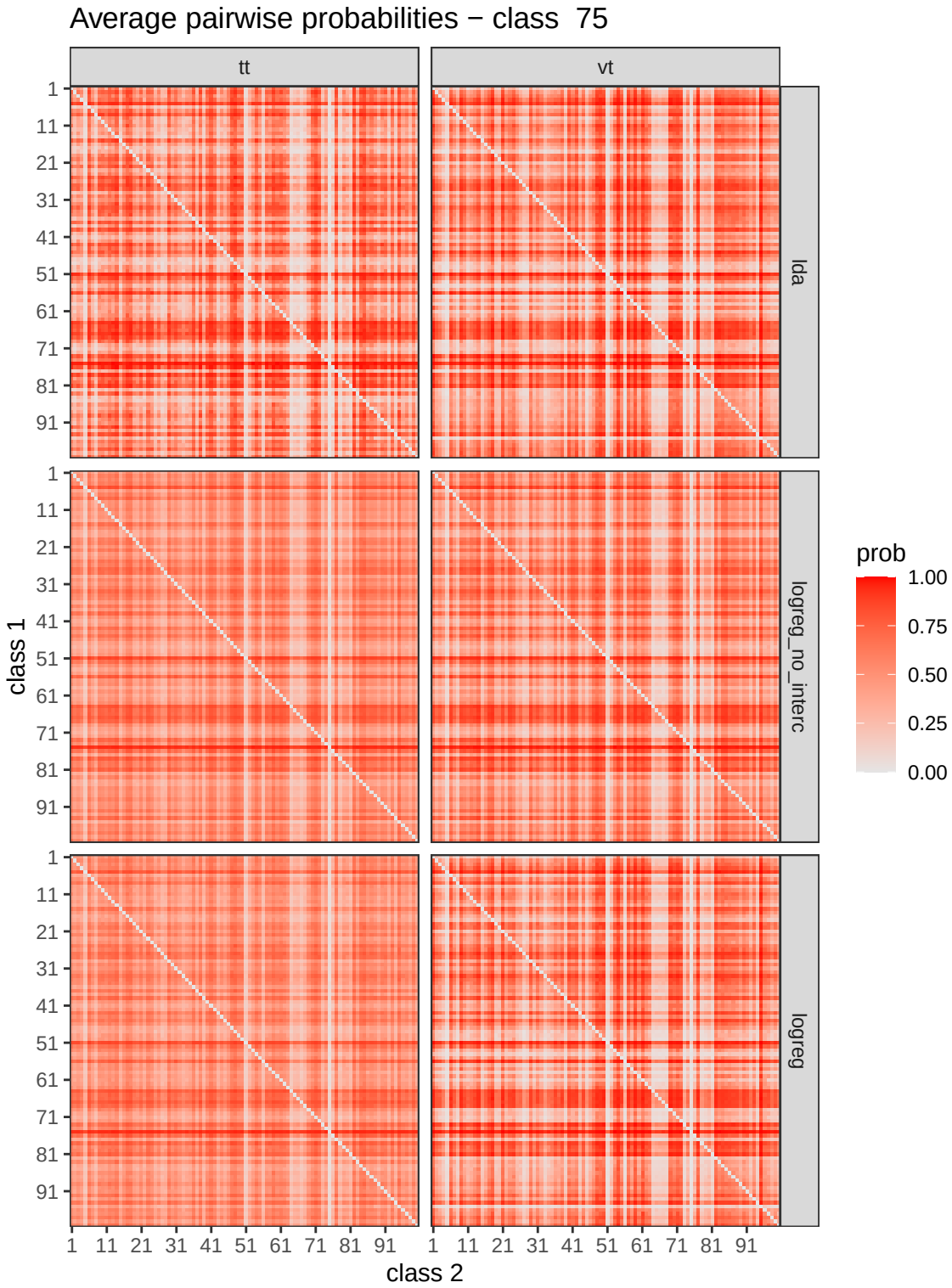
Average pairwise probabilities − class 75
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lda
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logreg
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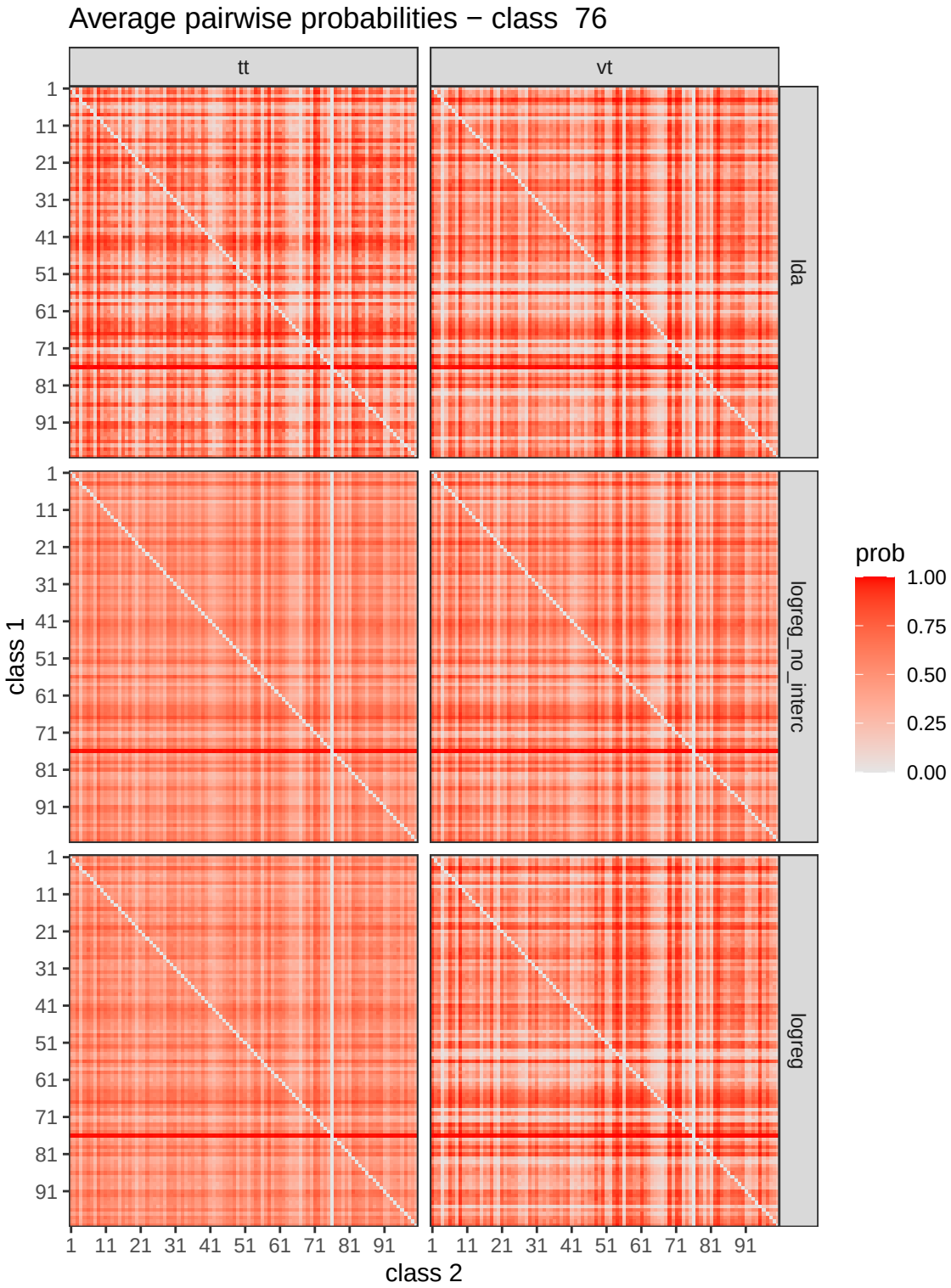
Average pairwise probabilities − class 76
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logreg
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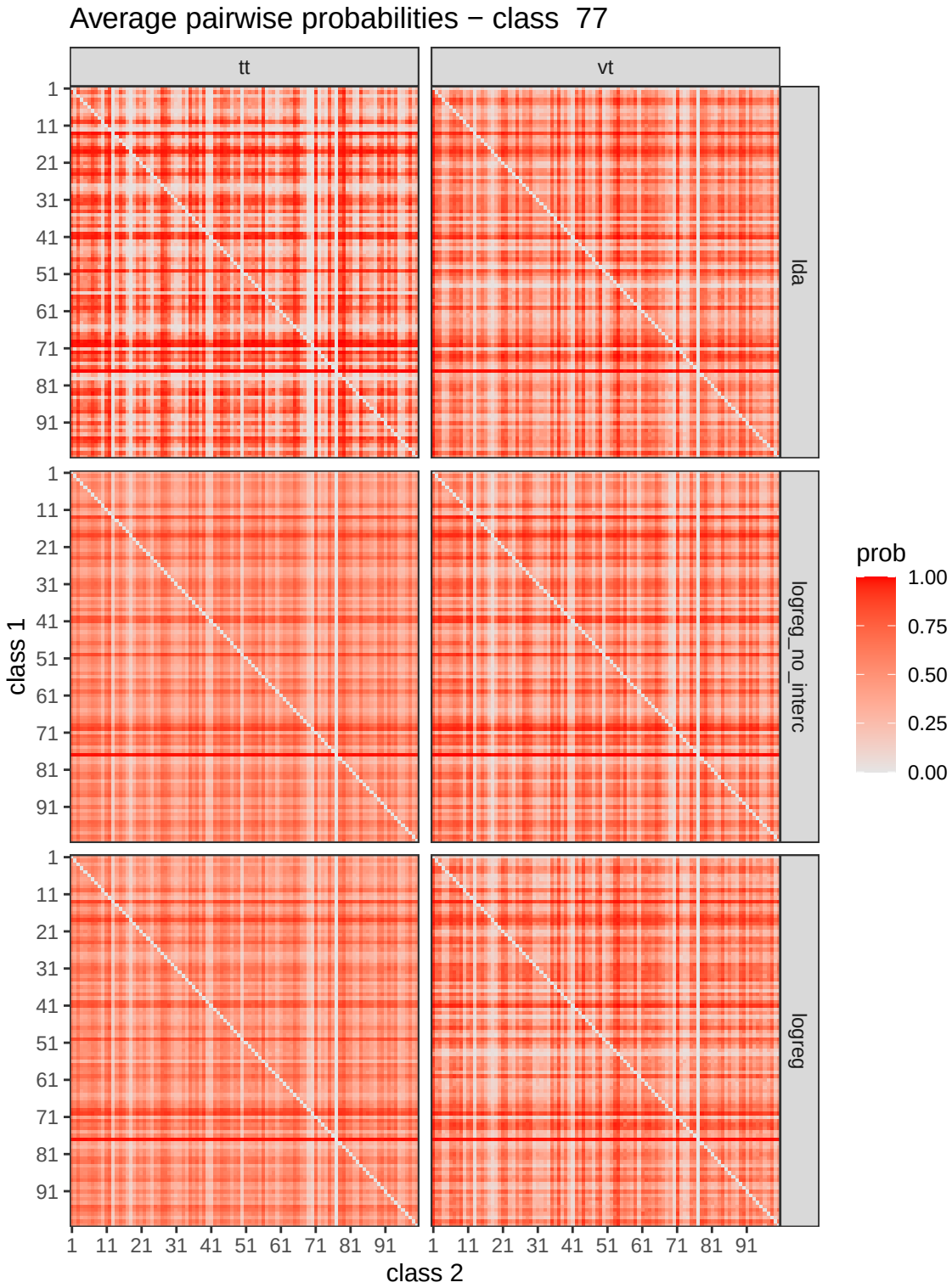
Average pairwise probabilities − class 77
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lda
logreg_no_interc
logreg
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class 2
prob
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0.00
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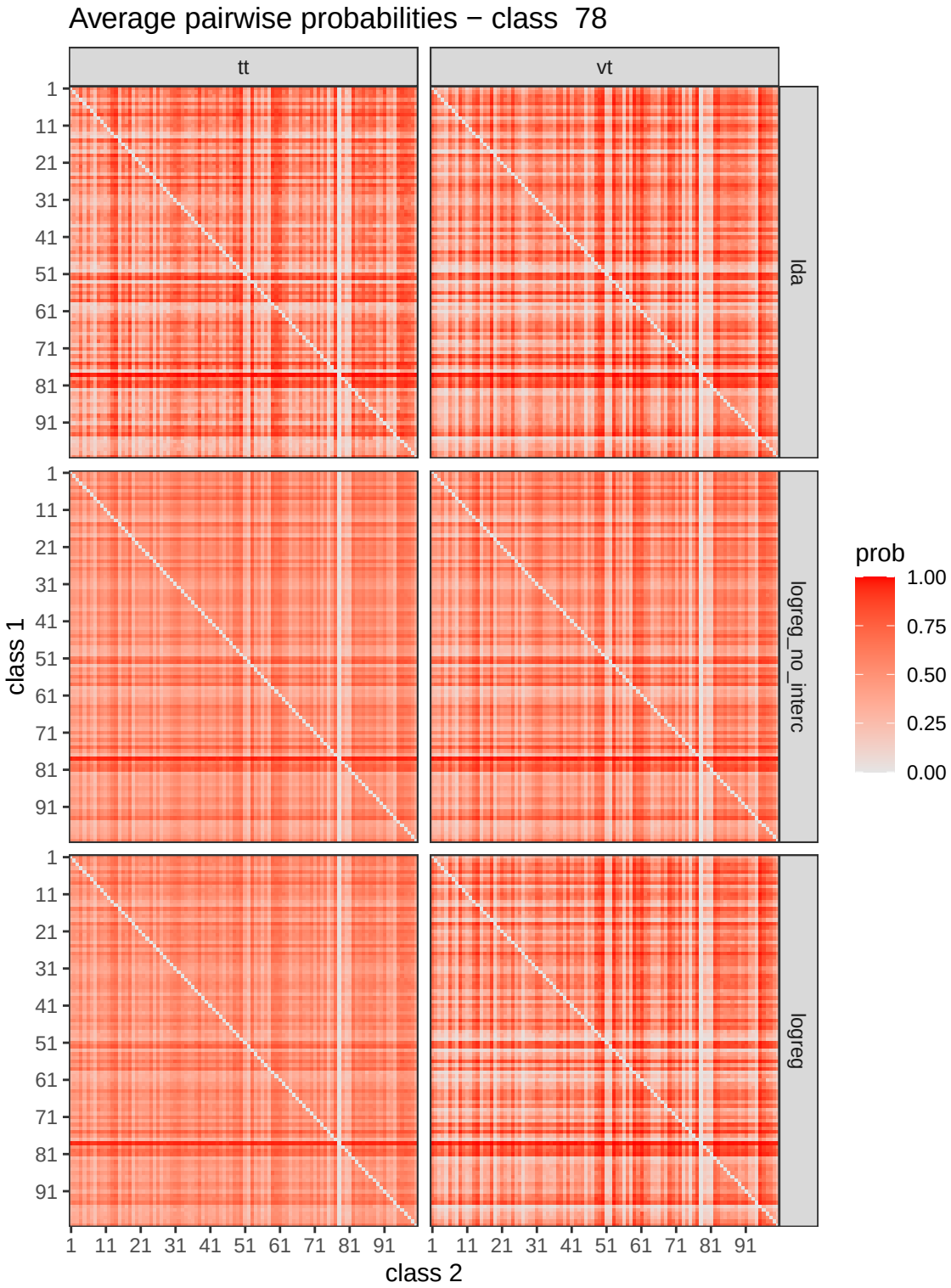
Average pairwise probabilities − class 78
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lda
logreg_no_interc
logreg
class 1
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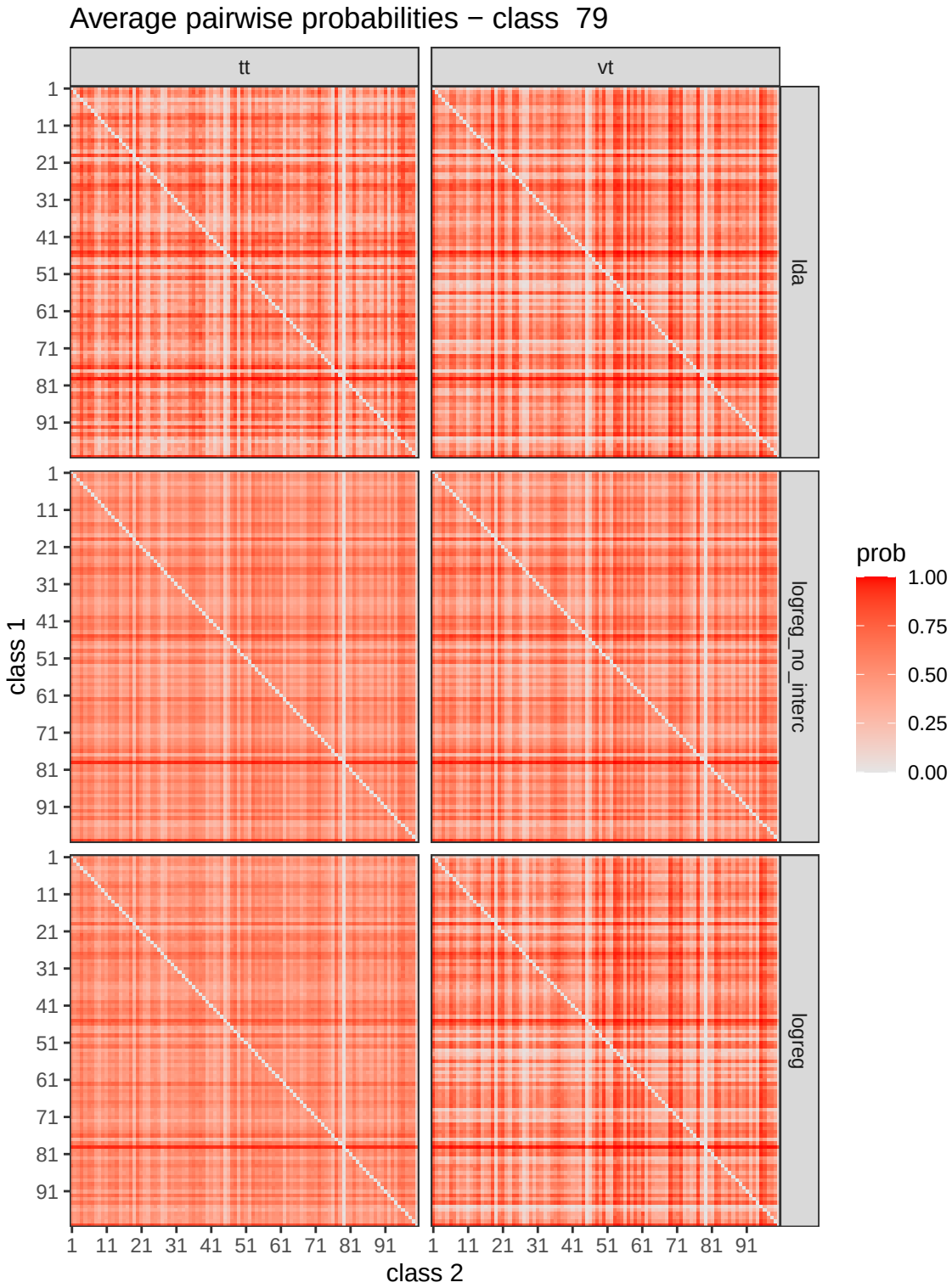
Average pairwise probabilities − class 79
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lda
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logreg
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class 2
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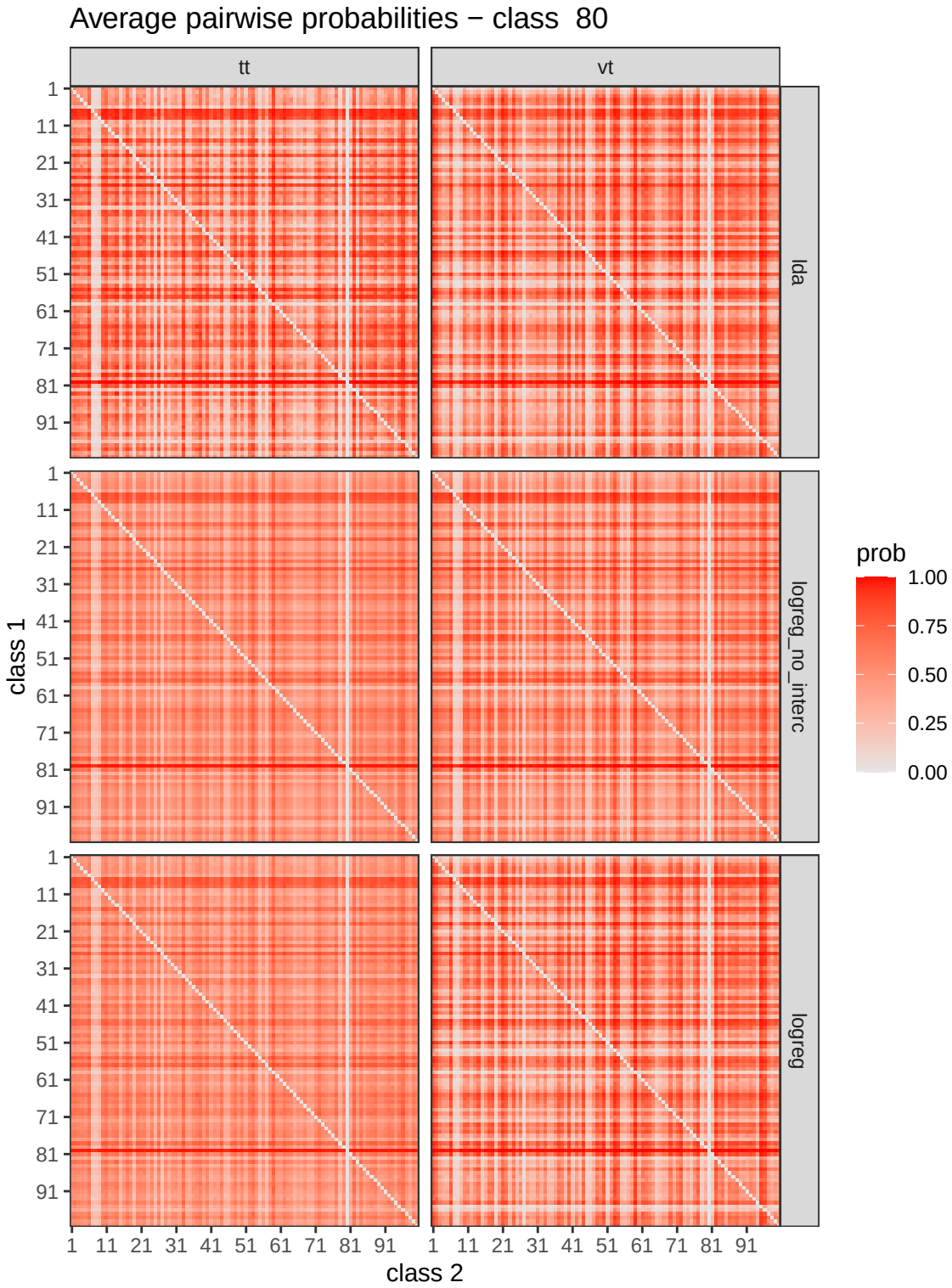
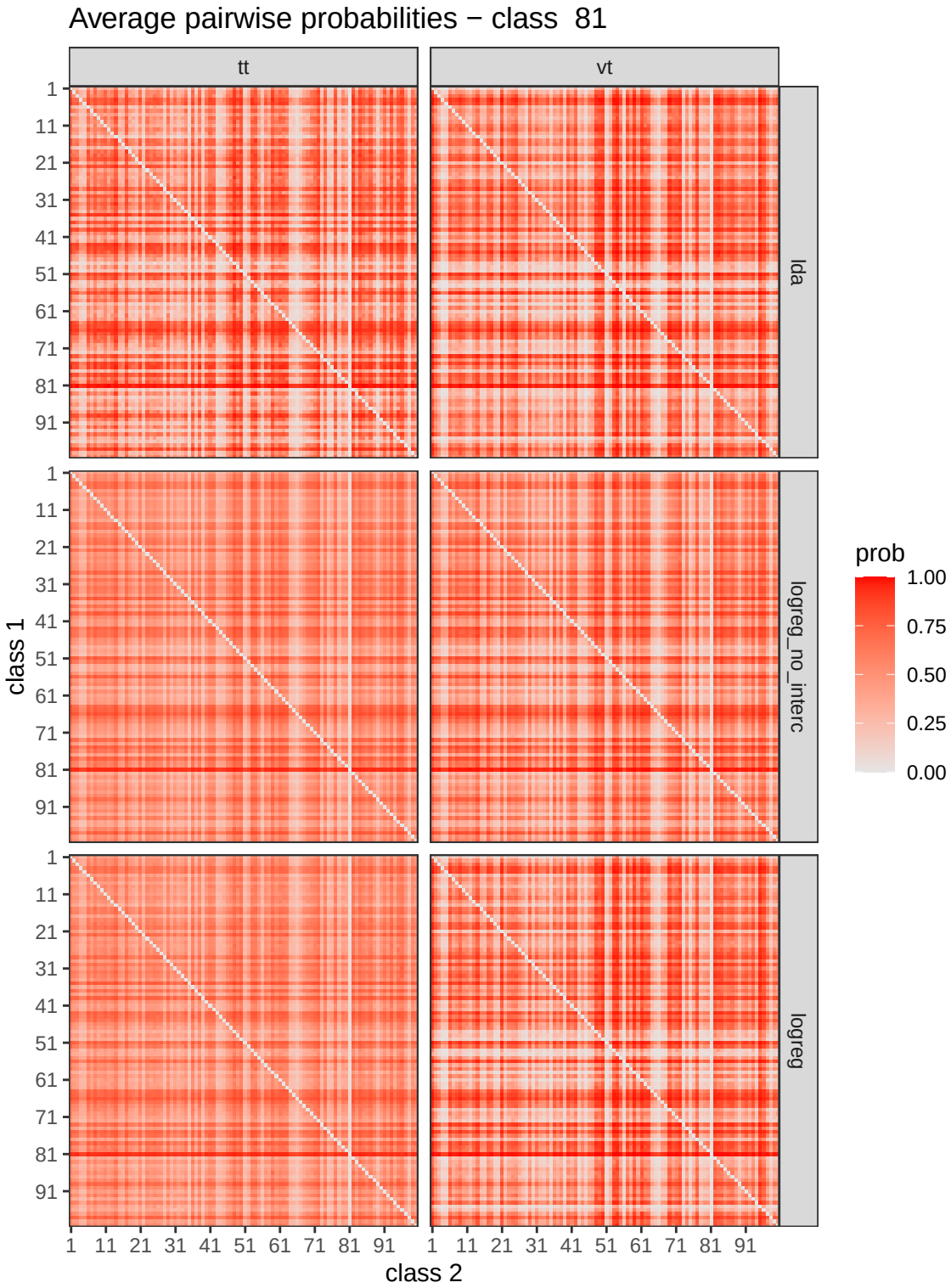
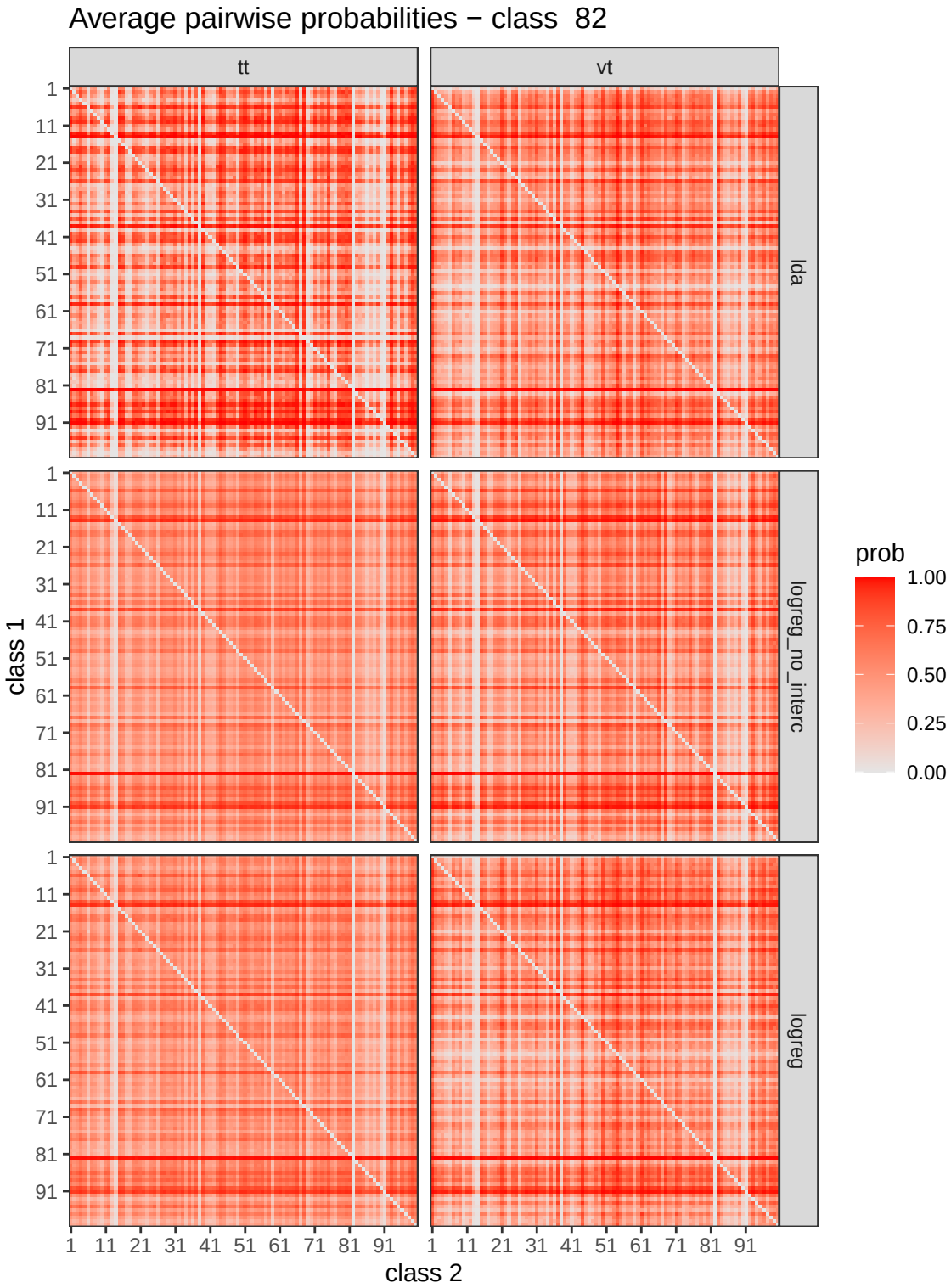
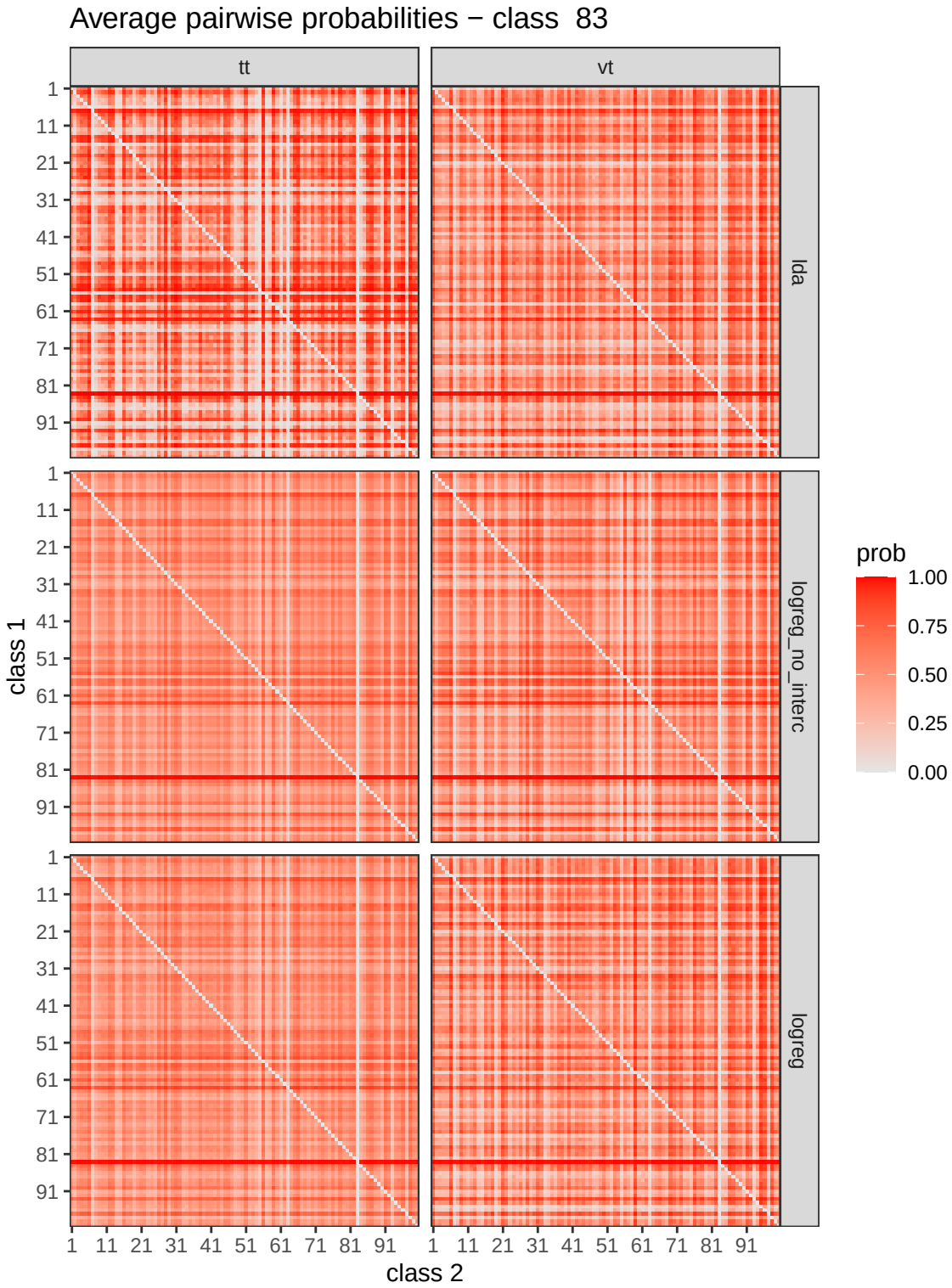
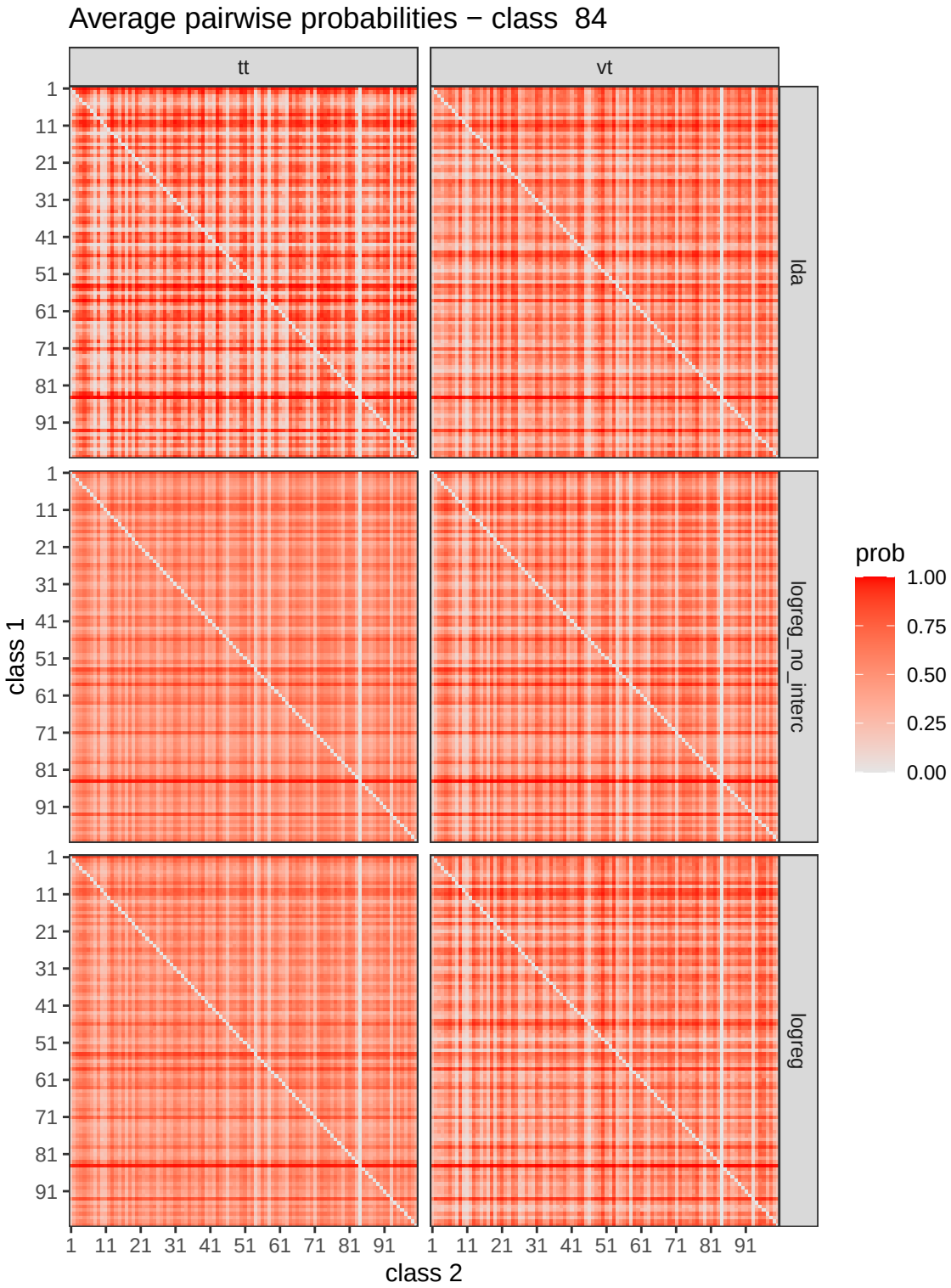
81
91

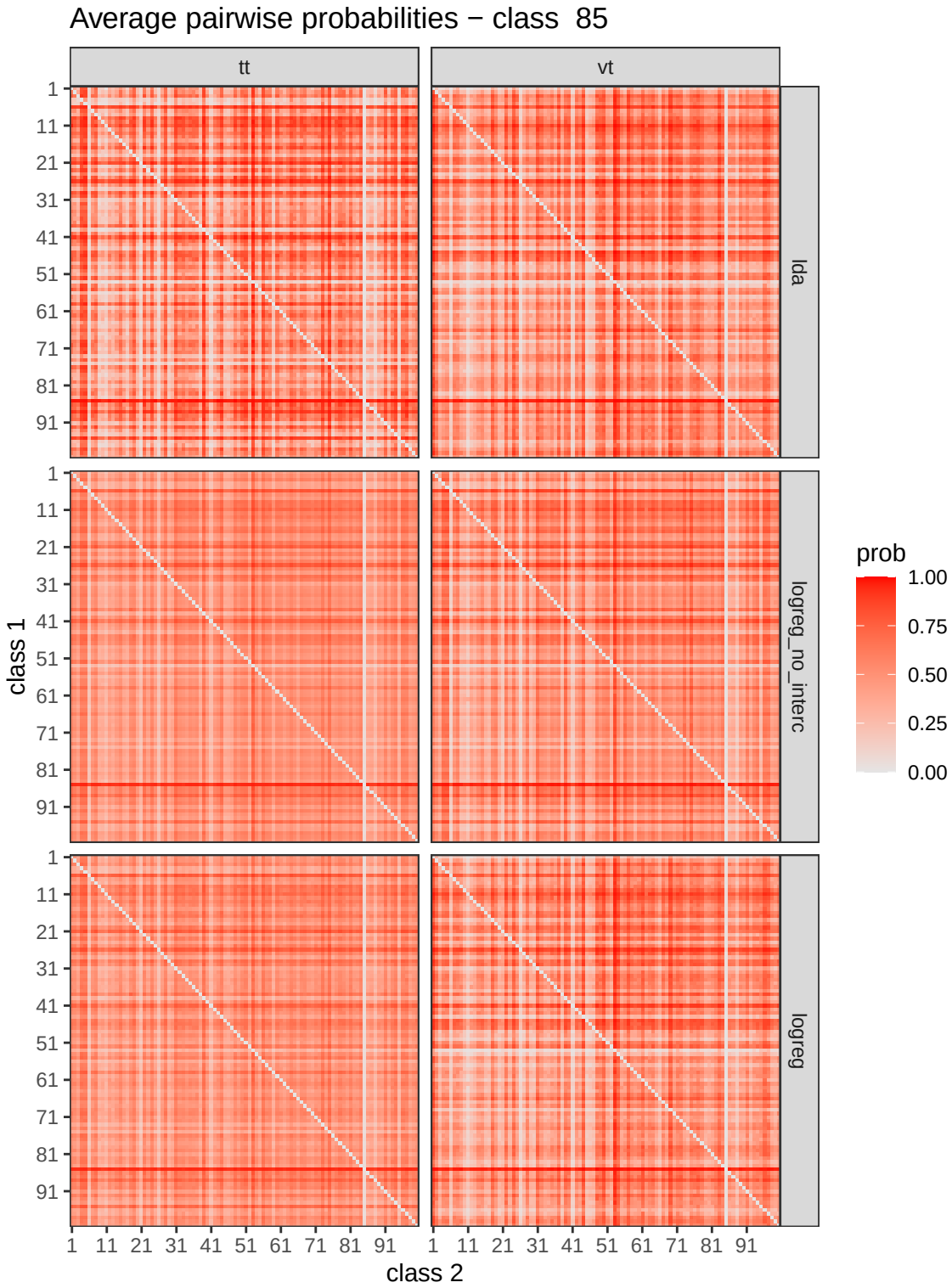

Average pairwise probabilities − class 80
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
1
11
21
31
41
51
61
71
81
91
prob
1.00
0.75
0.50
0.25
0.00

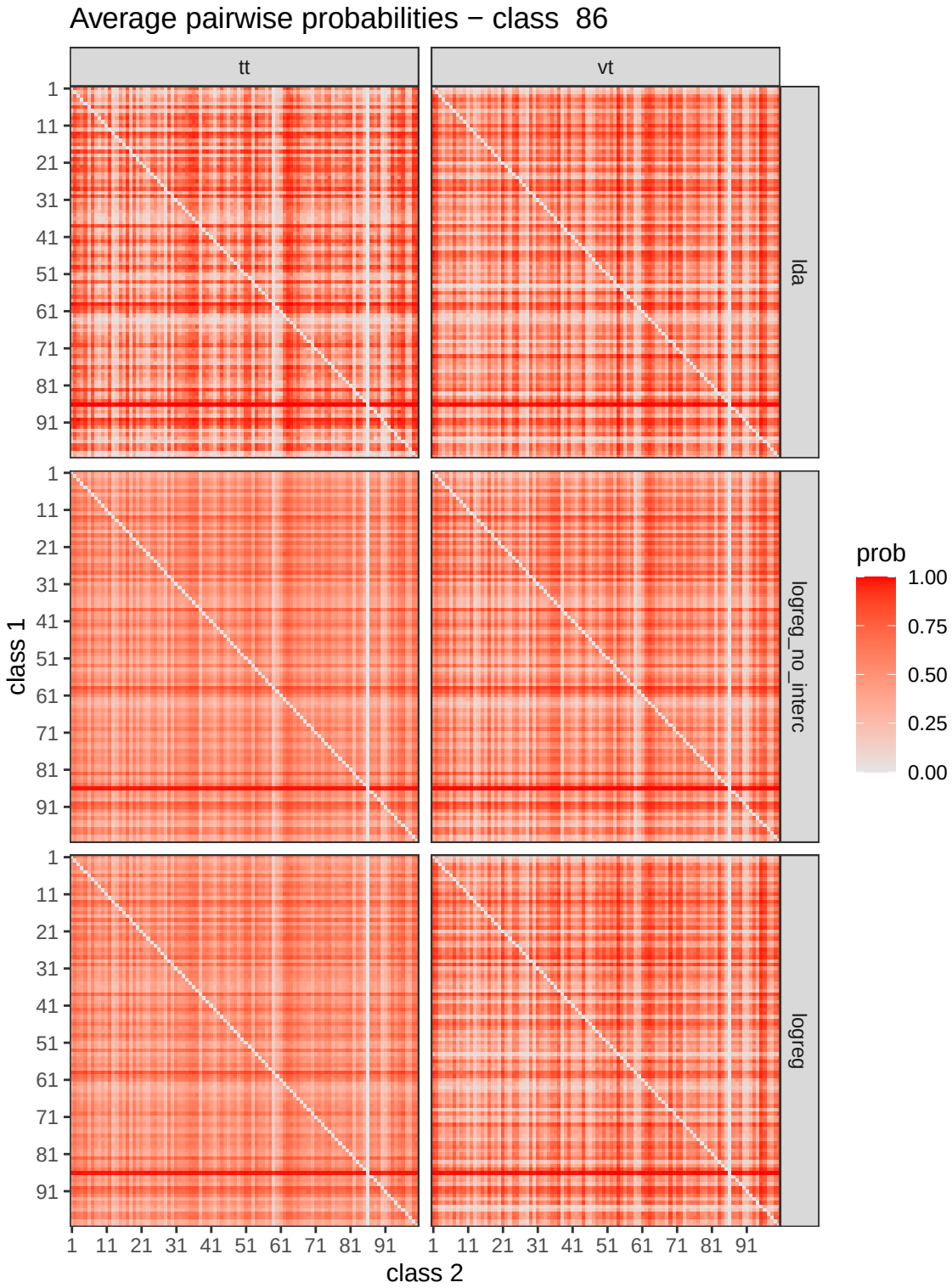

Average pairwise probabilities − class 81
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

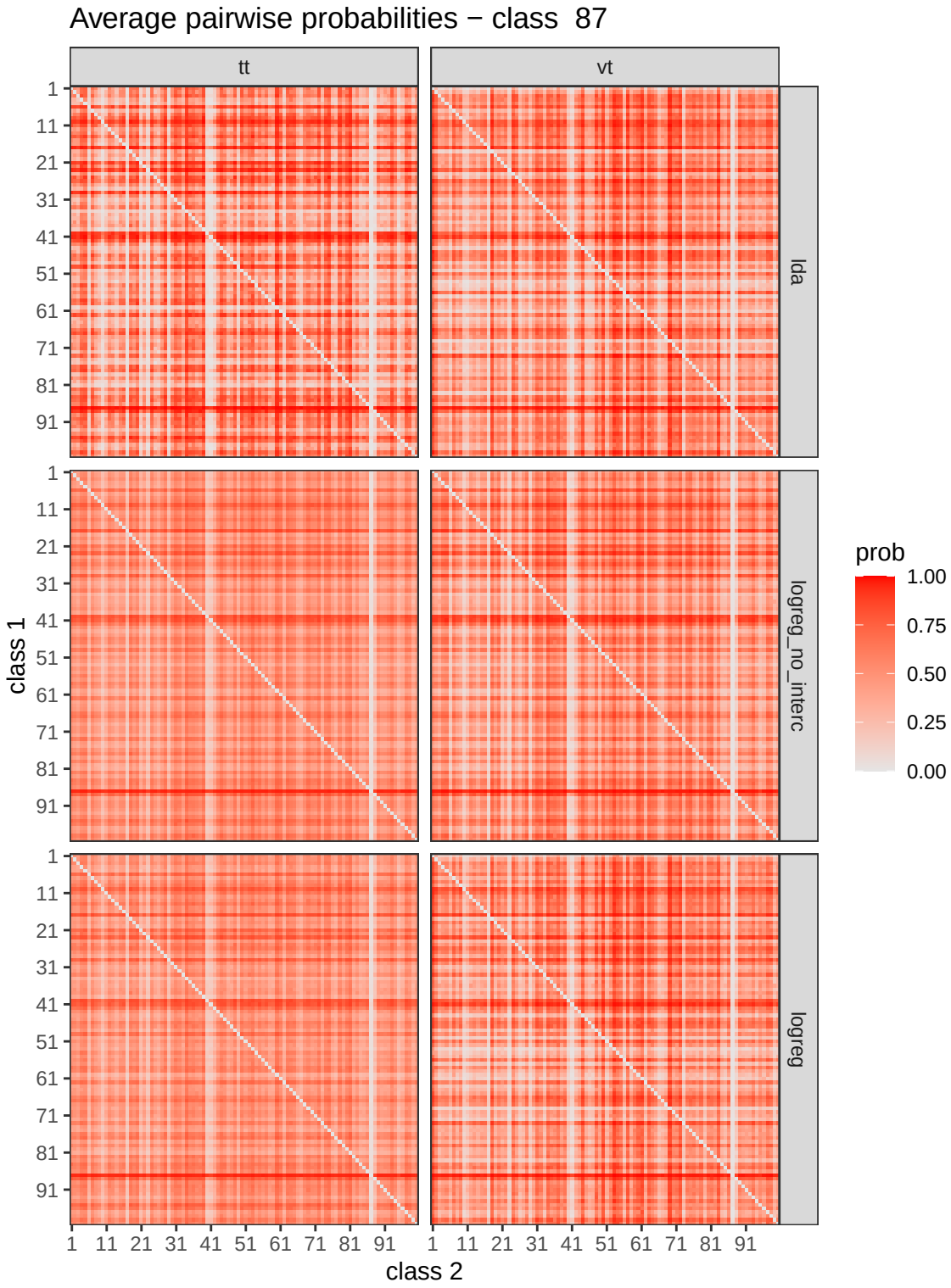

Average pairwise probabilities − class 82
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

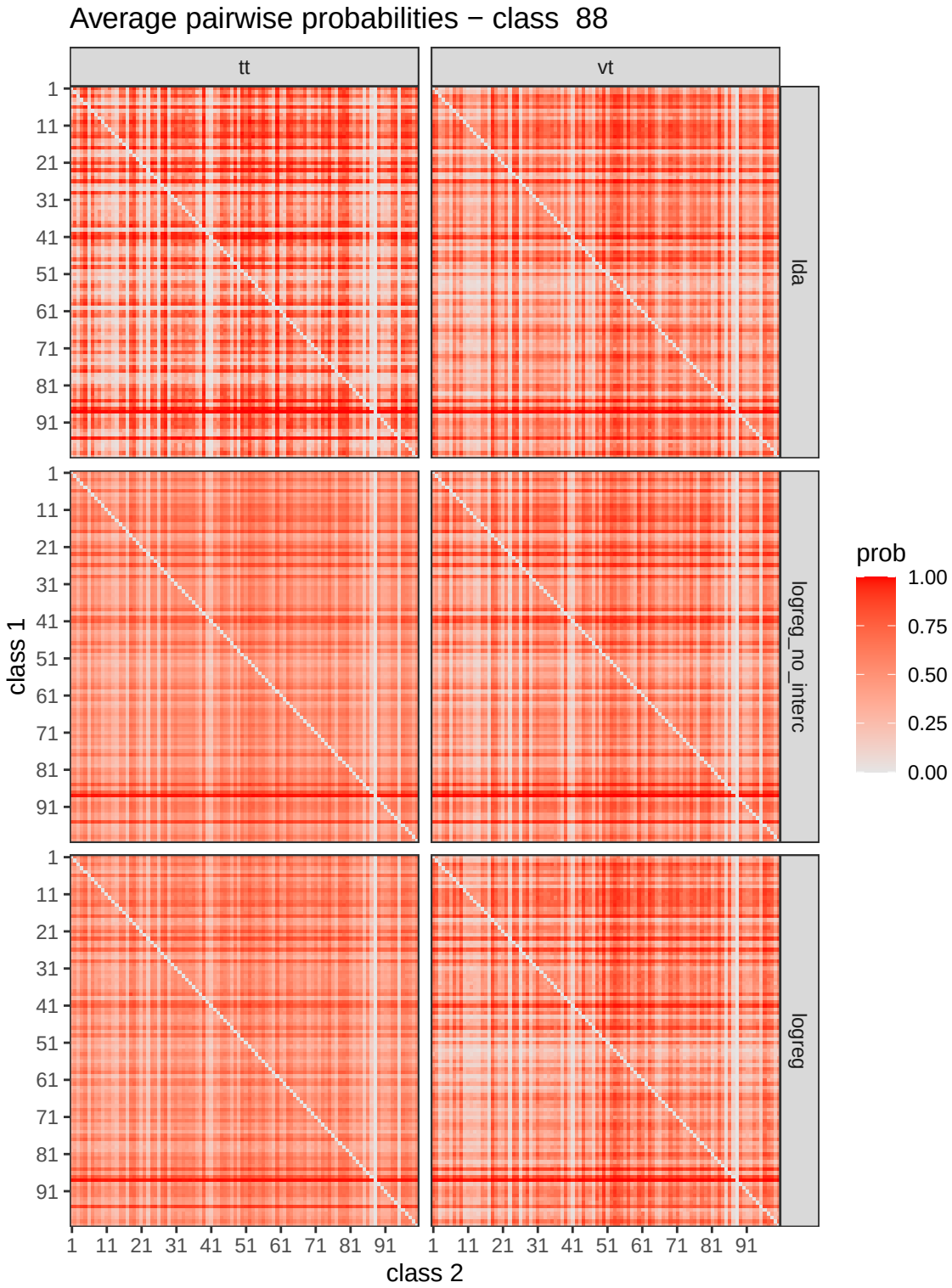

Average pairwise probabilities − class 83
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

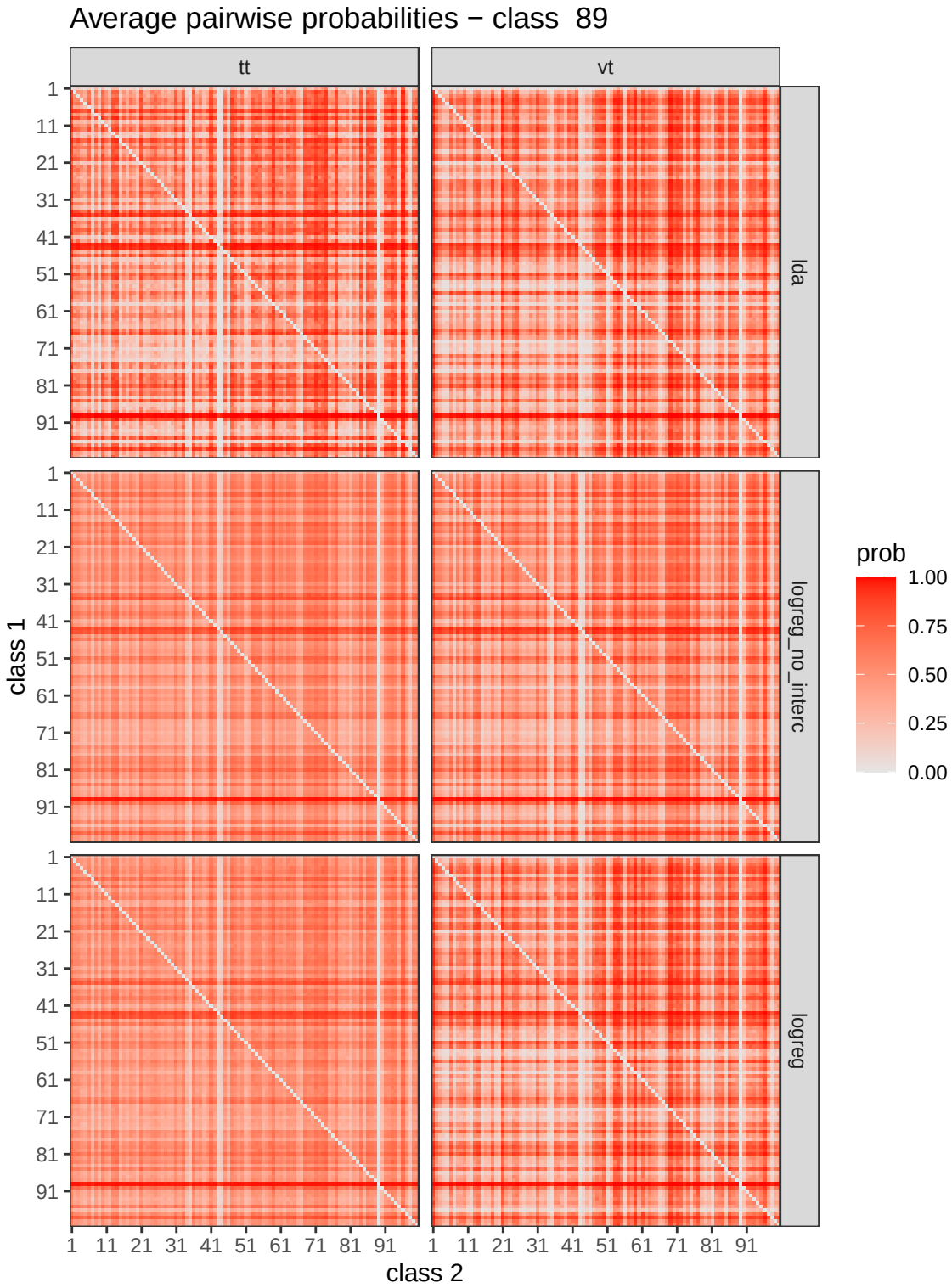

Average pairwise probabilities − class 84
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

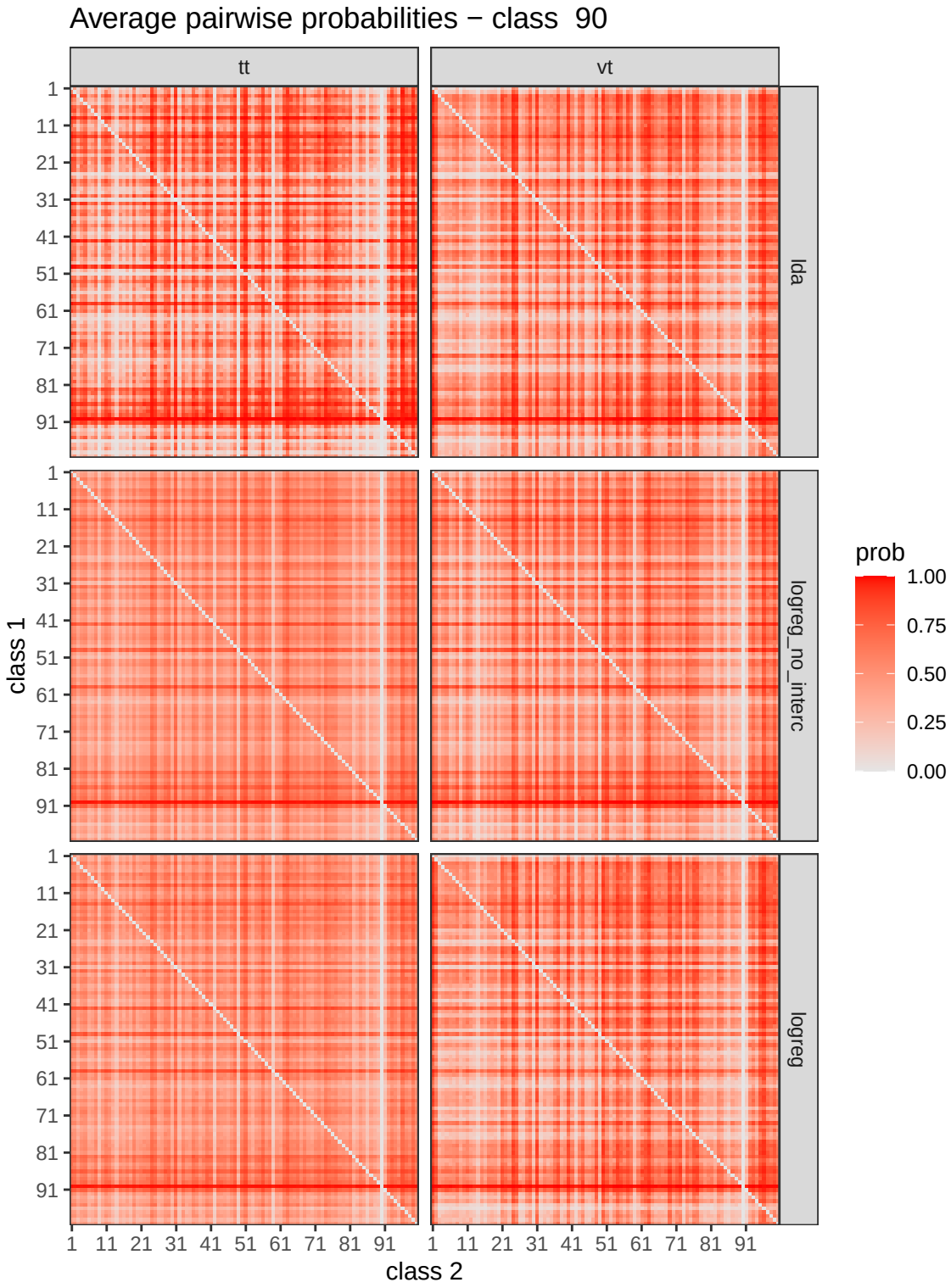

Average pairwise probabilities − class 85
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

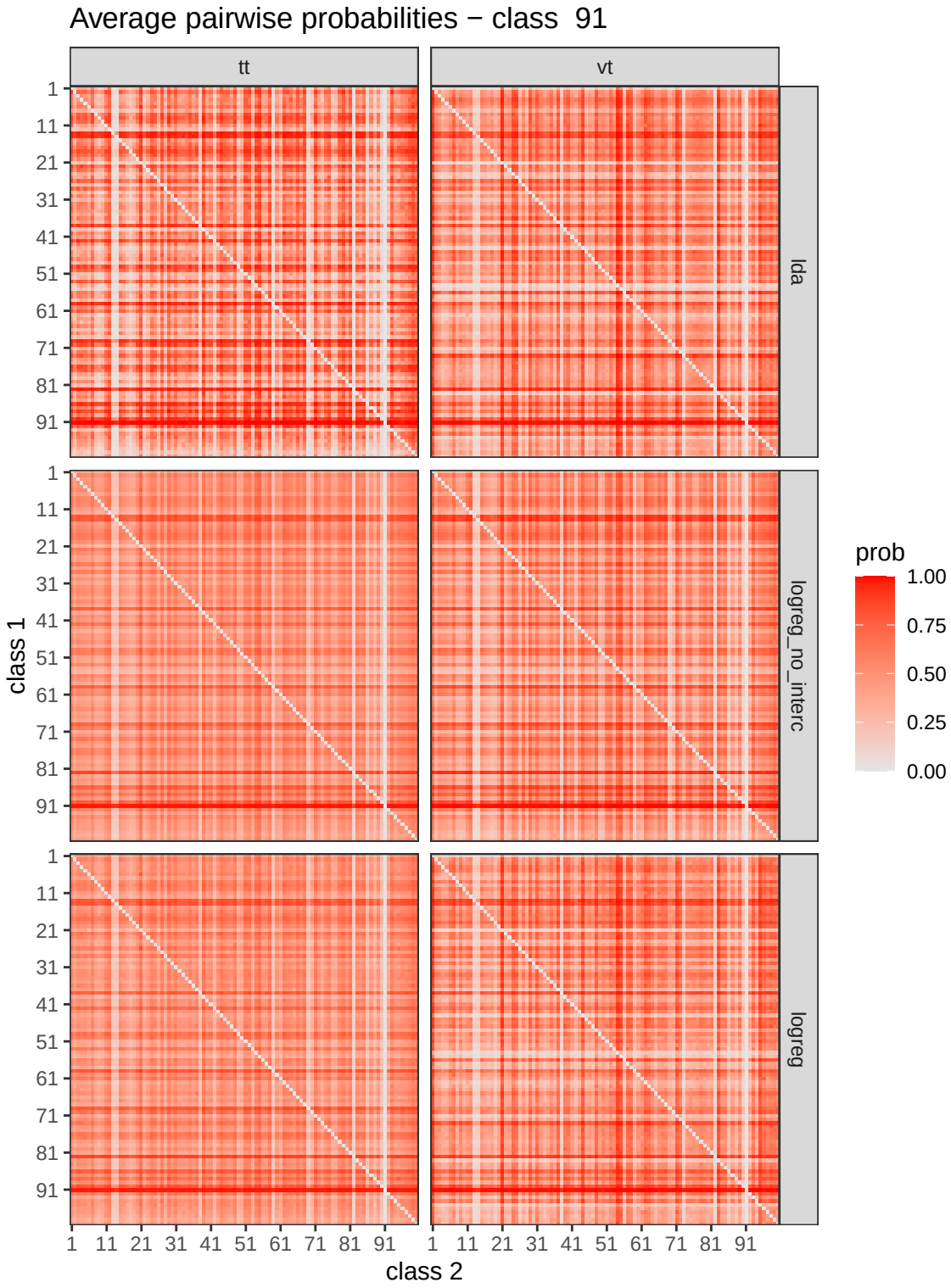

Average pairwise probabilities − class 86
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

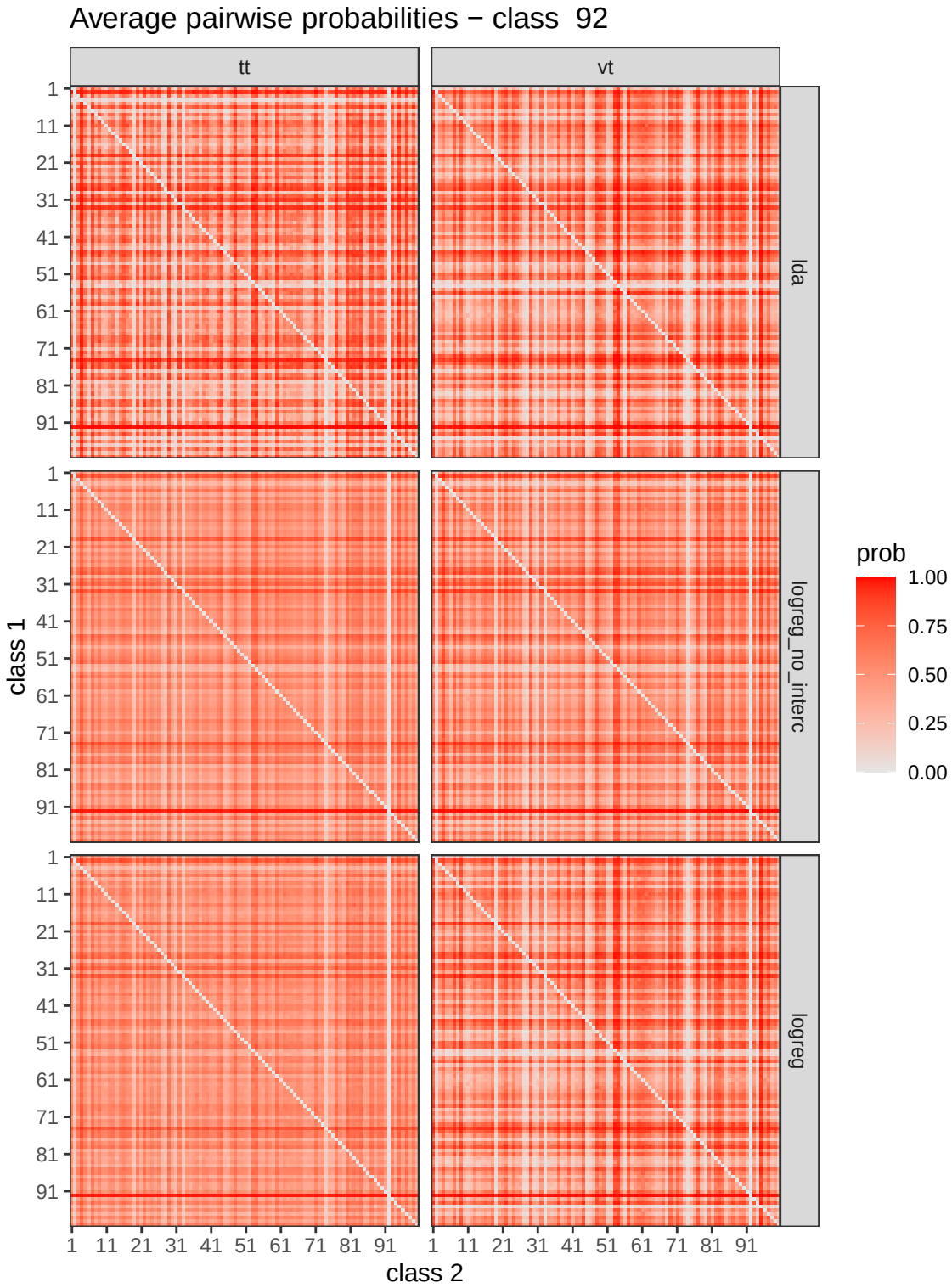

Average pairwise probabilities − class 87
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

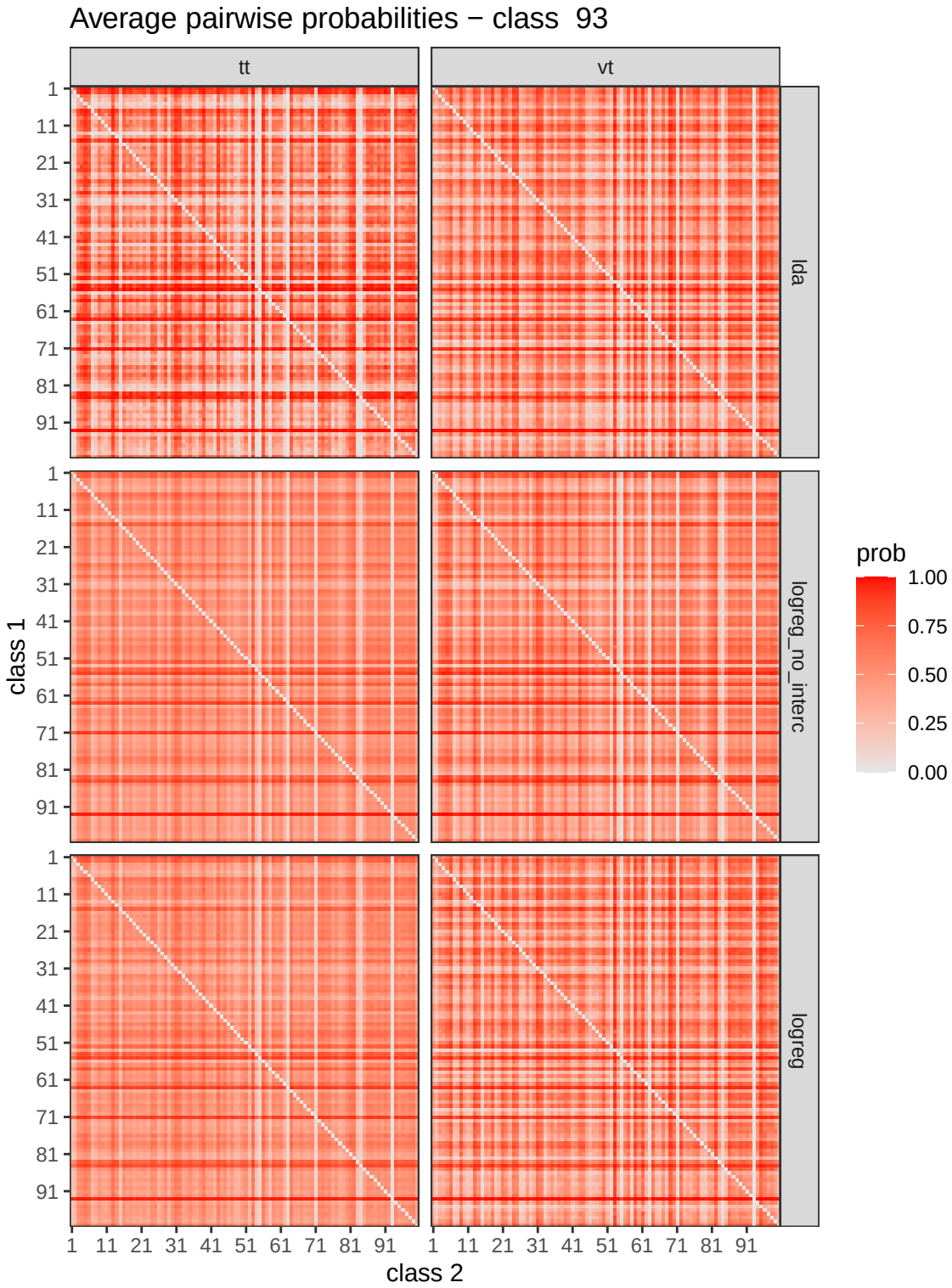

Average pairwise probabilities − class 88
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

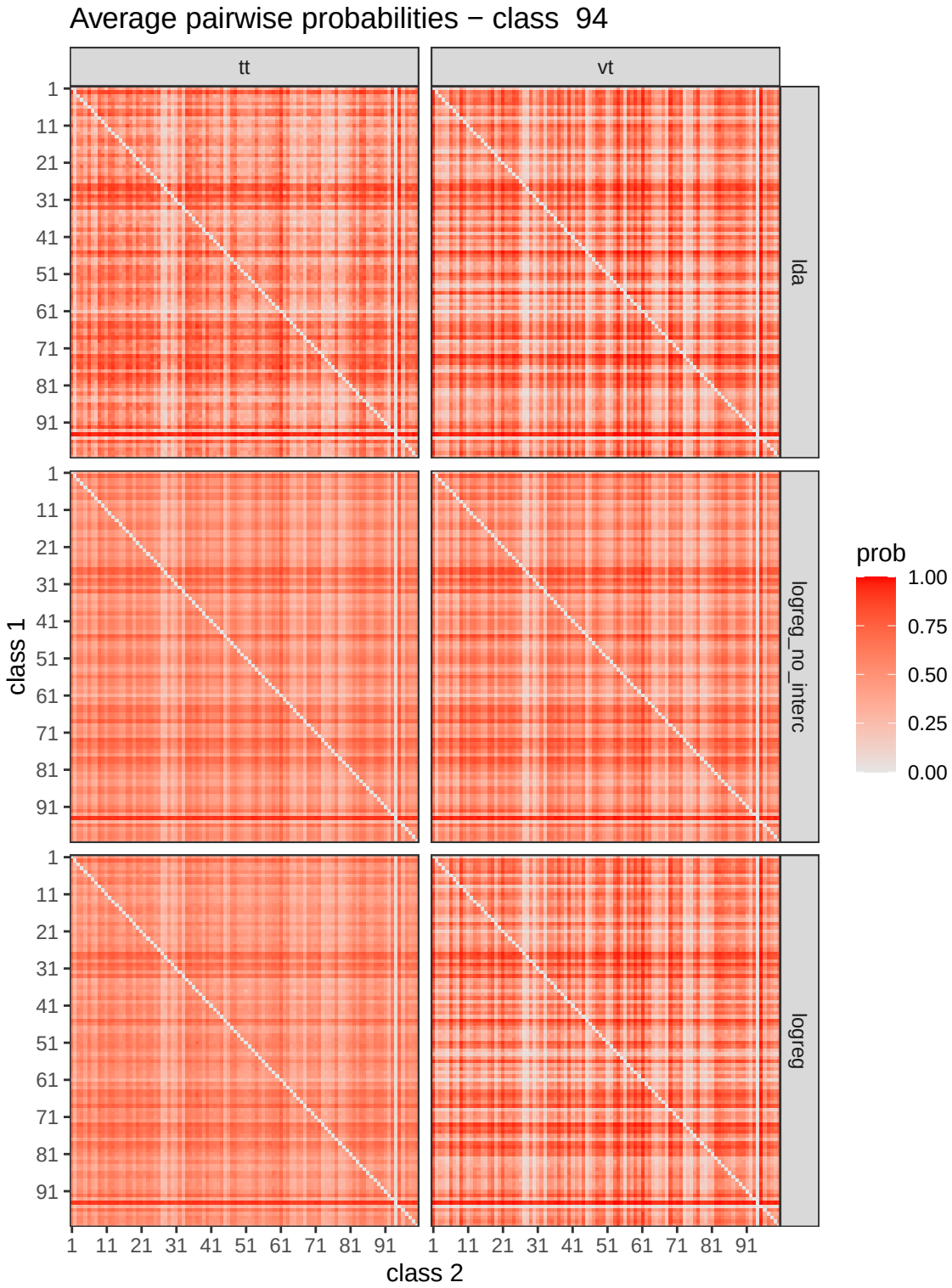

Average pairwise probabilities − class 89
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
1
11
21
31
41
51
61
71
81
91
prob
1.00
0.75
0.50
0.25
0.00

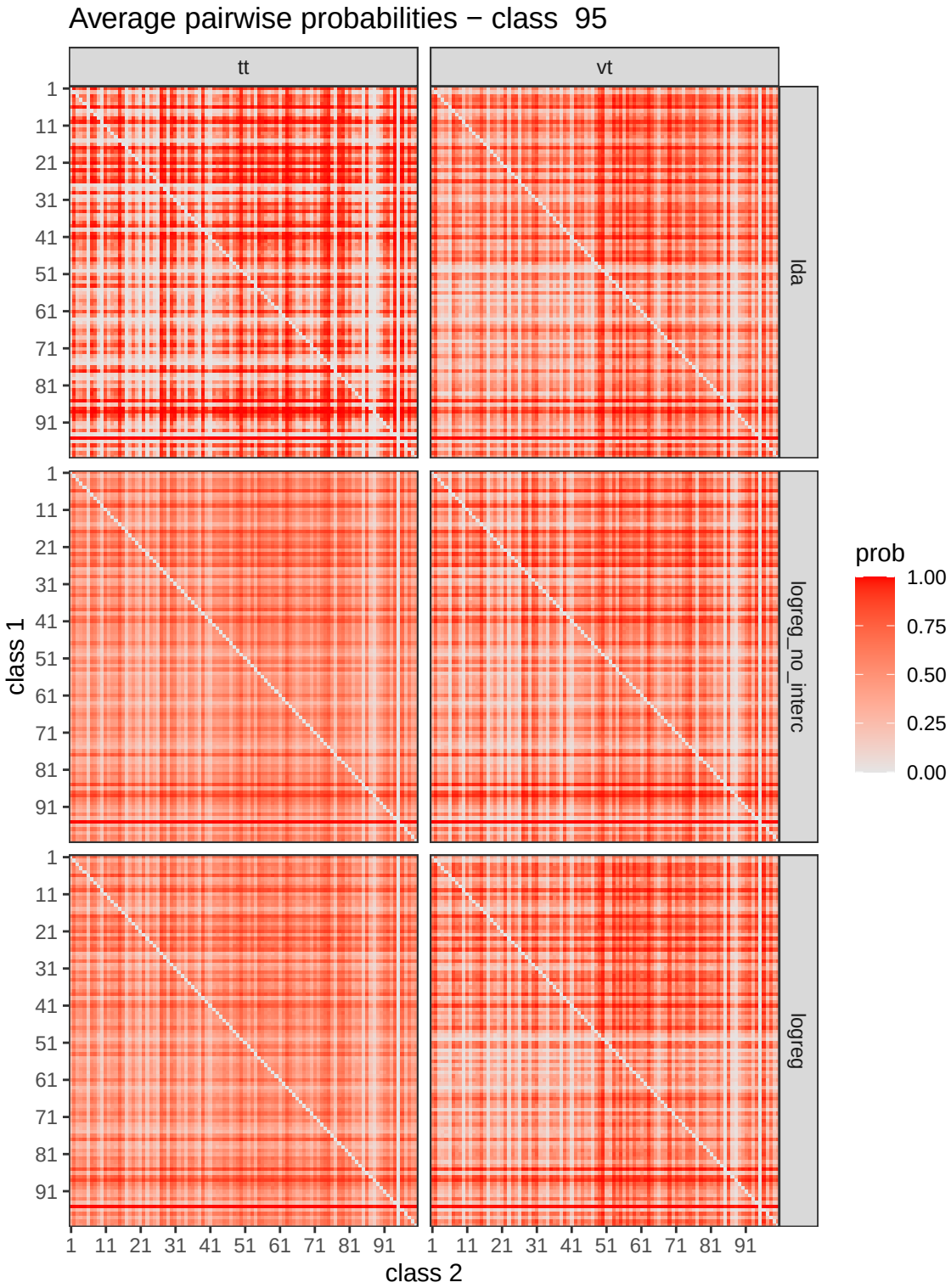

Average pairwise probabilities − class 90
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

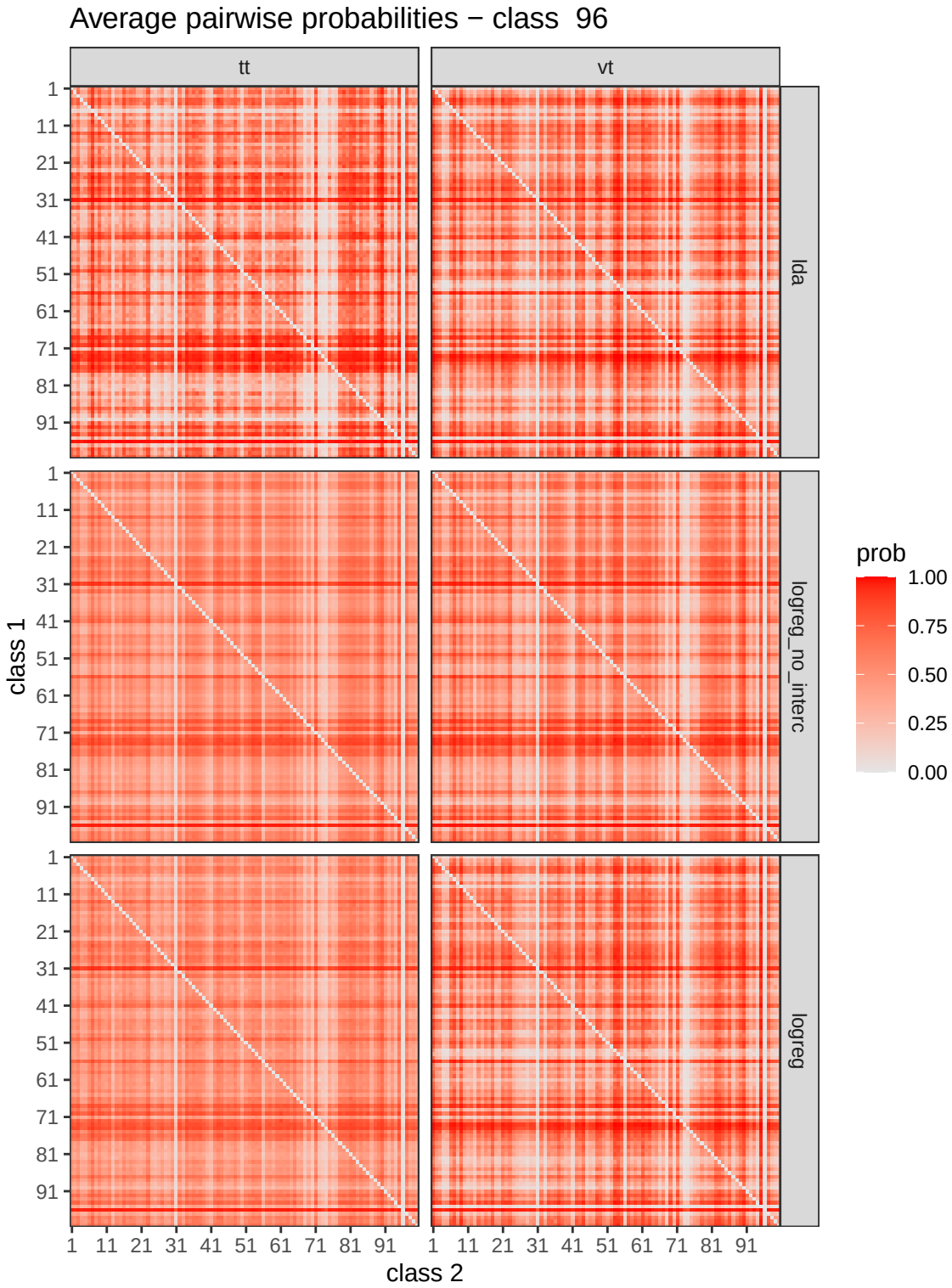

Average pairwise probabilities − class 91
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

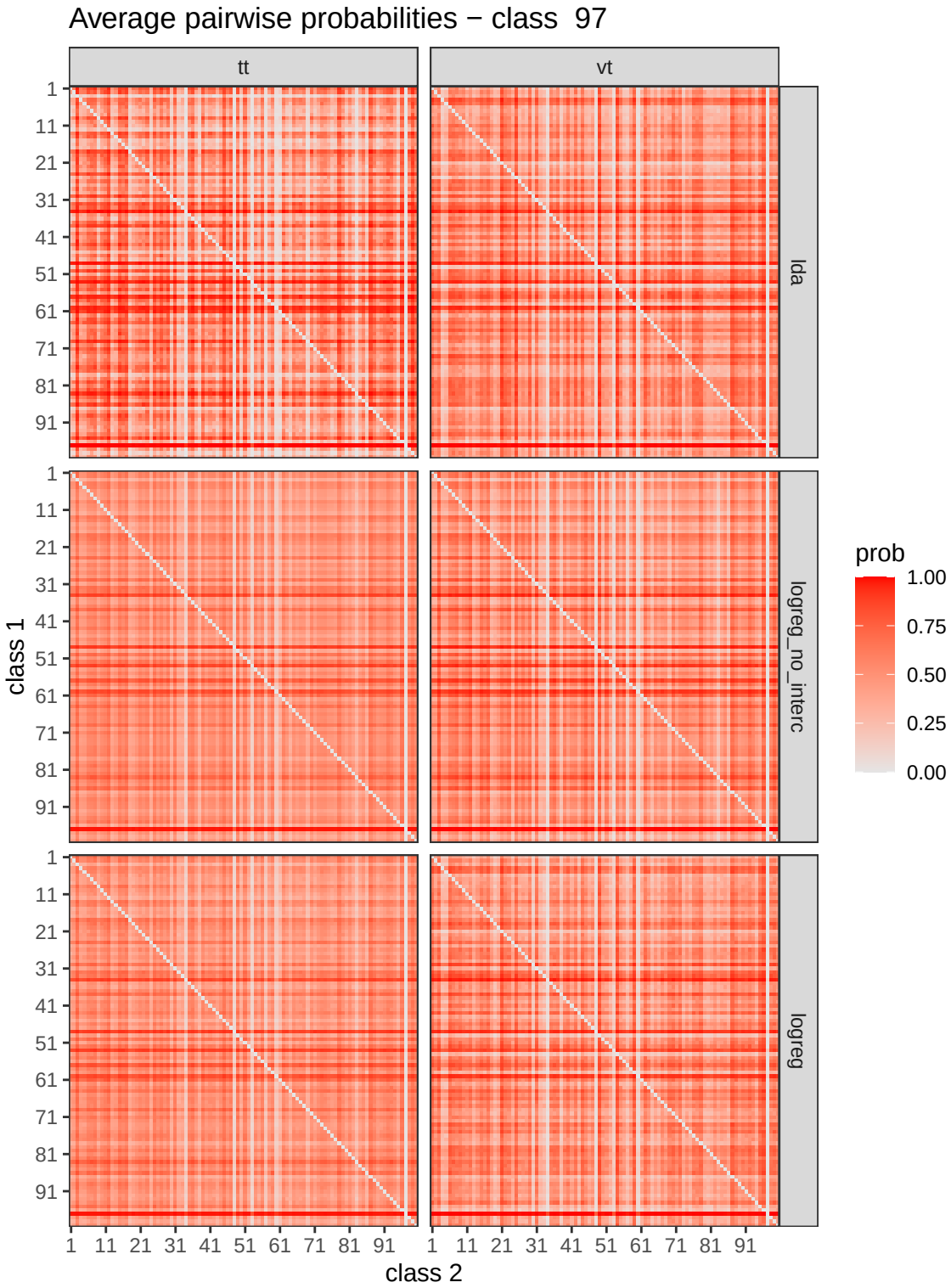

Average pairwise probabilities − class 92
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

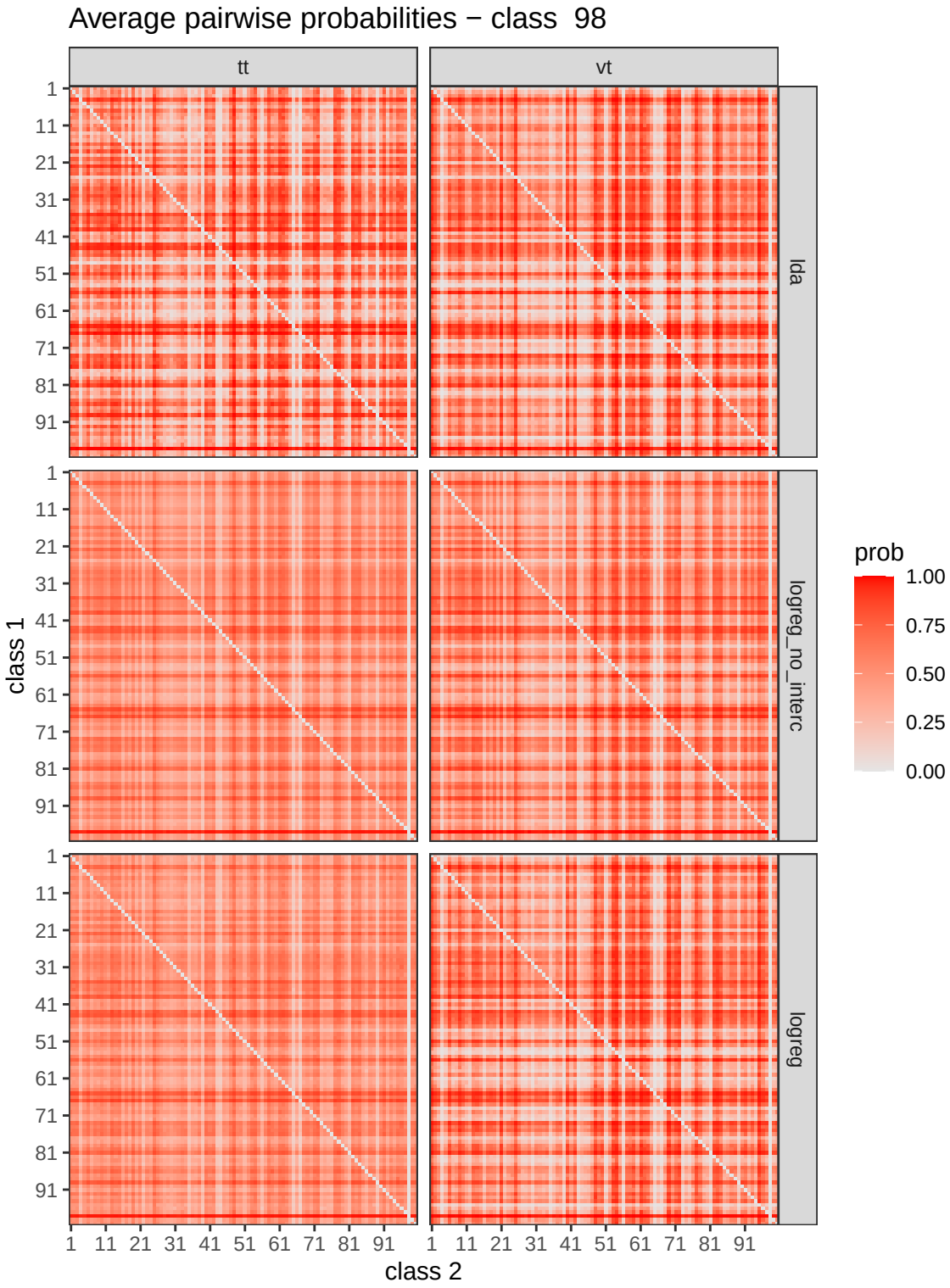

Average pairwise probabilities − class 93
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

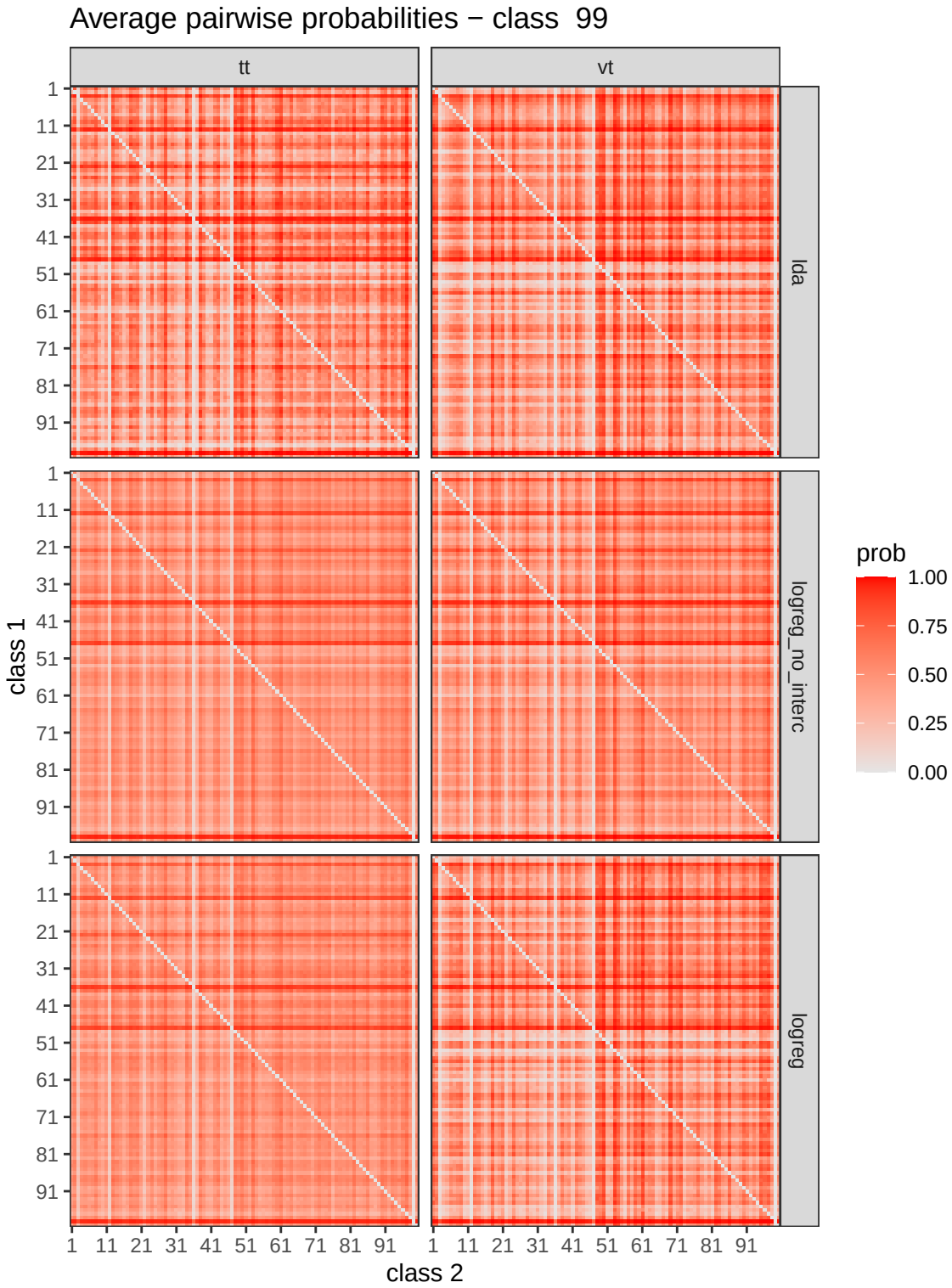

Average pairwise probabilities − class 94
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
1
11
21
31
41
51
61
71
81
91
prob
1.00
0.75
0.50
0.25
0.00

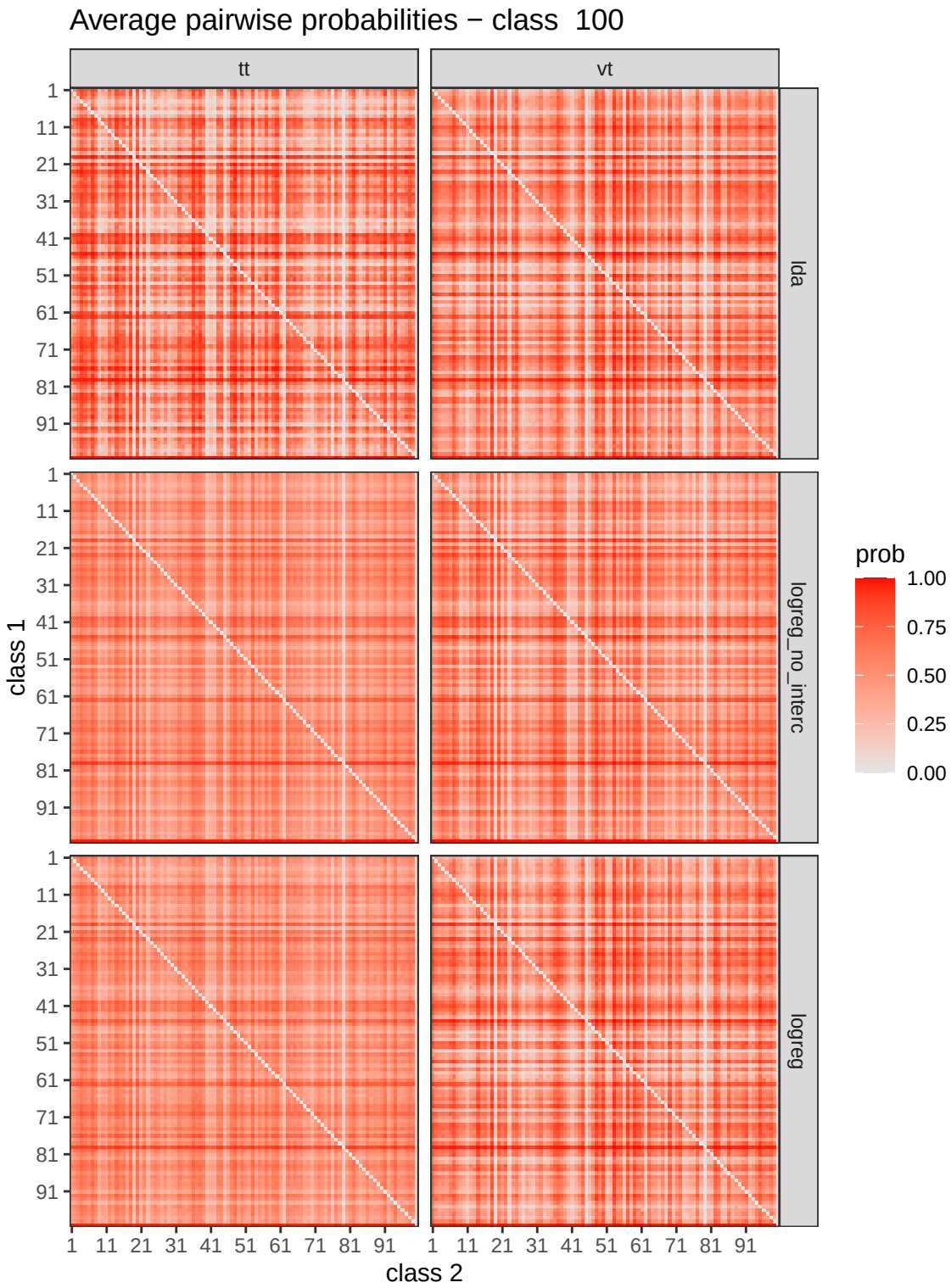

Average pairwise probabilities − class 95
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 96
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 97
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 98
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91


Average pairwise probabilities − class 99
tt
vt
lda
logreg_no_interc
logreg
class 1
class 2
prob
1.00
0.75
0.50
0.25
0.00
1
11
21
31
41
51
61
71
81
91

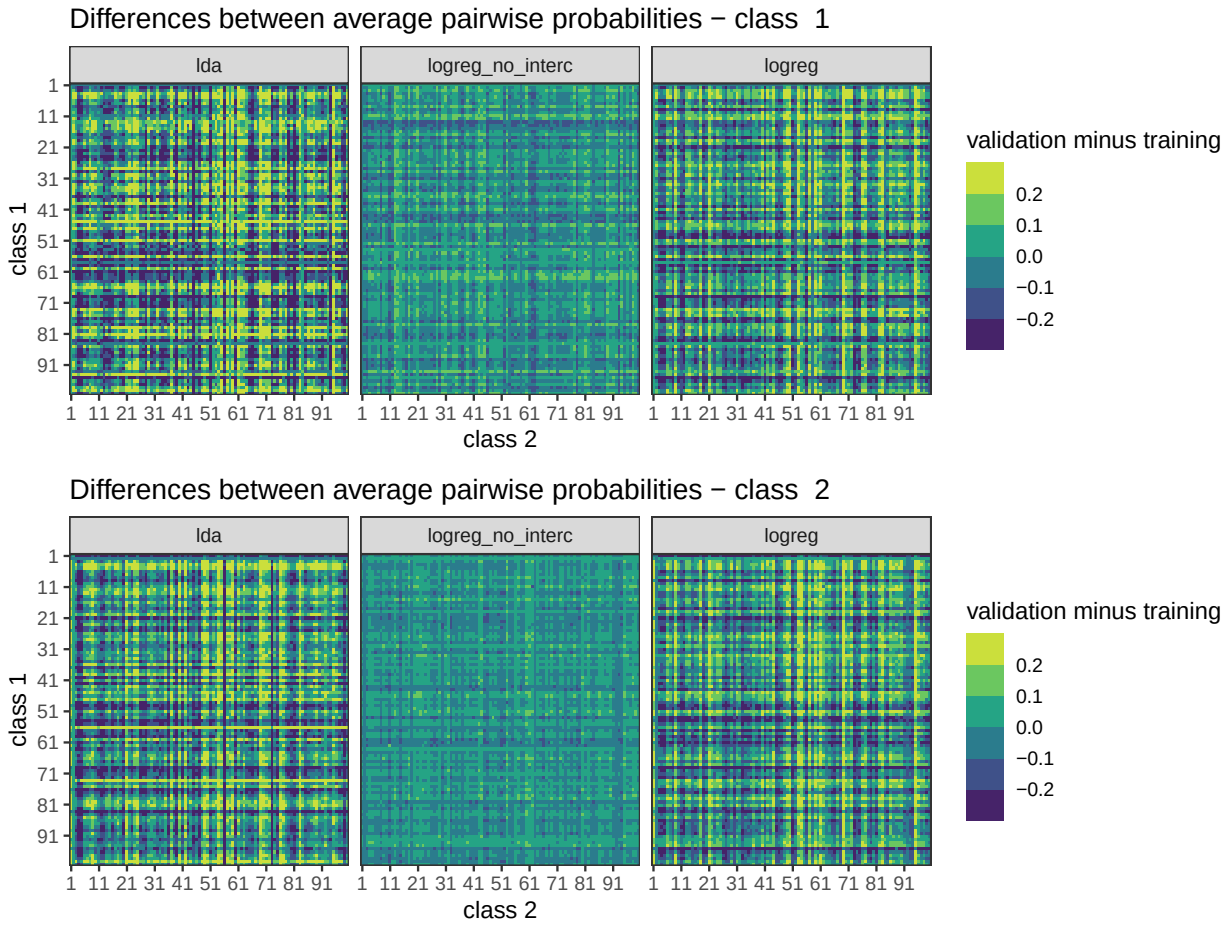


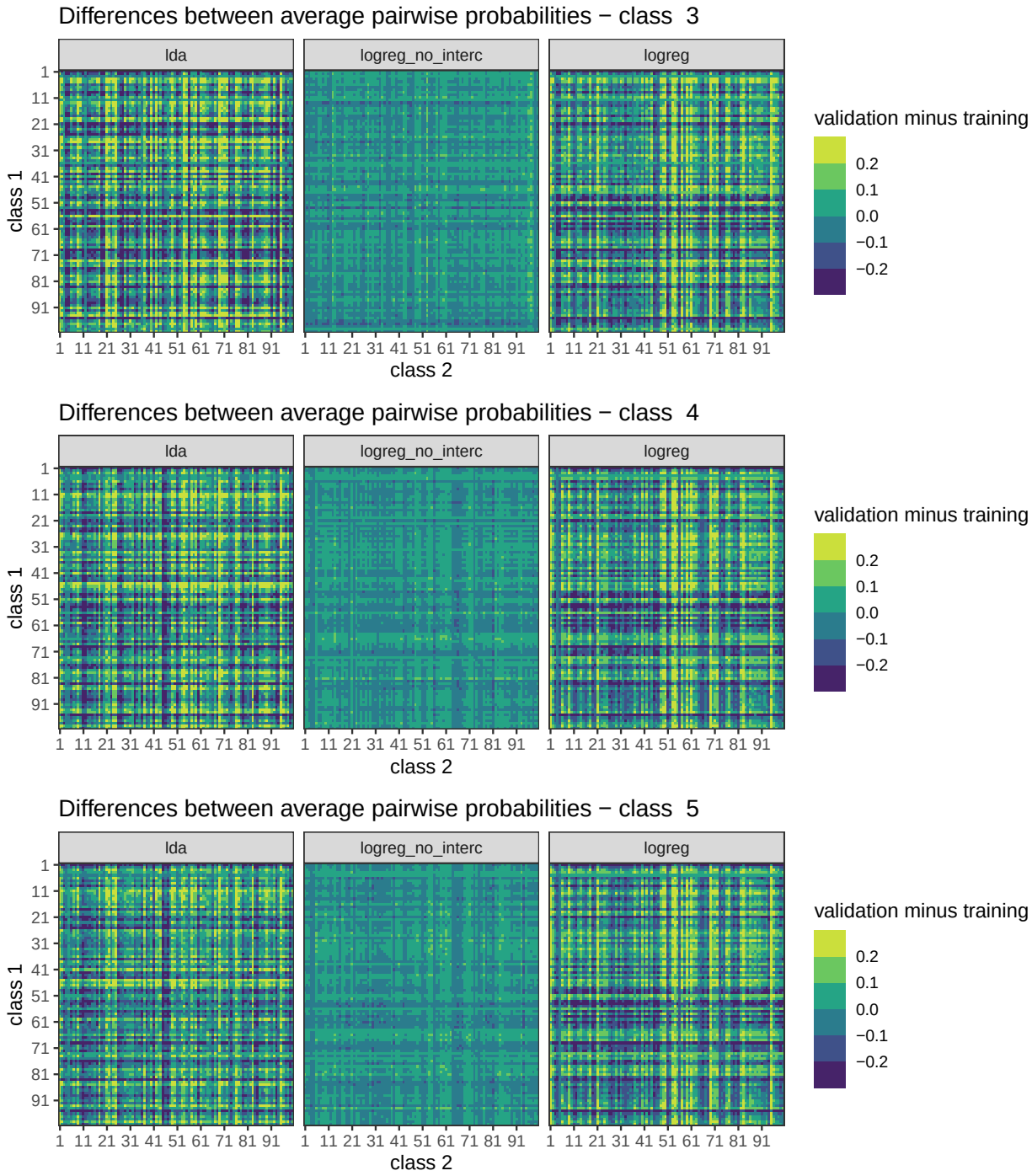
ma-

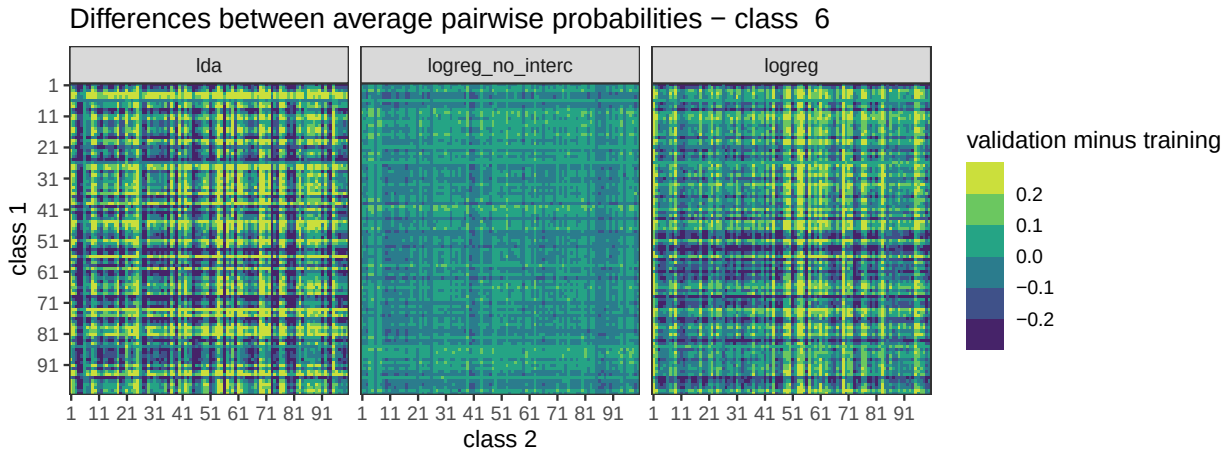
trices for logreg are less sharp - this is visible mainly for tt.

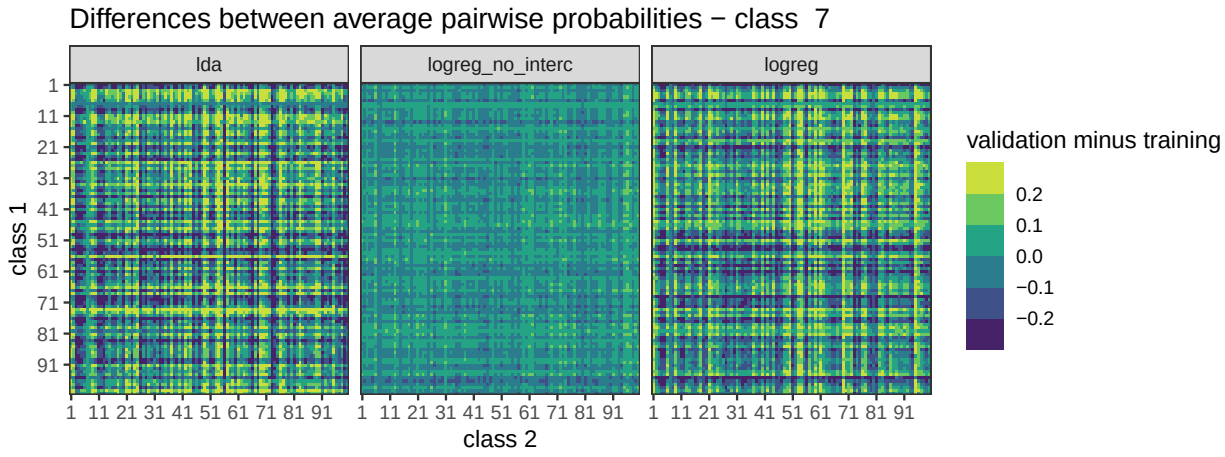
```
for (cls in 1:classes)
{
  cur_class_Rs <- df_aggr_Rs_diff %>% filter(class == cls)
  plot_cls <-  ggplot(cur_class_Rs, aes(x = class2, y = class1)) +
```

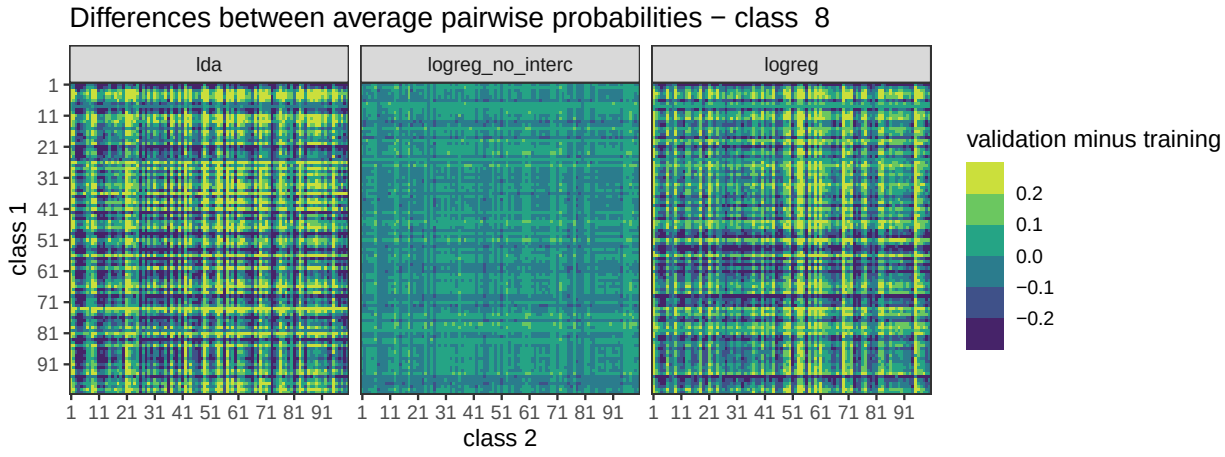
```
    geom_raster(aes(fill=val_min_train)) +
    facet_wrap(~combining_method) +
    scale_fill_binned(type="viridis", limits=c(-0.3, 0.3), name="validation minus training") +
    scale_y_discrete(limits=rev, breaks=seq(1, 100, 10)) +
    scale_x_discrete(breaks=seq(1, 100, 10)) +
    labs(x="class 2", y="class 1", title=paste("Differences between average pairwise probabilities - cla
    theme_bw()

  print(plot_cls)
}
```

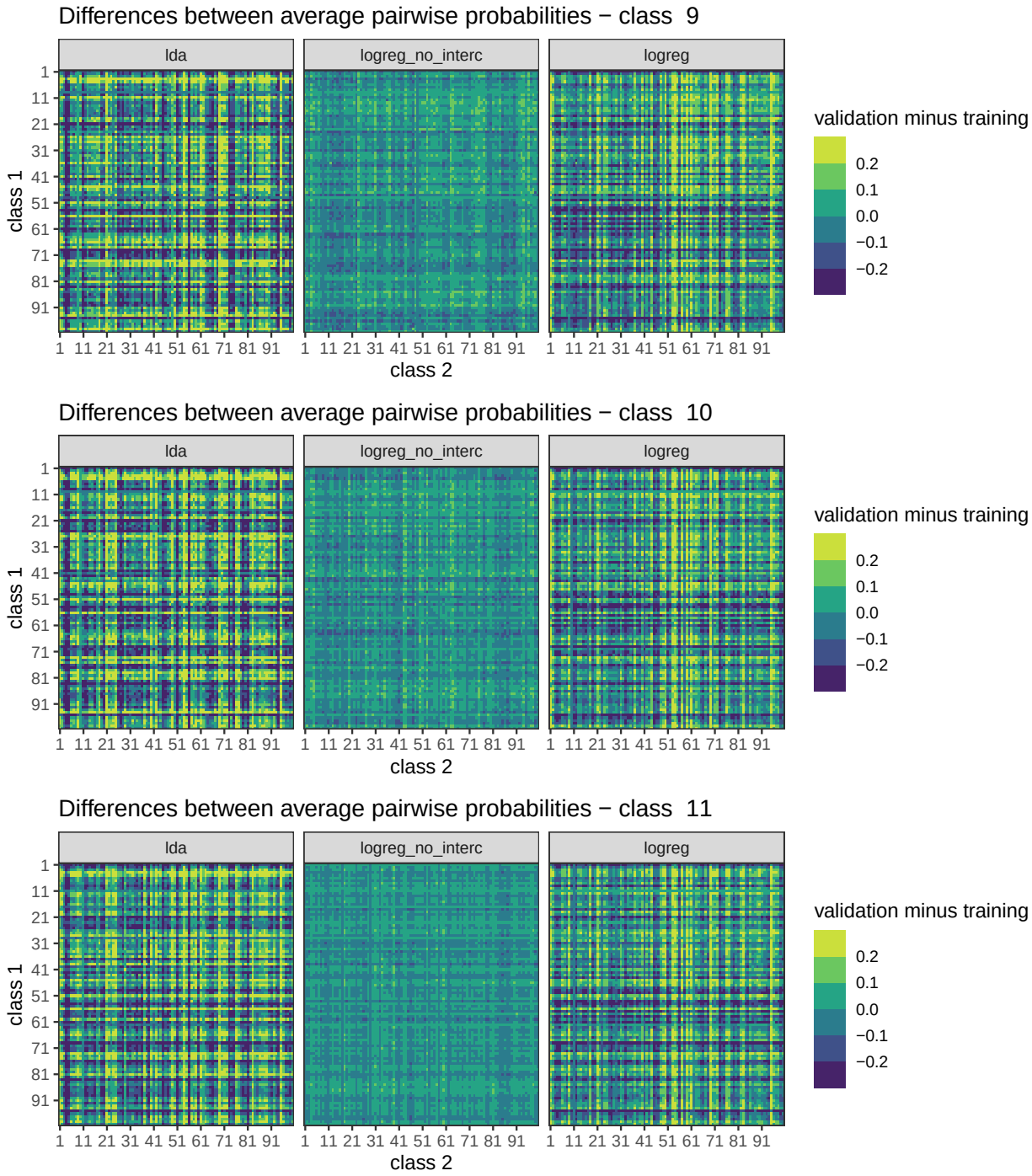


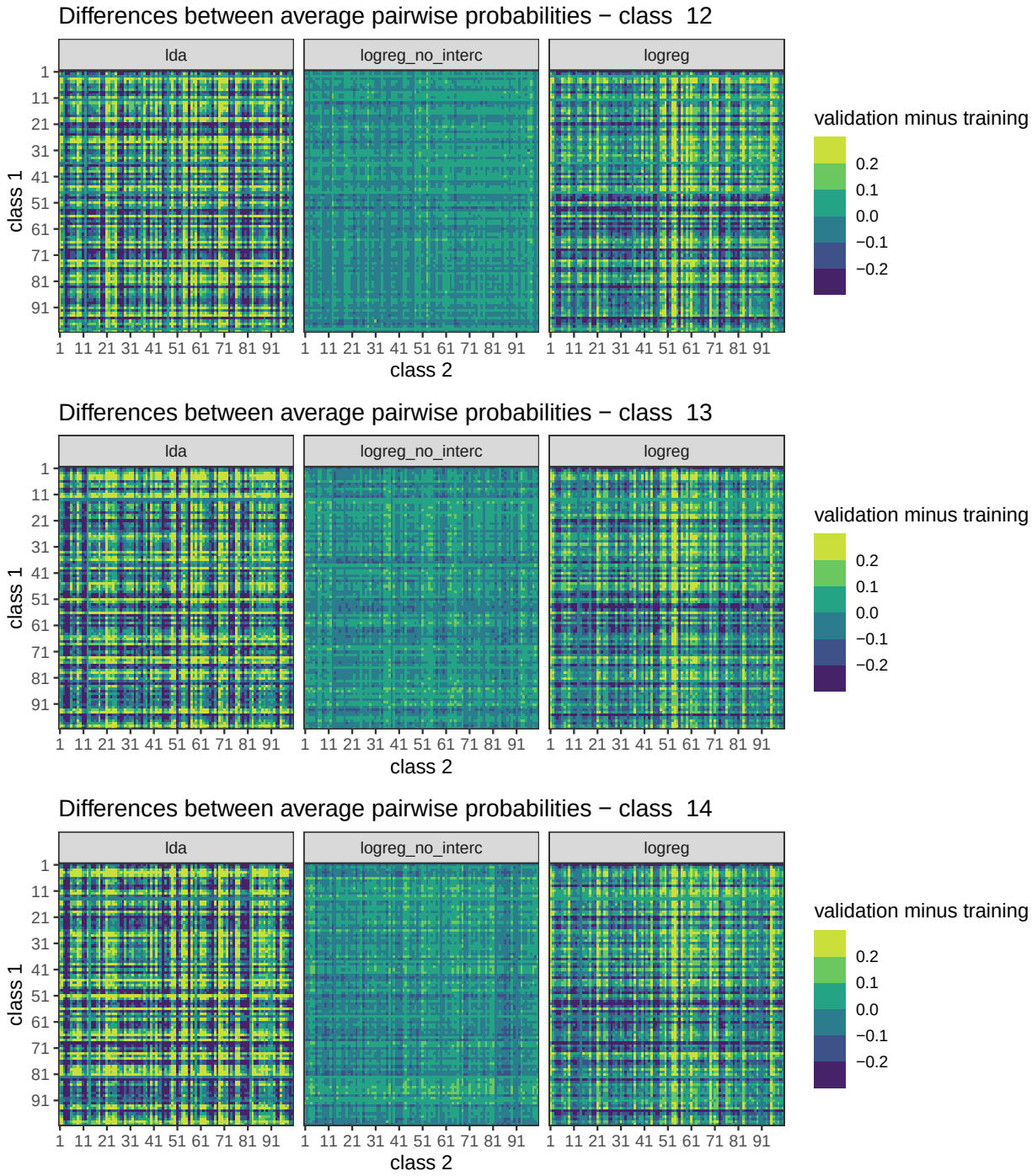

Differences between average pairwise probabilities − class 3
Differences between average pairwise probabilities − class 4
Differences between average pairwise probabilities − class 5
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

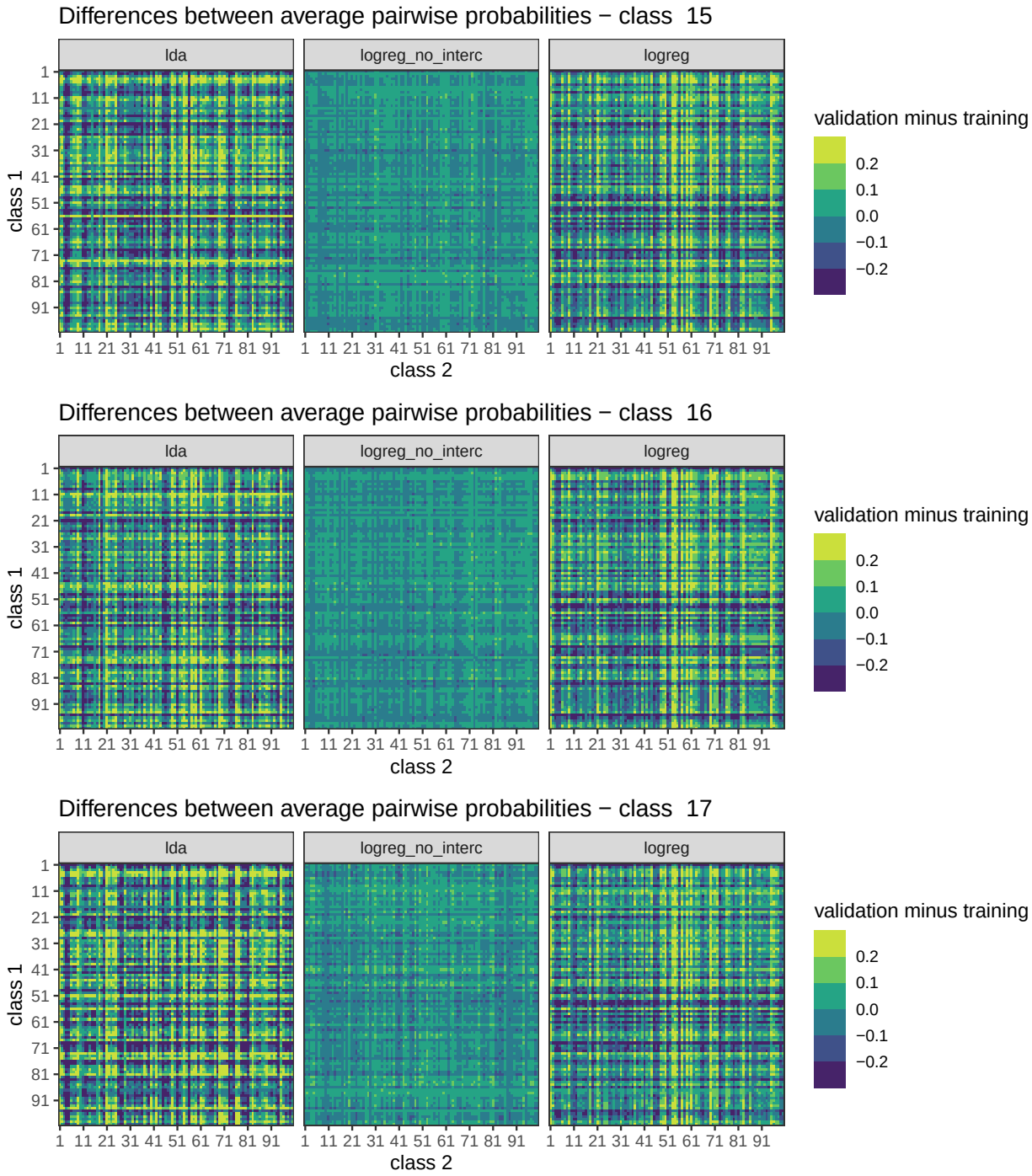

Differences between average pairwise probabilities − class 6
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

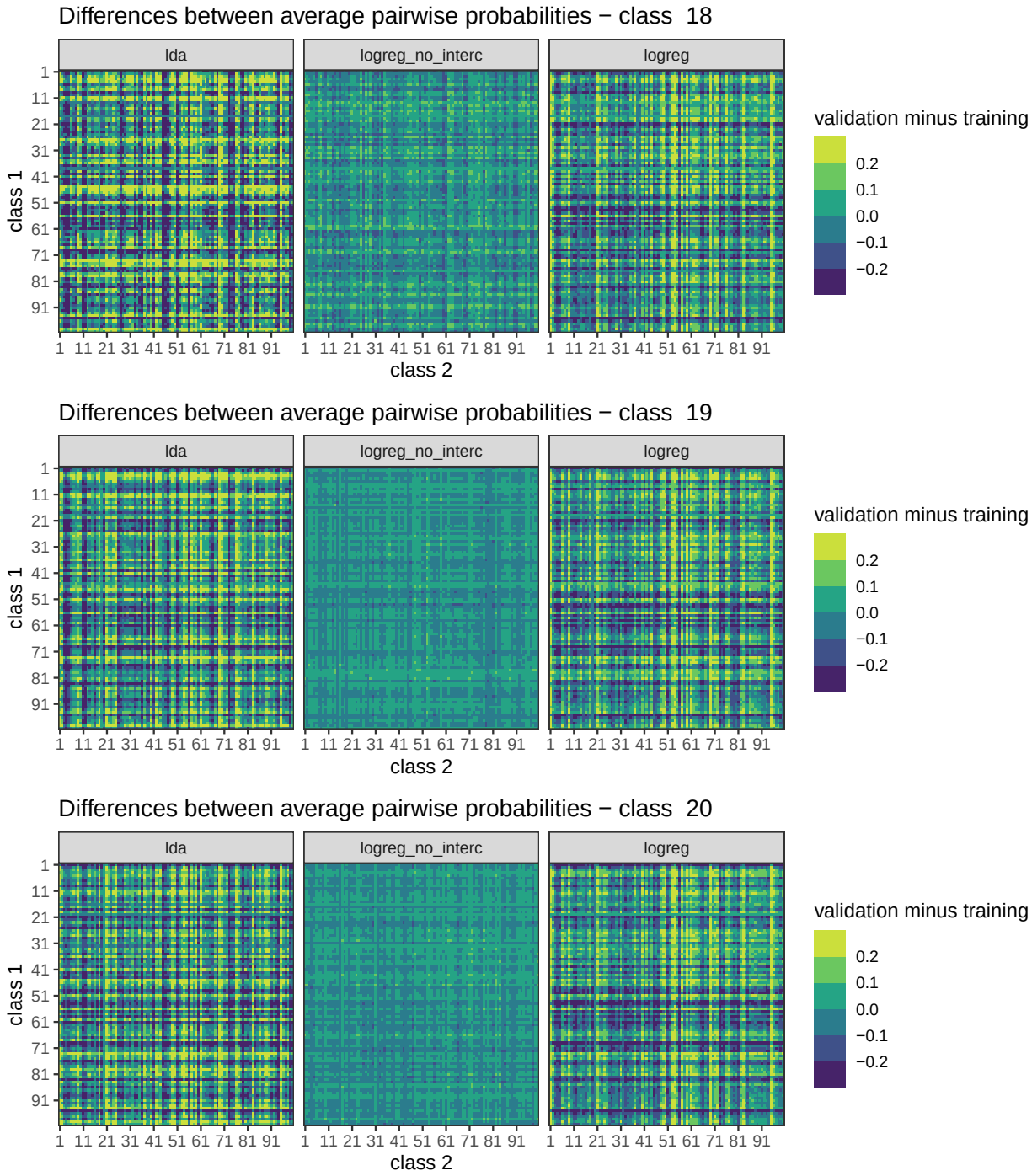

Differences between average pairwise probabilities − class 7
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

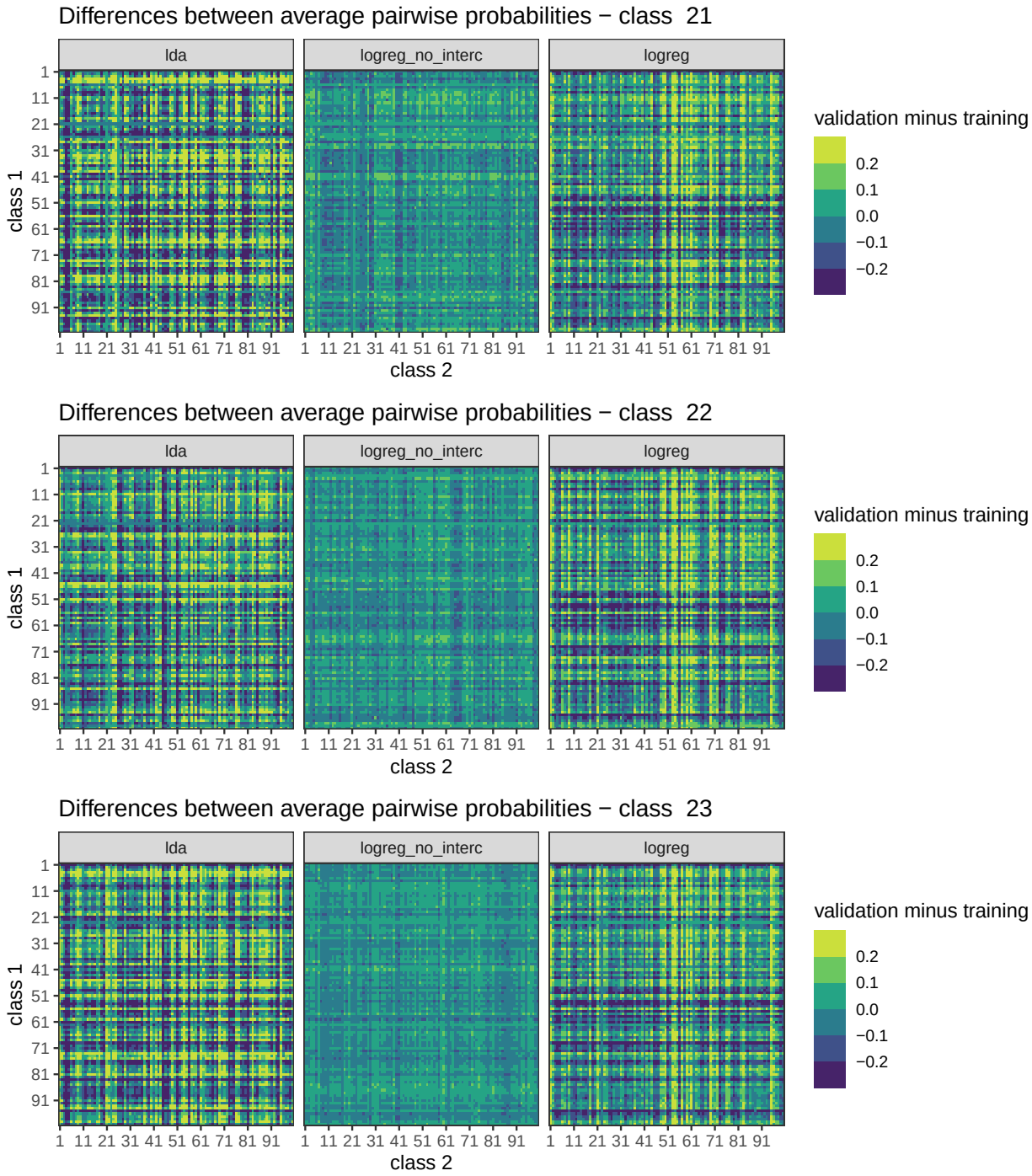

Differences between average pairwise probabilities − class 8
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

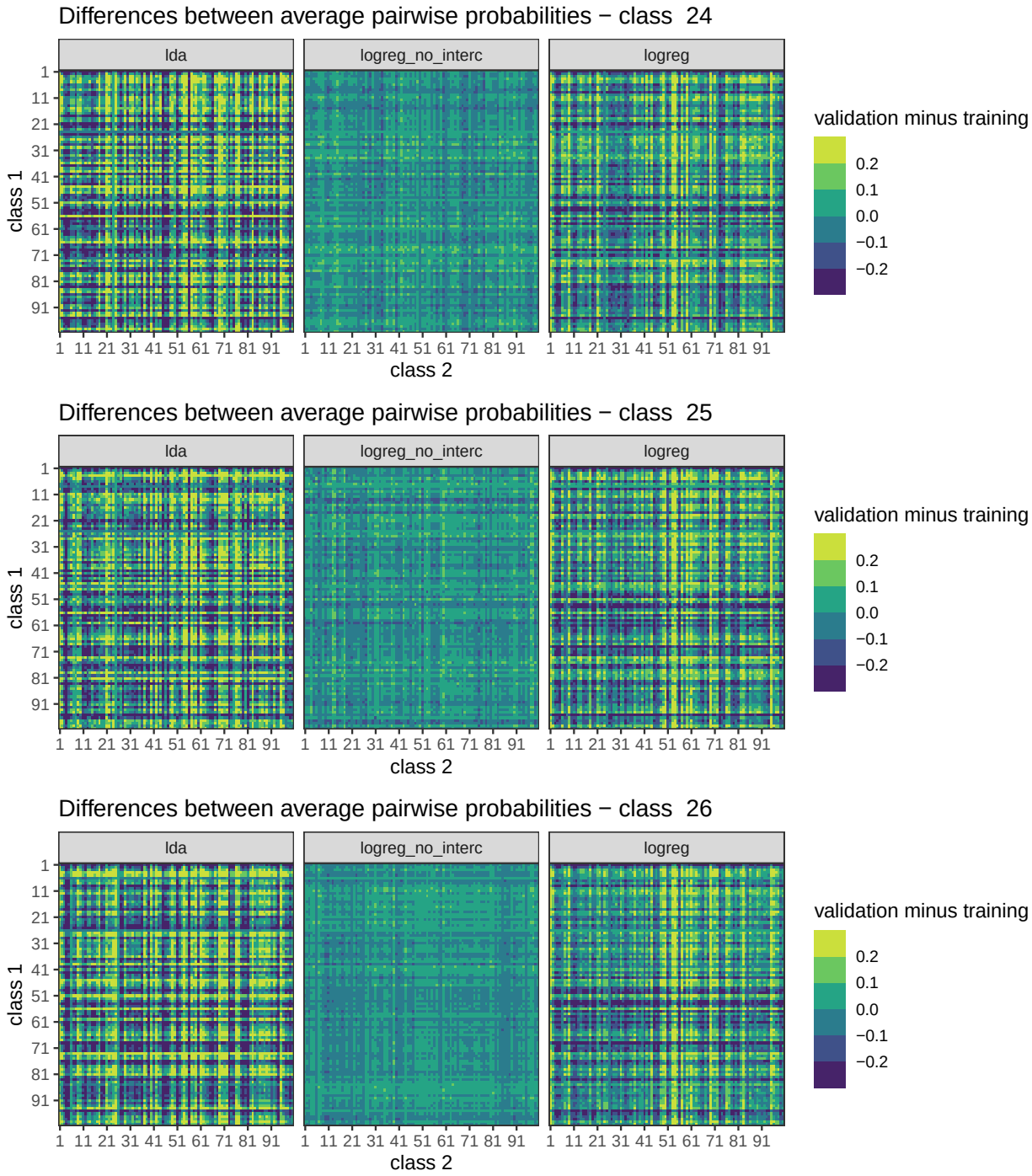

Differences between average pairwise probabilities − class 9
Differences between average pairwise probabilities − class 10
Differences between average pairwise probabilities − class 11
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

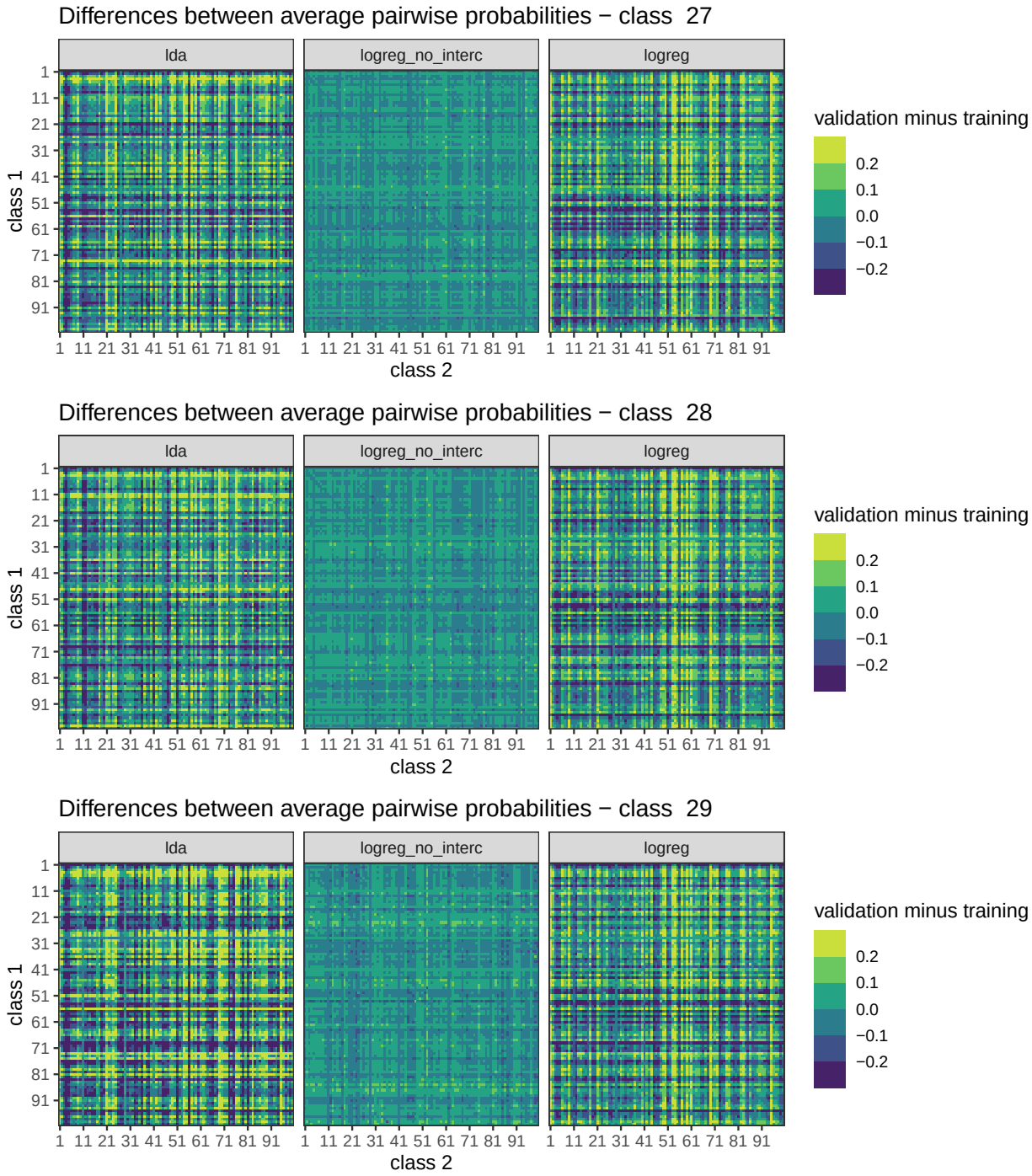

Differences between average pairwise probabilities − class 12
Differences between average pairwise probabilities − class 13
Differences between average pairwise probabilities − class 14
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

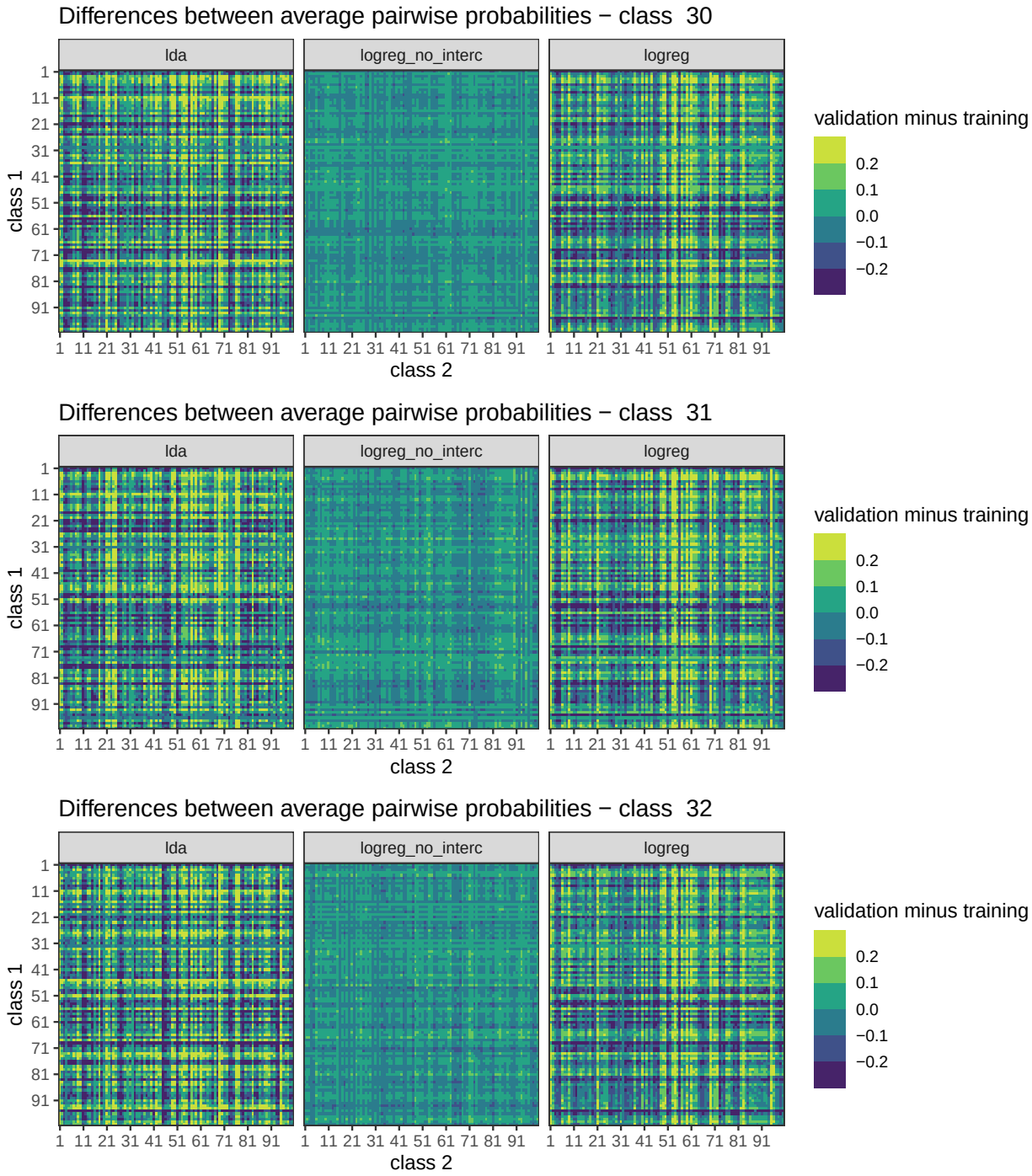

Differences between average pairwise probabilities − class 15
Differences between average pairwise probabilities − class 16
Differences between average pairwise probabilities − class 17
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

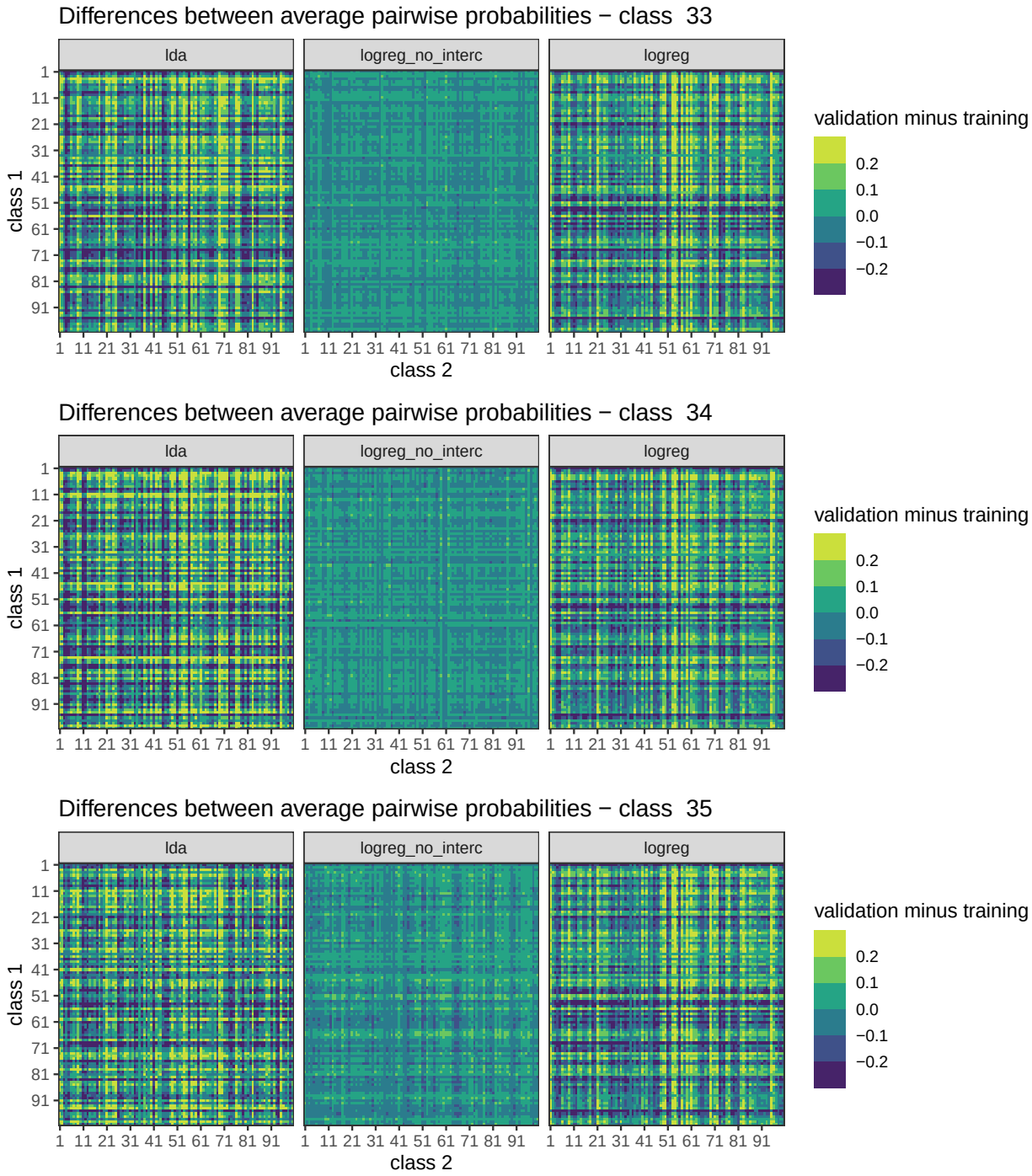

Differences between average pairwise probabilities − class 18
Differences between average pairwise probabilities − class 19
Differences between average pairwise probabilities − class 20
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
1 11 21 31 41 51 61 71 81 91

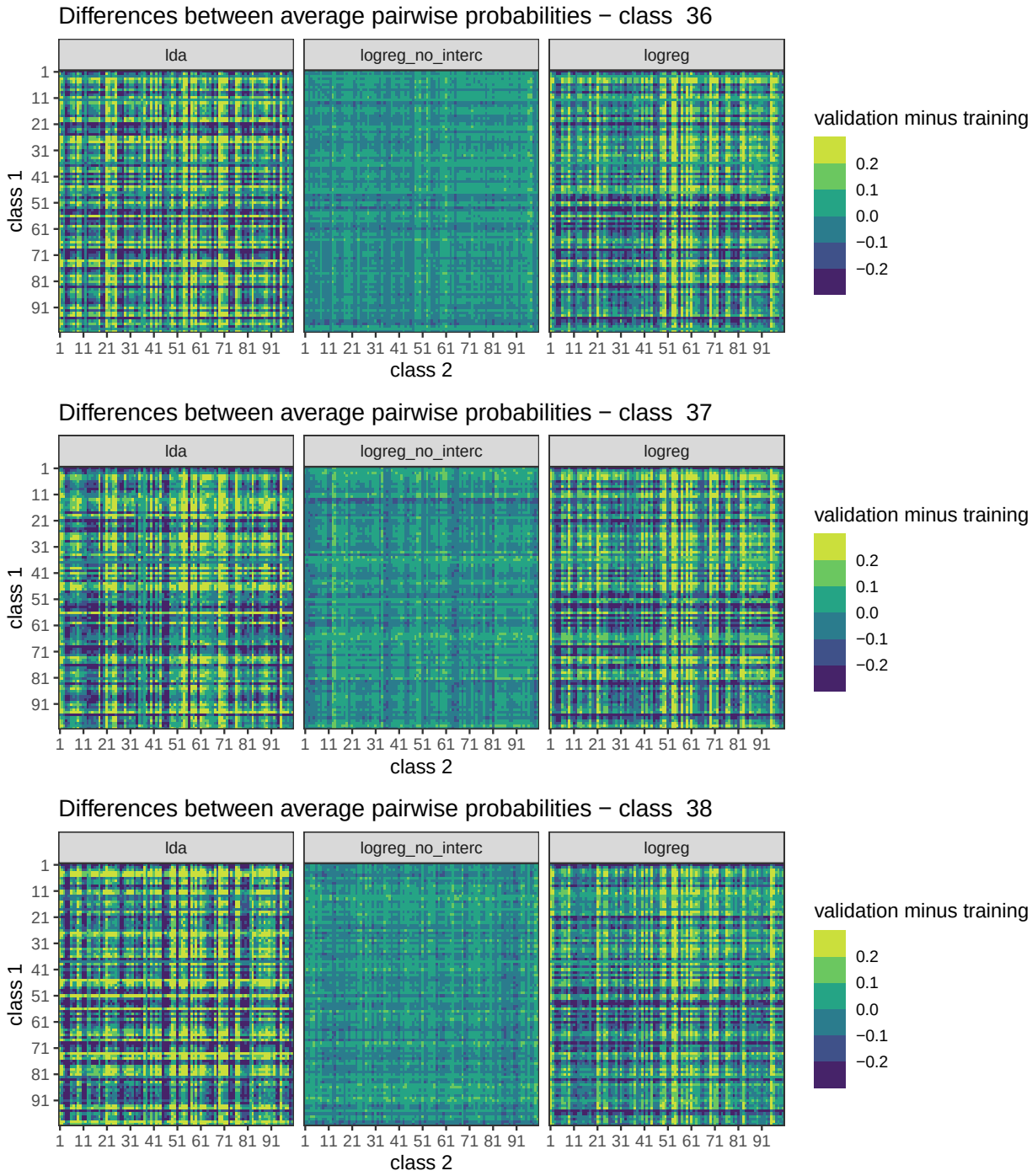

Differences between average pairwise probabilities − class 21
Differences between average pairwise probabilities − class 22
Differences between average pairwise probabilities − class 23
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

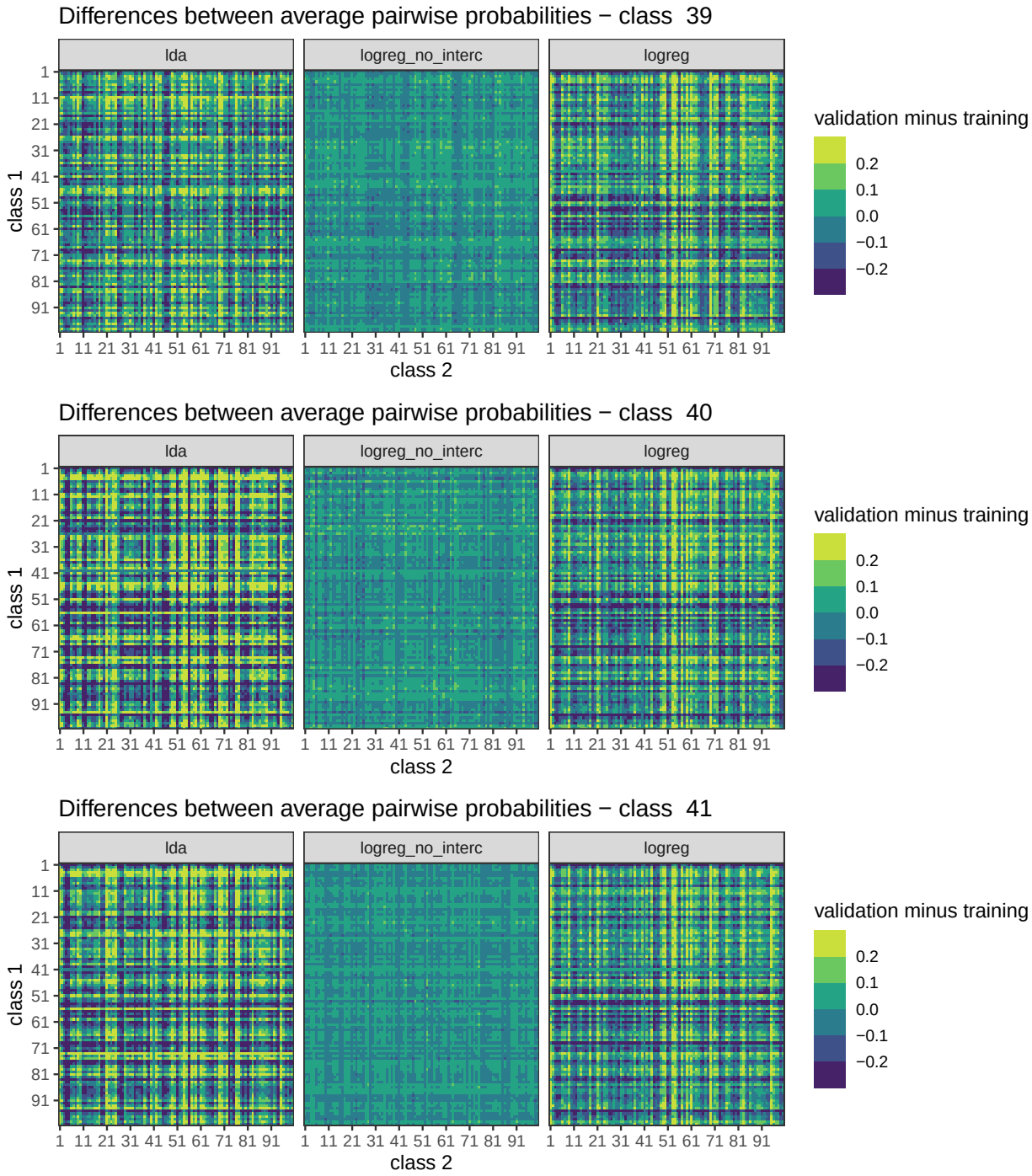

Differences between average pairwise probabilities − class 24
Differences between average pairwise probabilities − class 25
Differences between average pairwise probabilities − class 26
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

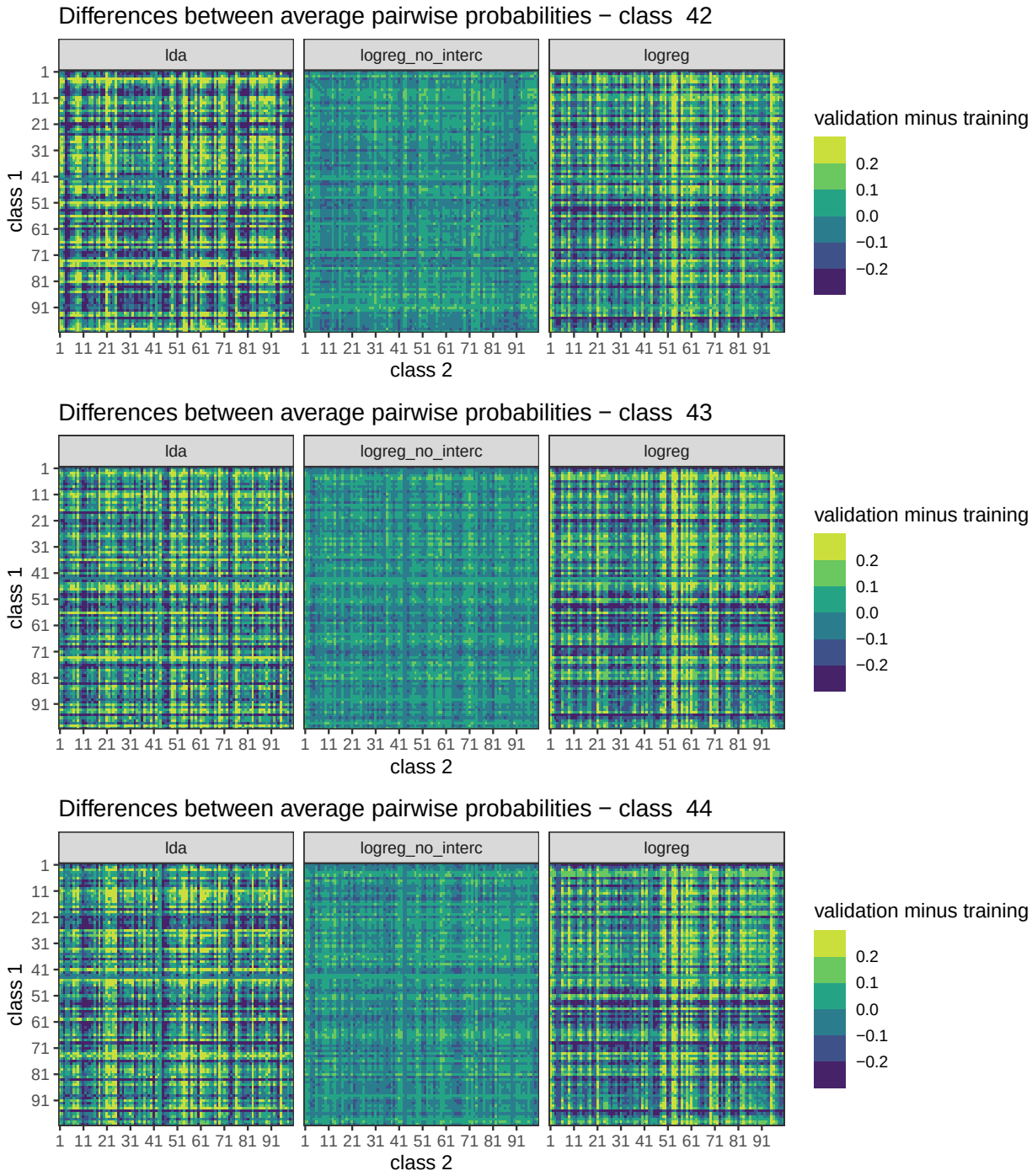

Differences between average pairwise probabilities − class 27
Differences between average pairwise probabilities − class 28
Differences between average pairwise probabilities − class 29
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

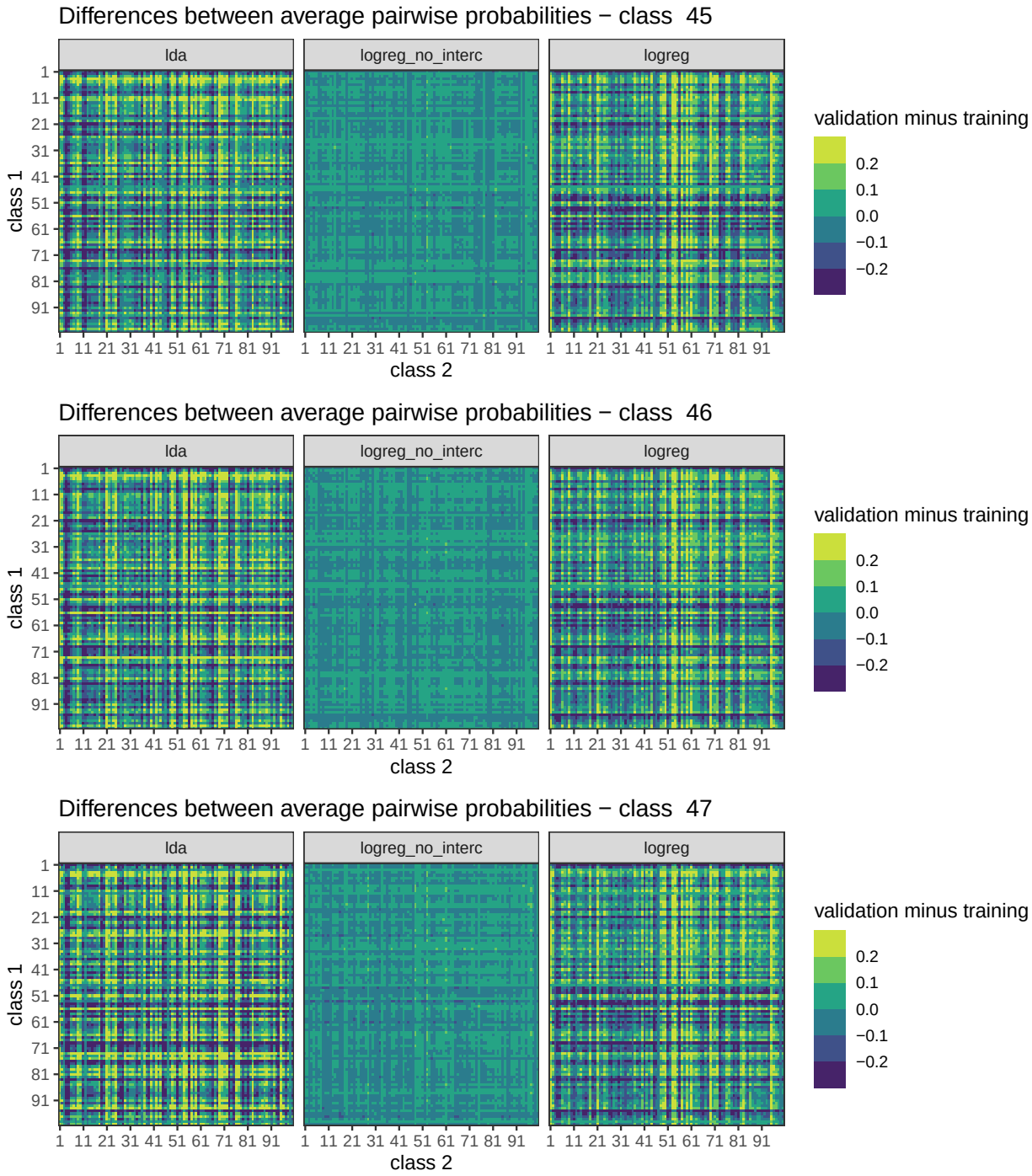

Differences between average pairwise probabilities − class 30
Differences between average pairwise probabilities − class 31
Differences between average pairwise probabilities − class 32
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

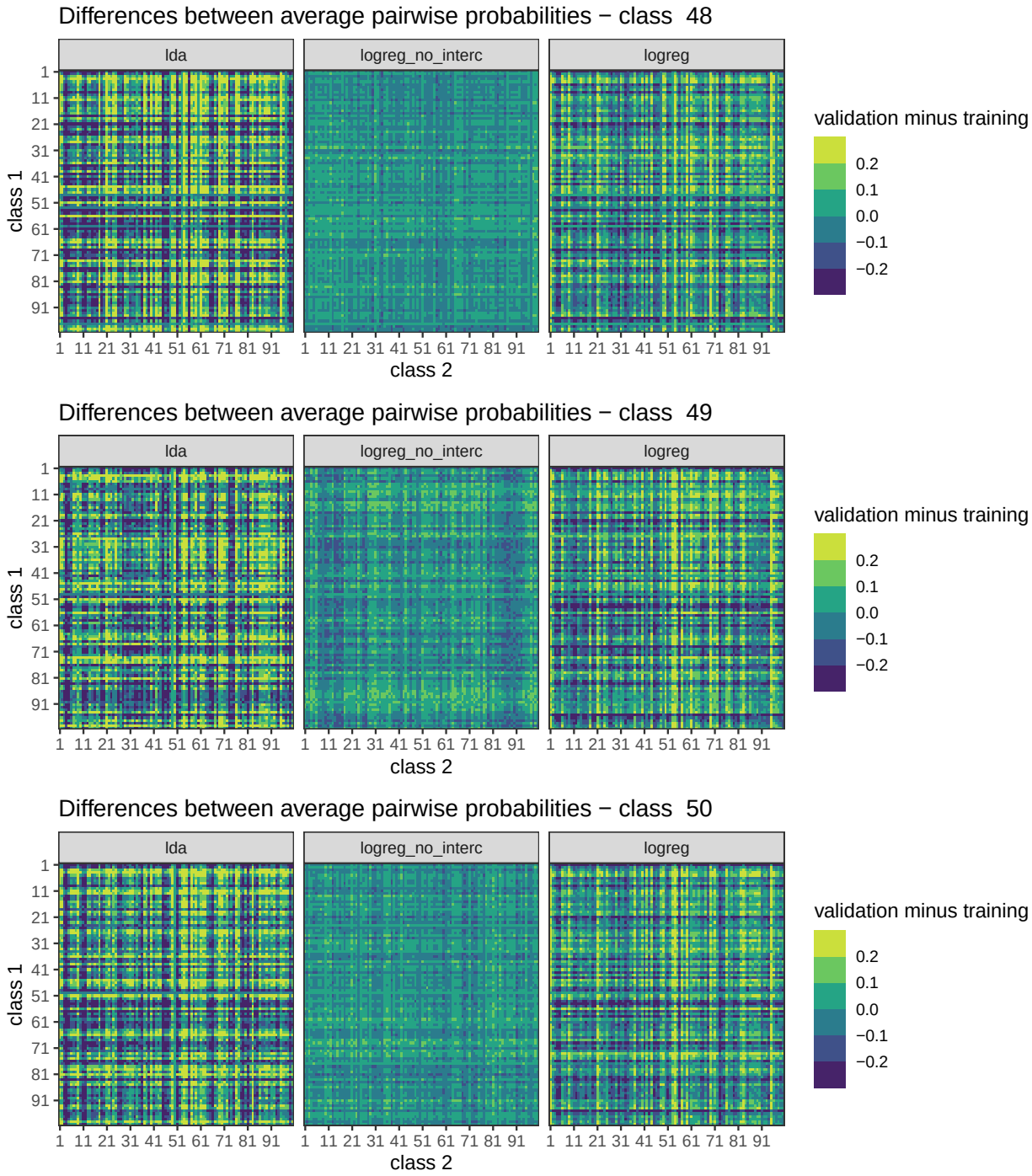

Differences between average pairwise probabilities − class 33
Differences between average pairwise probabilities − class 34
Differences between average pairwise probabilities − class 35
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

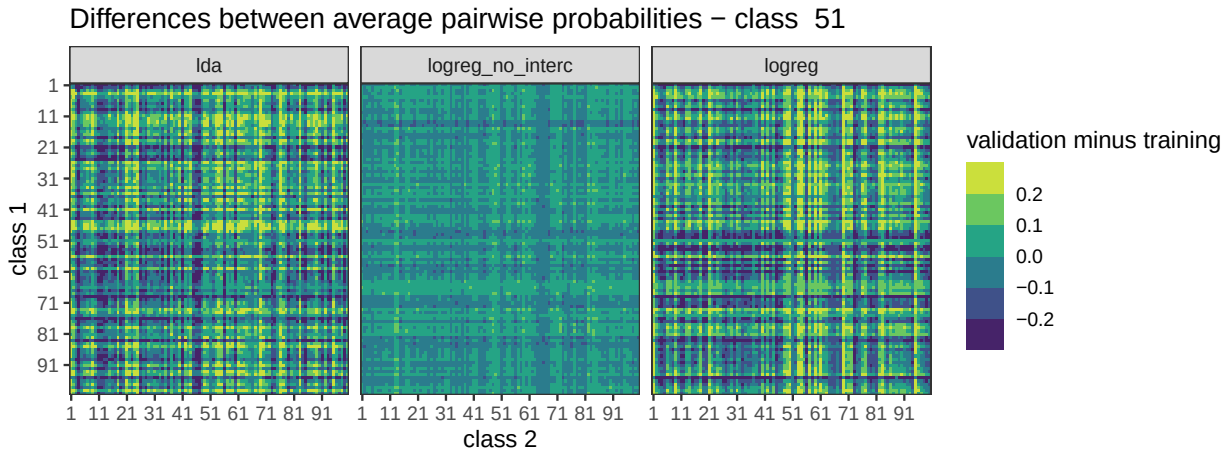

Differences between average pairwise probabilities − class 36
Differences between average pairwise probabilities − class 37
Differences between average pairwise probabilities − class 38
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

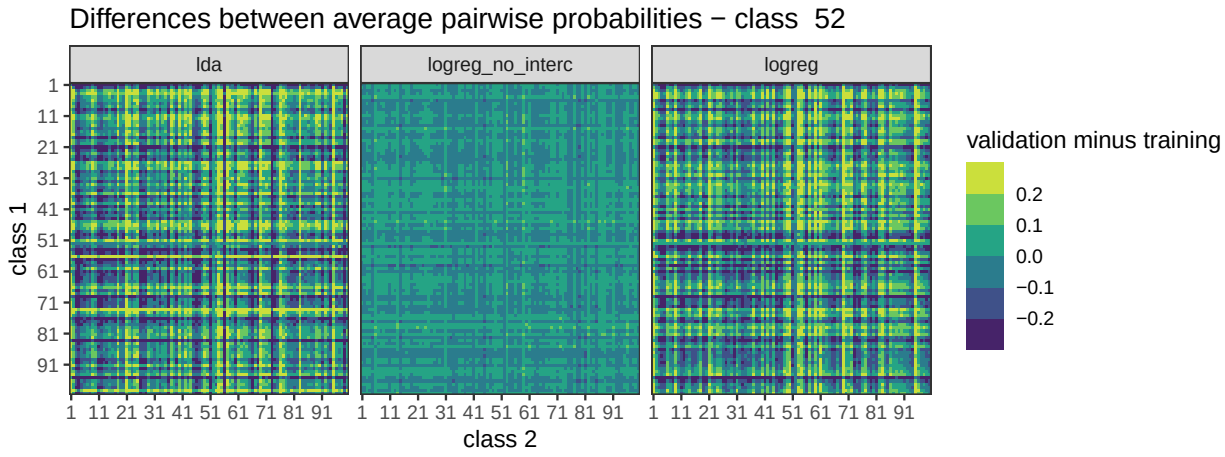

Differences between average pairwise probabilities − class 39
Differences between average pairwise probabilities − class 40
Differences between average pairwise probabilities − class 41
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

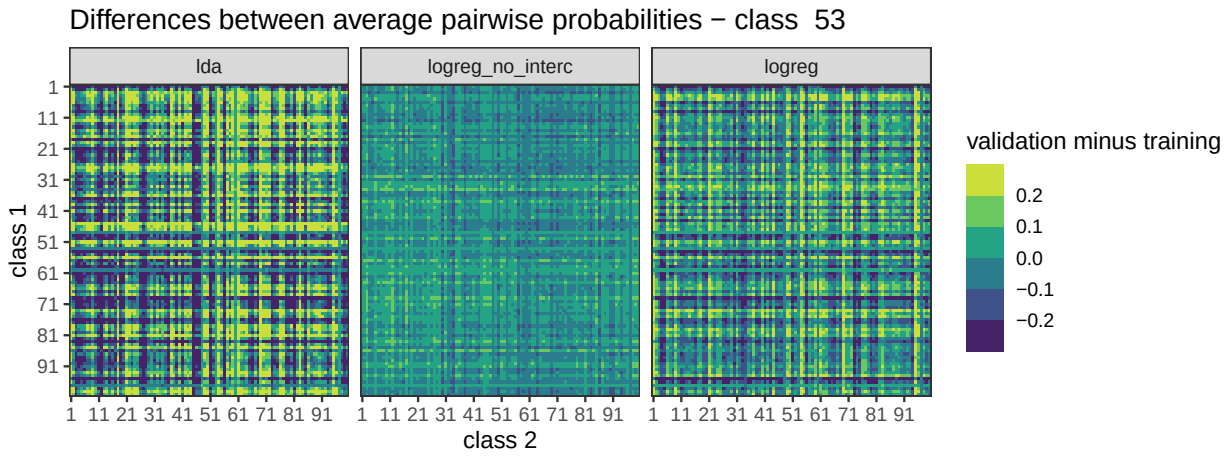

Differences between average pairwise probabilities − class 42
Differences between average pairwise probabilities − class 43
Differences between average pairwise probabilities − class 44
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

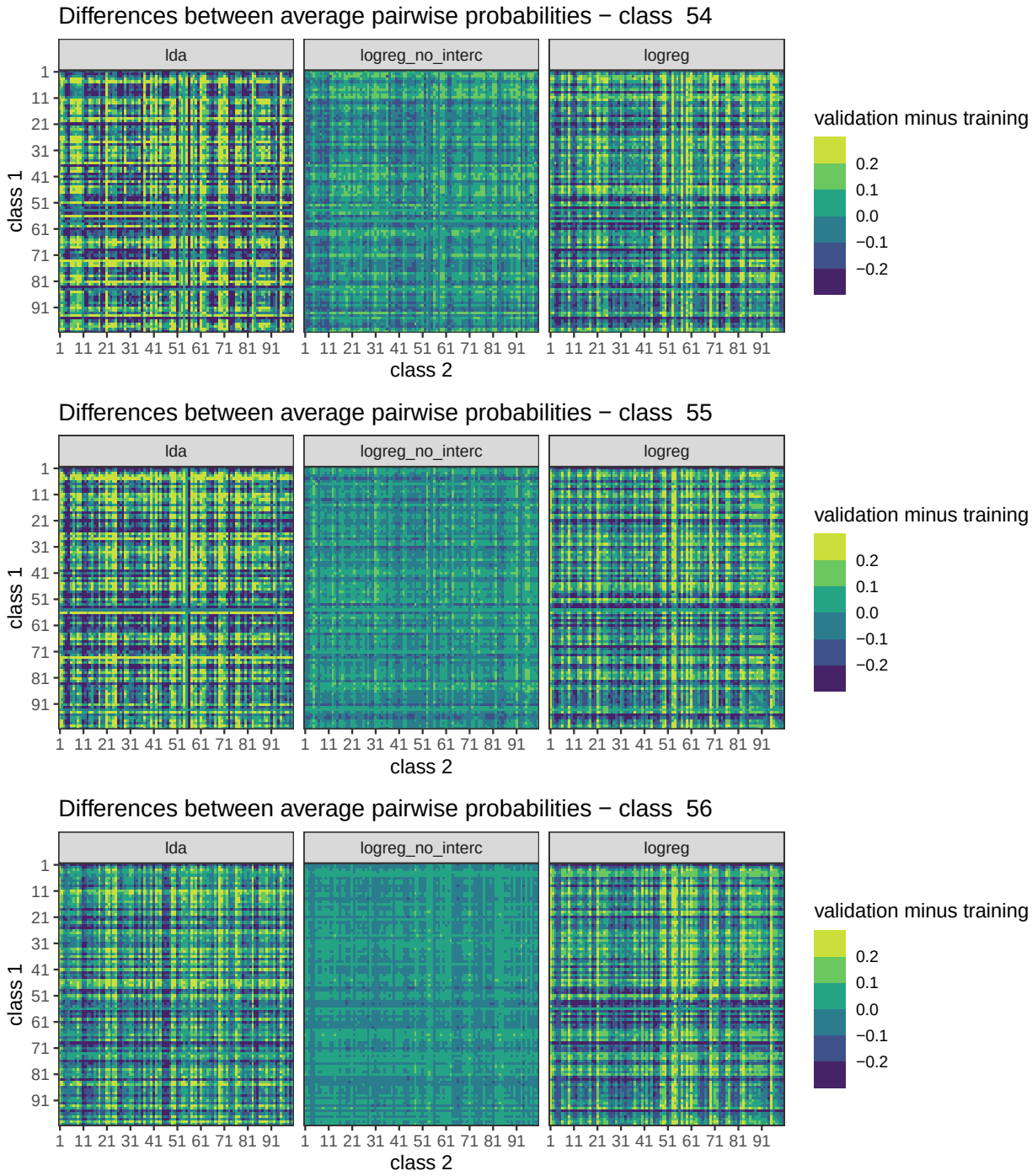

Differences between average pairwise probabilities − class 45
Differences between average pairwise probabilities − class 46
Differences between average pairwise probabilities − class 47
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

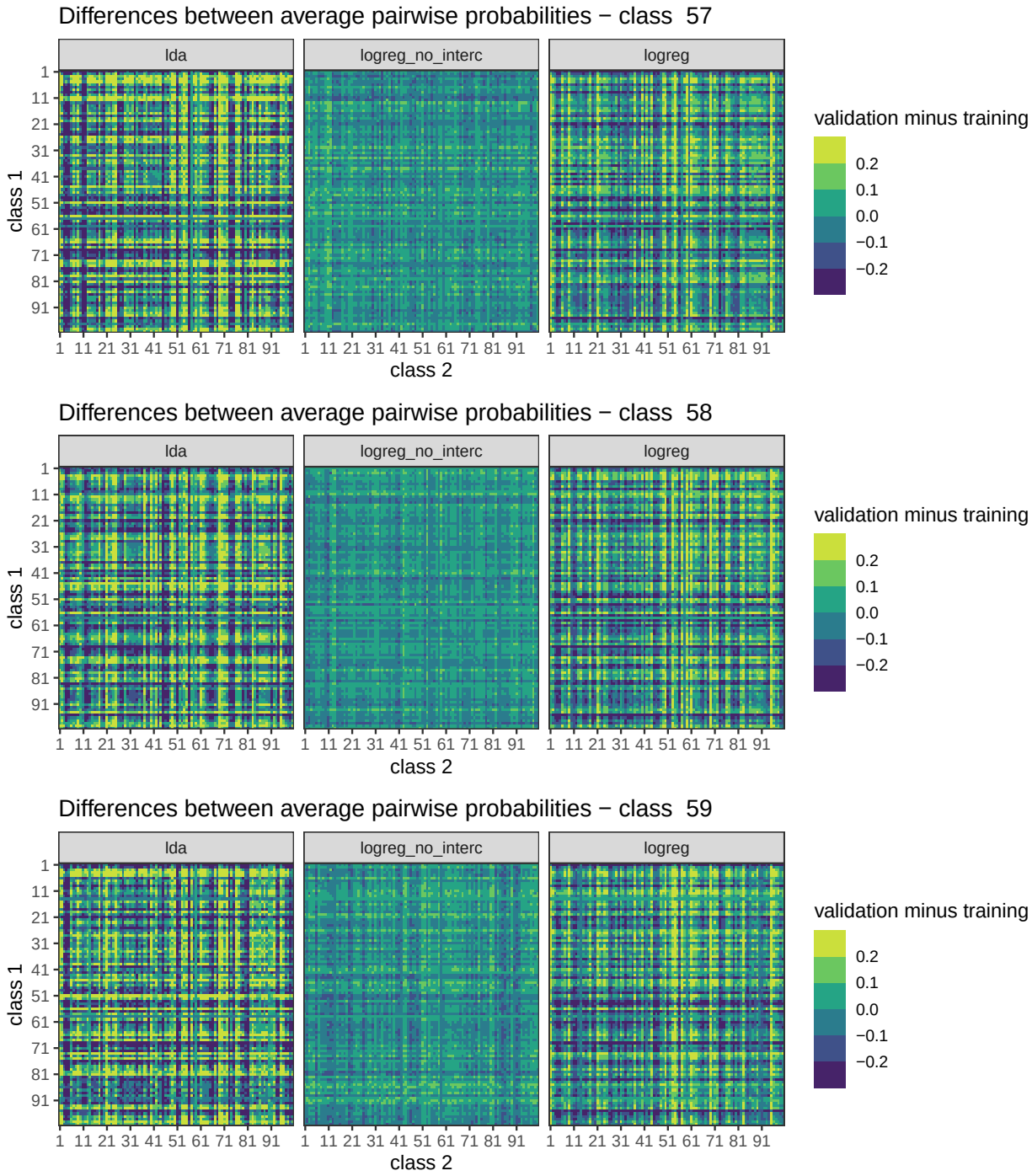

Differences between average pairwise probabilities − class 48
Differences between average pairwise probabilities − class 49
Differences between average pairwise probabilities − class 50
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

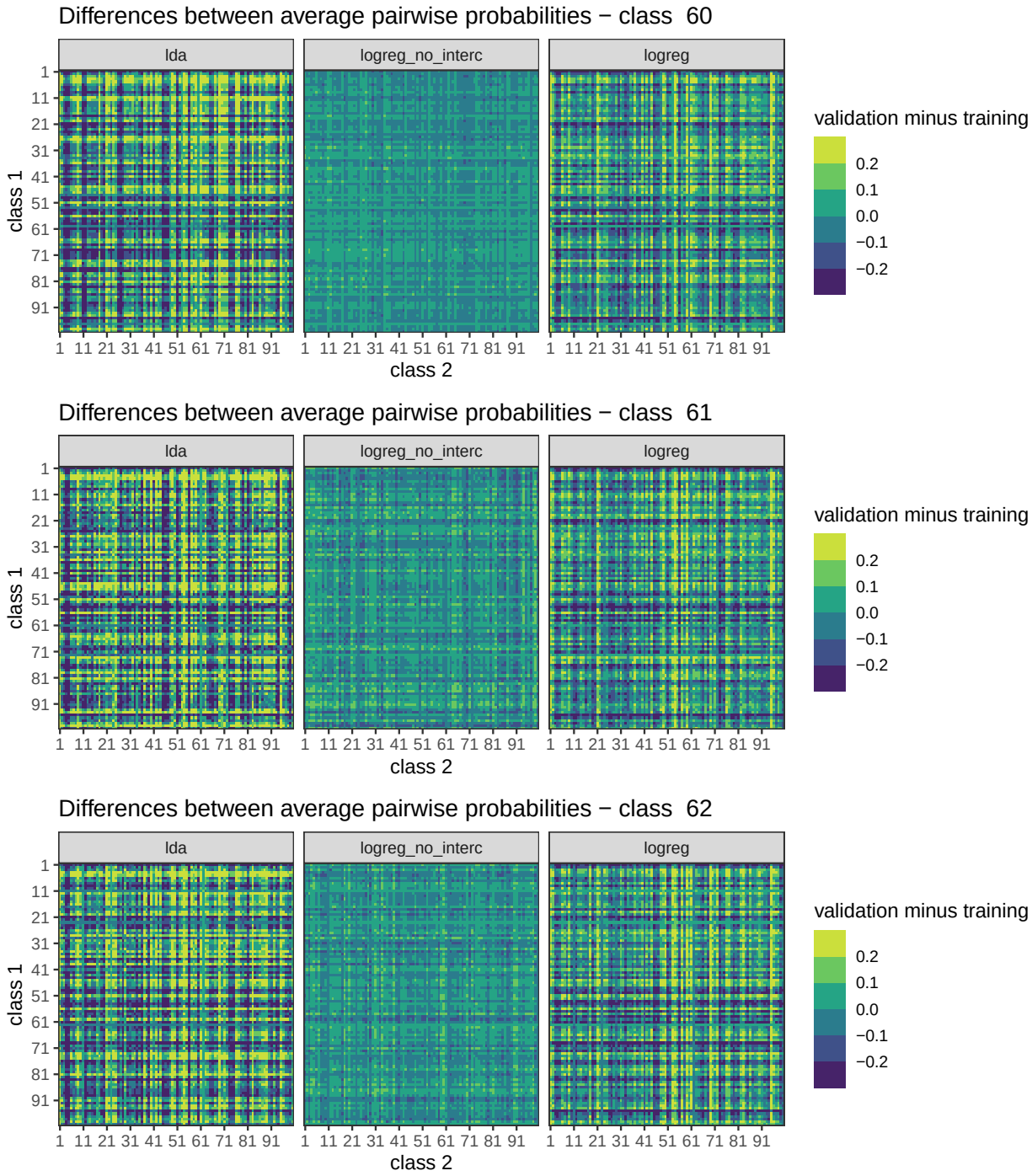

Differences between average pairwise probabilities − class 51
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

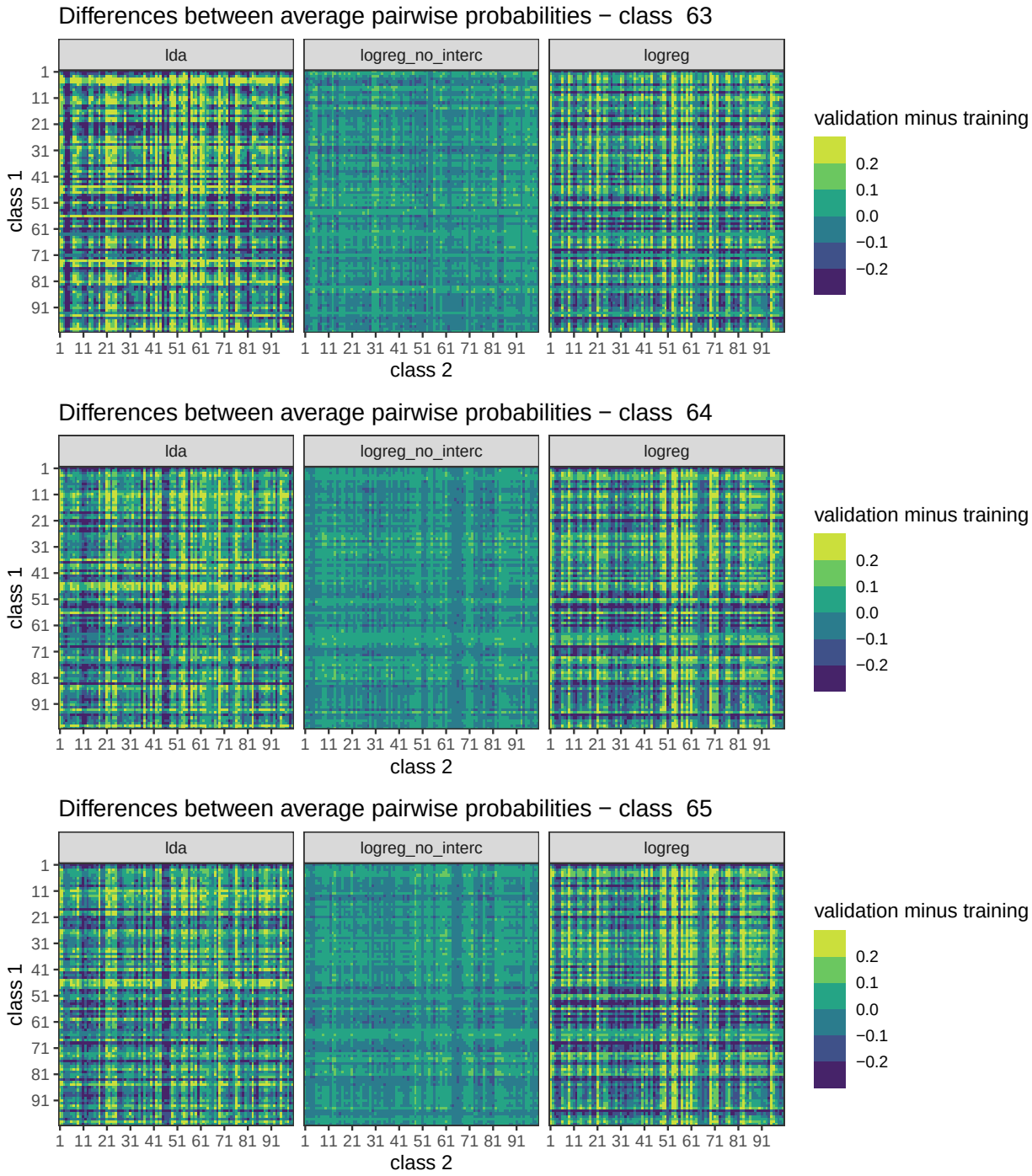

Differences between average pairwise probabilities − class 52
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

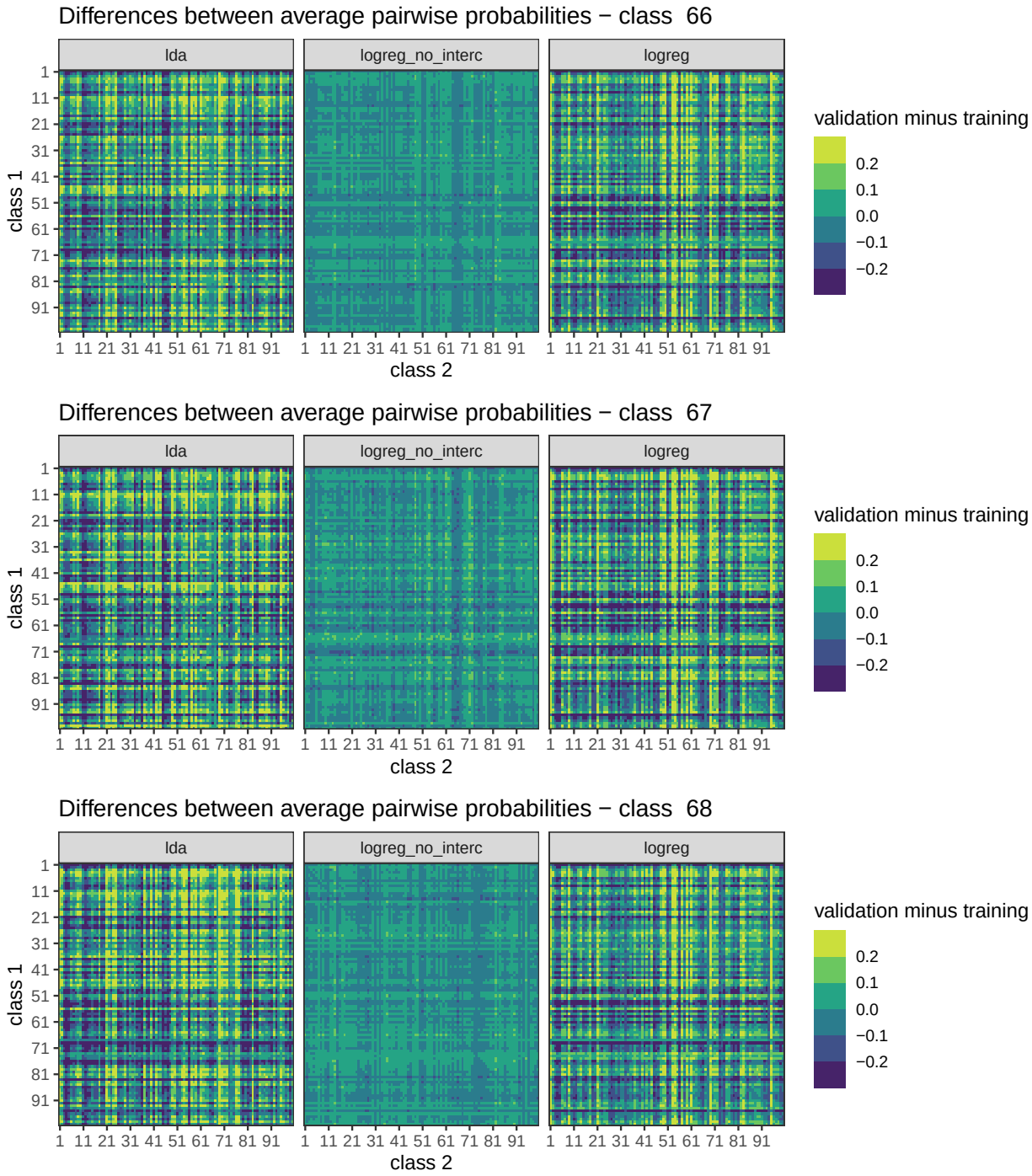

Differences between average pairwise probabilities − class 53
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

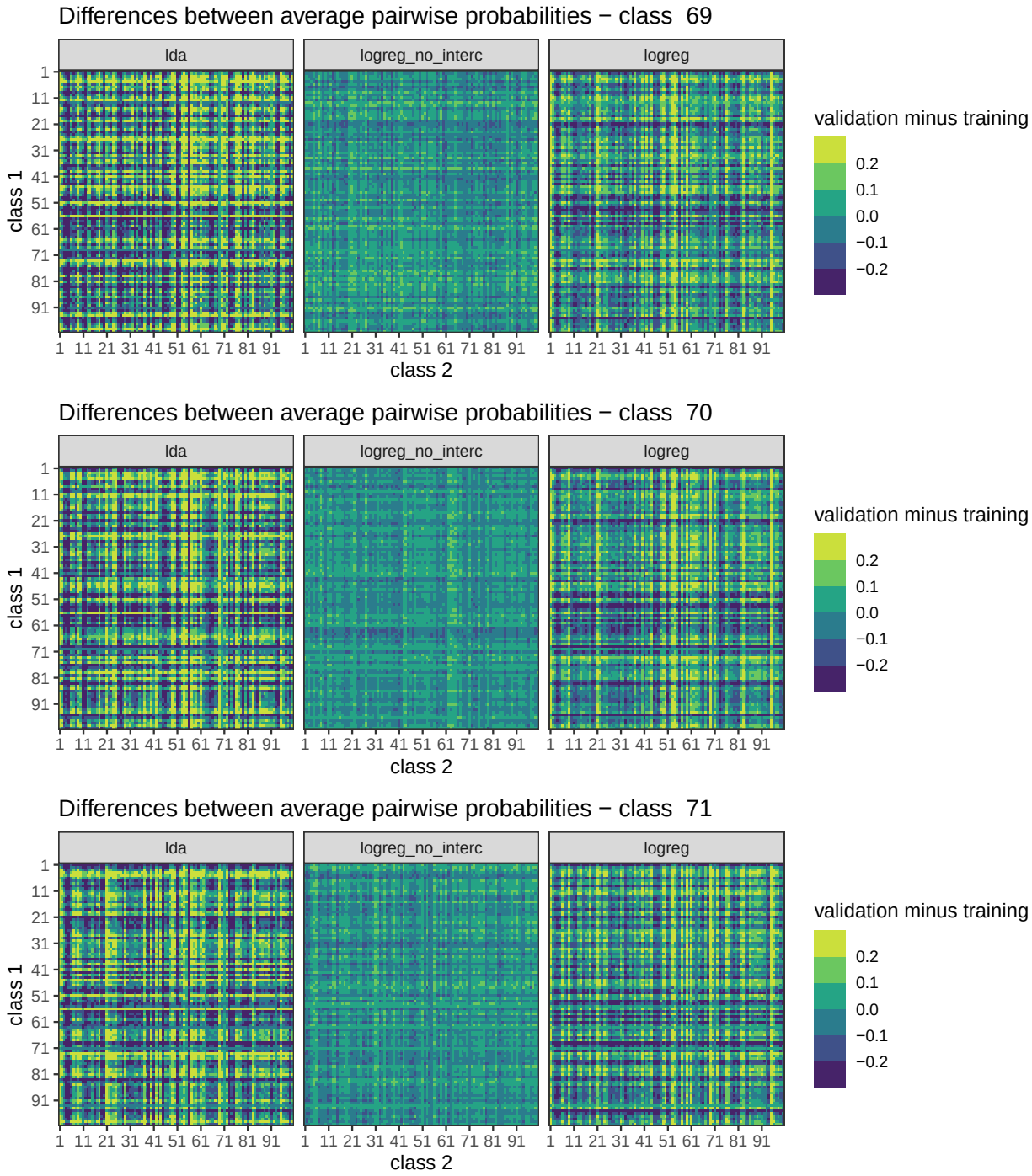

Differences between average pairwise probabilities − class 54
Differences between average pairwise probabilities − class 55
Differences between average pairwise probabilities − class 56
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

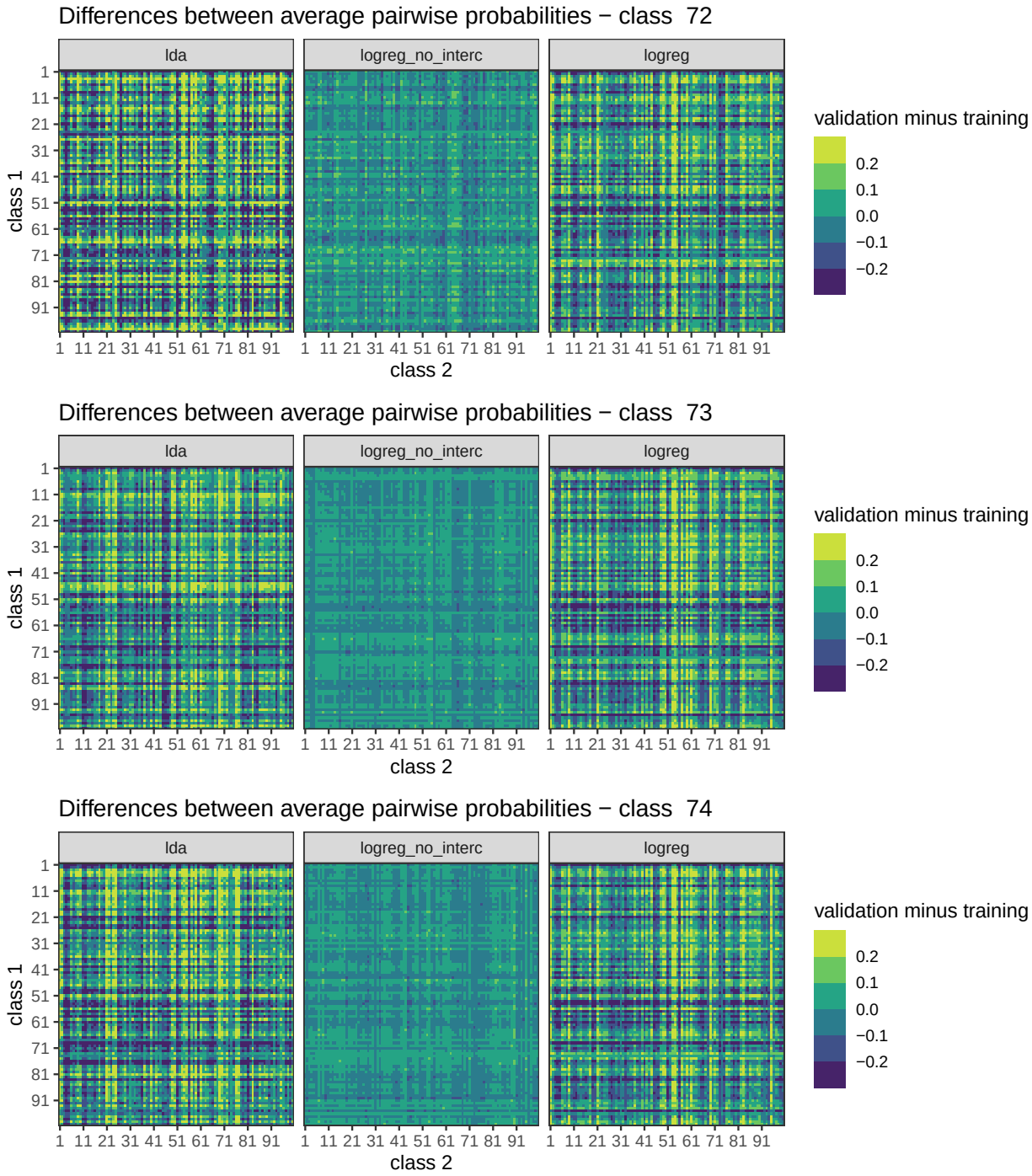

Differences between average pairwise probabilities − class 57
Differences between average pairwise probabilities − class 58
Differences between average pairwise probabilities − class 59
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

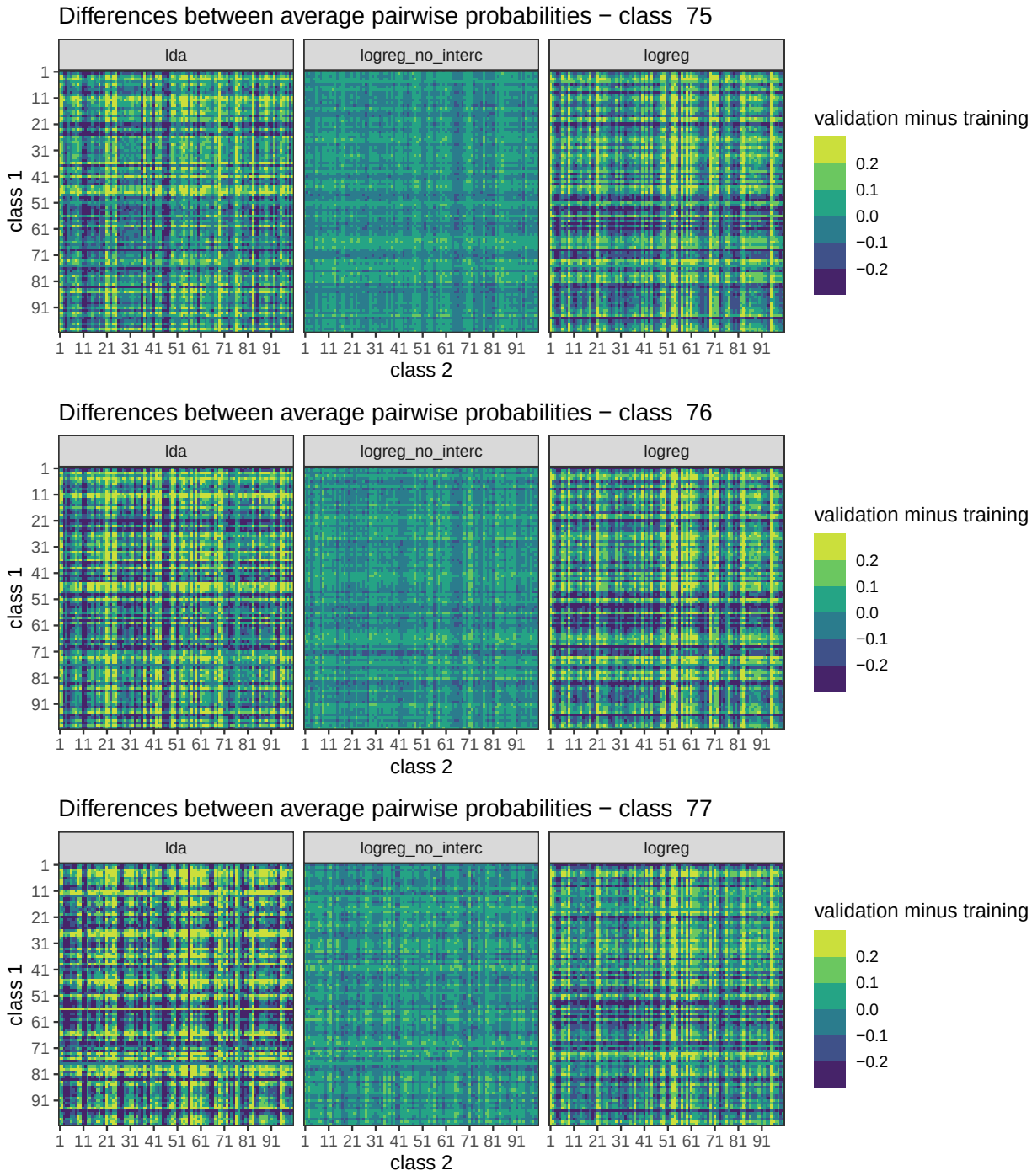

Differences between average pairwise probabilities − class 60
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
Differences between average pairwise probabilities − class 61
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
Differences between average pairwise probabilities − class 62
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

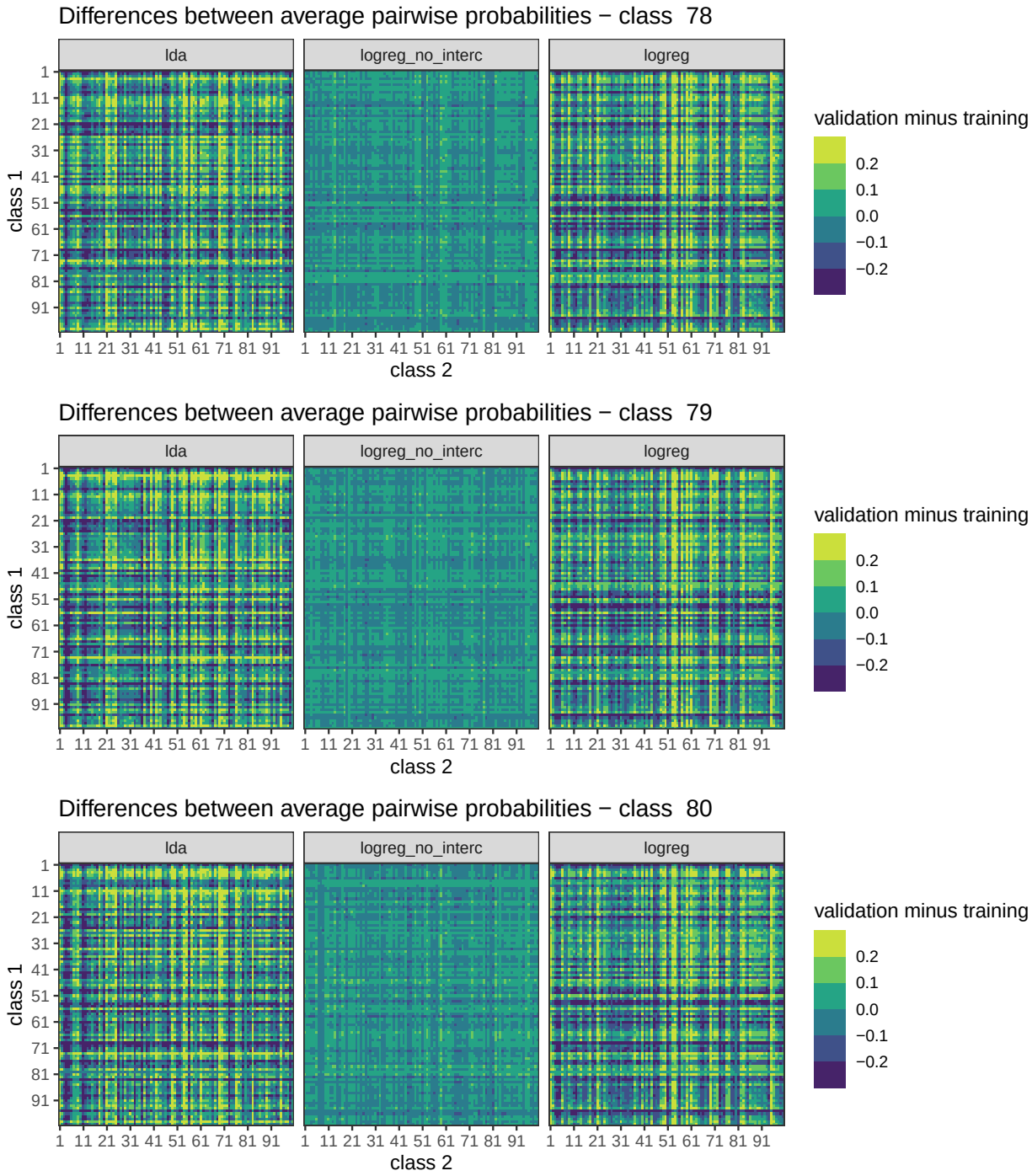

Differences between average pairwise probabilities − class 63
Differences between average pairwise probabilities − class 64
Differences between average pairwise probabilities − class 65
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

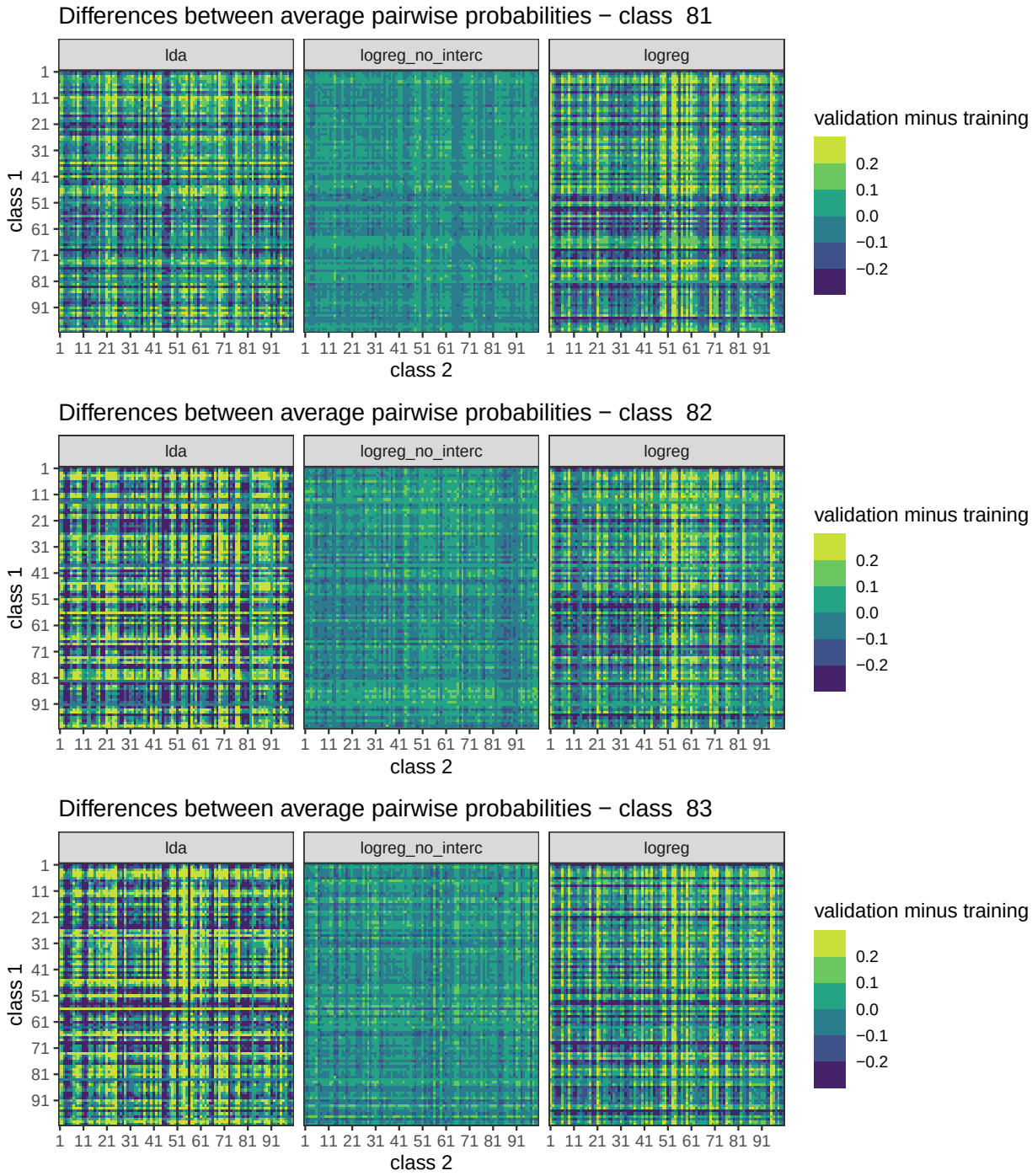

Differences between average pairwise probabilities − class 66
Differences between average pairwise probabilities − class 67
Differences between average pairwise probabilities − class 68
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

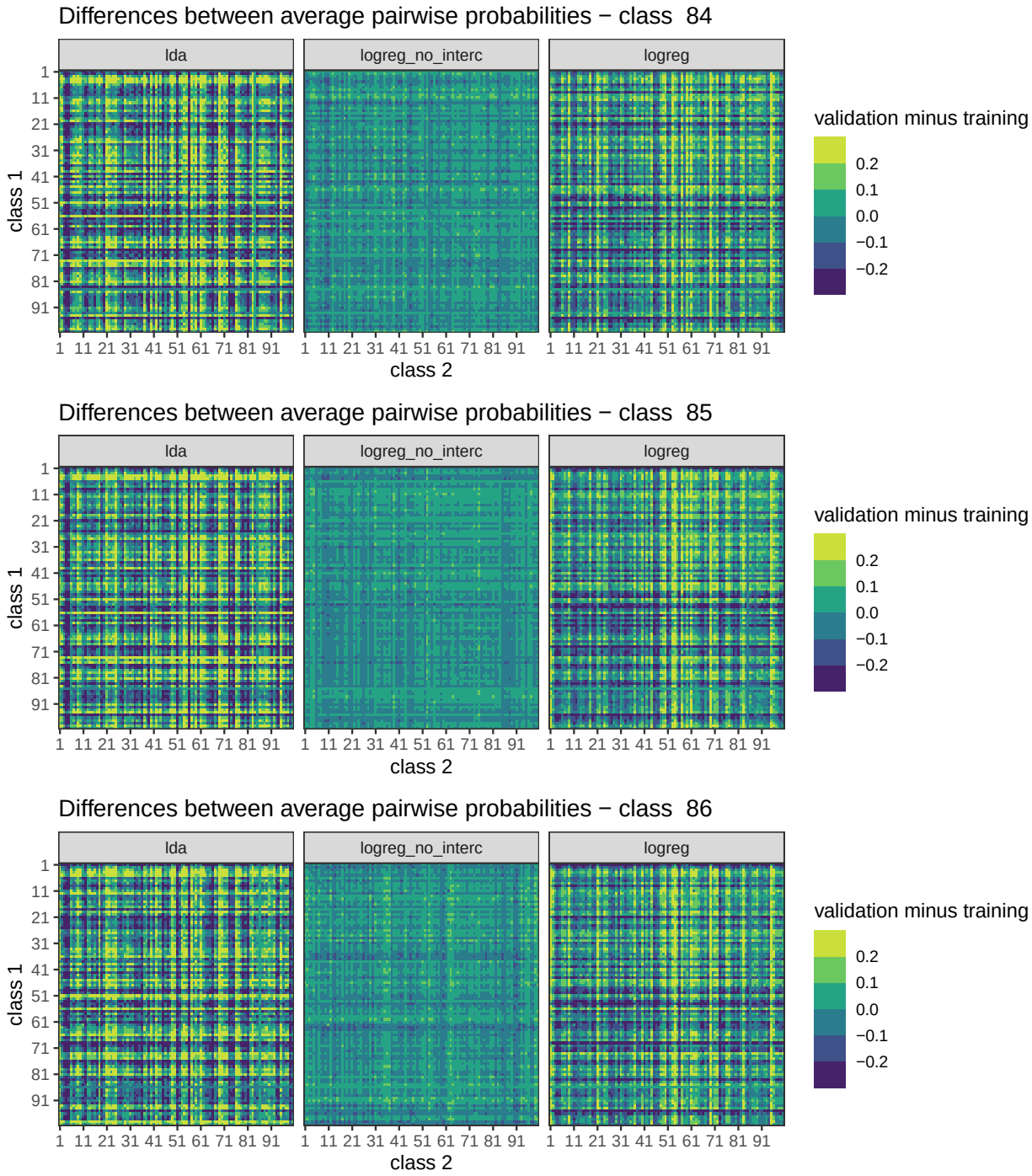

Differences between average pairwise probabilities − class 69
Differences between average pairwise probabilities − class 70
Differences between average pairwise probabilities − class 71
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
1 11 21 31 41 51 61 71 81 91

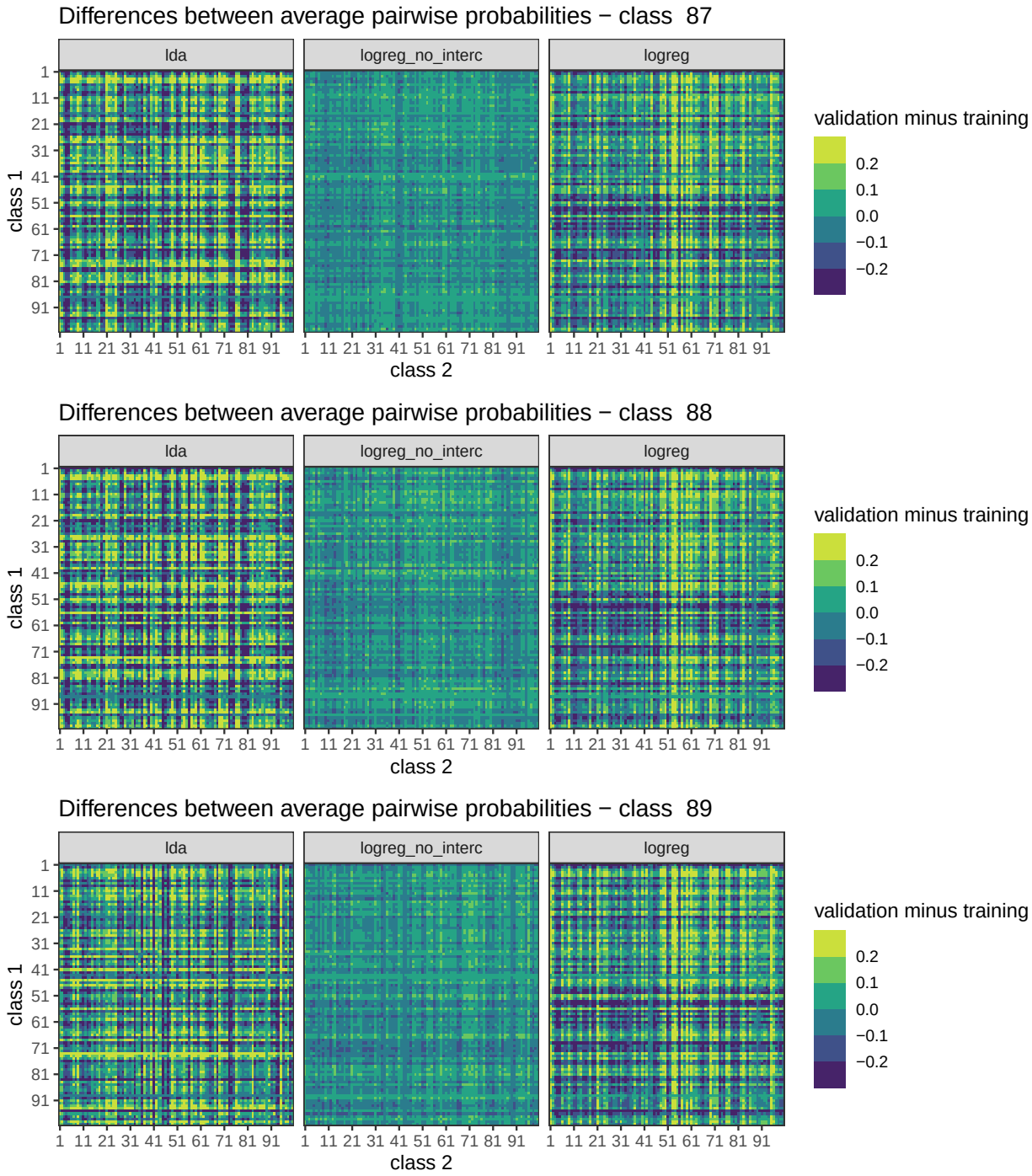

Differences between average pairwise probabilities − class 72
Differences between average pairwise probabilities − class 73
Differences between average pairwise probabilities − class 74
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

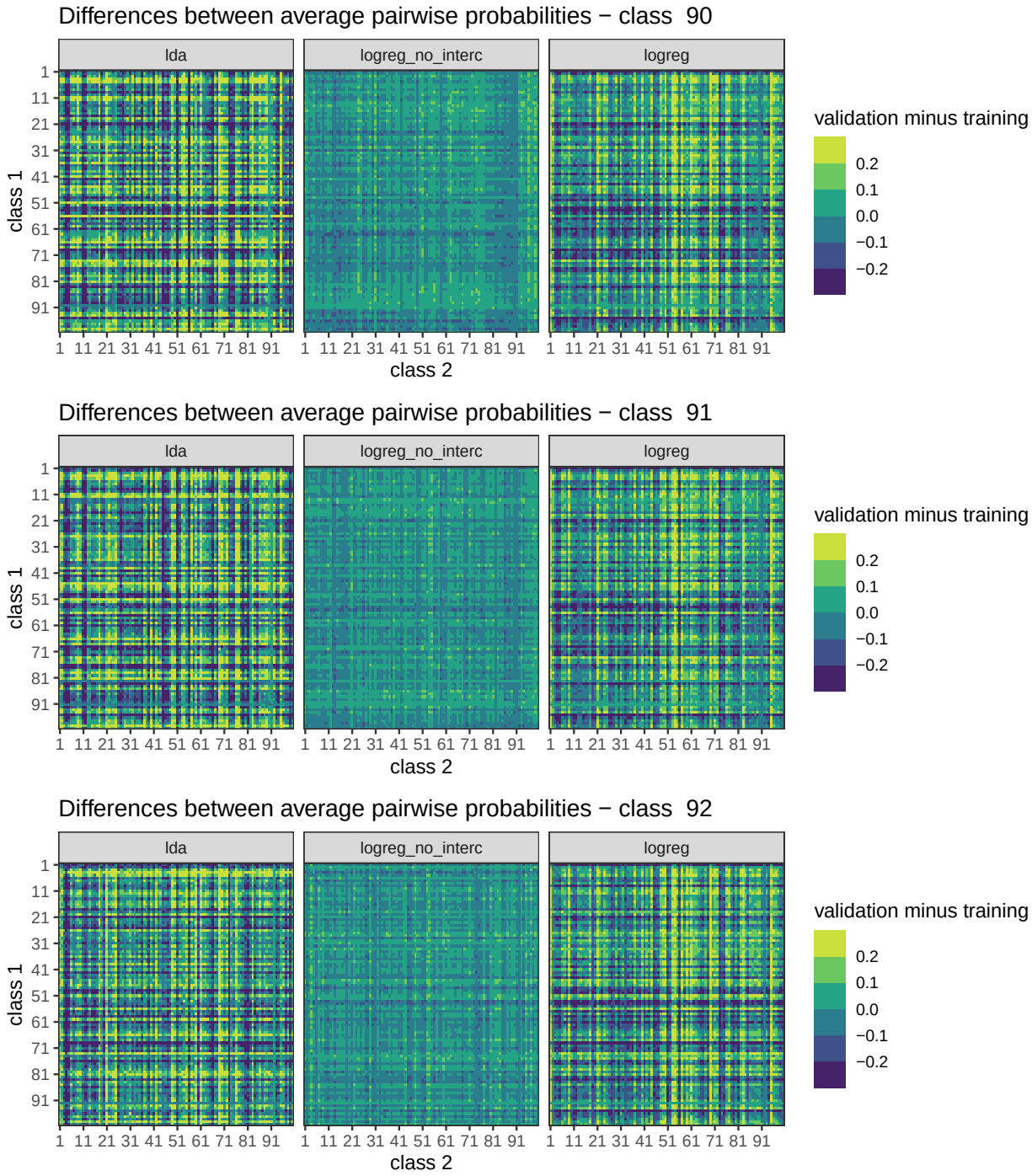

Differences between average pairwise probabilities − class 75
Differences between average pairwise probabilities − class 76
Differences between average pairwise probabilities − class 77
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

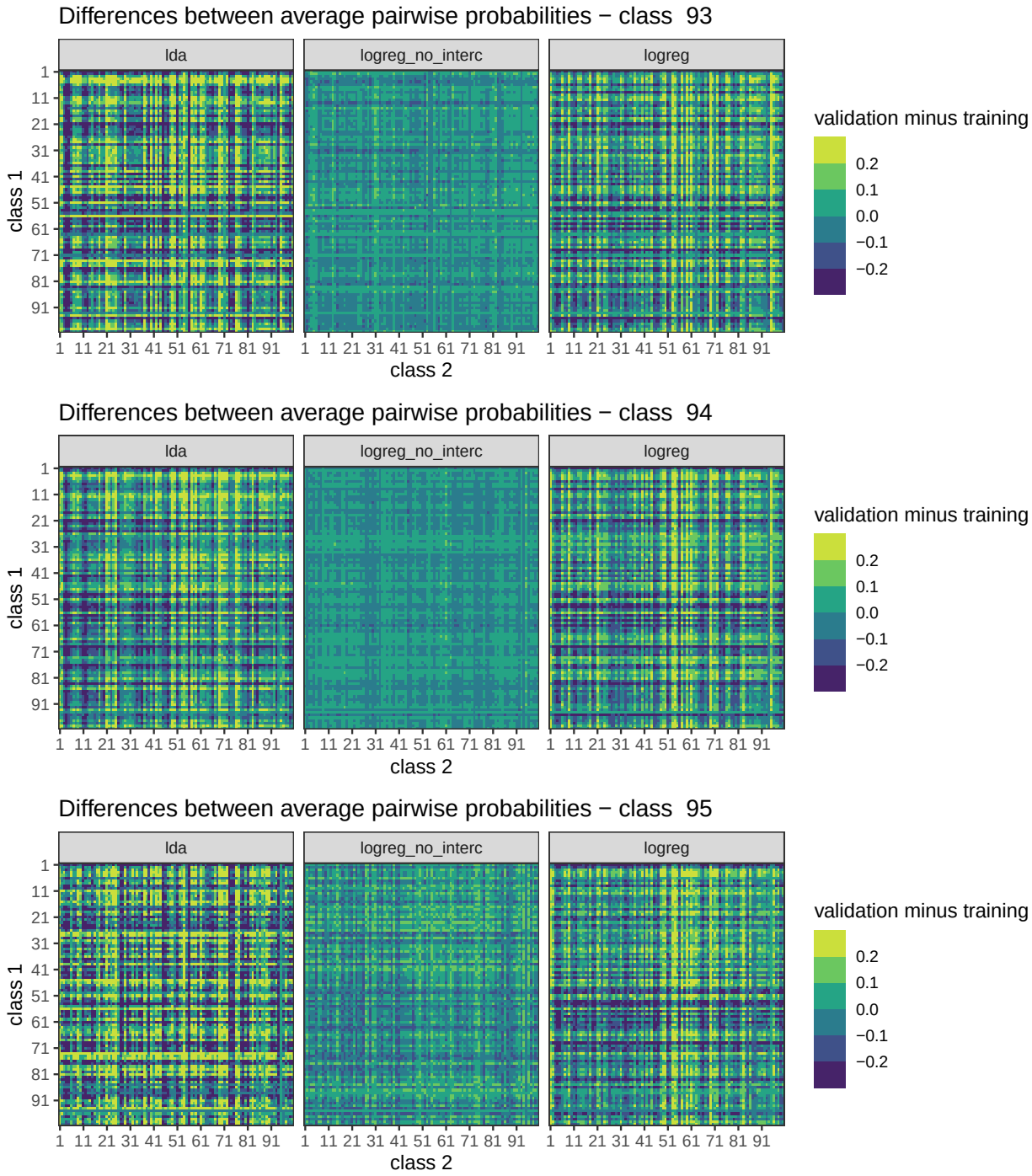

Differences between average pairwise probabilities − class 78
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
Differences between average pairwise probabilities − class 79
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
Differences between average pairwise probabilities − class 80
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

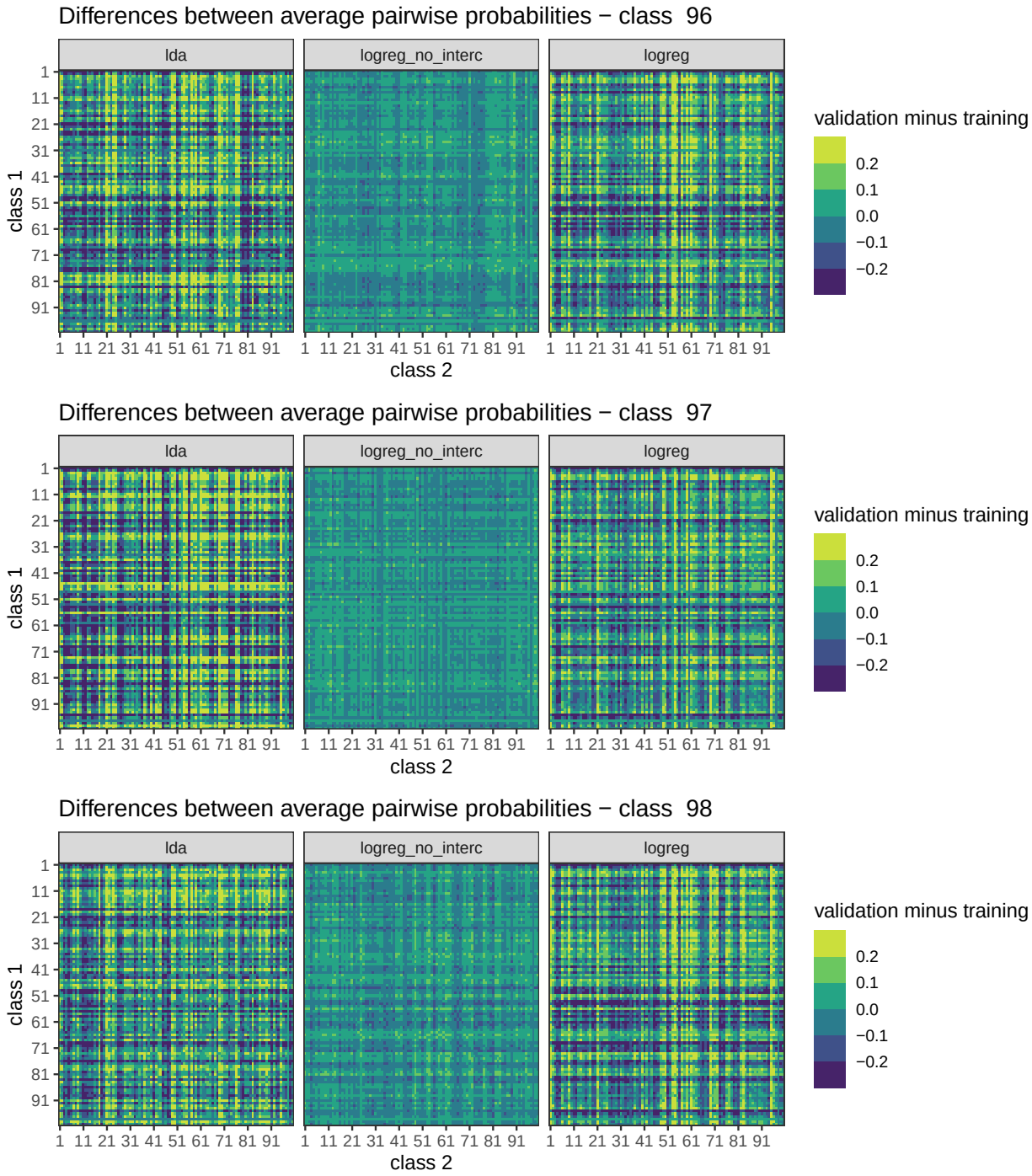

Differences between average pairwise probabilities − class 81
Differences between average pairwise probabilities − class 82
Differences between average pairwise probabilities − class 83
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

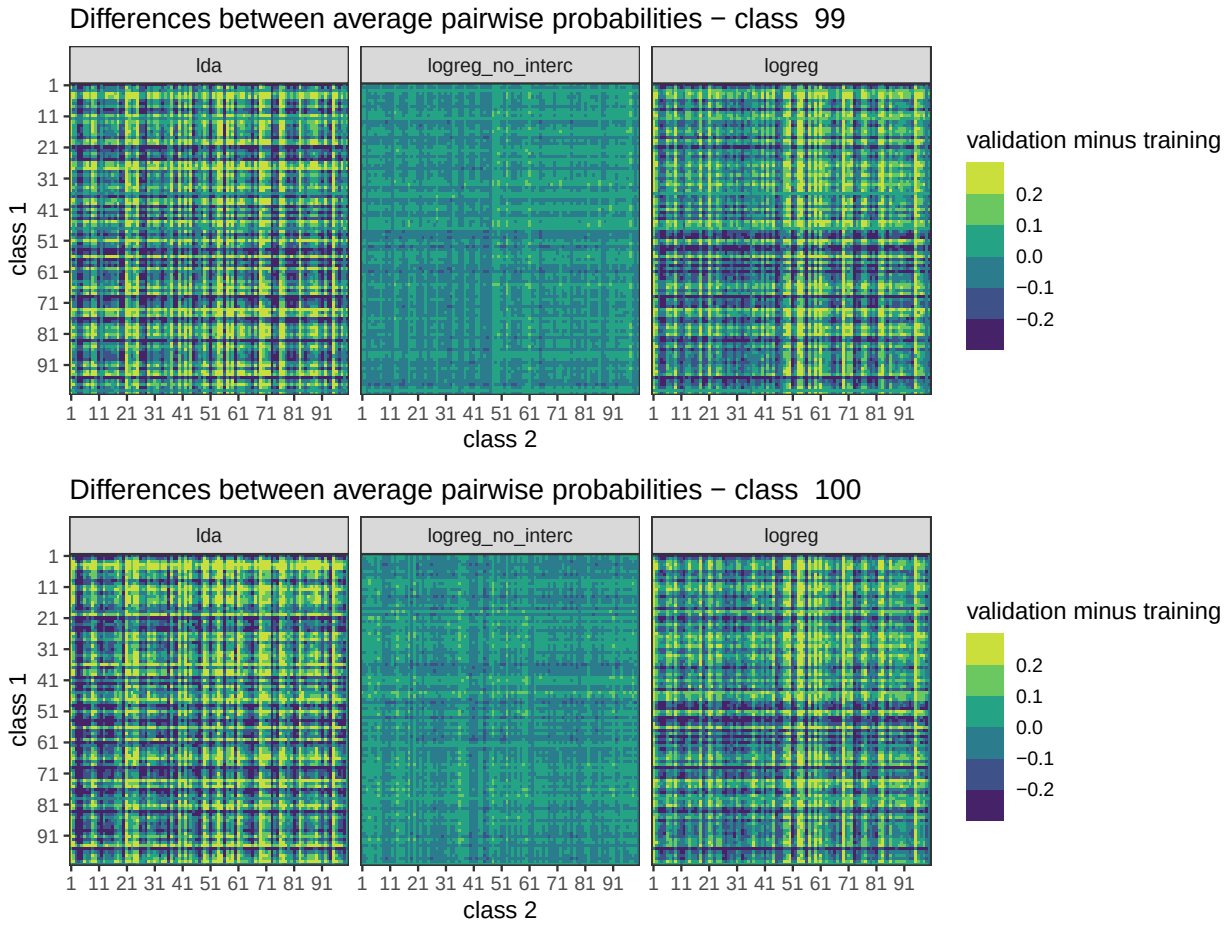

Differences between average pairwise probabilities − class 84
Differences between average pairwise probabilities − class 85
Differences between average pairwise probabilities − class 86
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2


Differences between average pairwise probabilities − class 87
Differences between average pairwise probabilities − class 88
Differences between average pairwise probabilities − class 89
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2


Differences between average pairwise probabilities − class 90
Differences between average pairwise probabilities − class 91
Differences between average pairwise probabilities − class 92
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2


Differences between average pairwise probabilities − class 93
Differences between average pairwise probabilities − class 94
Differences between average pairwise probabilities − class 95
lda
logreg_no_interc
logreg
class 1
class 2
1 11 21 31 41 51 61 71 81 91
validation minus training
0.2
0.1
0.0
−0.1
−0.2

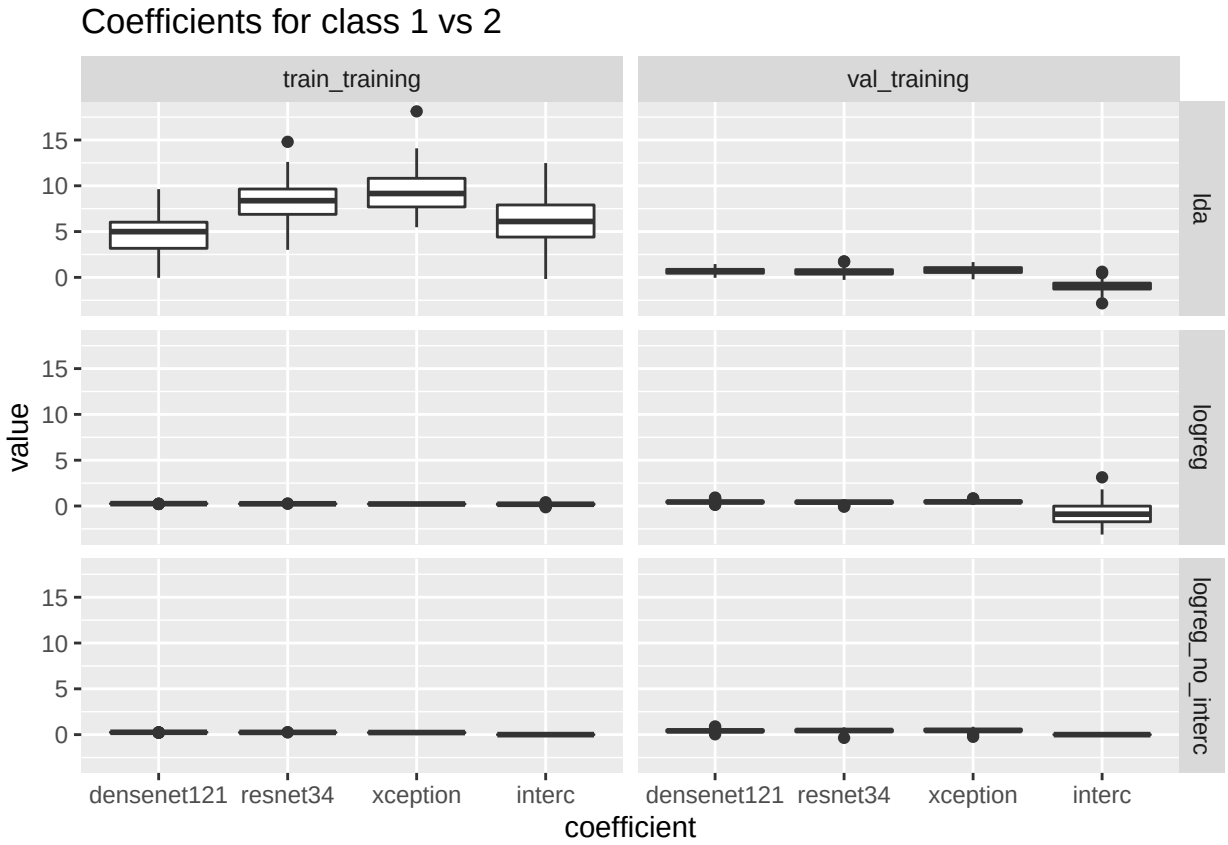

Differences between average pairwise probabilities − class 96
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
Differences between average pairwise probabilities − class 97
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2
Differences between average pairwise probabilities − class 98
lda
logreg_no_interc
logreg
class 1
class 2
validation minus training
0.2
0.1
0.0
−0.1
−0.2

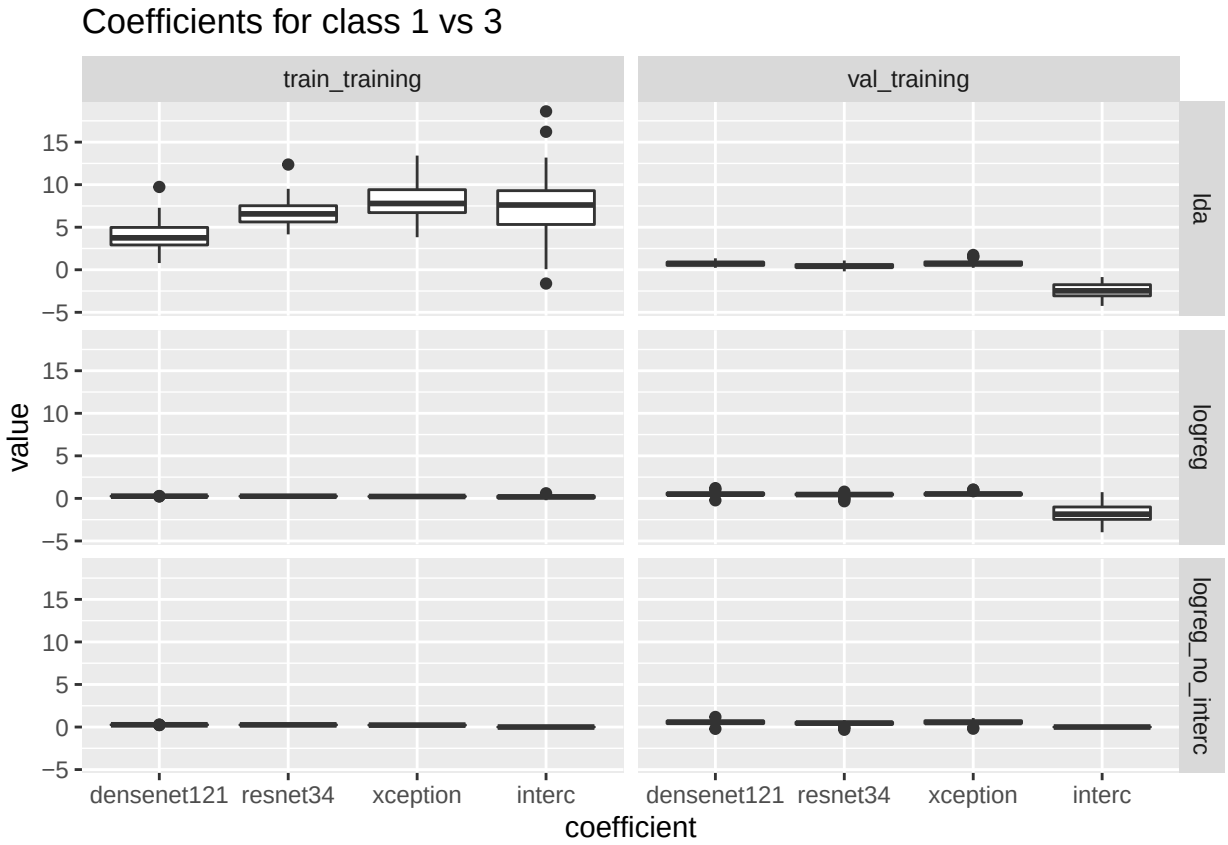


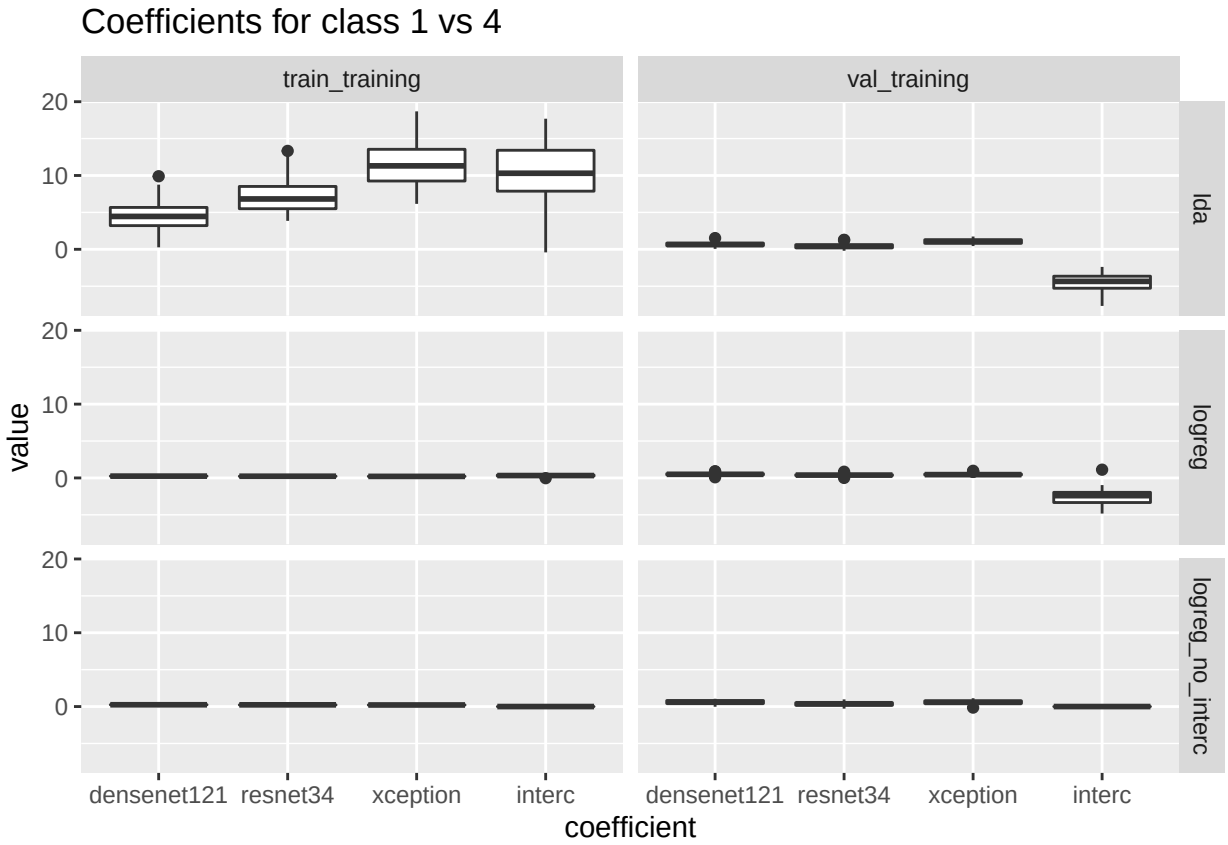
Logistic regression without intercept has lower differences between tt and vt R matrices than other combining methods.

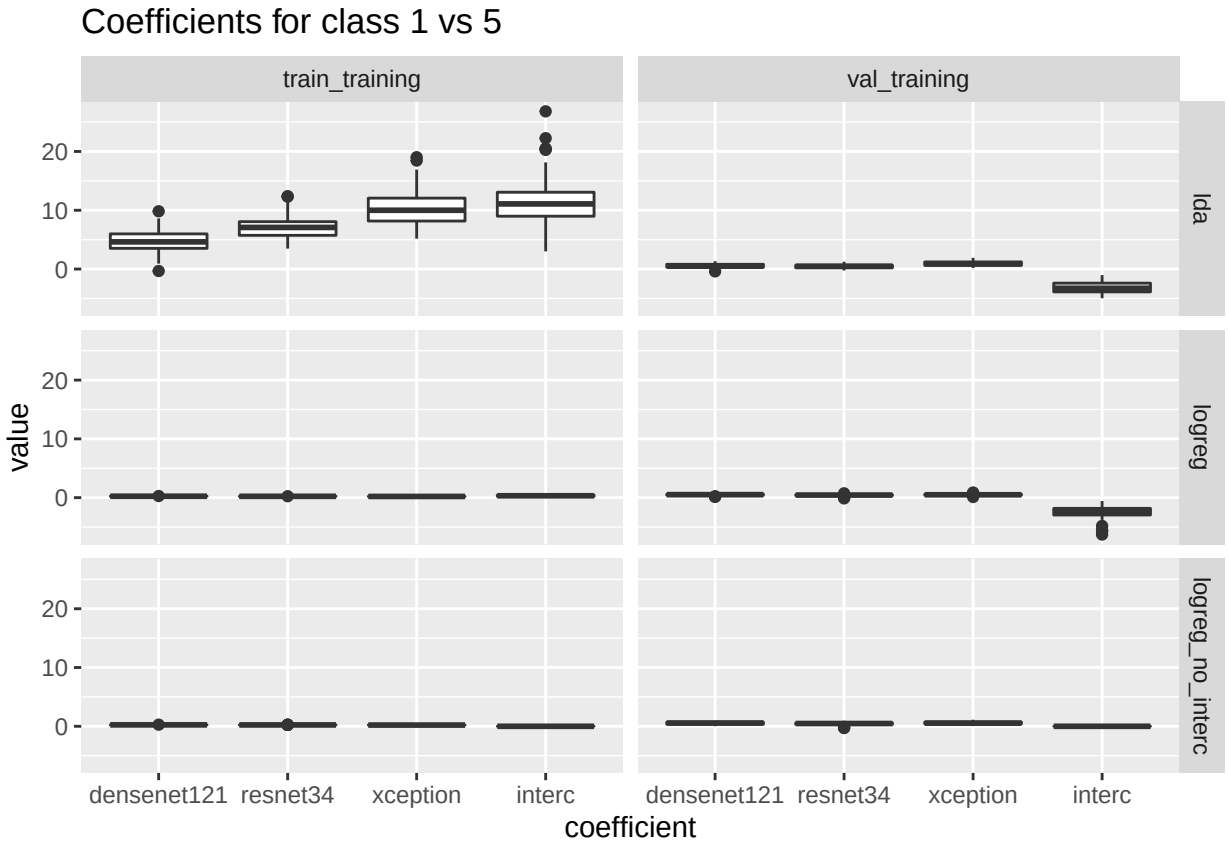
```
combiner_coefs <- load_combiner_coefs(base_dir, repls, folds)
```

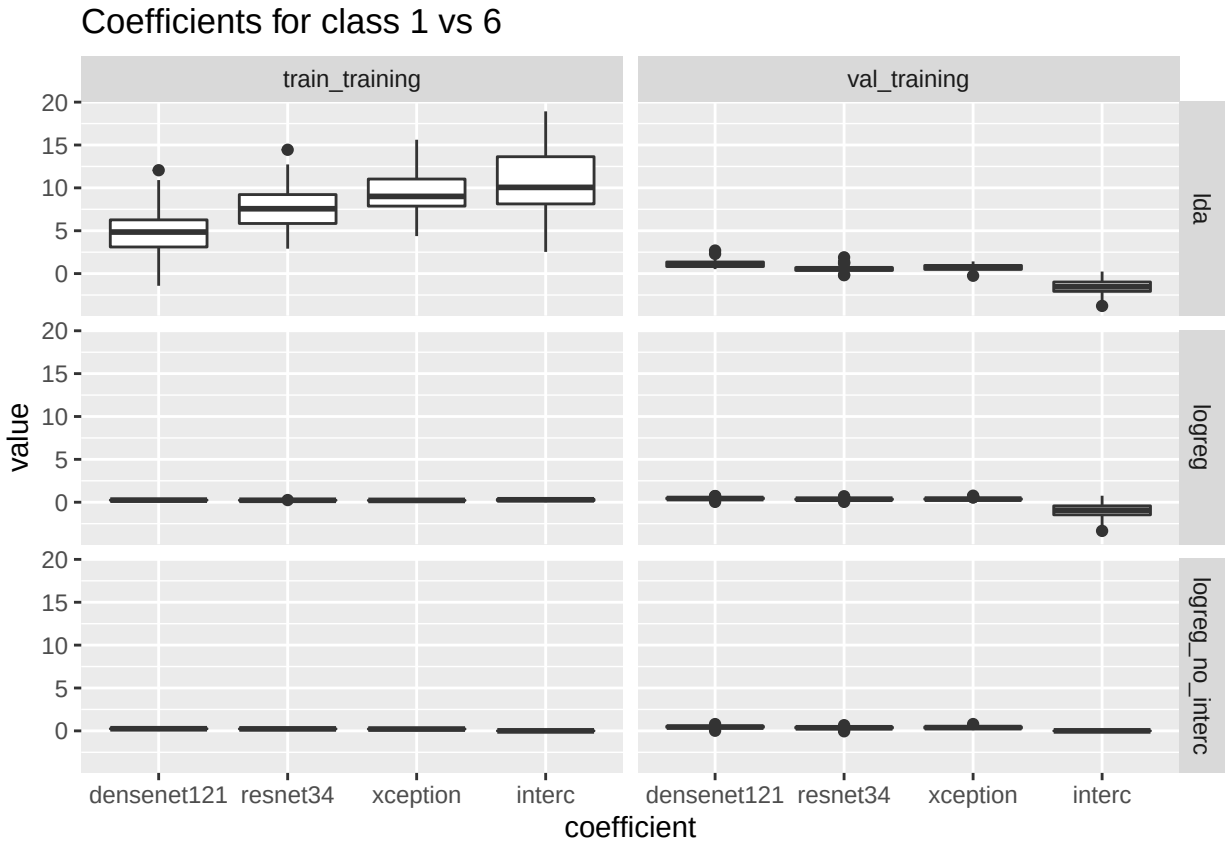
```
for (cl1 in 1:(10 - 1))
{
  for (cl2 in (cl1 + 1):10)
  {
    cur_plt <- combiner_coefs %>% filter(class1 == cl1 & class2 == cl2) %>% ggplot() + geom_boxplot(aes
      facet_grid(cols=vars(train_type), rows=vars(combining_method)) + ggtitle(paste("Coefficients for
    print(cur_plt)
  }
}
```

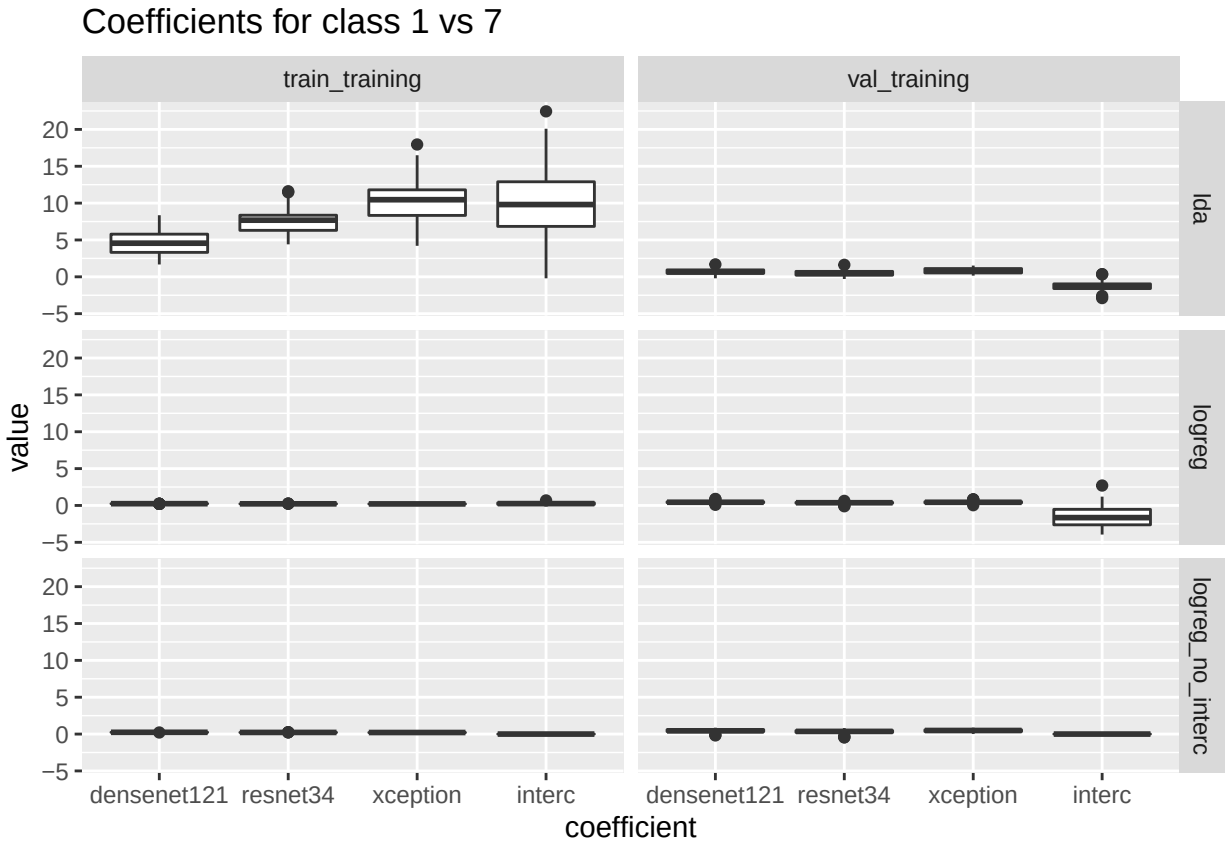

Coefficients for class 1 vs 2
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
densenet121
resnet34
xception
interc
coefficient

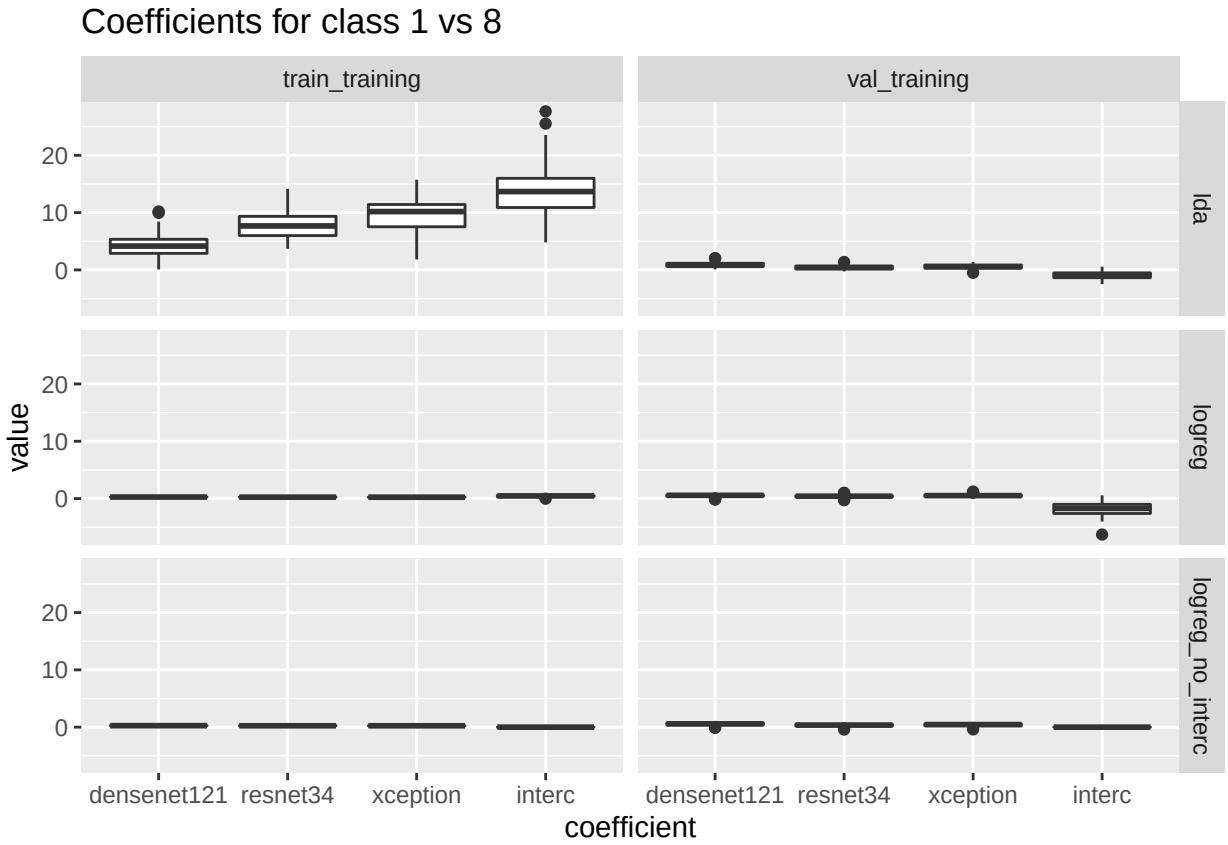

Coefficients for class 1 vs 3
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient

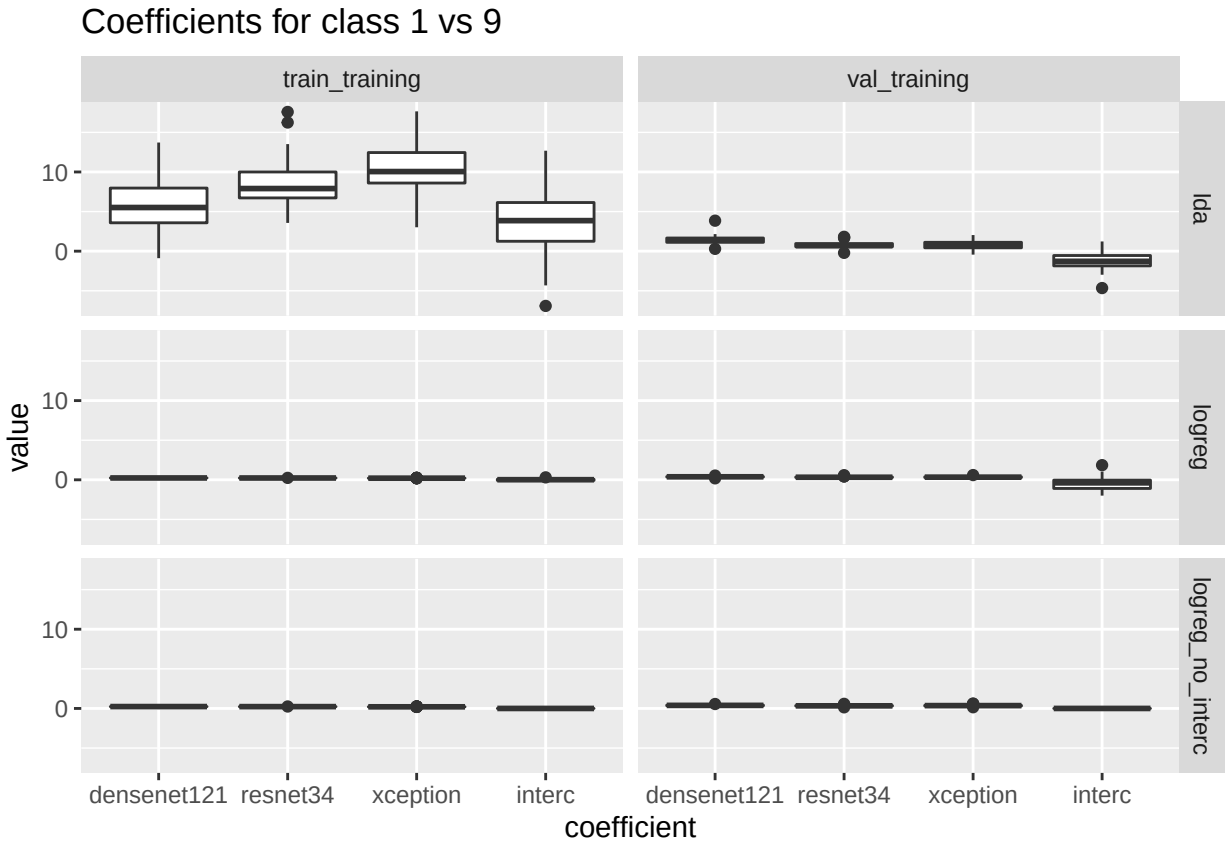

Coefficients for class 1 vs 4
train_training
val_training
lda
logreg
logreg_no_interc
value
20
10
0
densenet121
resnet34
xception
interc
coefficient

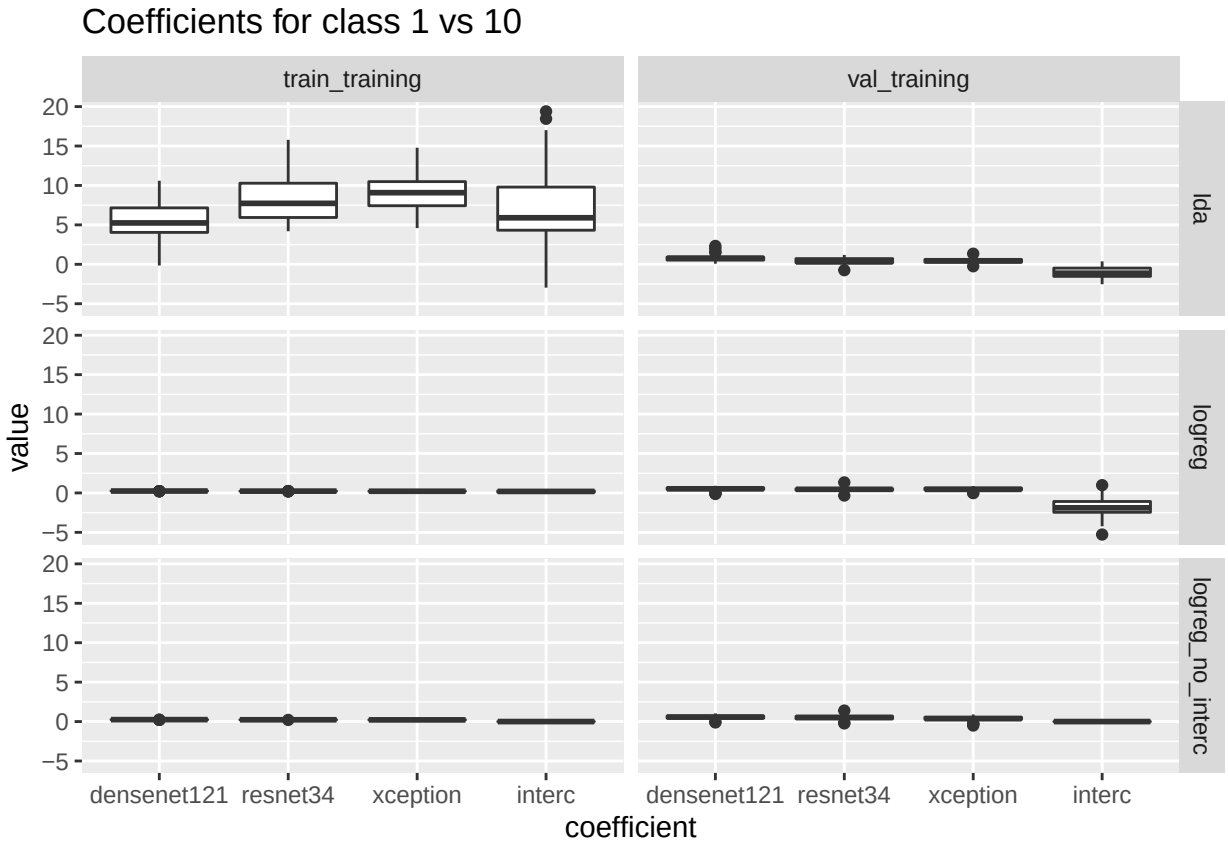

Coefficients for class 1 vs 5
train_training
val_training
lda
logreg
logreg_no_interc
value
20
10
0
densenet121
resnet34
xception
interc
coefficient

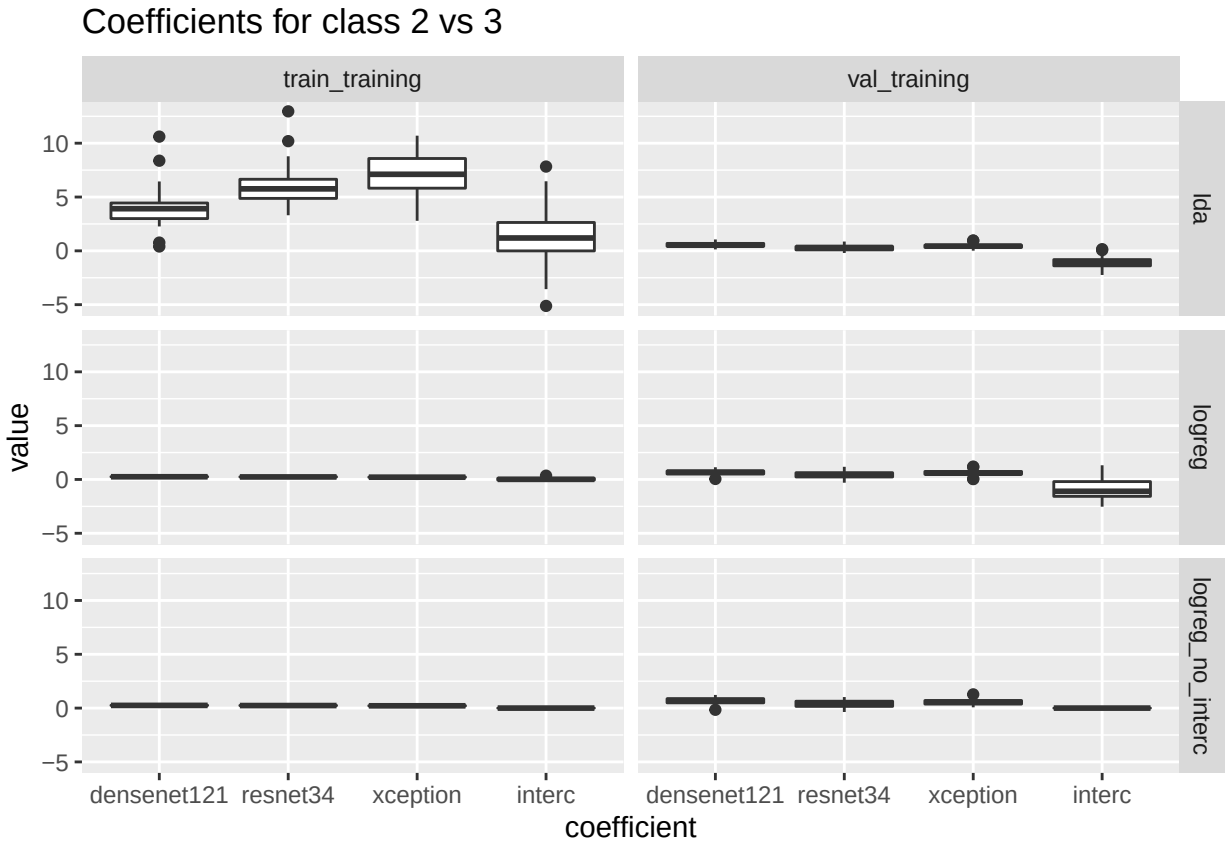

Coefficients for class 1 vs 6
train_training
val_training
lda
logreg
logreg_no_interc
value
20
15
10
5
0
densenet121
resnet34
xception
interc
coefficient

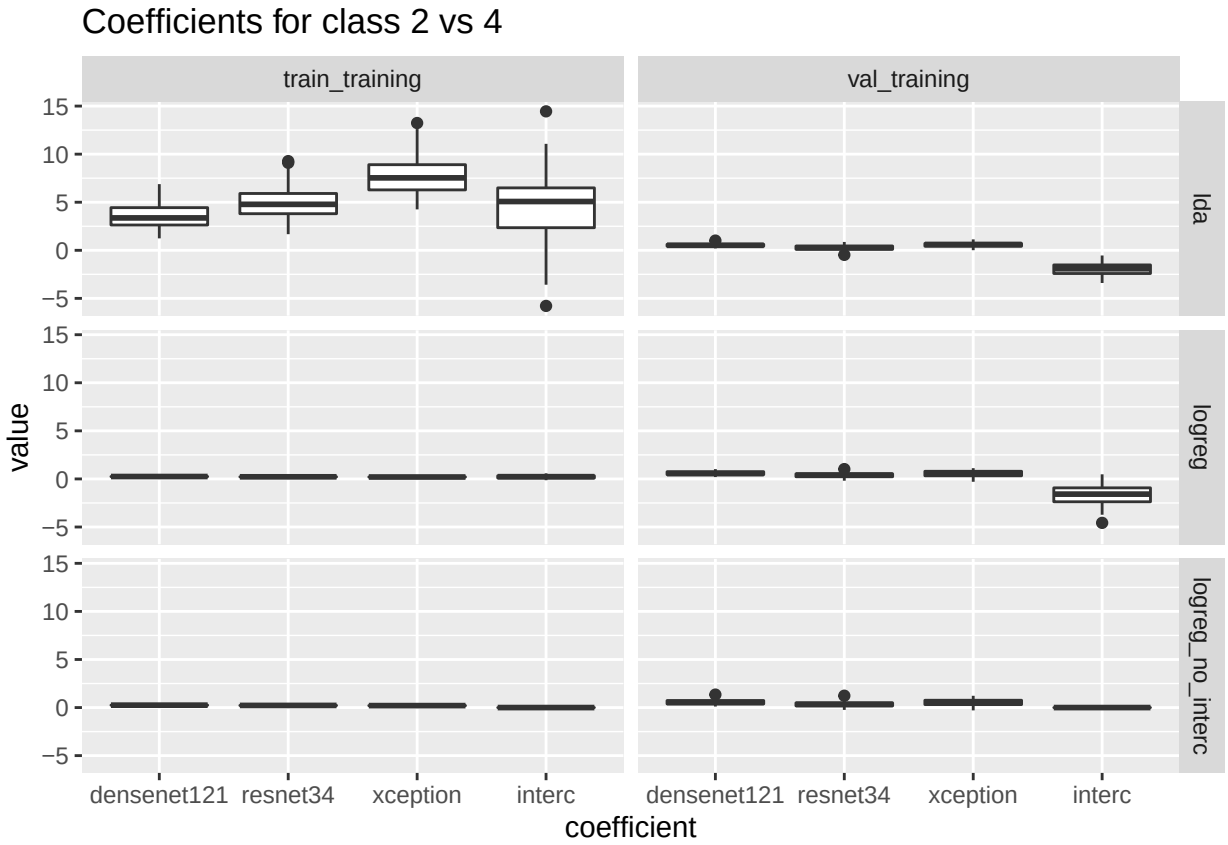

Coefficients for class 1 vs 7
train_training
val_training
lda
logreg
logreg_no_interc
value
20
15
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient

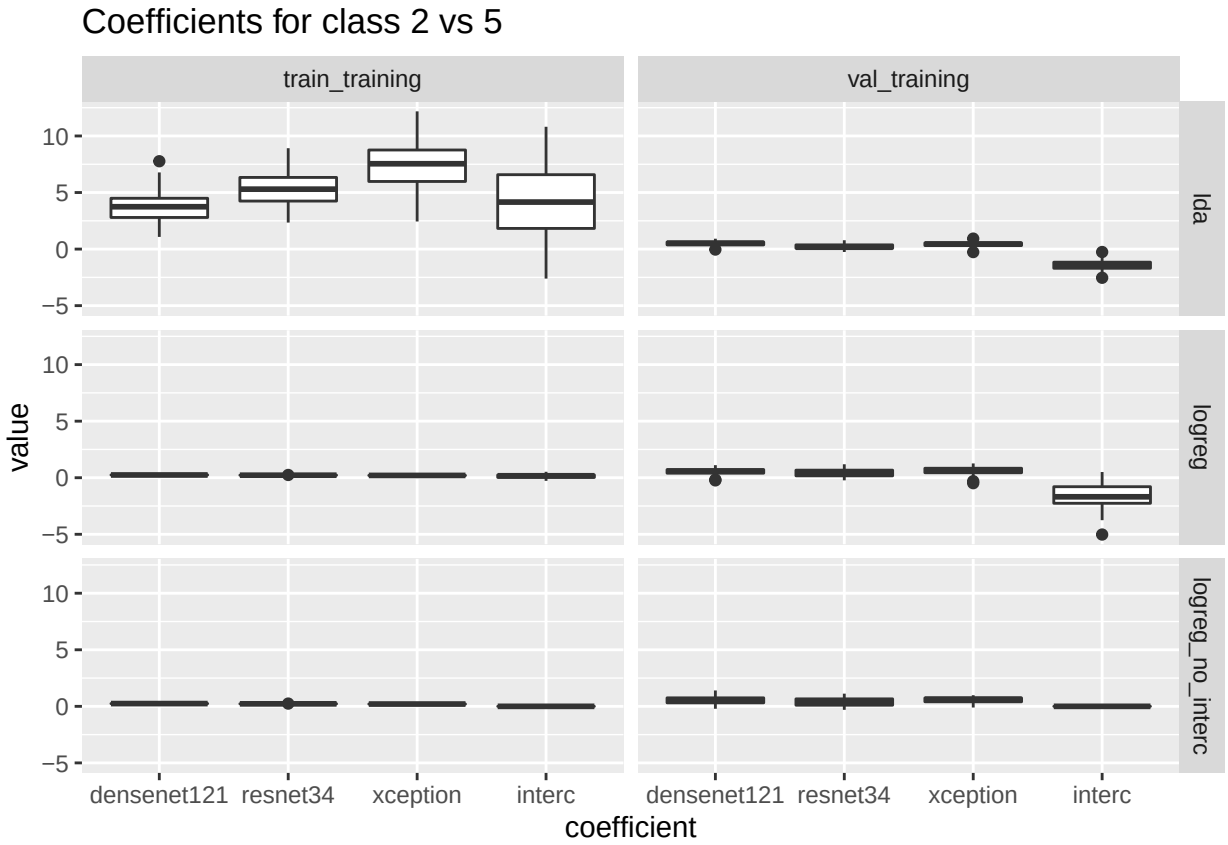

Coefficients for class 1 vs 8
train_training
val_training
lda
logreg
logreg_no_interc
value
20
10
0
densenet121
resnet34
xception
interc
coefficient

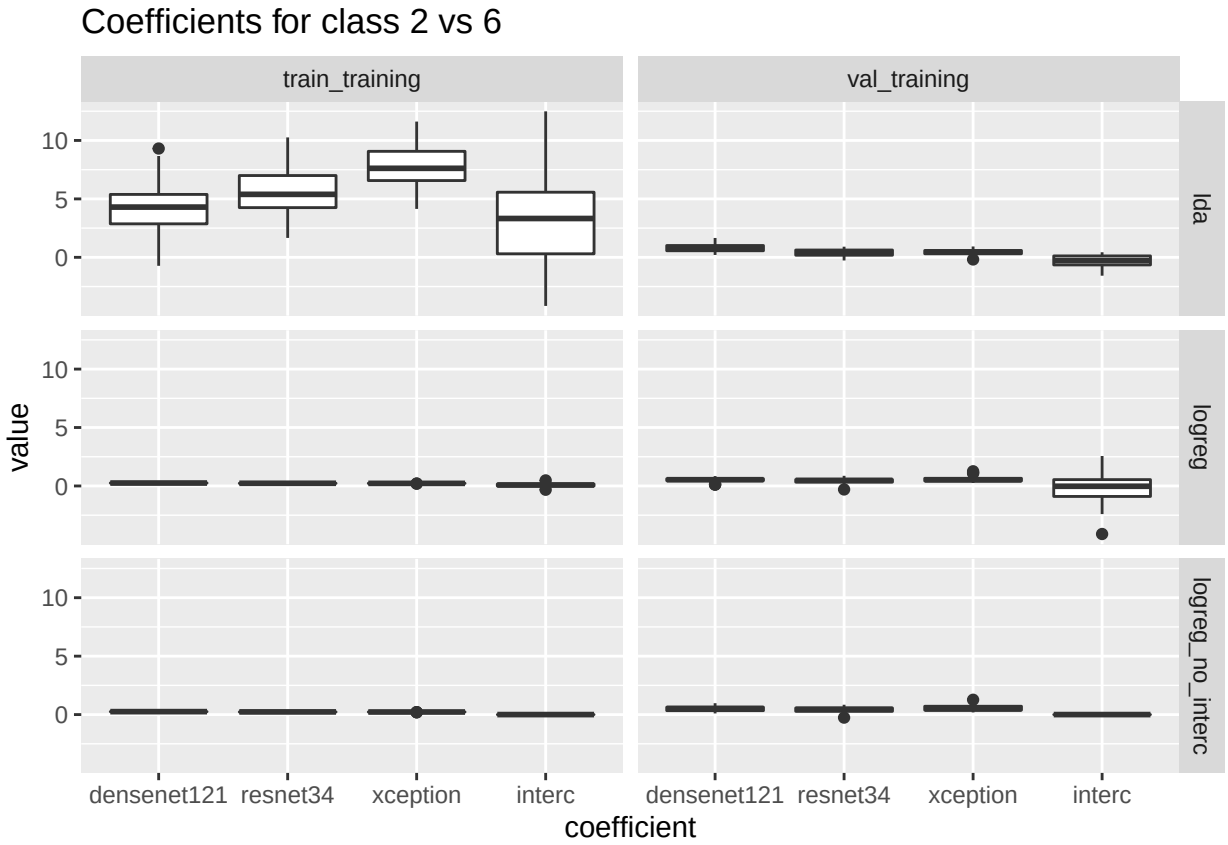

Coefficients for class 1 vs 9
train_training
val_training
lda
logreg
logreg_no_interc
value
10
0
densenet121
resnet34
xception
interc
coefficient

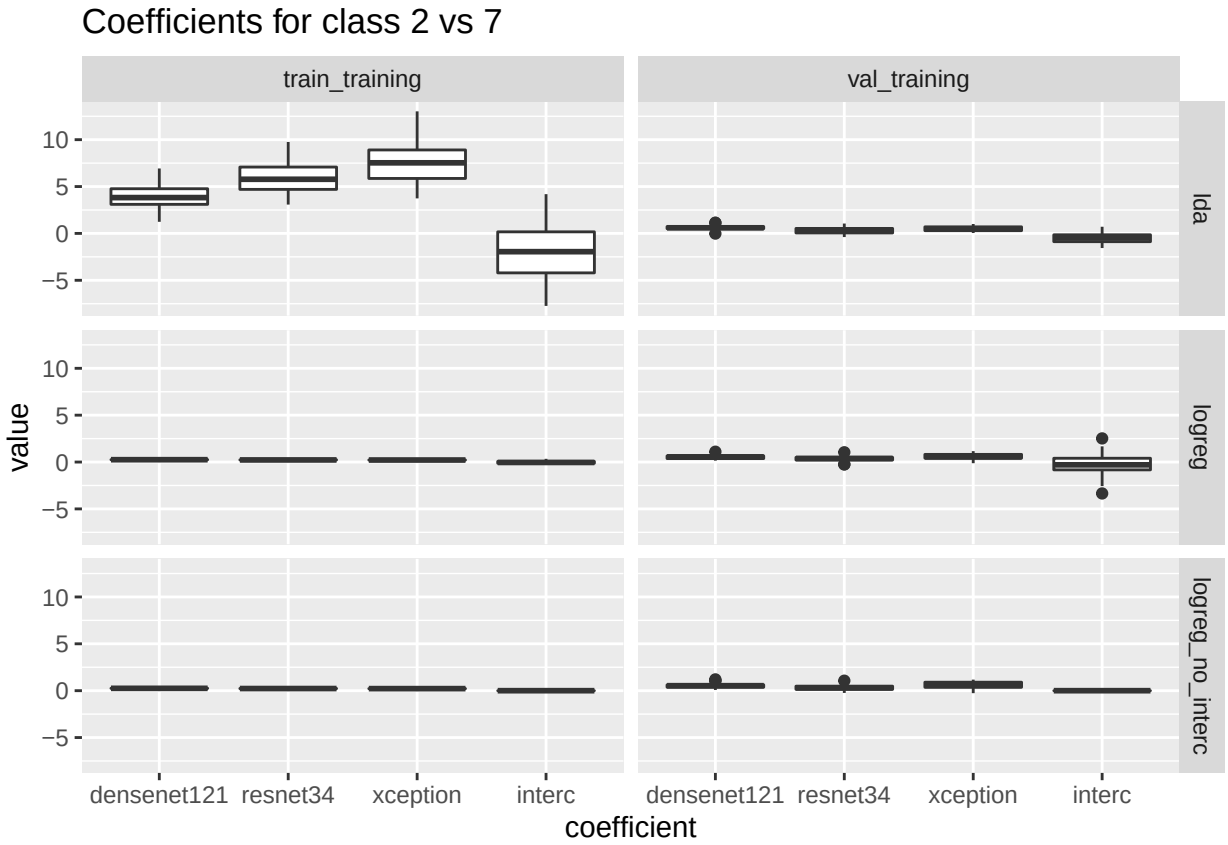

Coefficients for class 1 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
20
15
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient

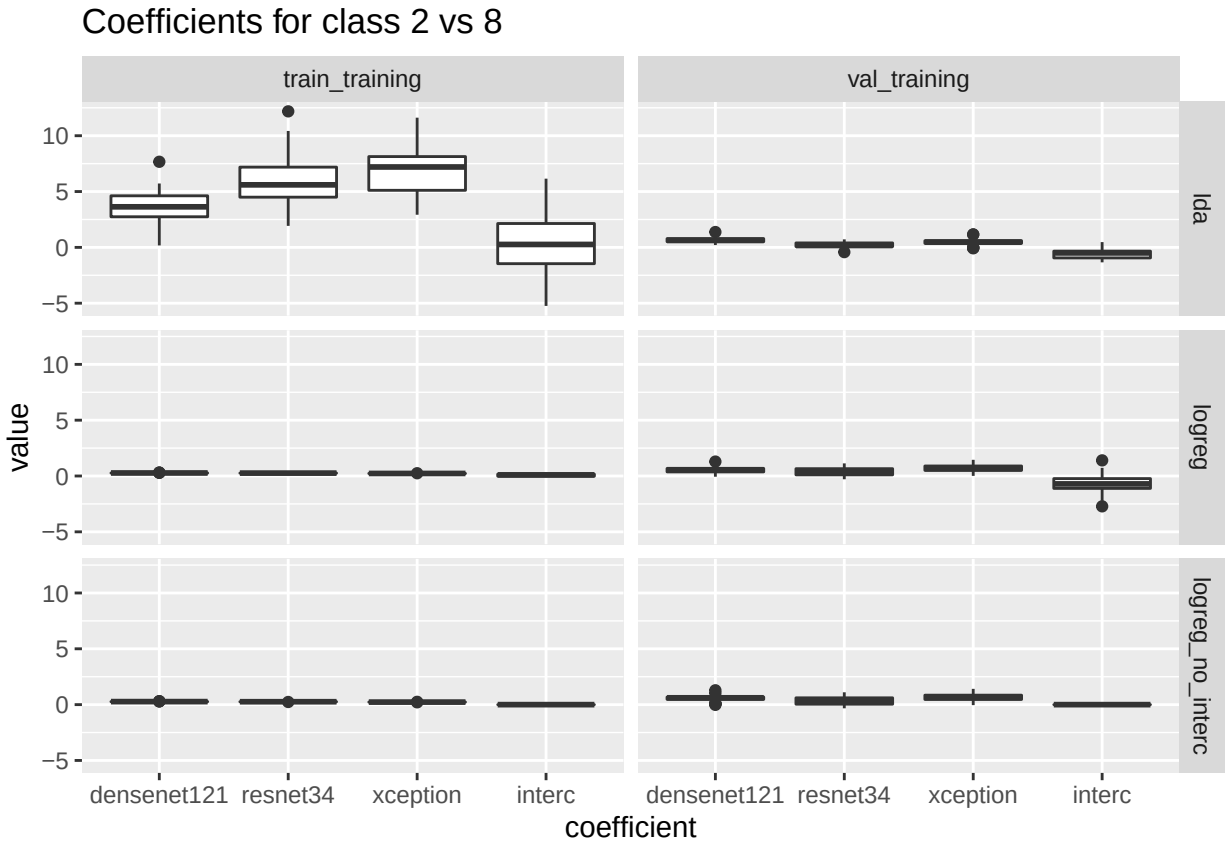

Coefficients for class 2 vs 3
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient

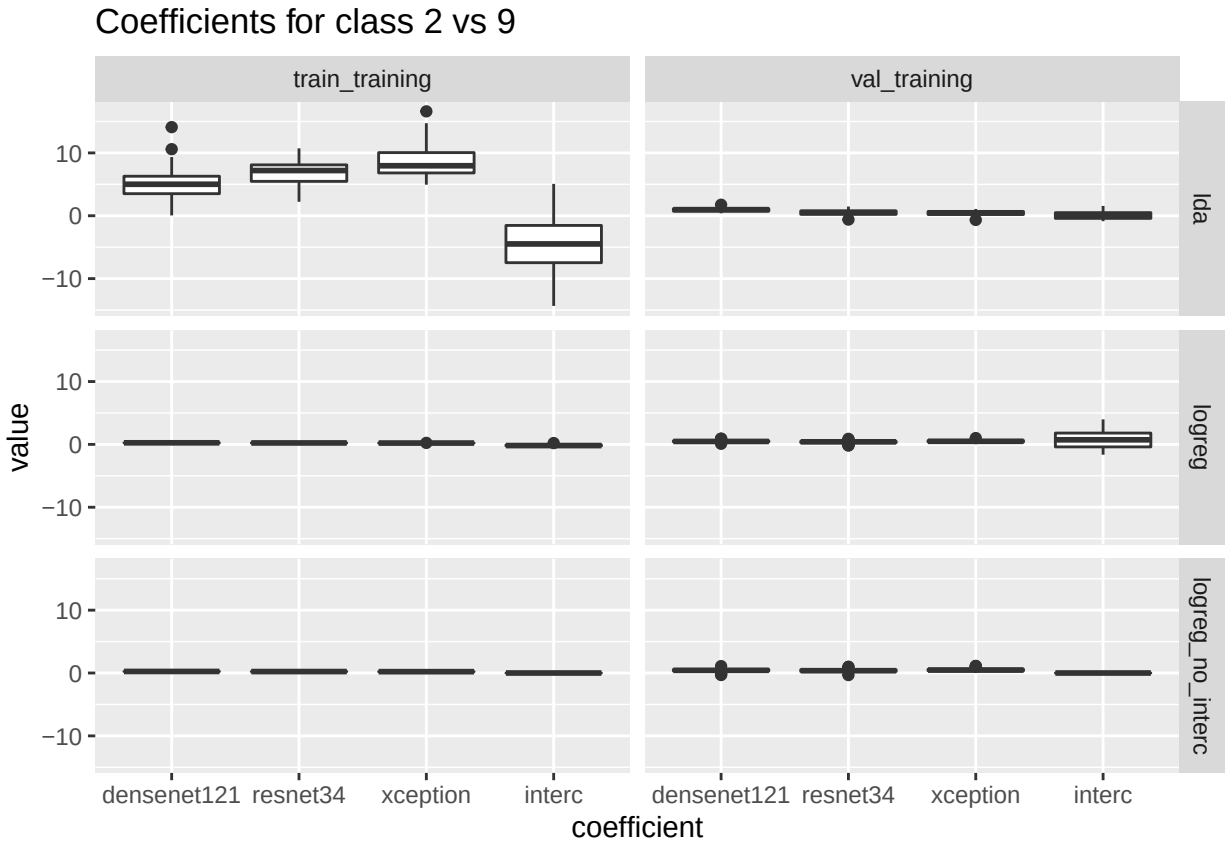

Coefficients for class 2 vs 4
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient

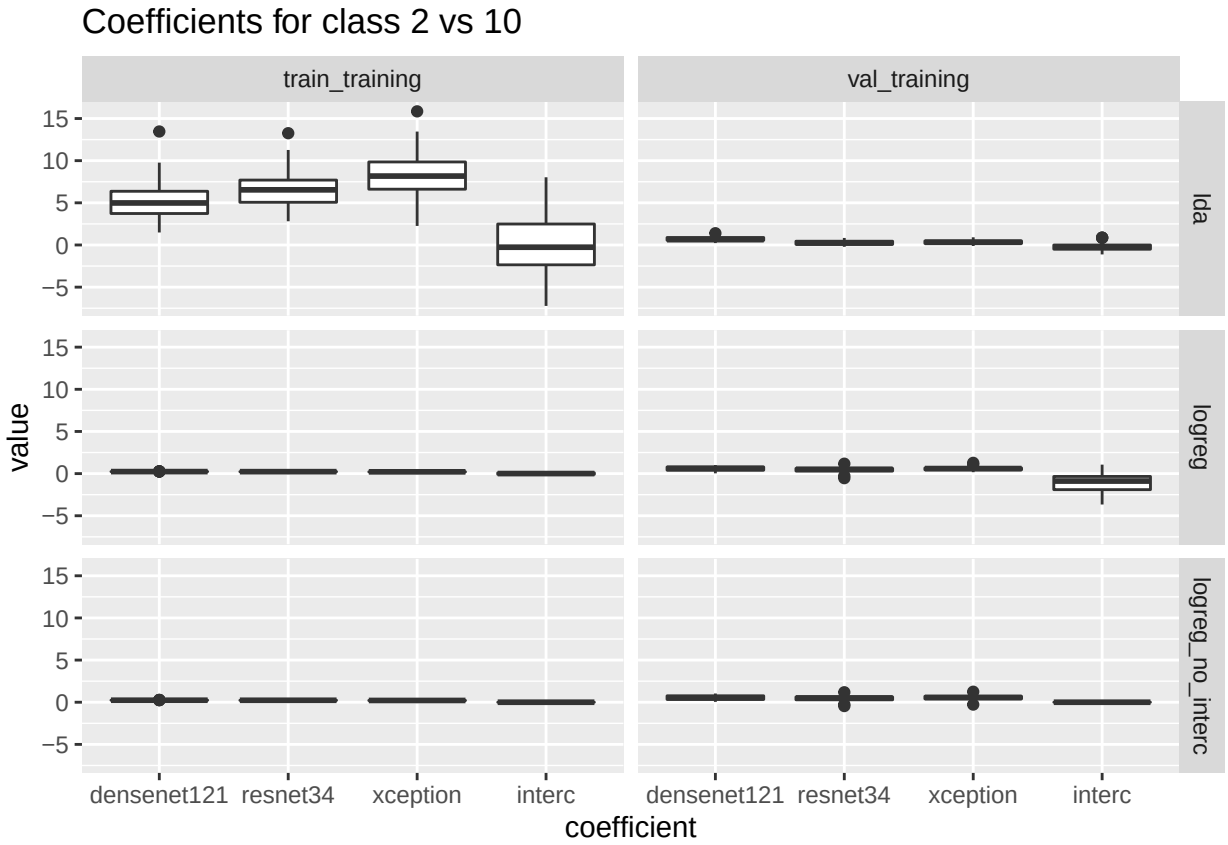

Coefficients for class 2 vs 5
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient

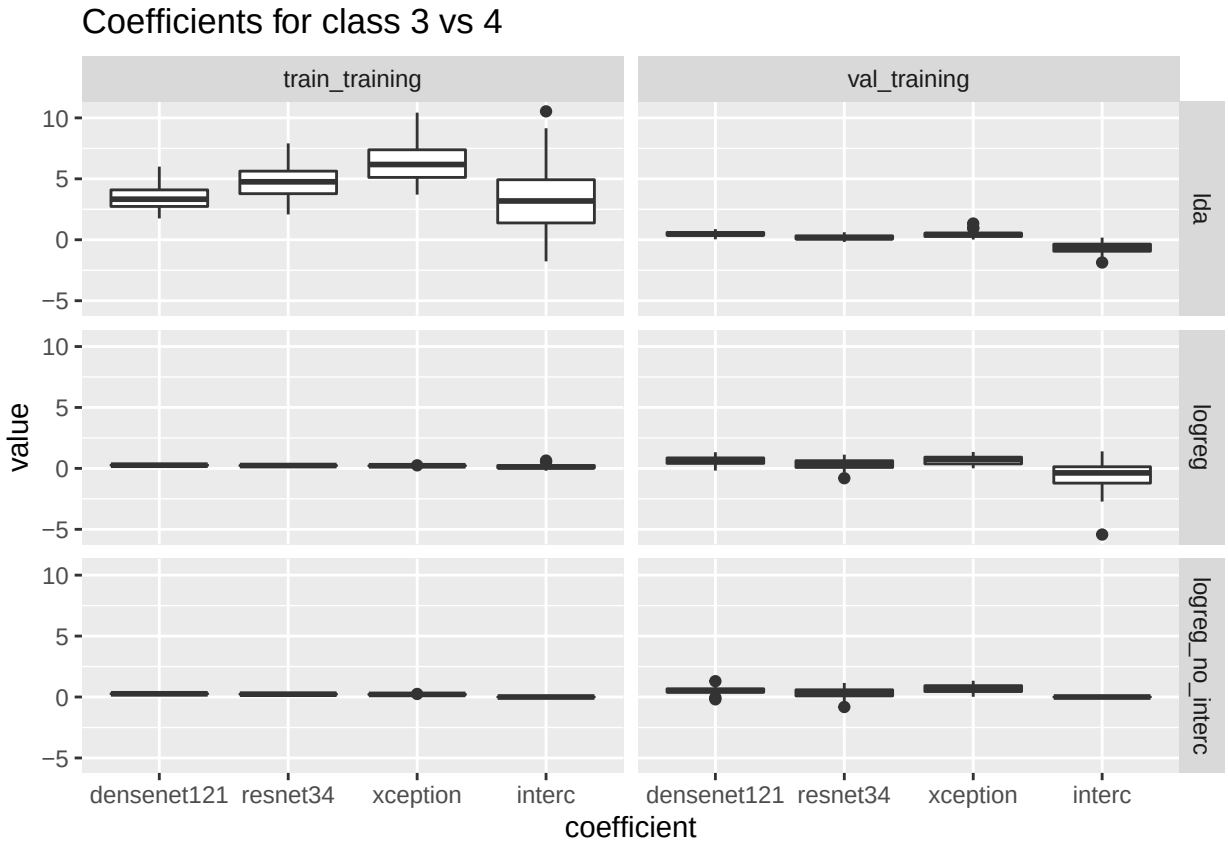

Coefficients for class 2 vs 6
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
densenet121
resnet34
xception
interc
coefficient

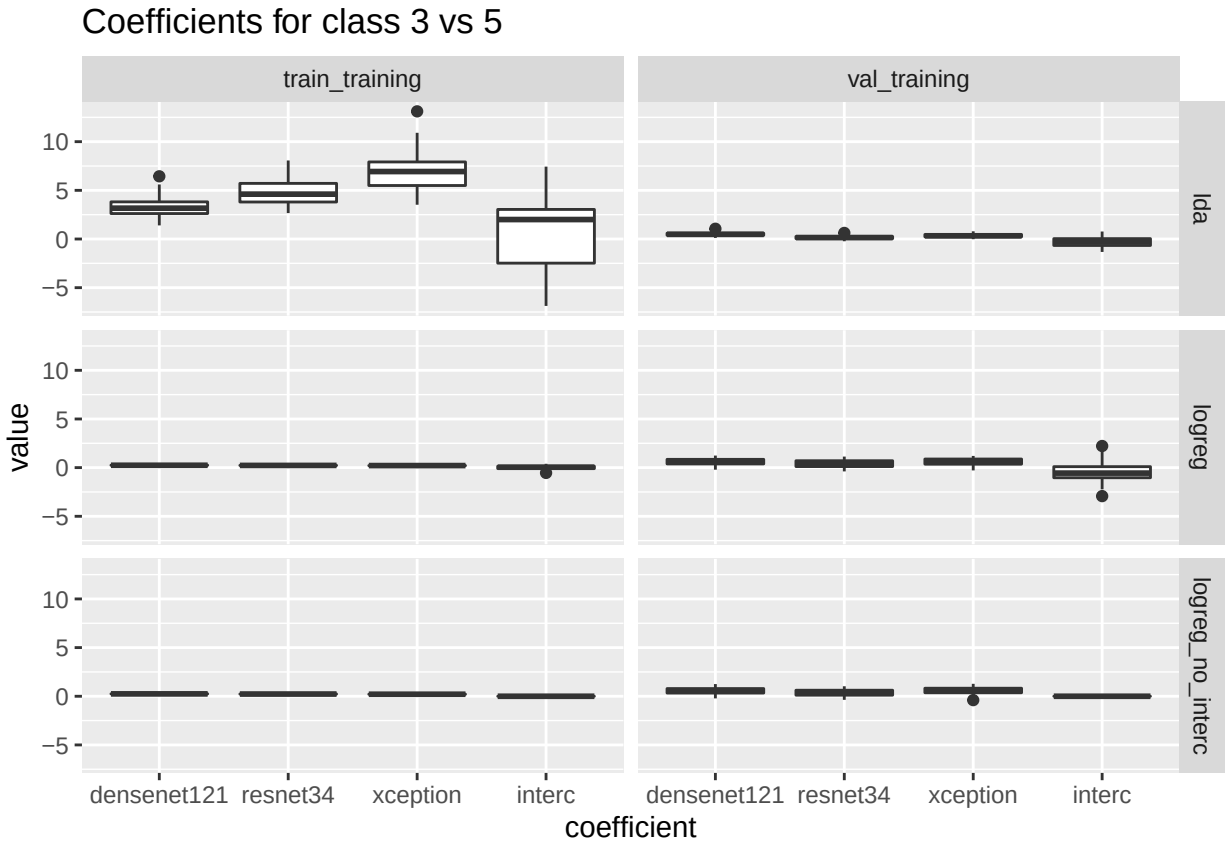

Coefficients for class 2 vs 7
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 2 vs 8
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 2 vs 9
train_training
val_training
lda
logreg
logreg_no_interc
value
10
0
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 2 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 4
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 5
train_training
val_training
lda
logreg
logreg_no_interc
value
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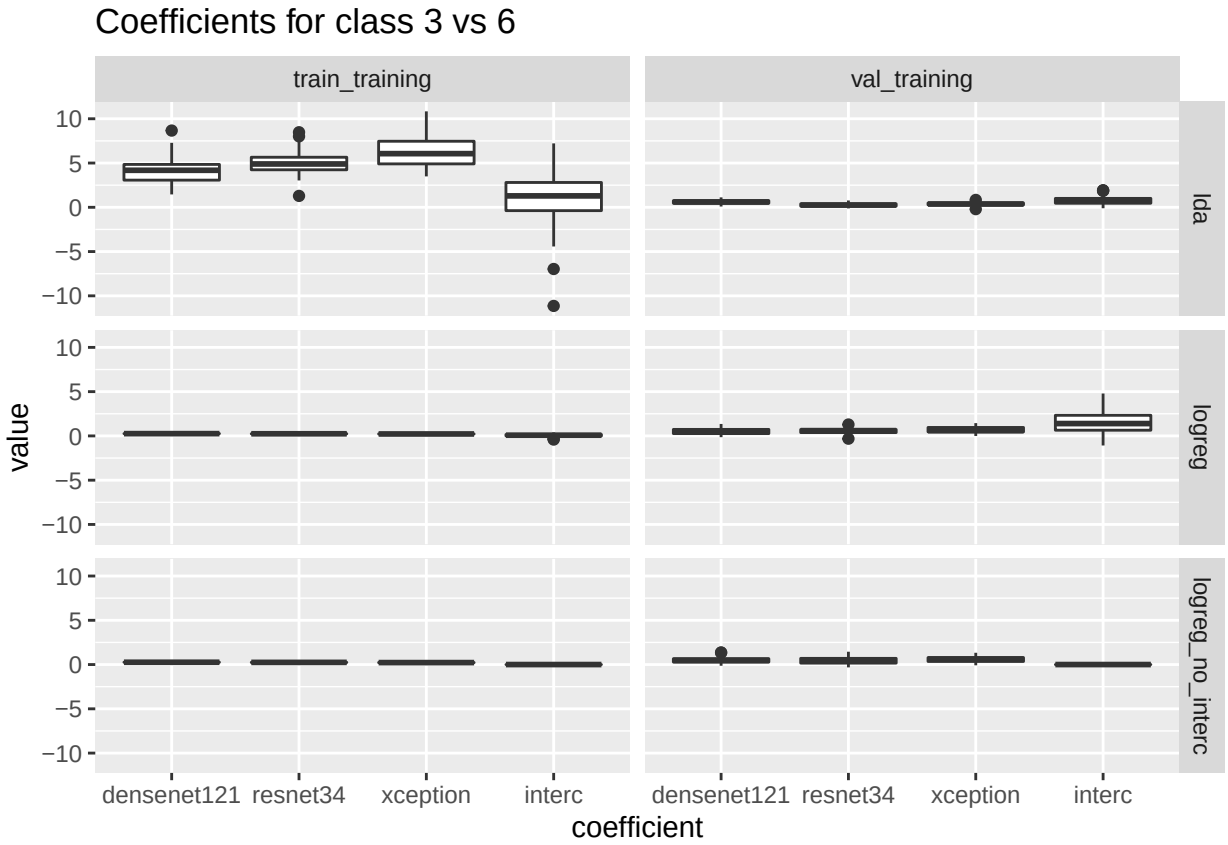
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 6
train_training
val_training
lda
logreg
logreg_no_interc
value
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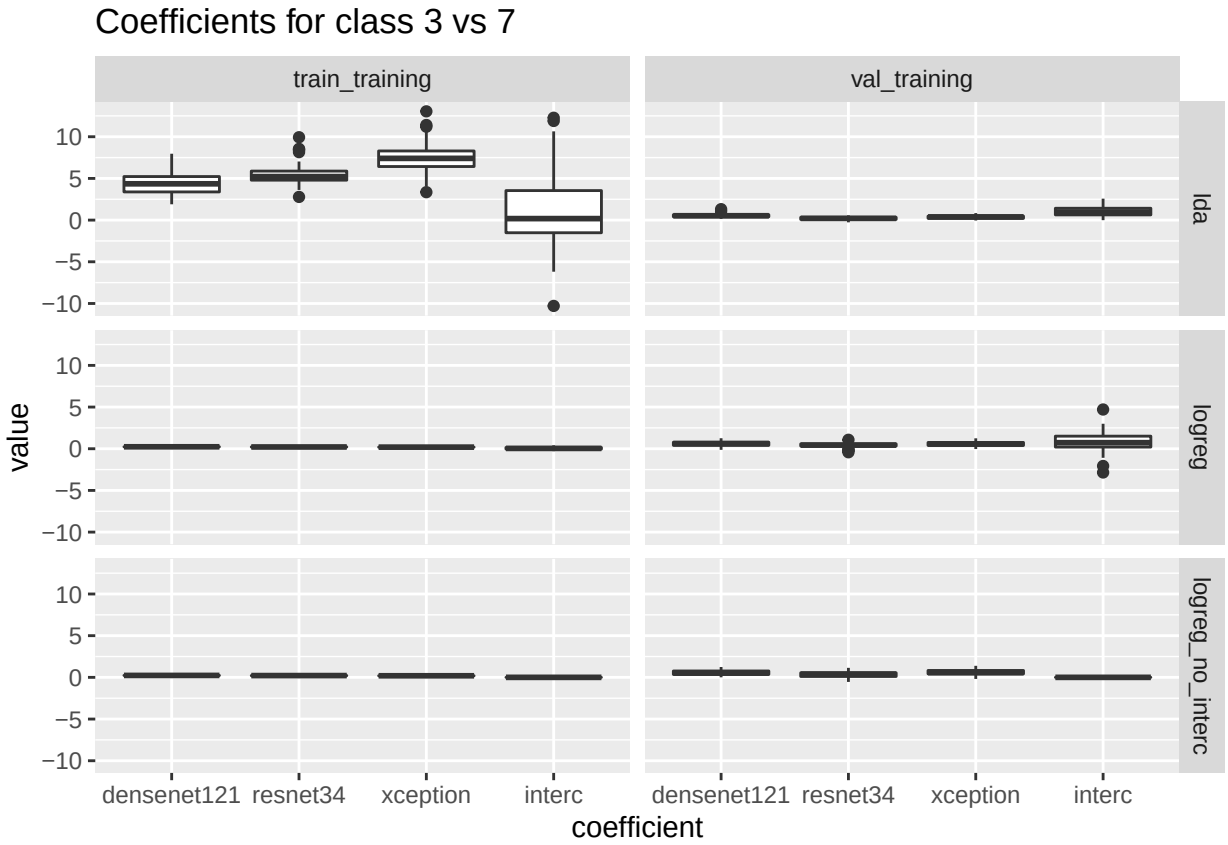
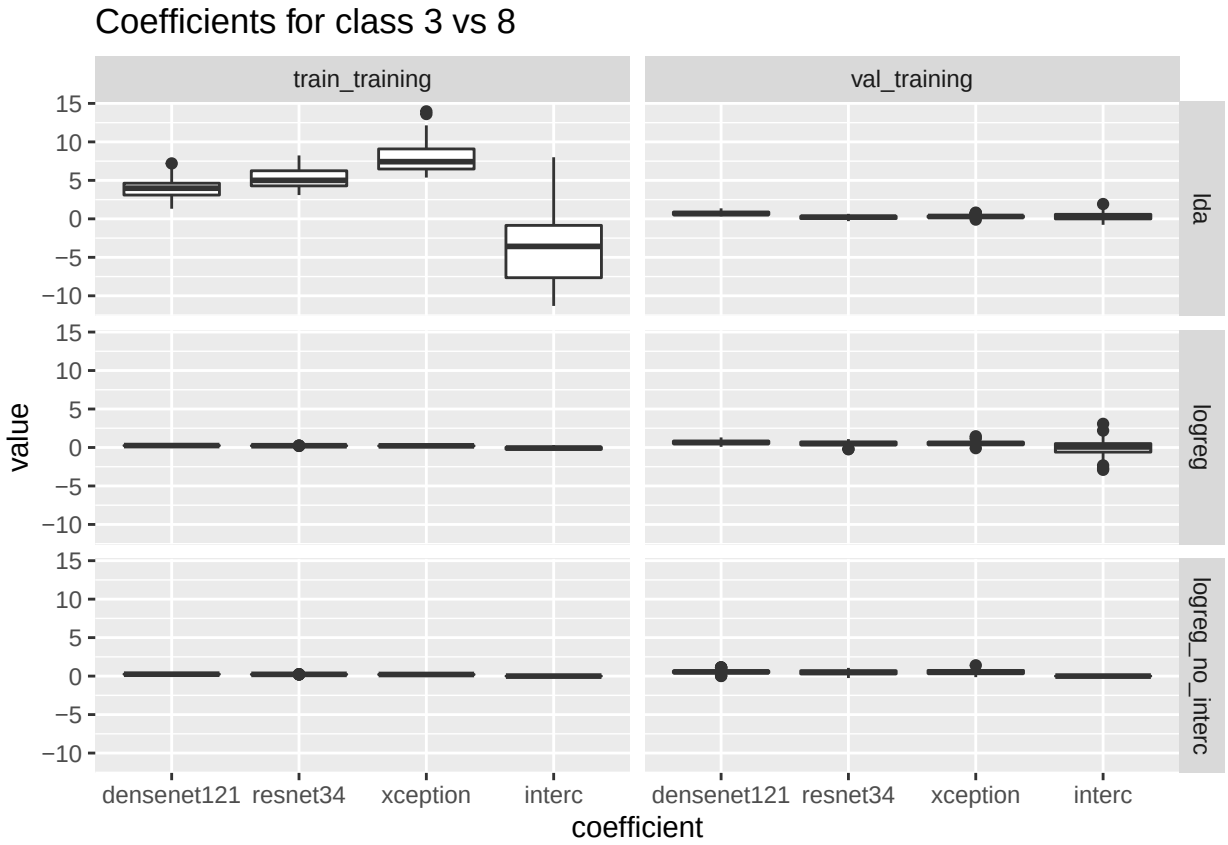
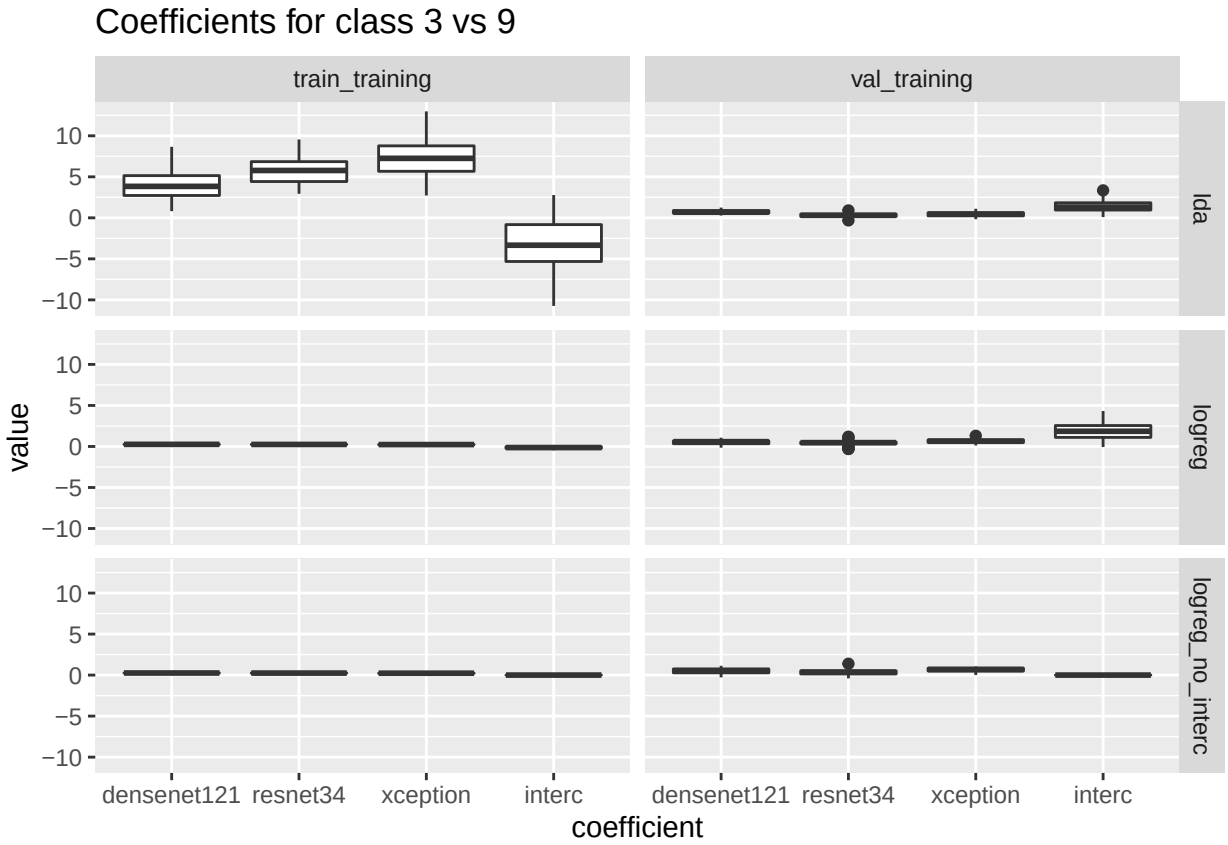
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 7
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 8
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 9
train_training
val_training
lda
logreg
logreg_no_interc
value
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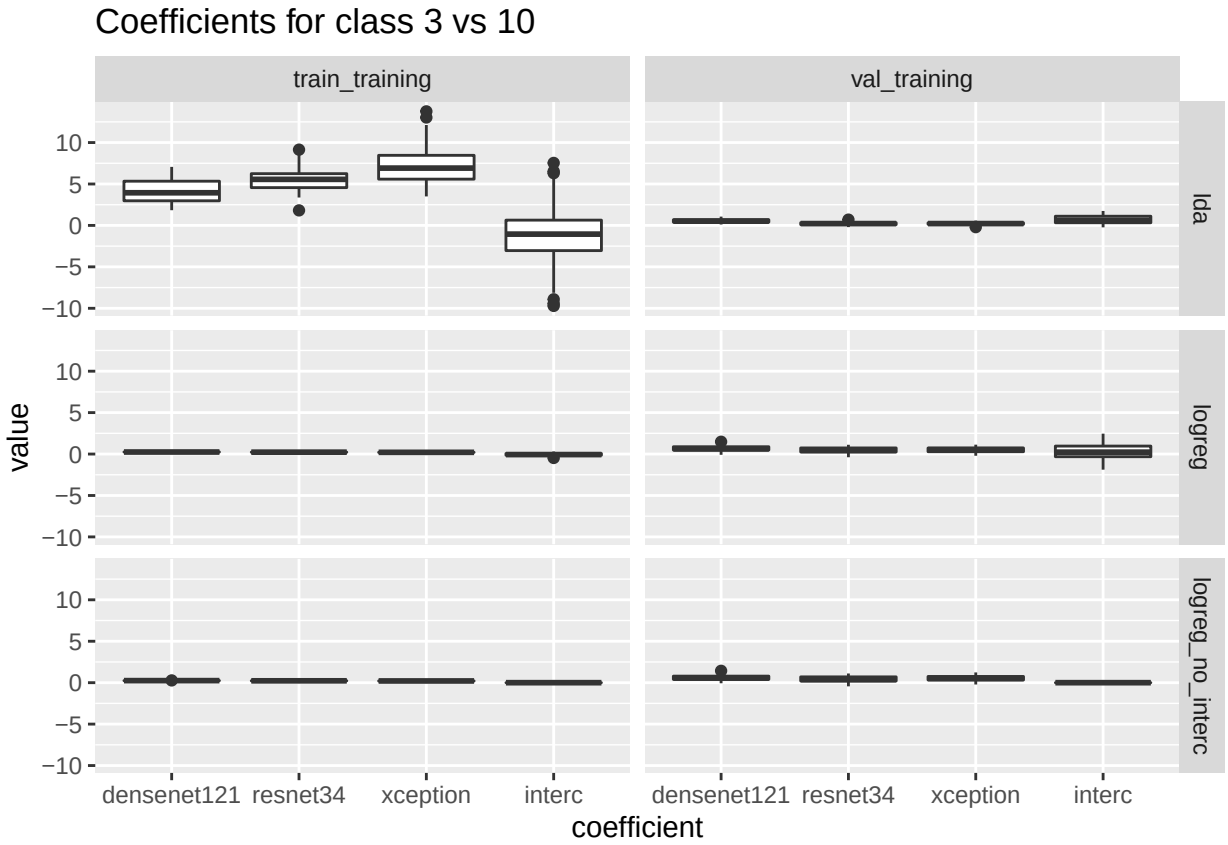
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 3 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
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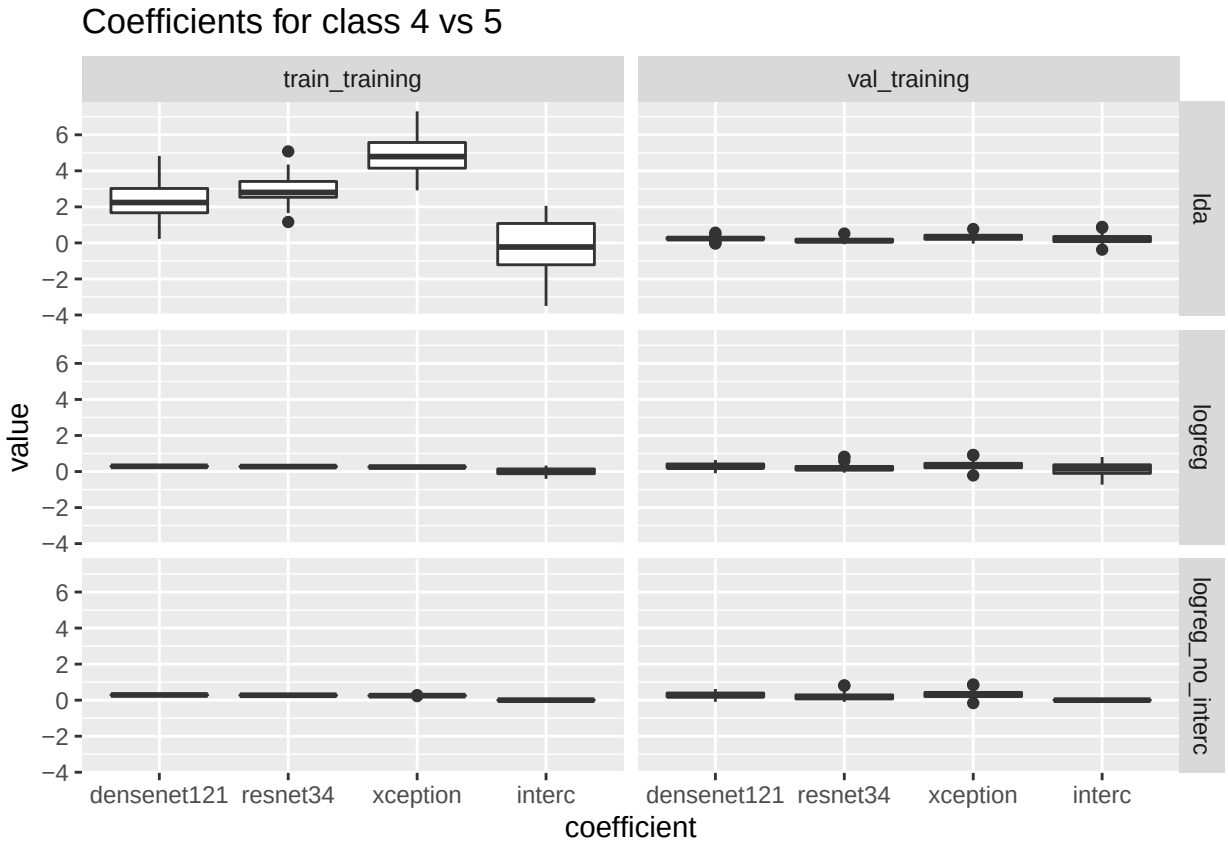
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 4 vs 5
train_training
val_training
lda
logreg
logreg_no_interc
value
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4
2
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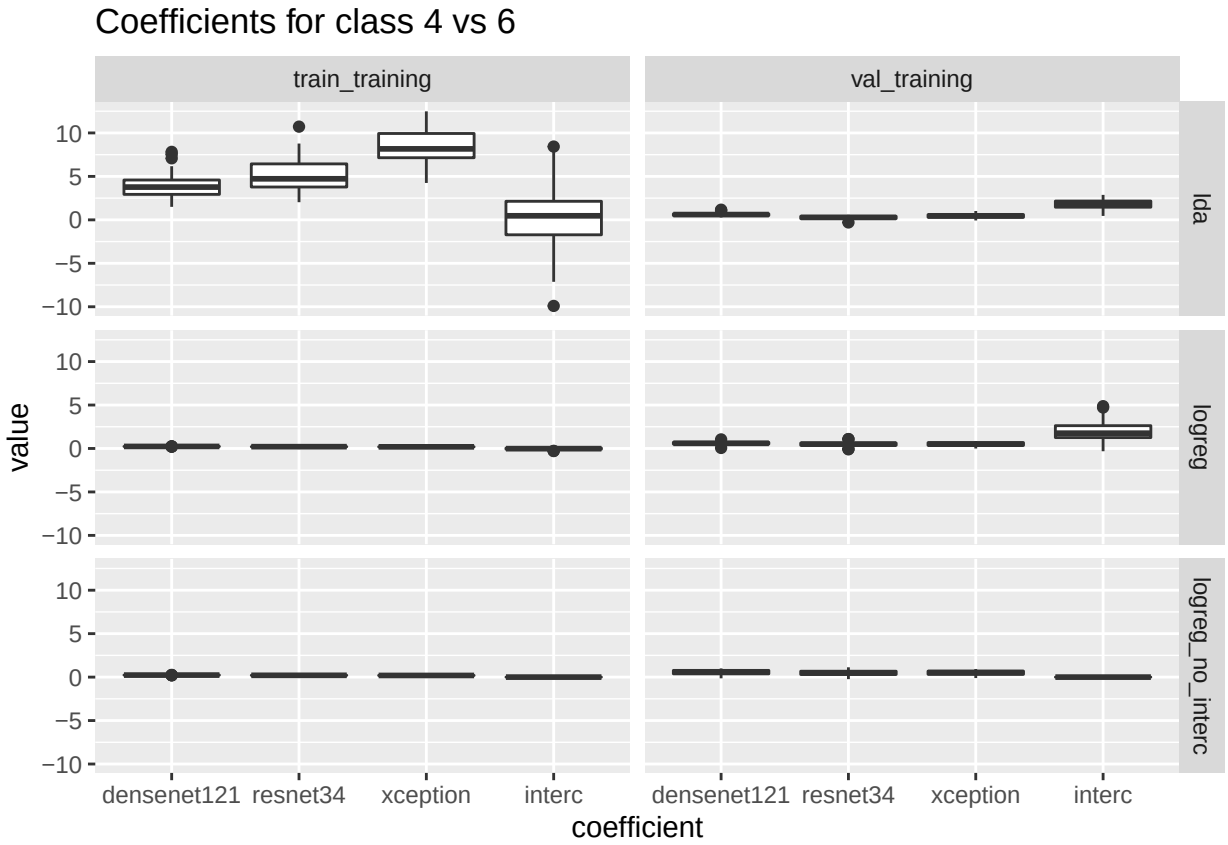
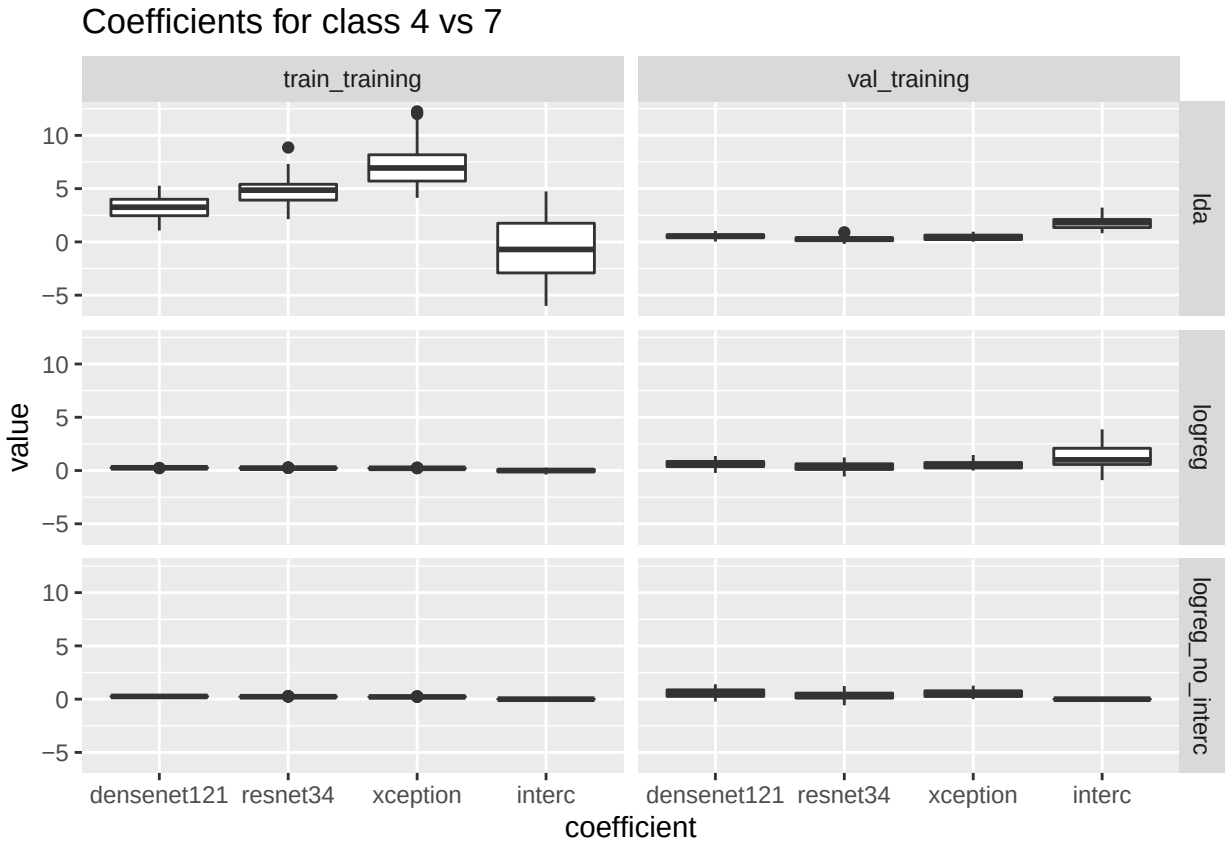
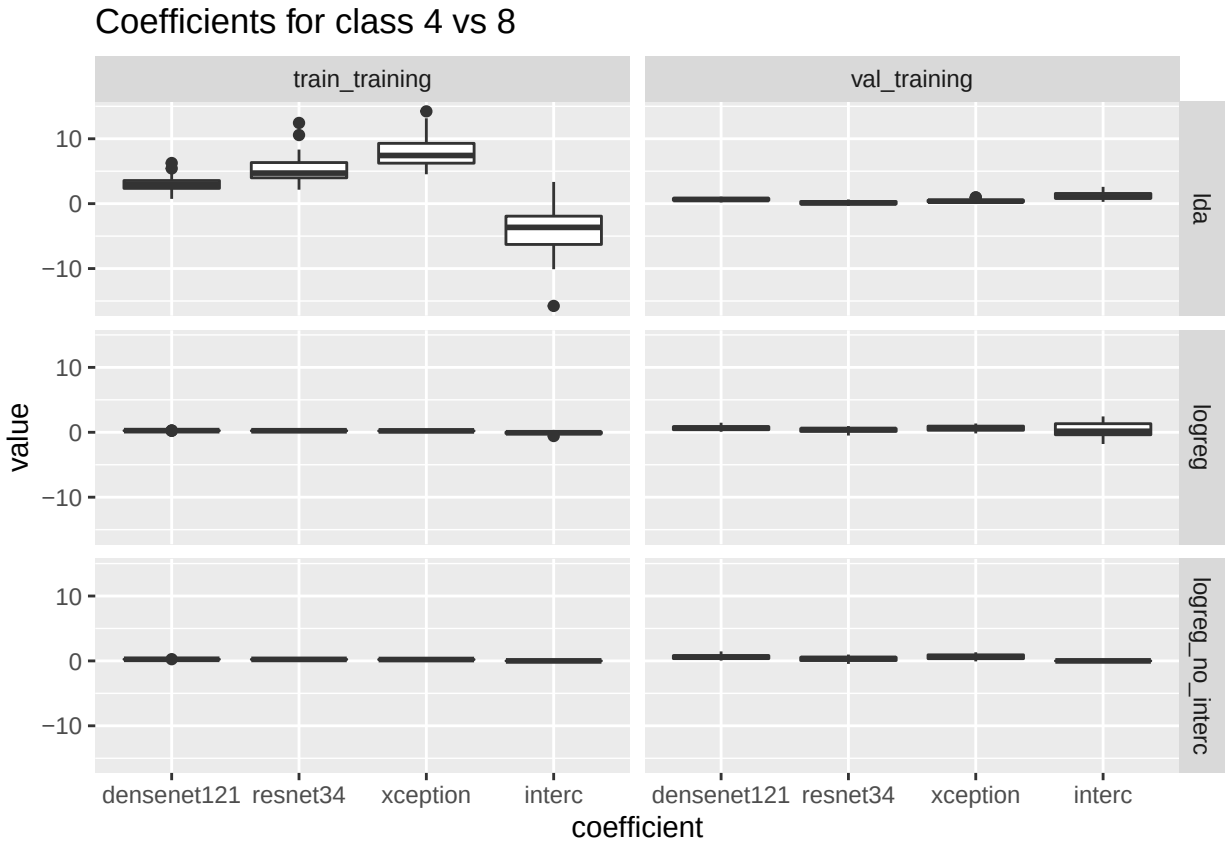
−2
−4
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 4 vs 6
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 4 vs 7
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 4 vs 8
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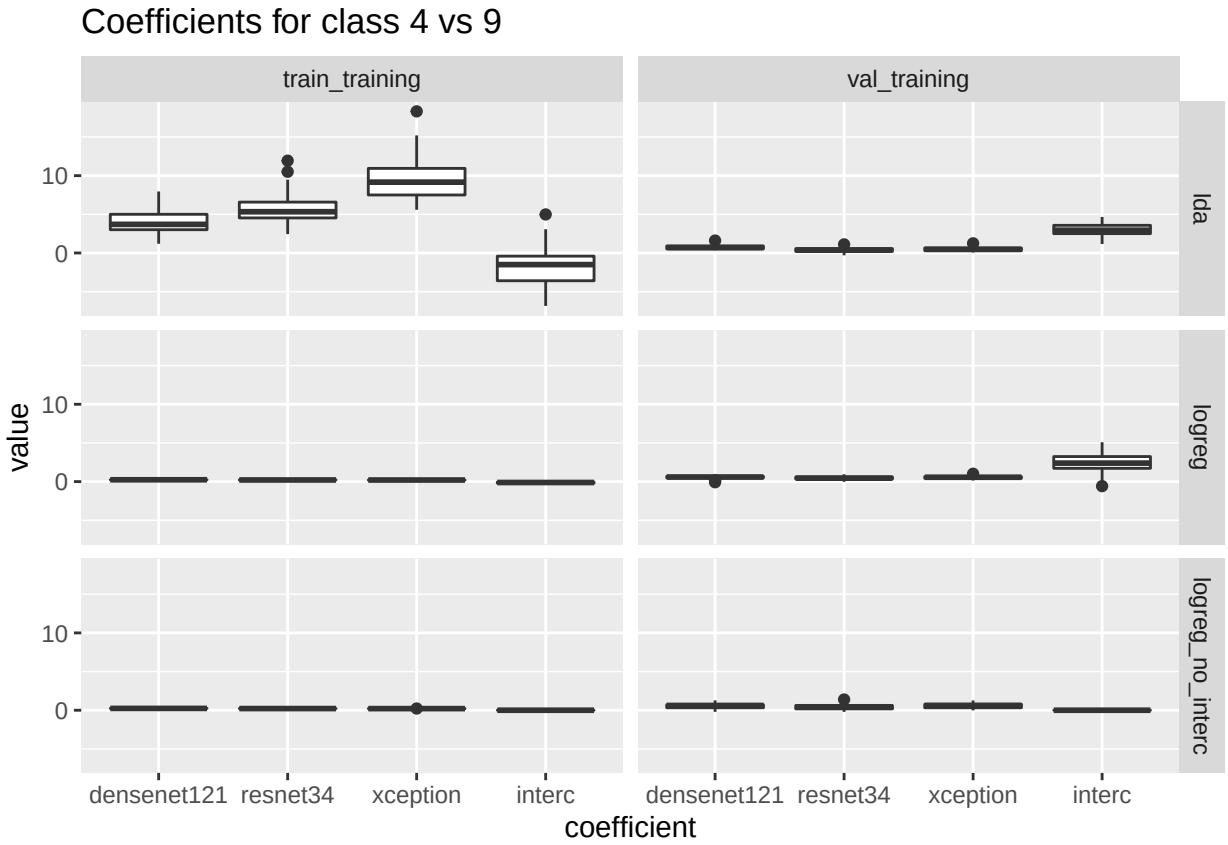
val_training
lda
logreg
logreg_no_interc
value
10
0
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 4 vs 9
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val_training
lda
logreg
logreg_no_interc
value
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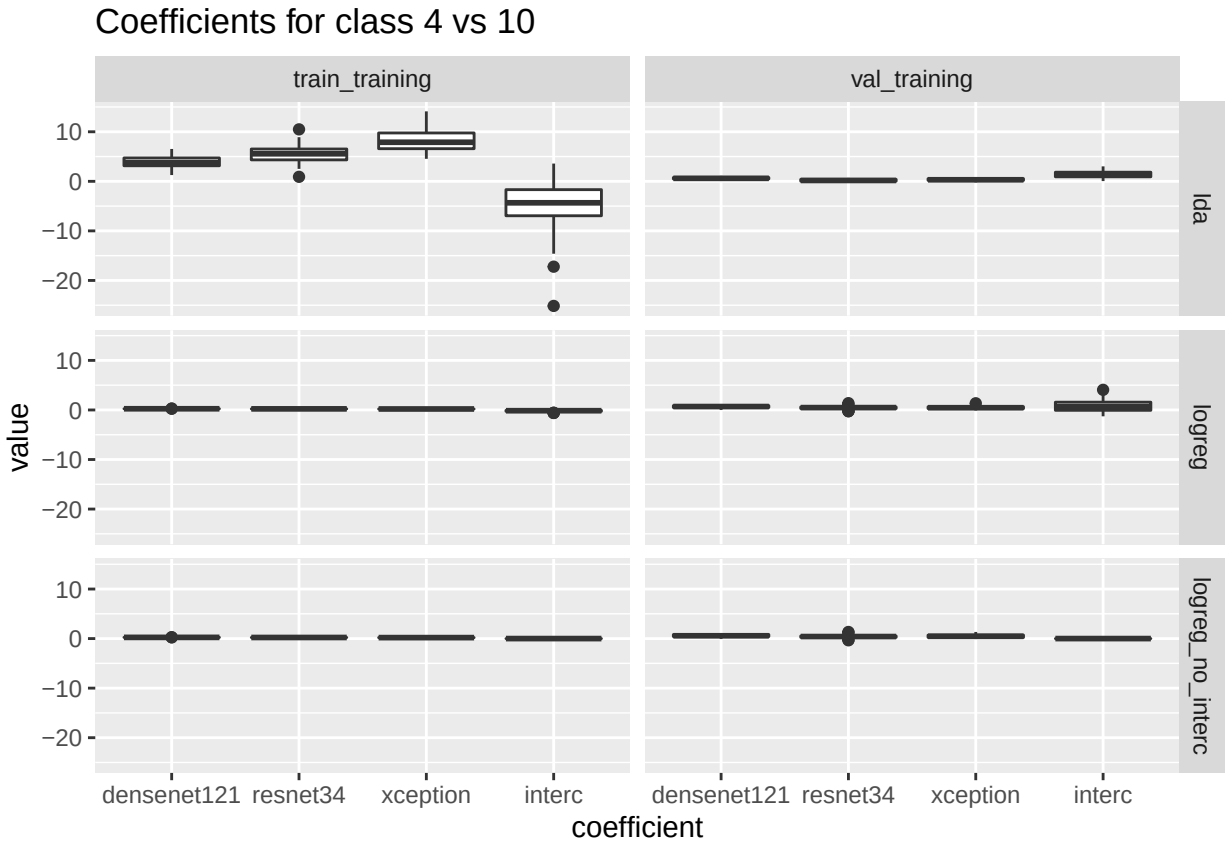
0
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 4 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
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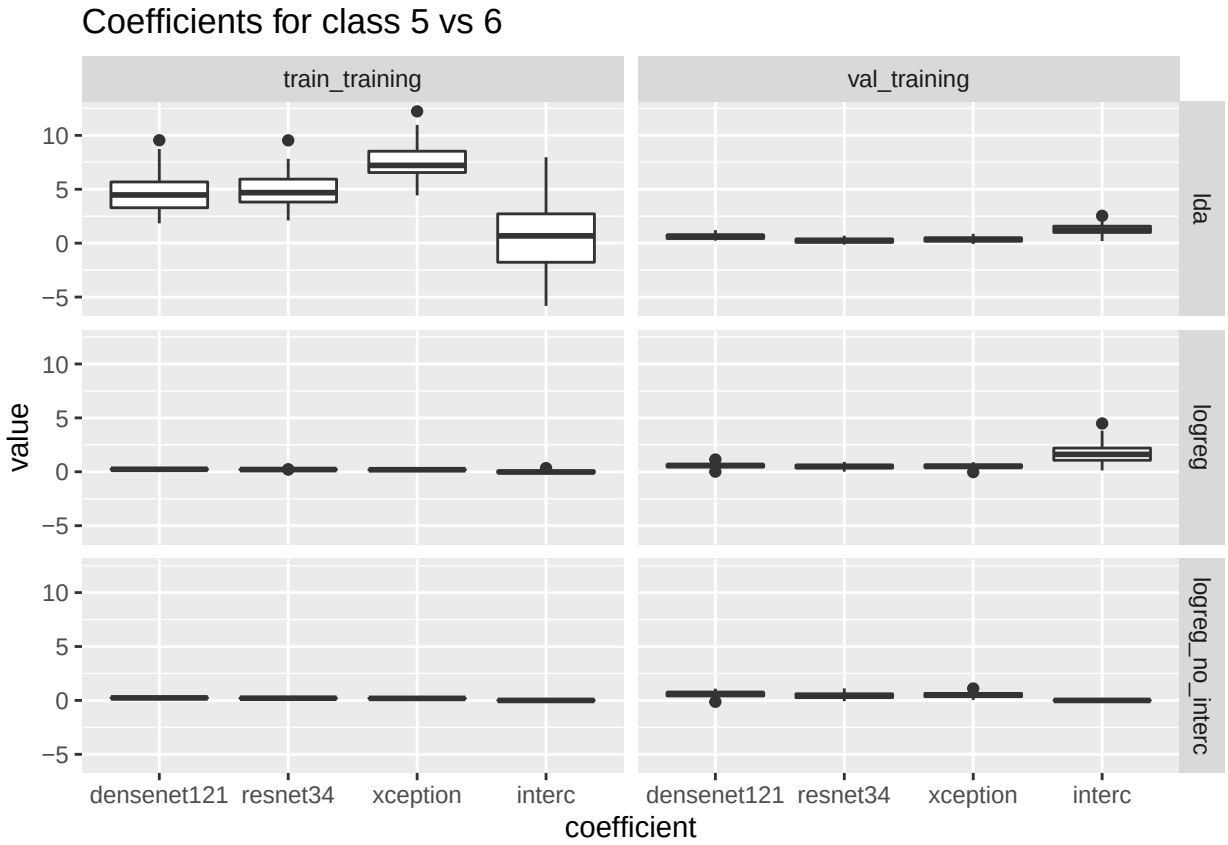
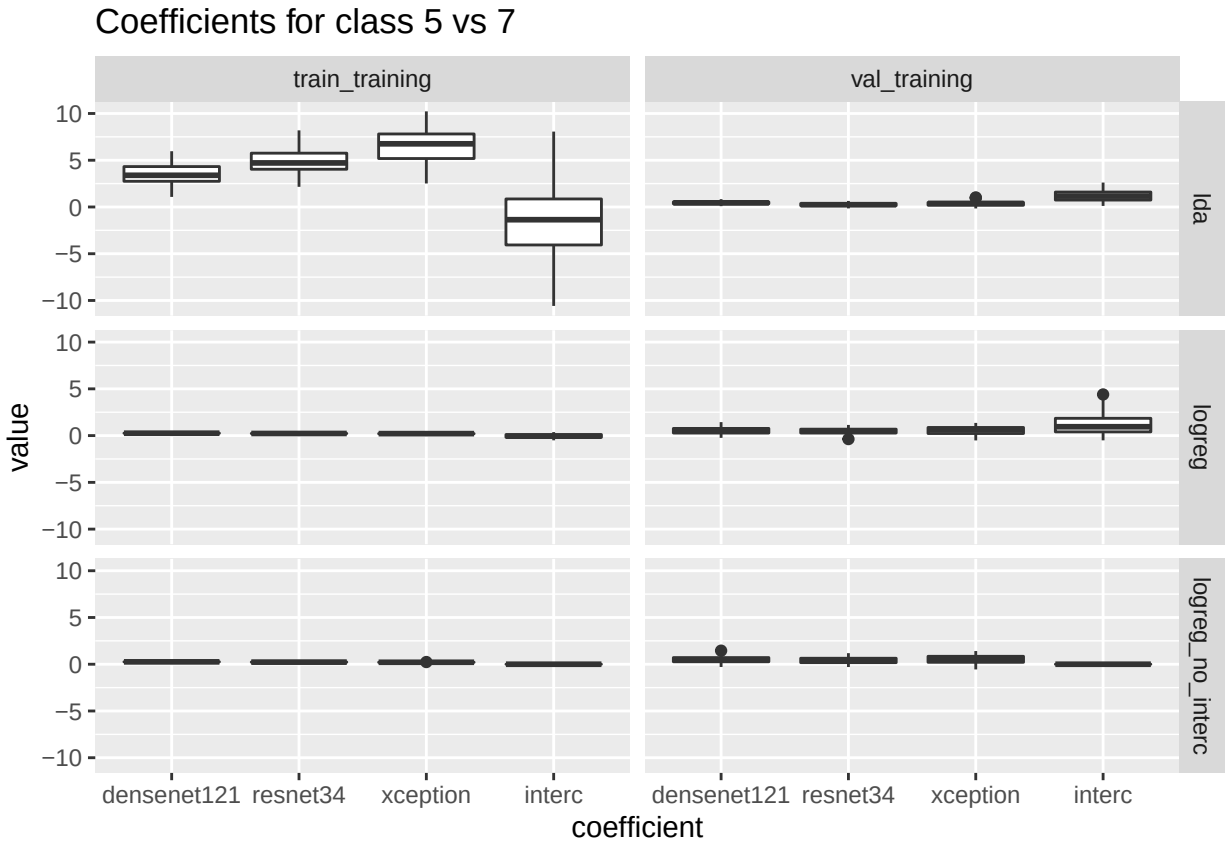
−10
−20
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 5 vs 6
train_training
val_training
lda
logreg
logreg_no_interc
value
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 5 vs 7
train_training
val_training
lda
logreg
logreg_no_interc
value
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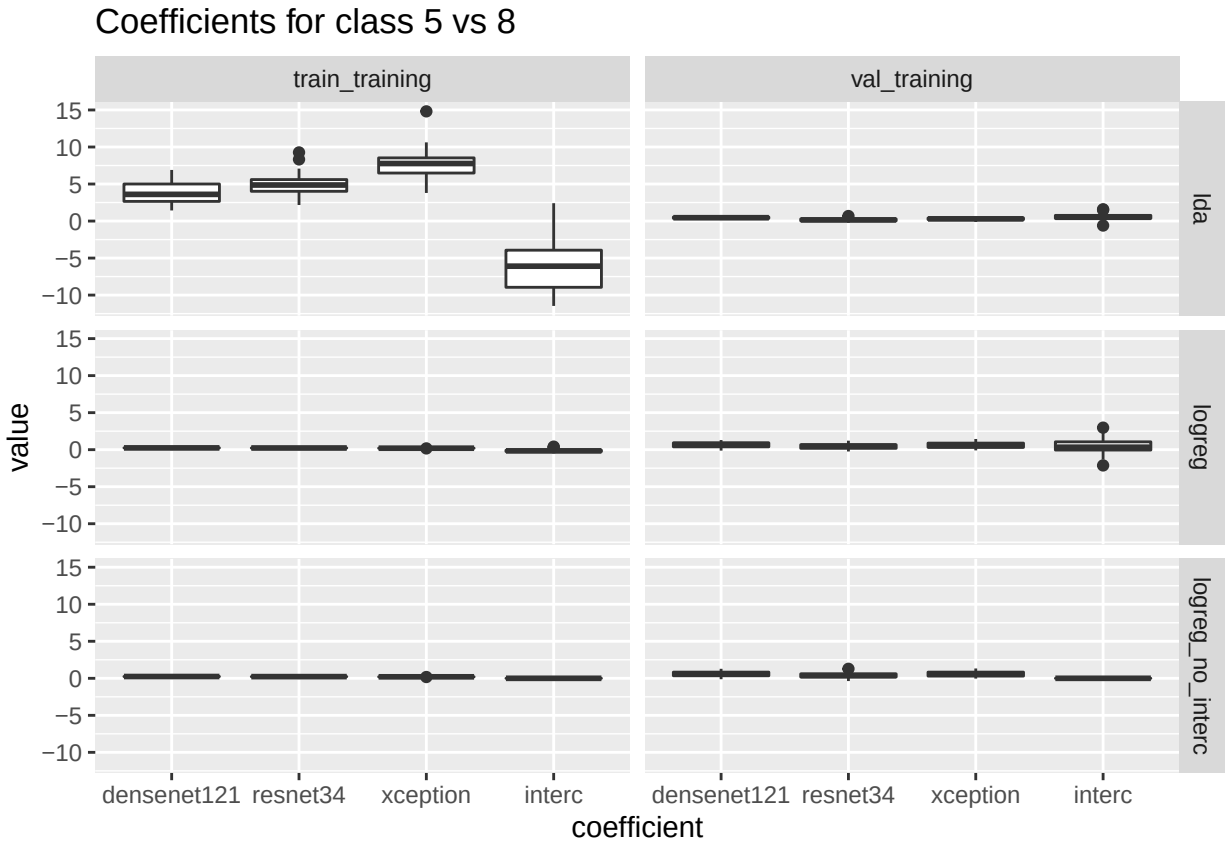
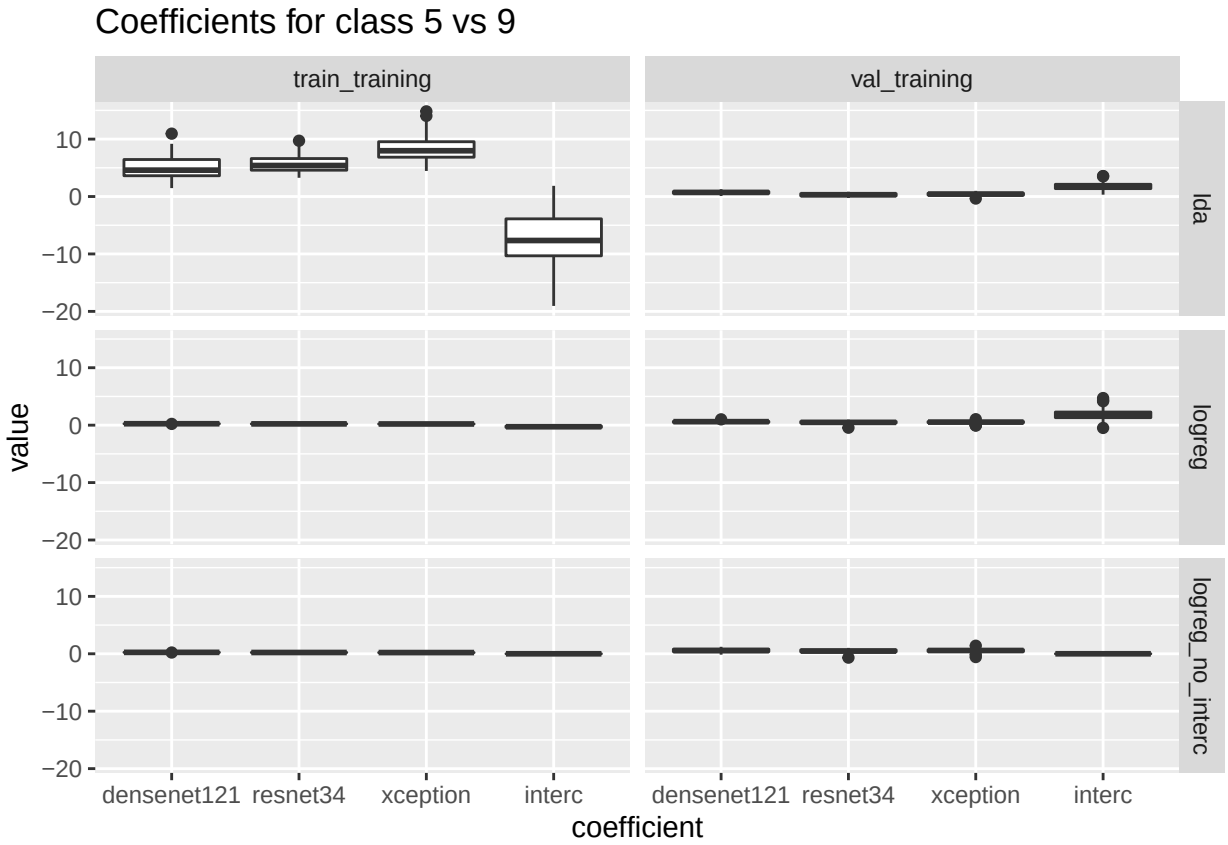
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 5 vs 8
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 5 vs 9
train_training
val_training
lda
logreg
logreg_no_interc
value
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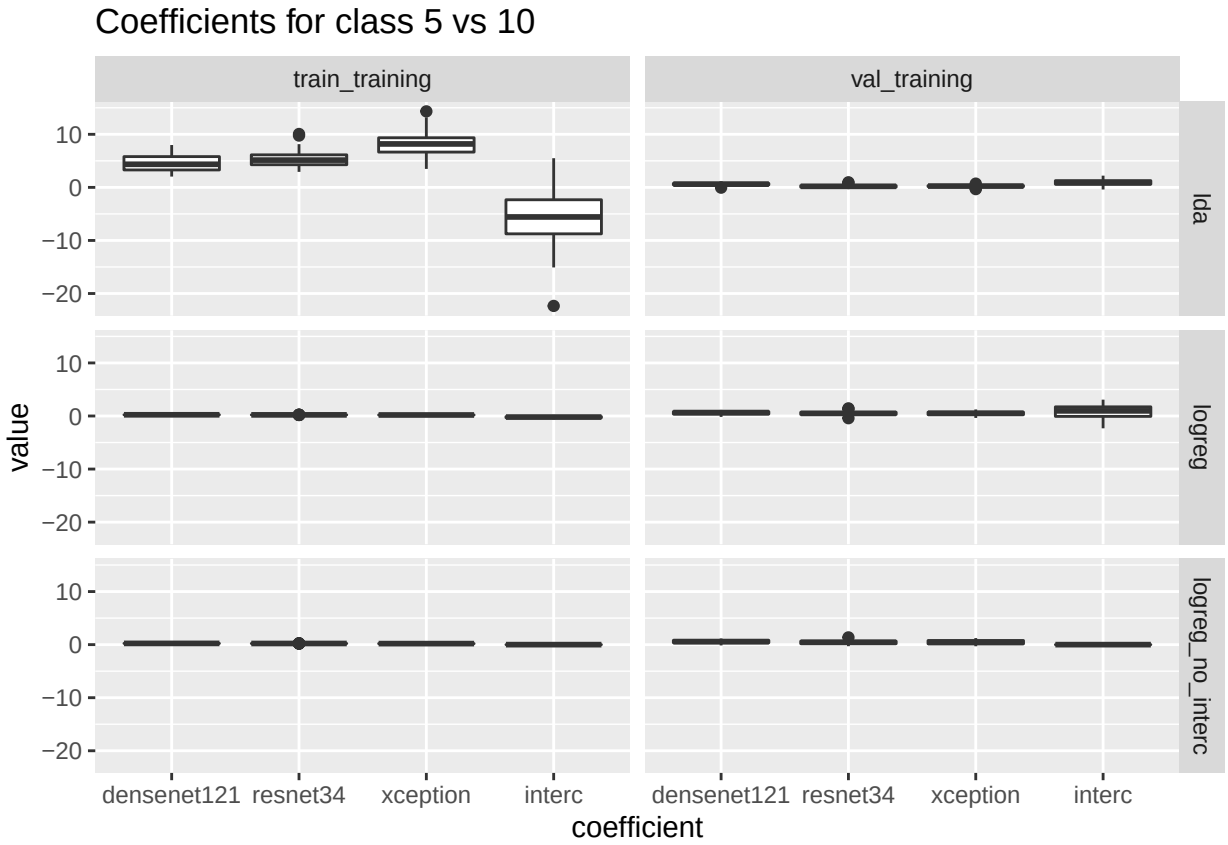
−10
−20
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 5 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
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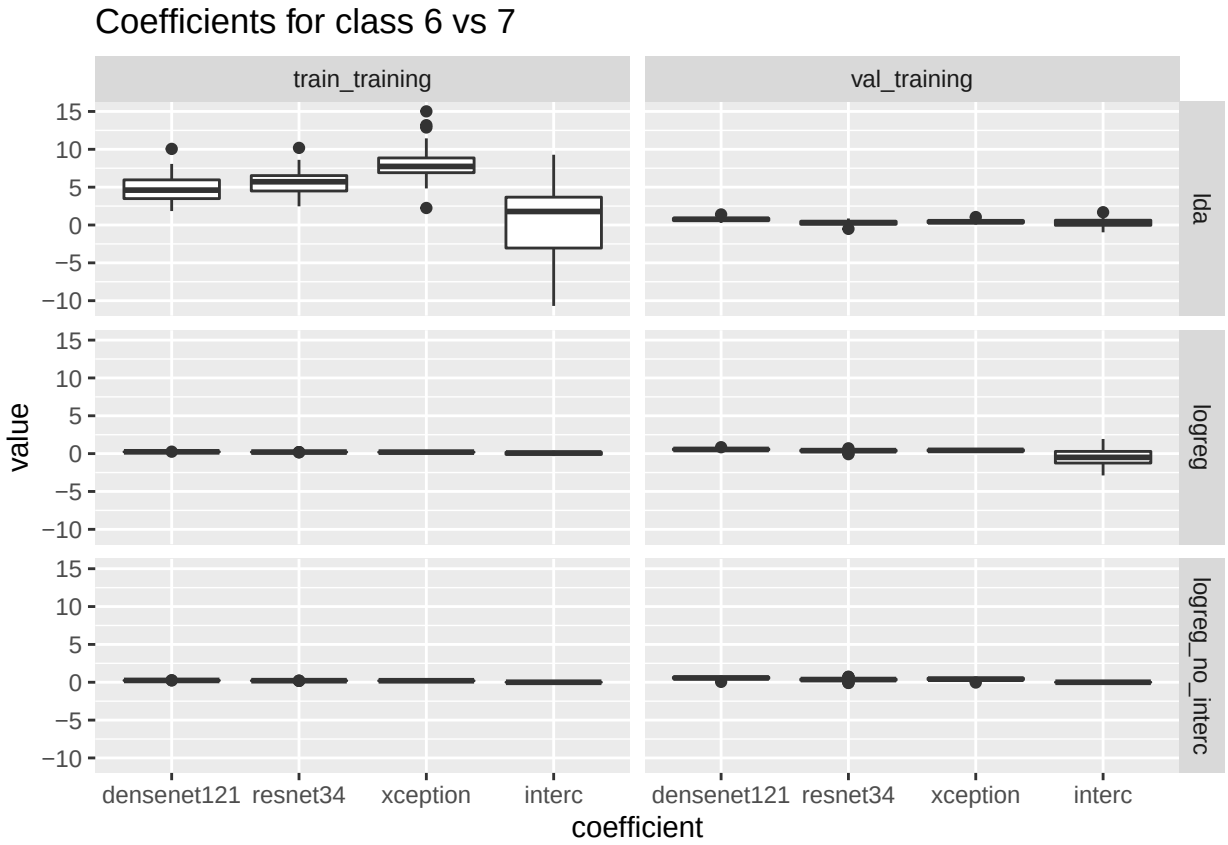
0
−10
−20
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 6 vs 7
train_training
val_training
lda
logreg
logreg_no_interc
value
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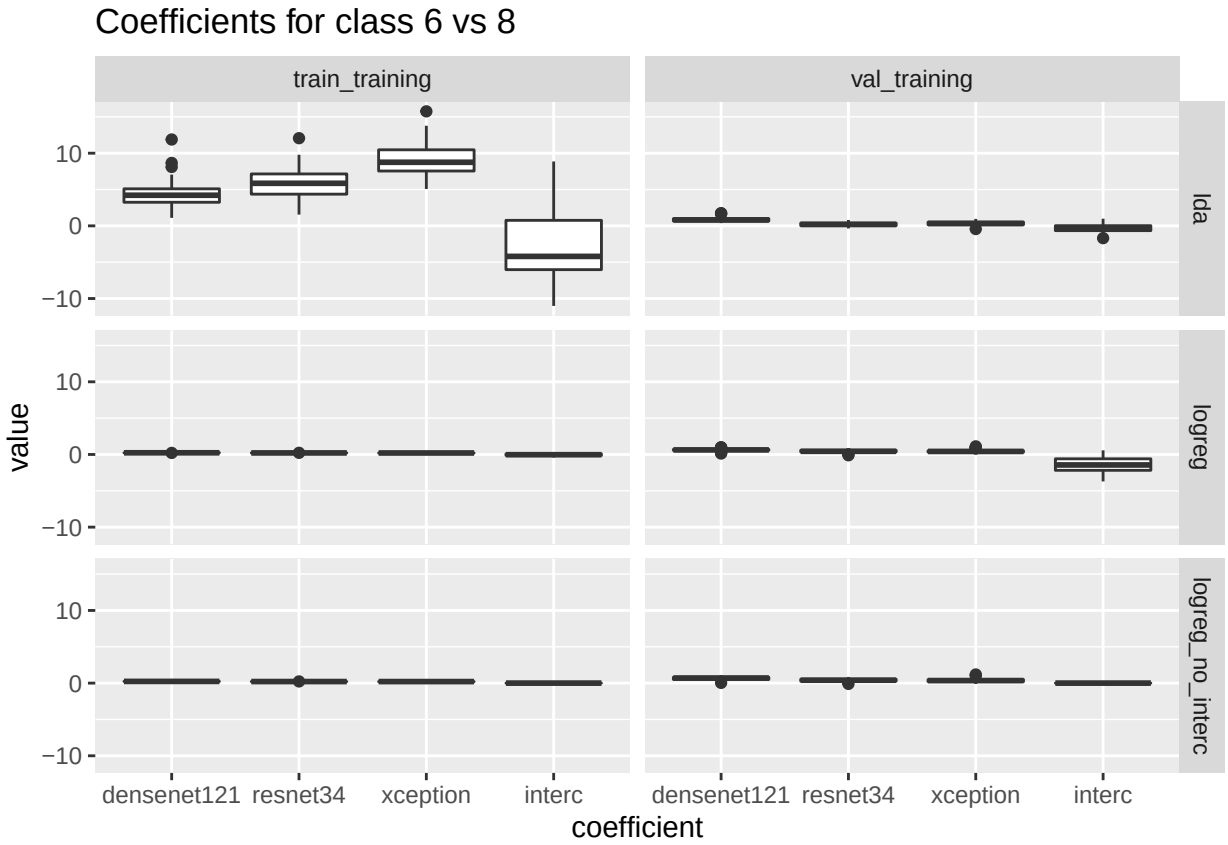
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 6 vs 8
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val_training
lda
logreg
logreg_no_interc
value
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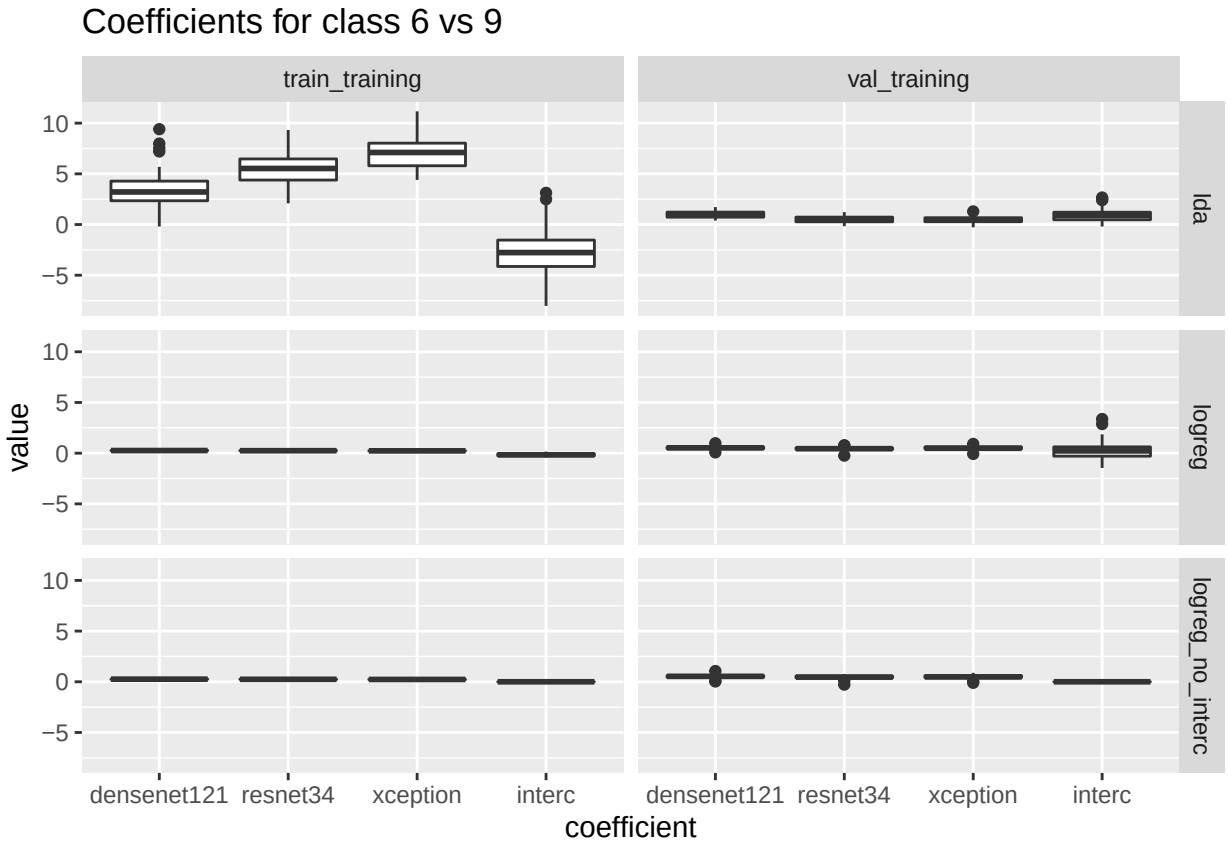
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 6 vs 9
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lda
logreg
logreg_no_interc
value
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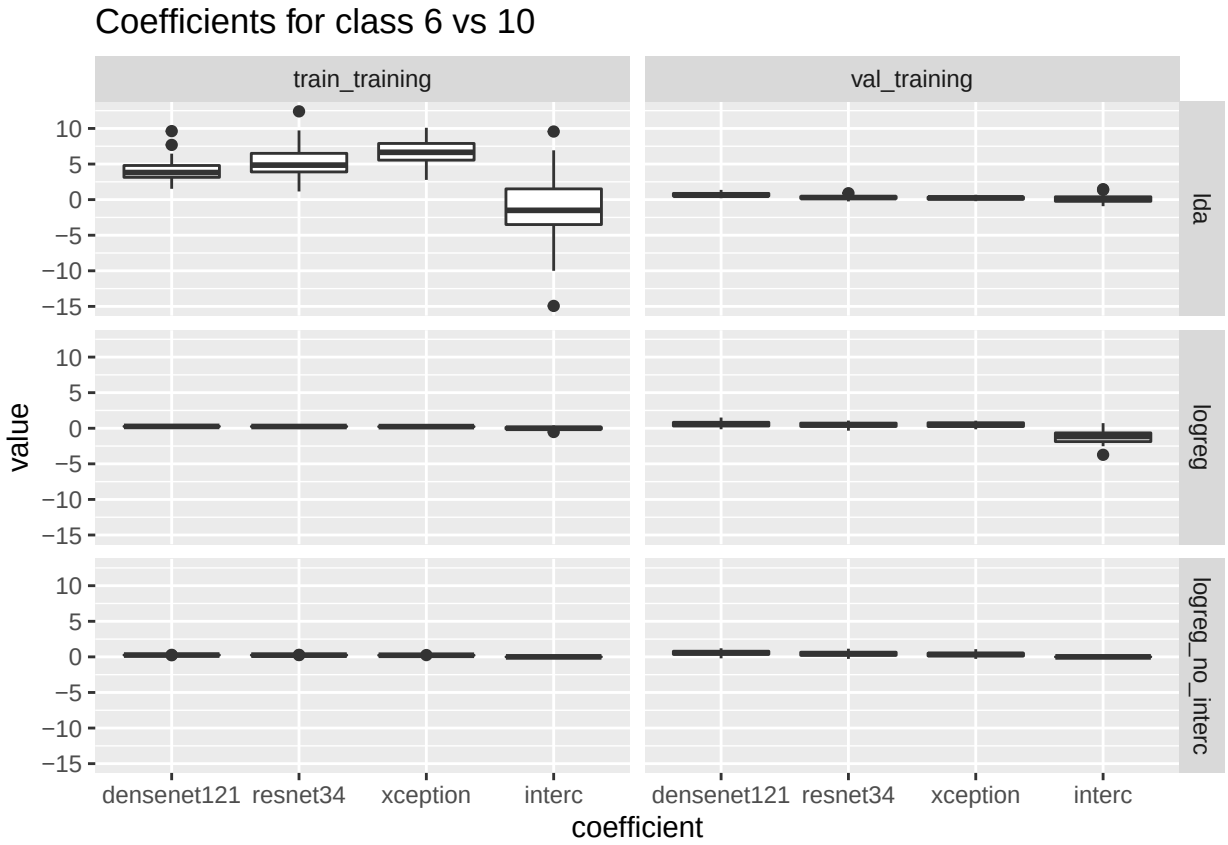
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 6 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
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5
0
−5
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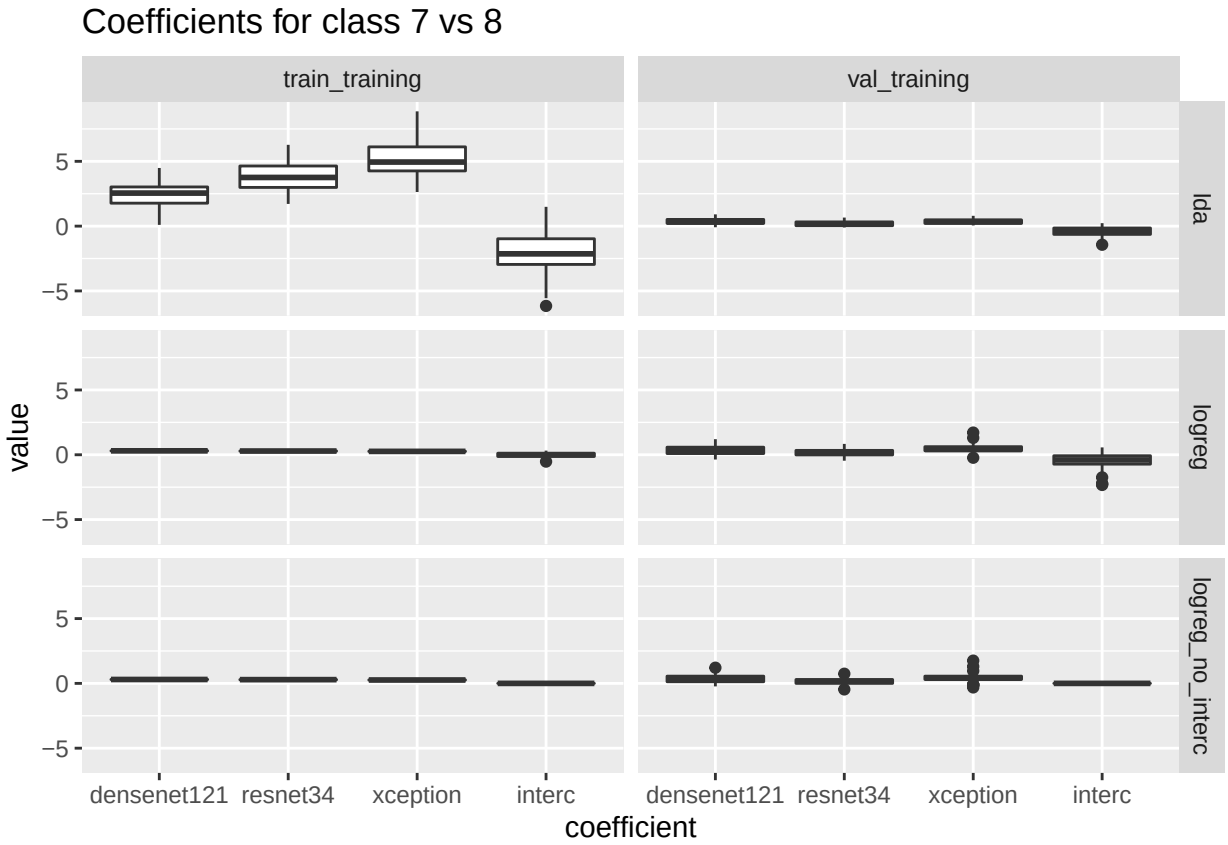
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 7 vs 8
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val_training
lda
logreg
logreg_no_interc
value
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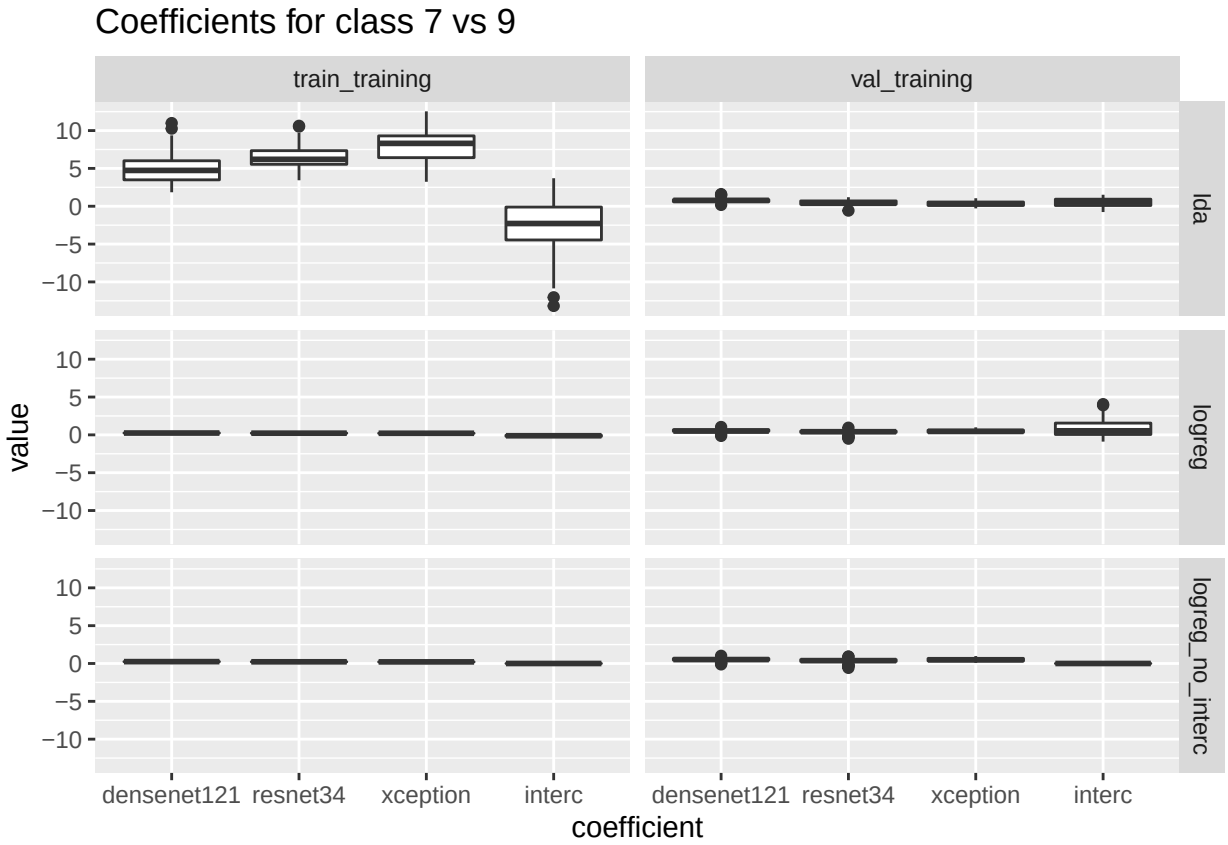
−5
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 7 vs 9
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val_training
lda
logreg
logreg_no_interc
value
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5
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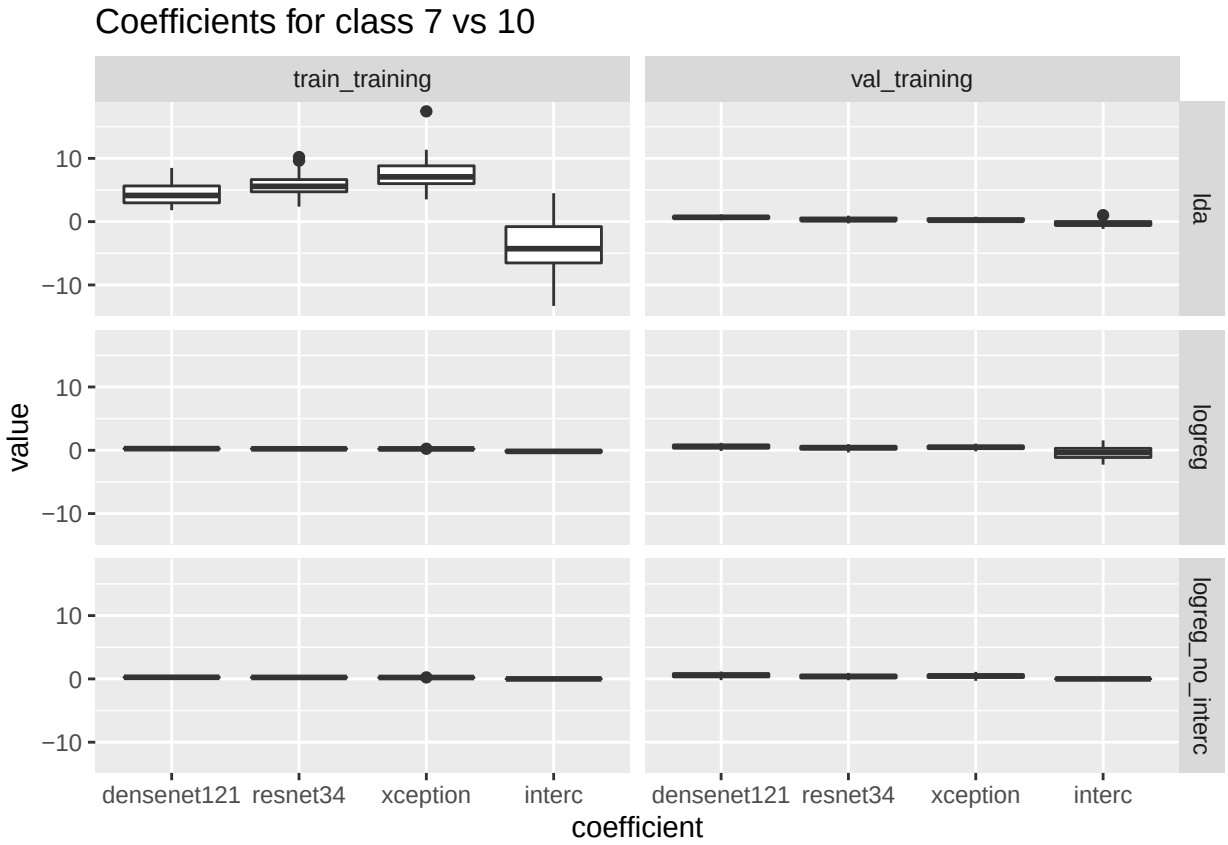
−5
−10
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 7 vs 10
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val_training
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logreg
logreg_no_interc
value
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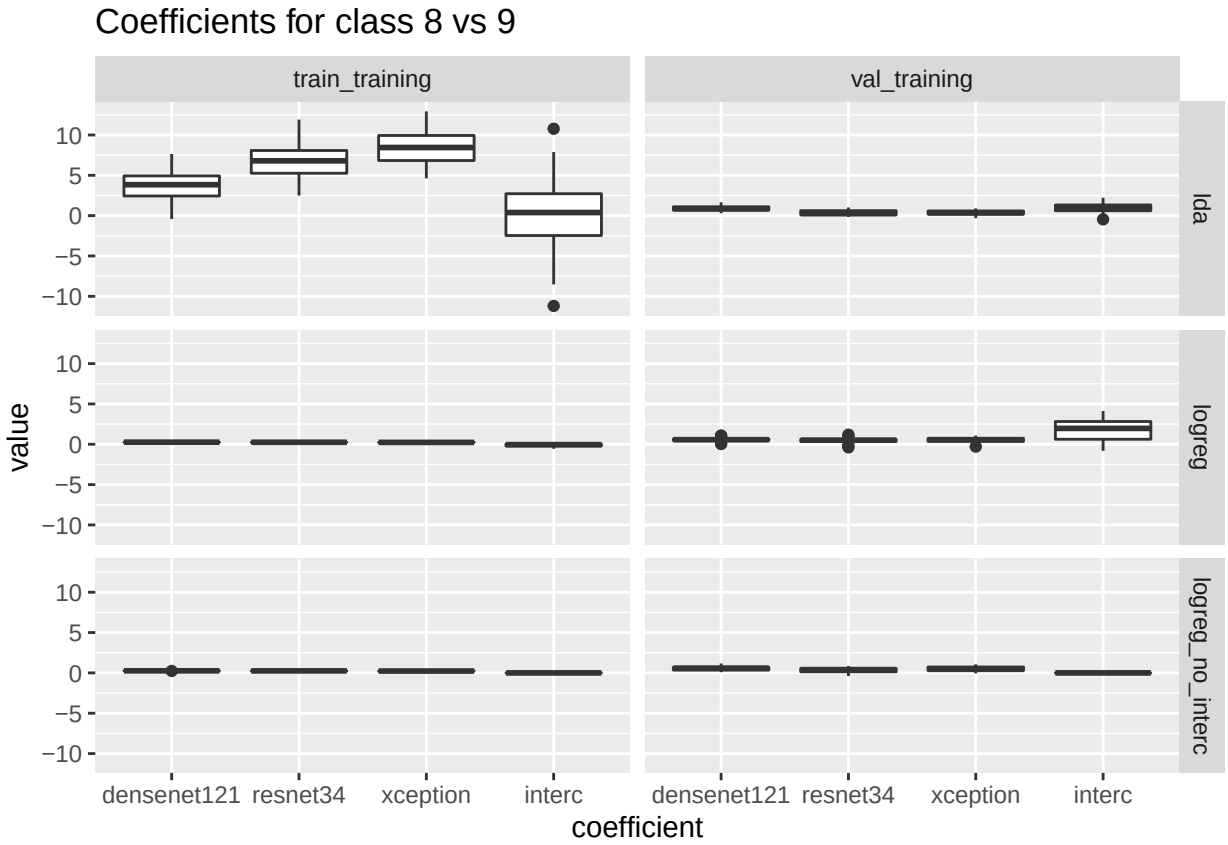
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 8 vs 9
train_training
val_training
lda
logreg
logreg_no_interc
value
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5
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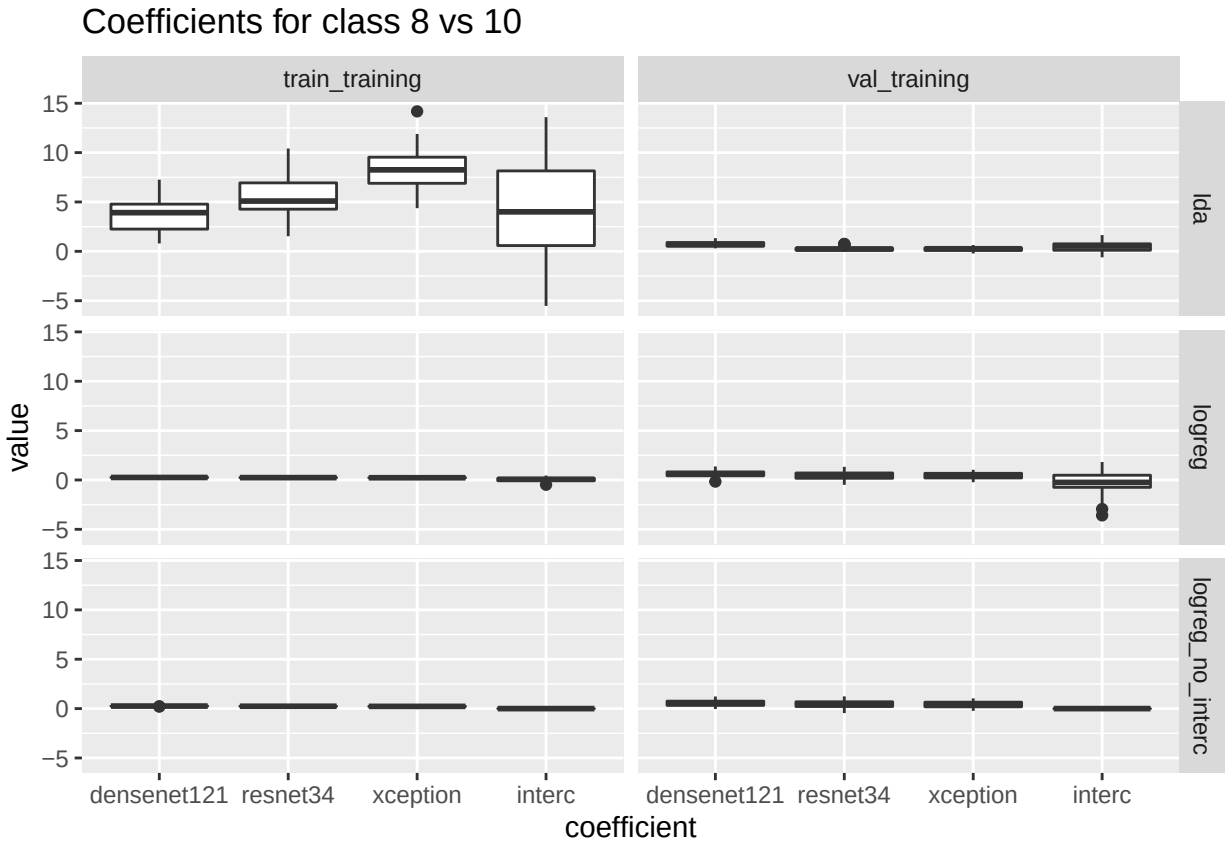
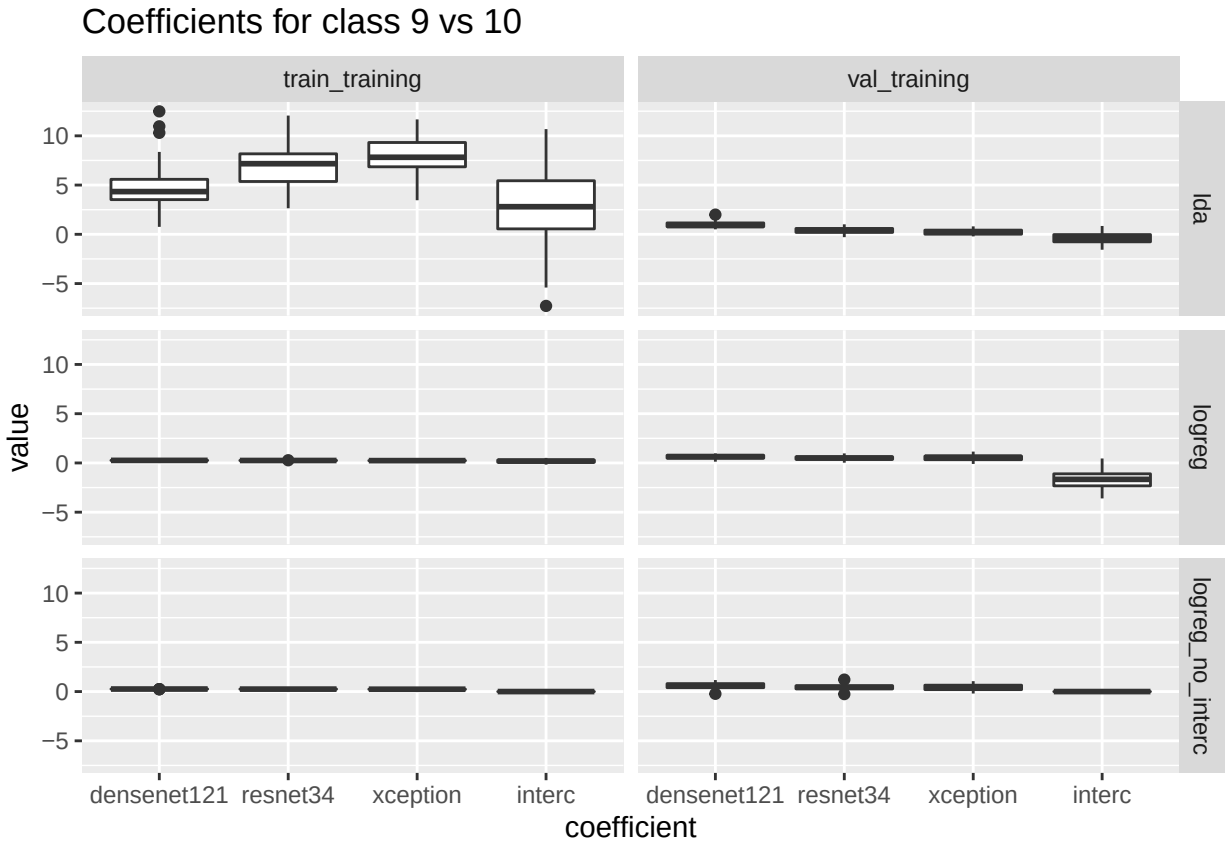
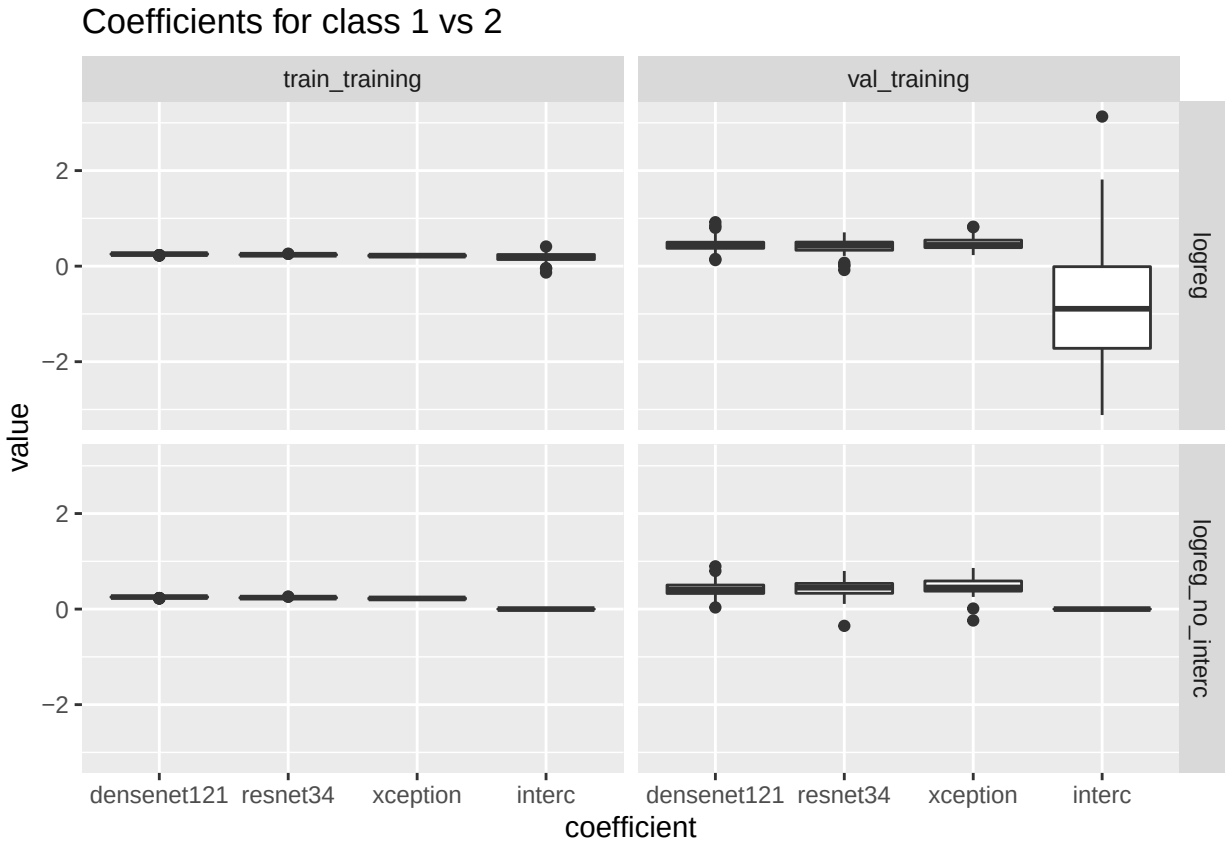
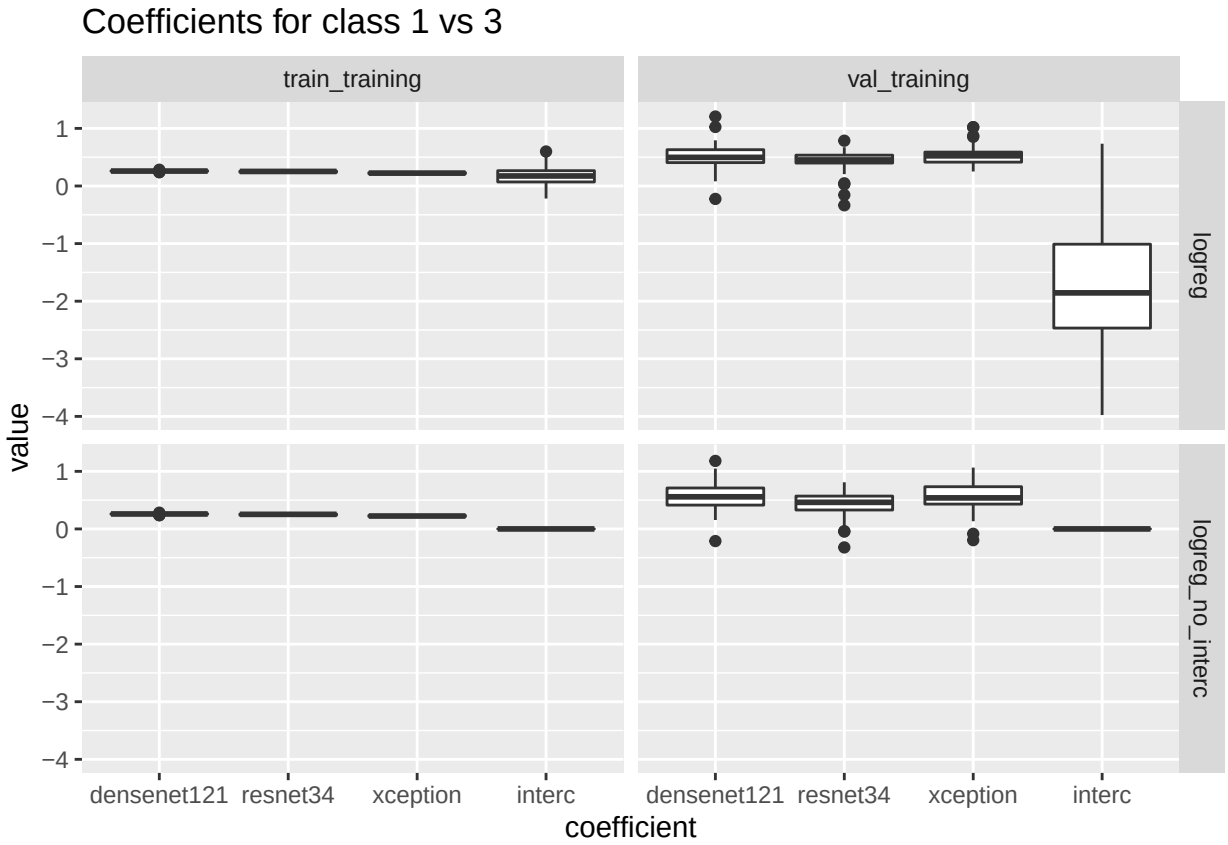
−5
−10
densenet121
resnet34
xception
interc
coefficient

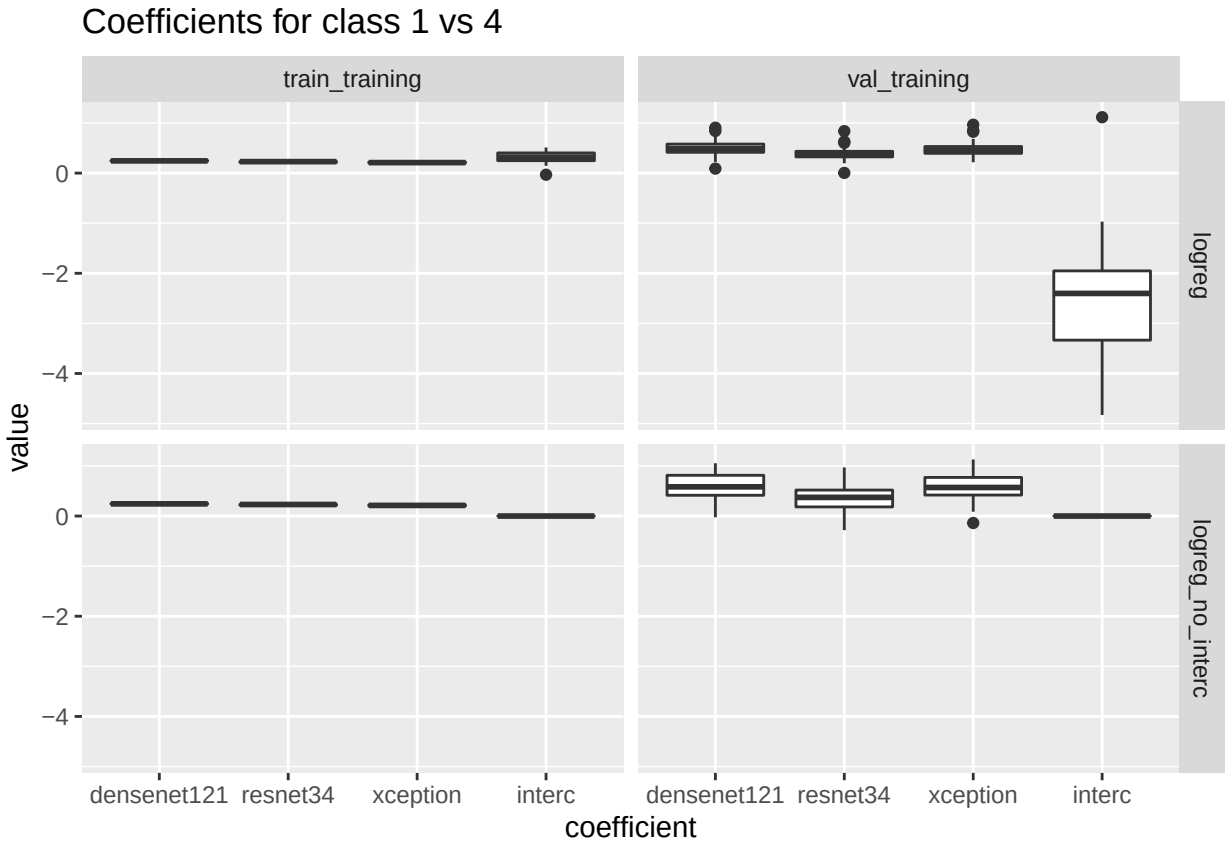

Coefficients for class 8 vs 10
train_training
val_training
lda
logreg
logreg_no_interc
value
15
10
5
0
−5
densenet121
resnet34
xception
interc
coefficient




```
for (cl1 in 1:(10 - 1))
{
  for (cl2 in (cl1 + 1):10)
  {
    cur_plt <- combiner_coefs %>% filter(class1 == cl1 & class2 == cl2 & combining_method!="lda") %>% gg
      facet_grid(cols=vars(train_type), rows=vars(combining_method)) + ggtitle(paste("Coefficients for
    print(cur_plt)
  }
}
```


Coefficients for class 1 vs 2
train_training
val_training
logreg
logreg_no_interc
value
2
0
−2
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 1 vs 3
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
−3
−4
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 1 vs 4
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val_training
logreg
logreg_no_interc
value
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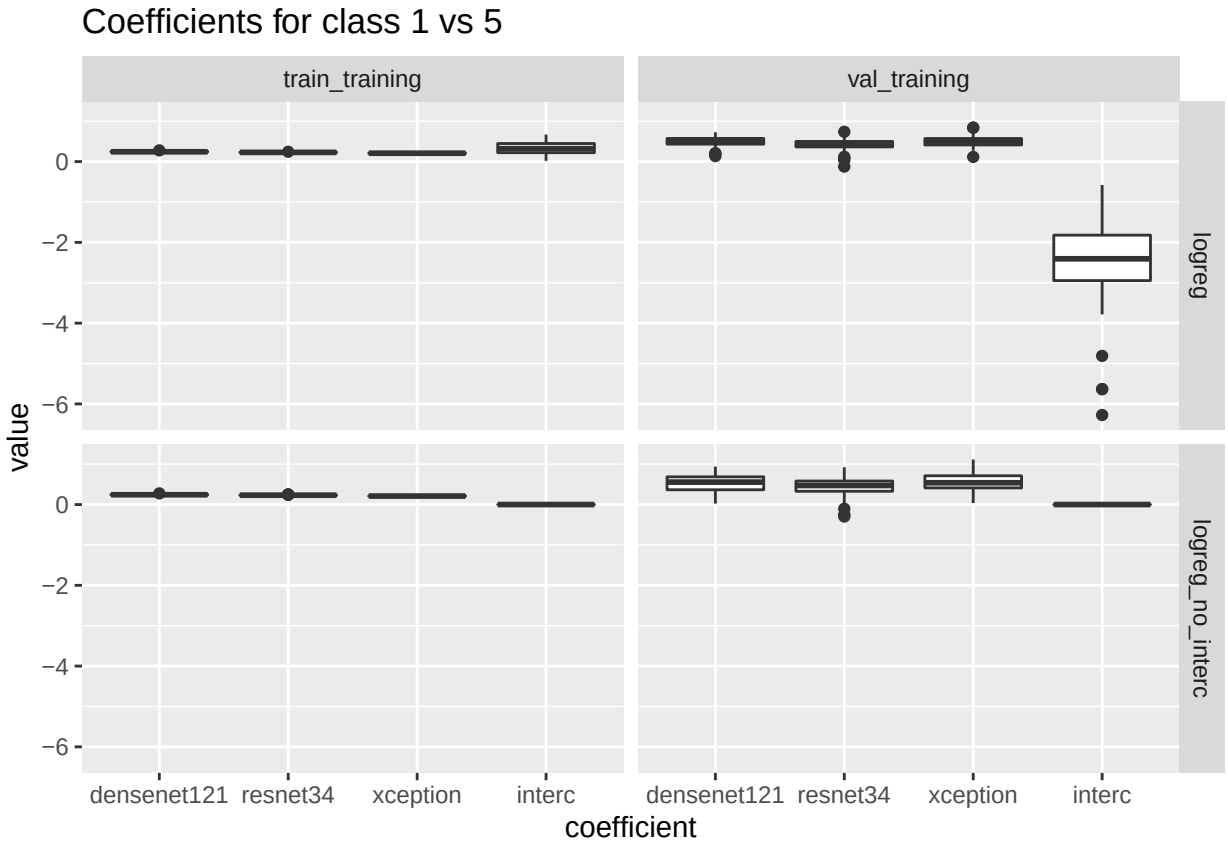
−2
−4
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 1 vs 5
train_training
val_training
logreg
logreg_no_interc
value
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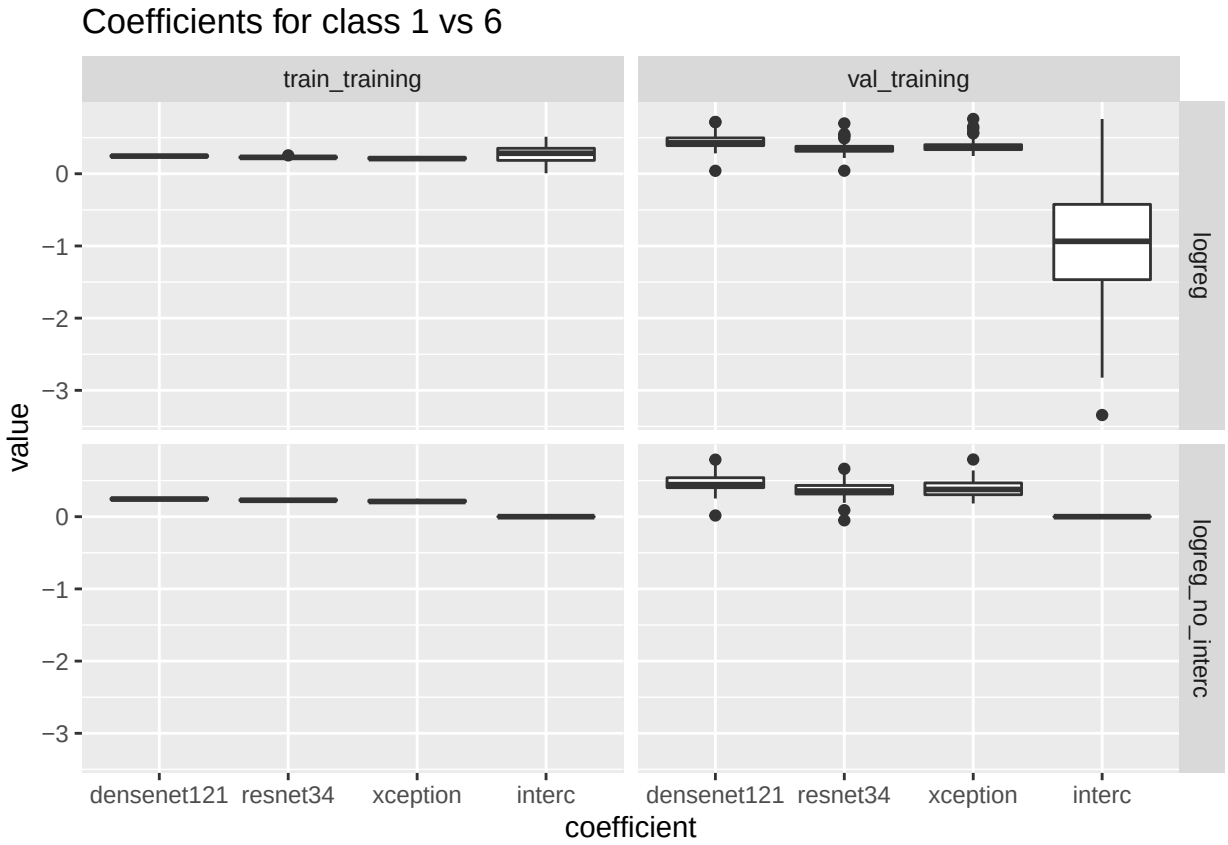
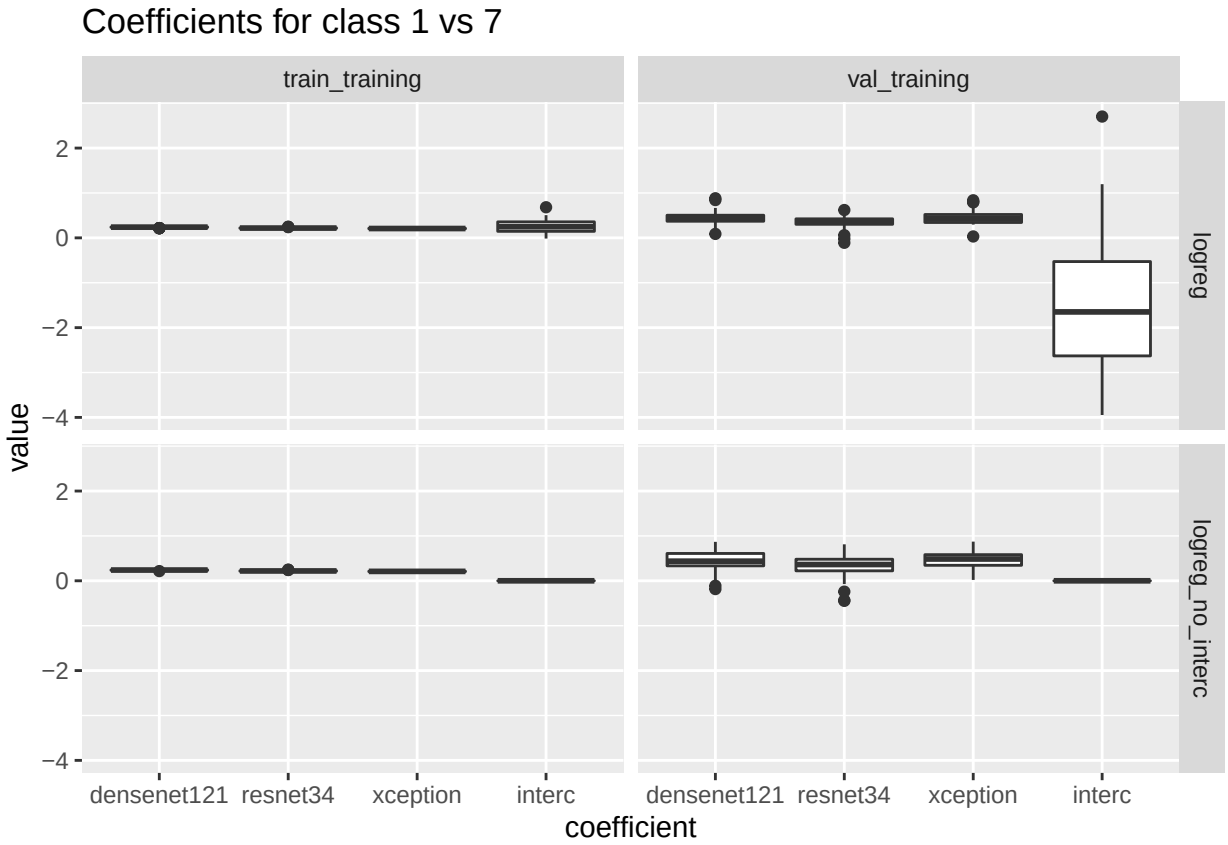
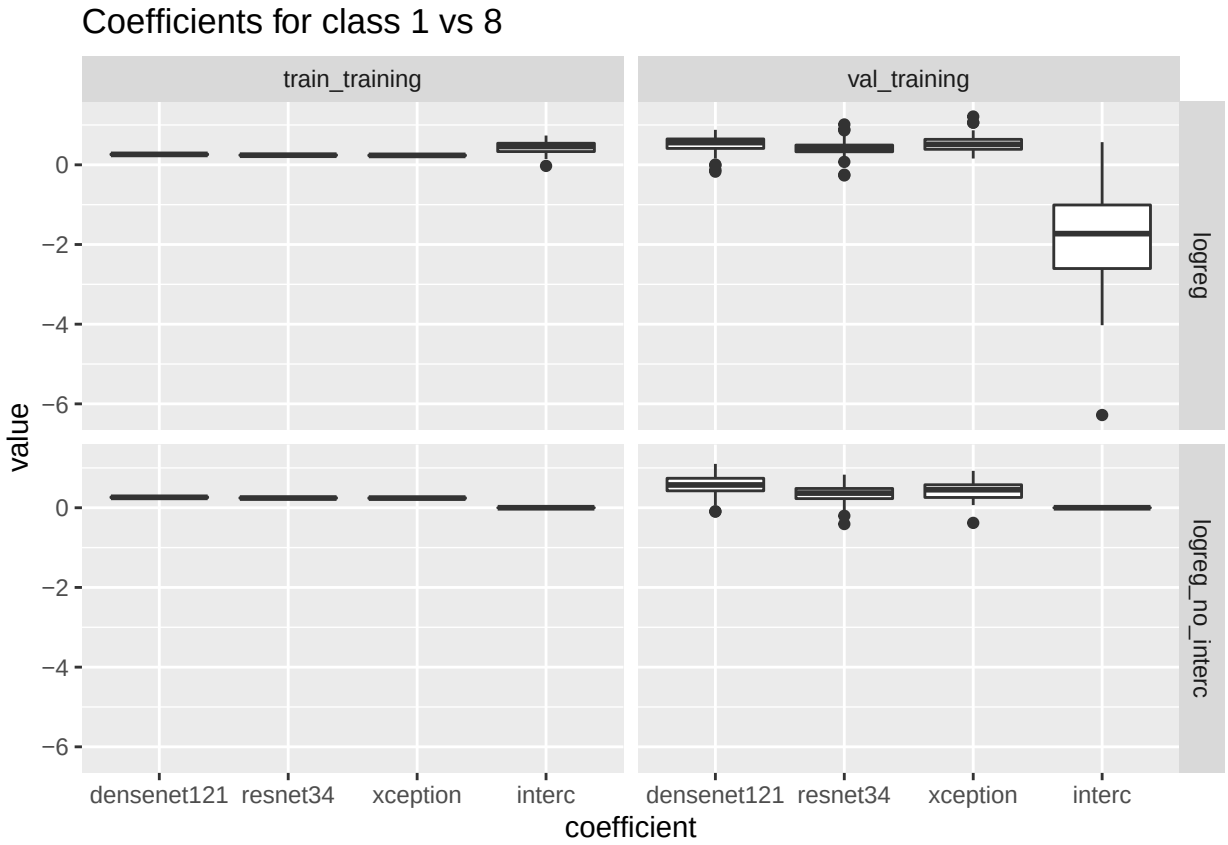
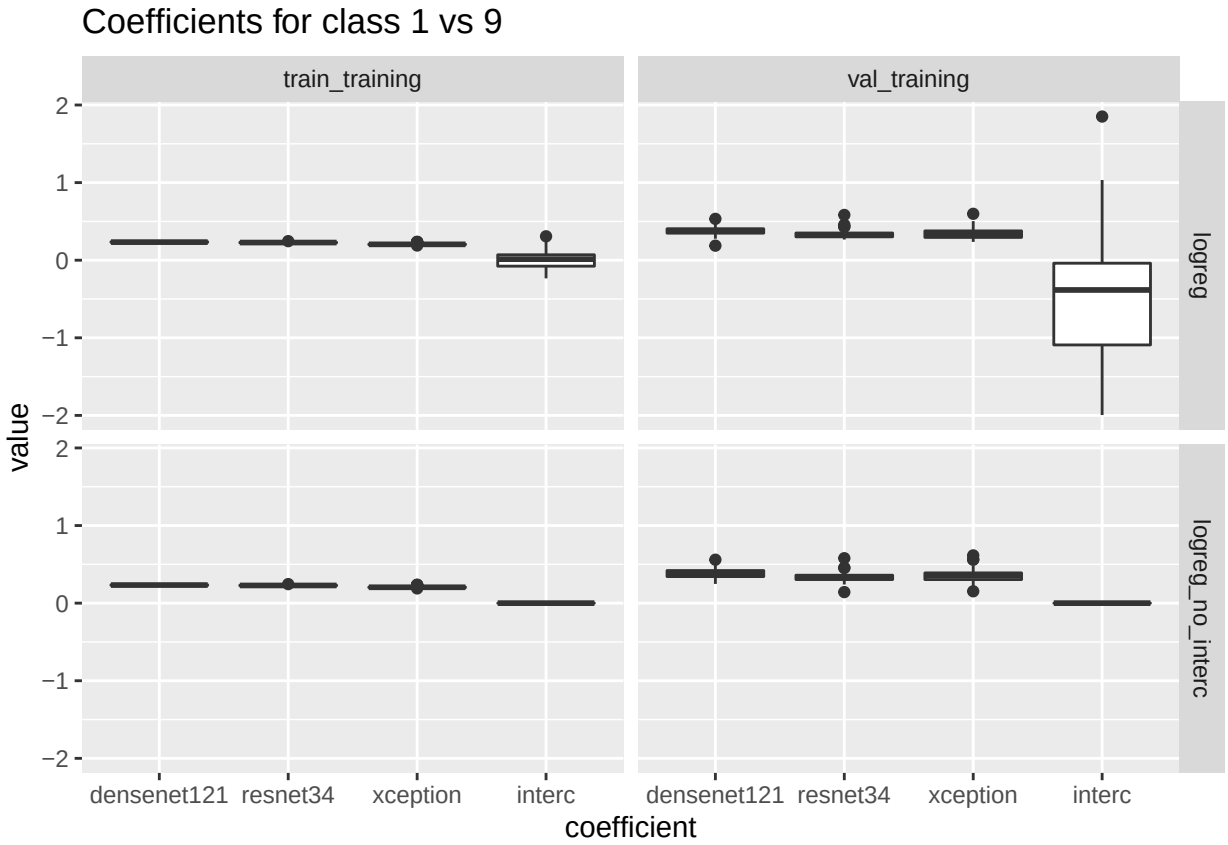
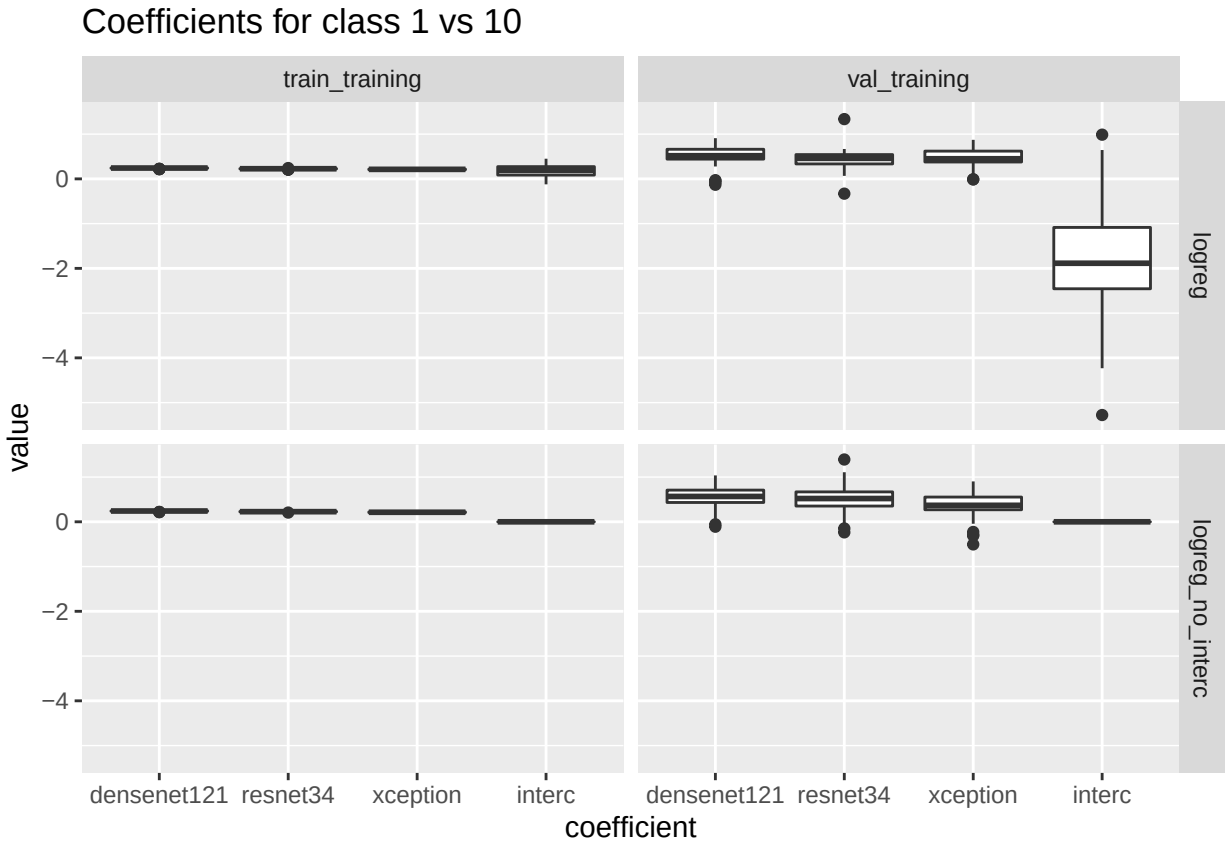
−4
−6
densenet121
resnet34
xception
interc
coefficient

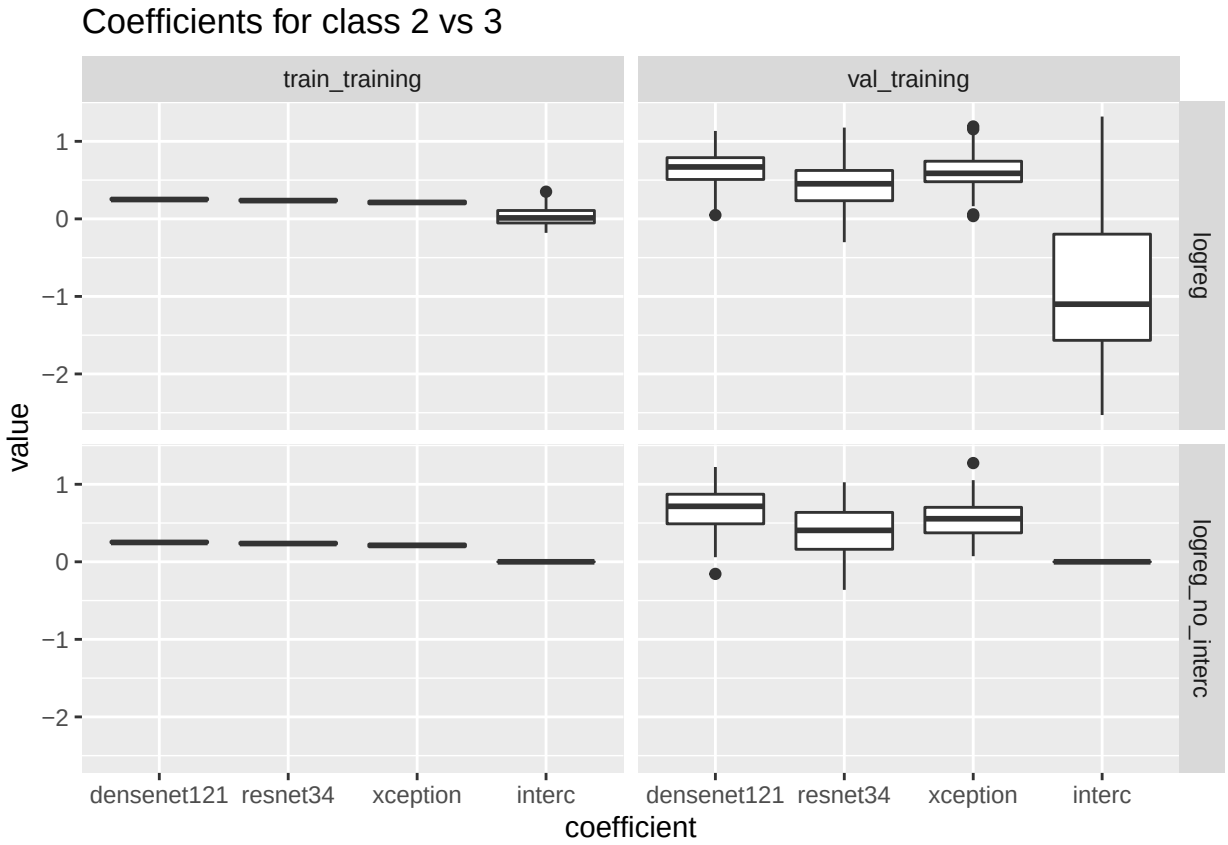

Coefficients for class 1 vs 6
train_training
val_training
logreg
logreg_no_interc
value
0
−1
−2
−3
densenet121
resnet34
xception
interc
coefficient

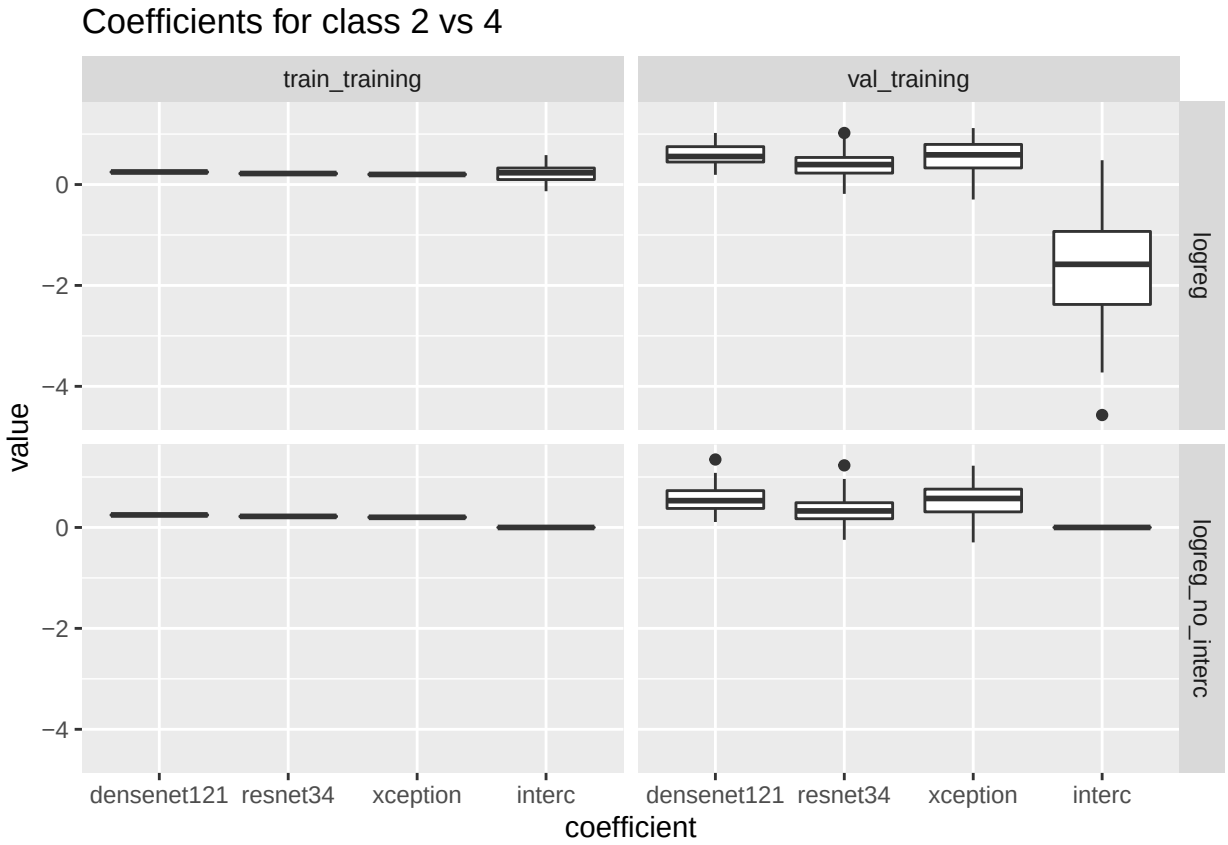

Coefficients for class 1 vs 7
train_training
val_training
logreg
logreg_no_interc
value
2
0
−2
−4
densenet121
resnet34
xception
interc
coefficient

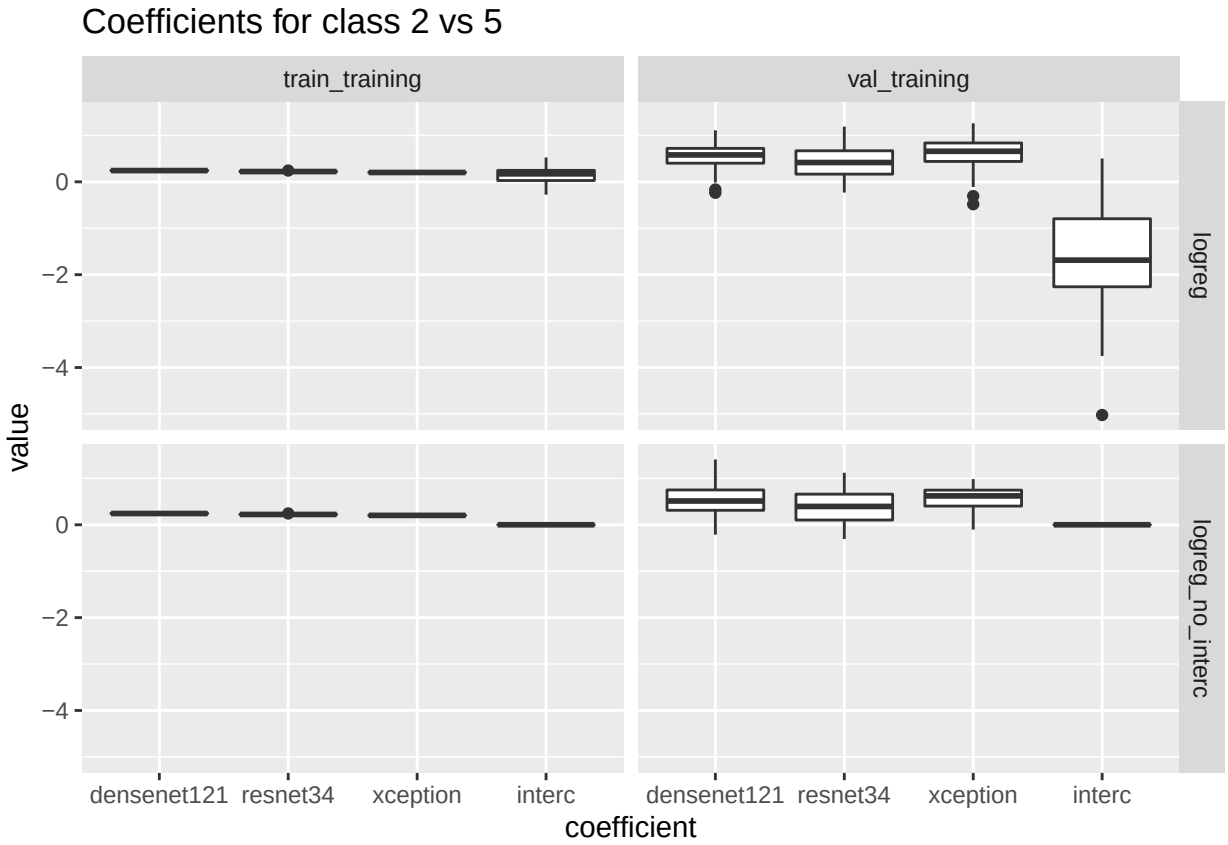

Coefficients for class 1 vs 8
train_training
val_training
logreg
logreg_no_interc
value
0
−2
−4
−6
densenet121
resnet34
xception
interc
coefficient

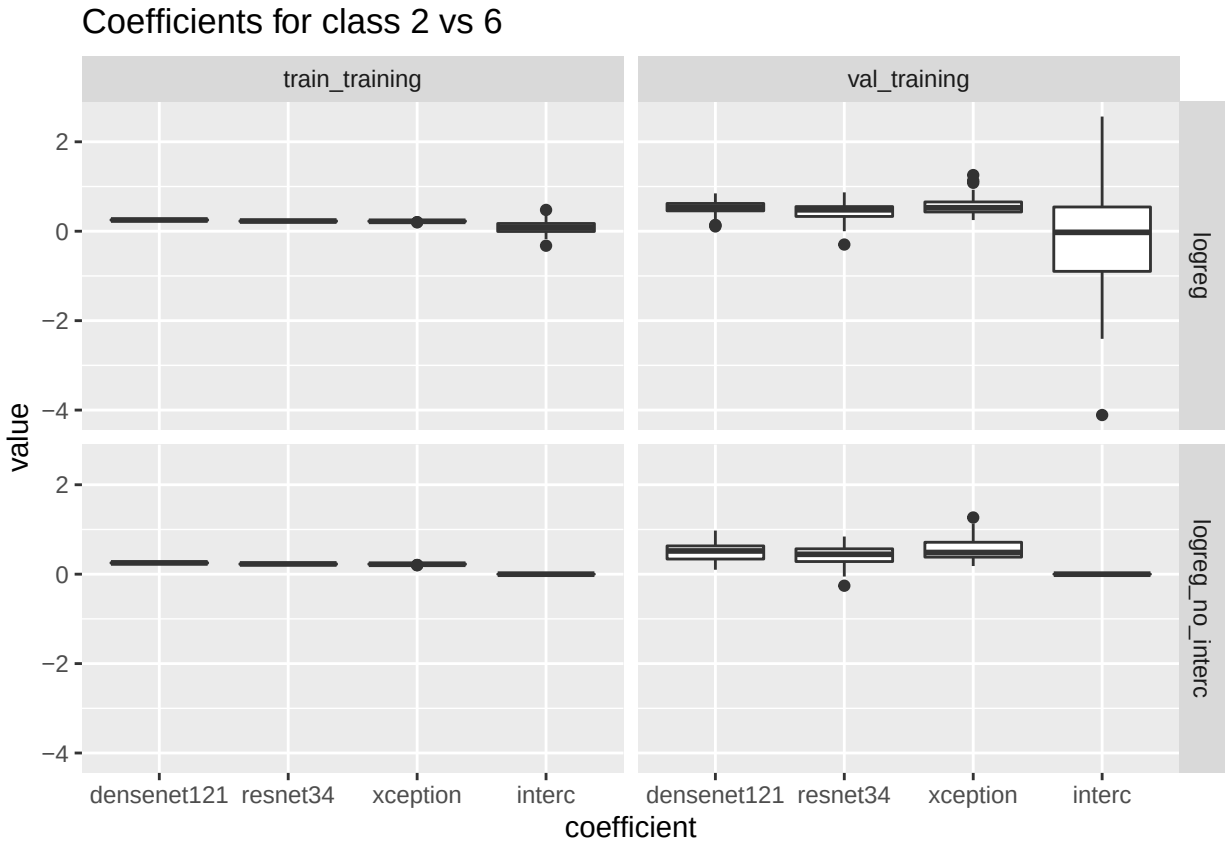

Coefficients for class 1 vs 9
train_training
val_training
logreg
logreg_no_interc
value
2
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

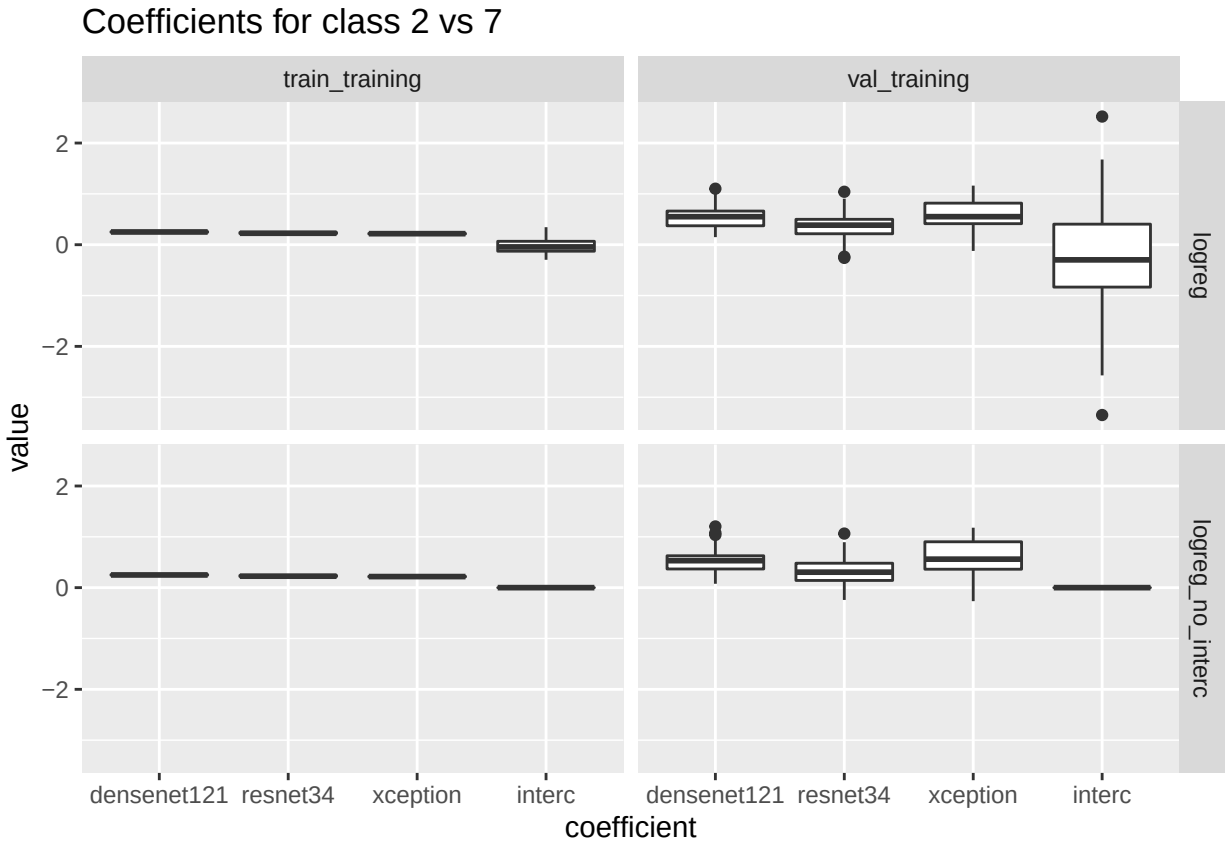

Coefficients for class 1 vs 10
train_training
val_training
logreg
logreg_no_interc
value
0
−2
−4
densenet121
resnet34
xception
interc
coefficient

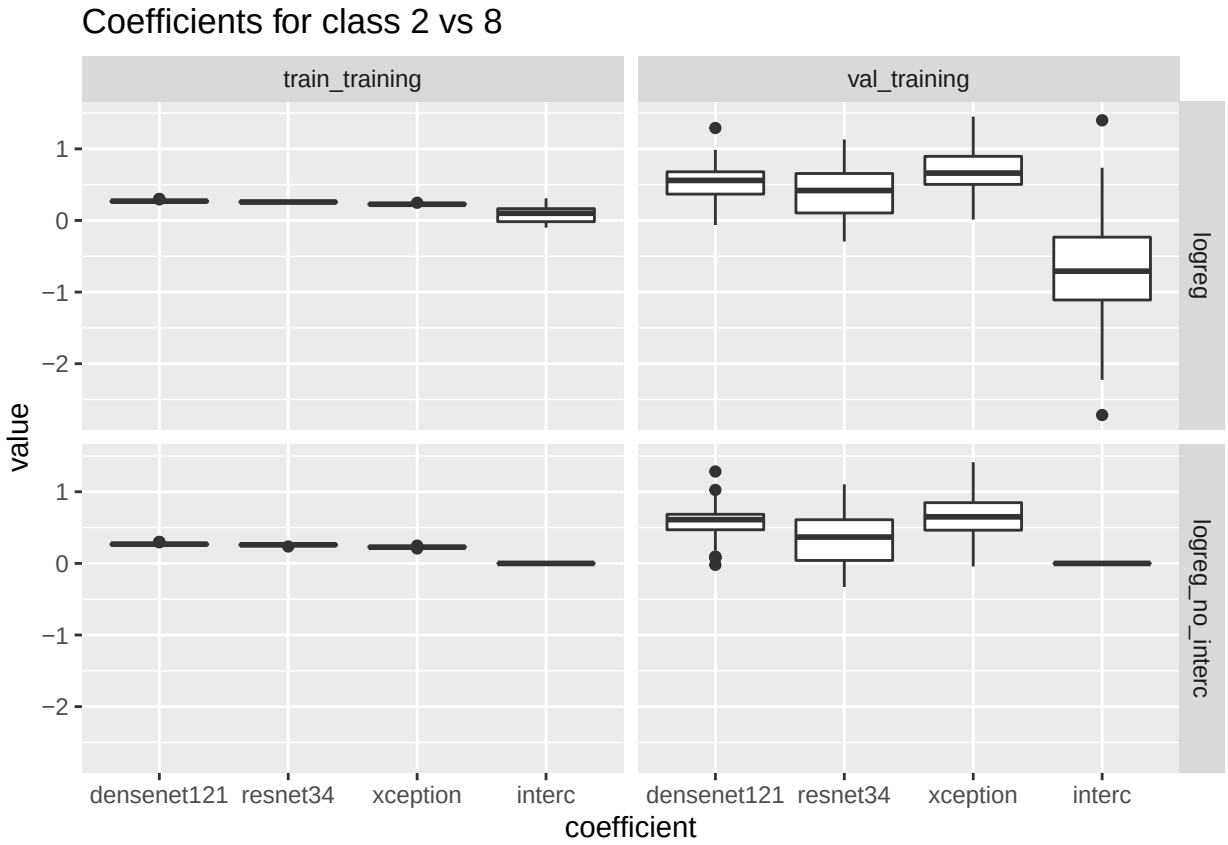

Coefficients for class 2 vs 3
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

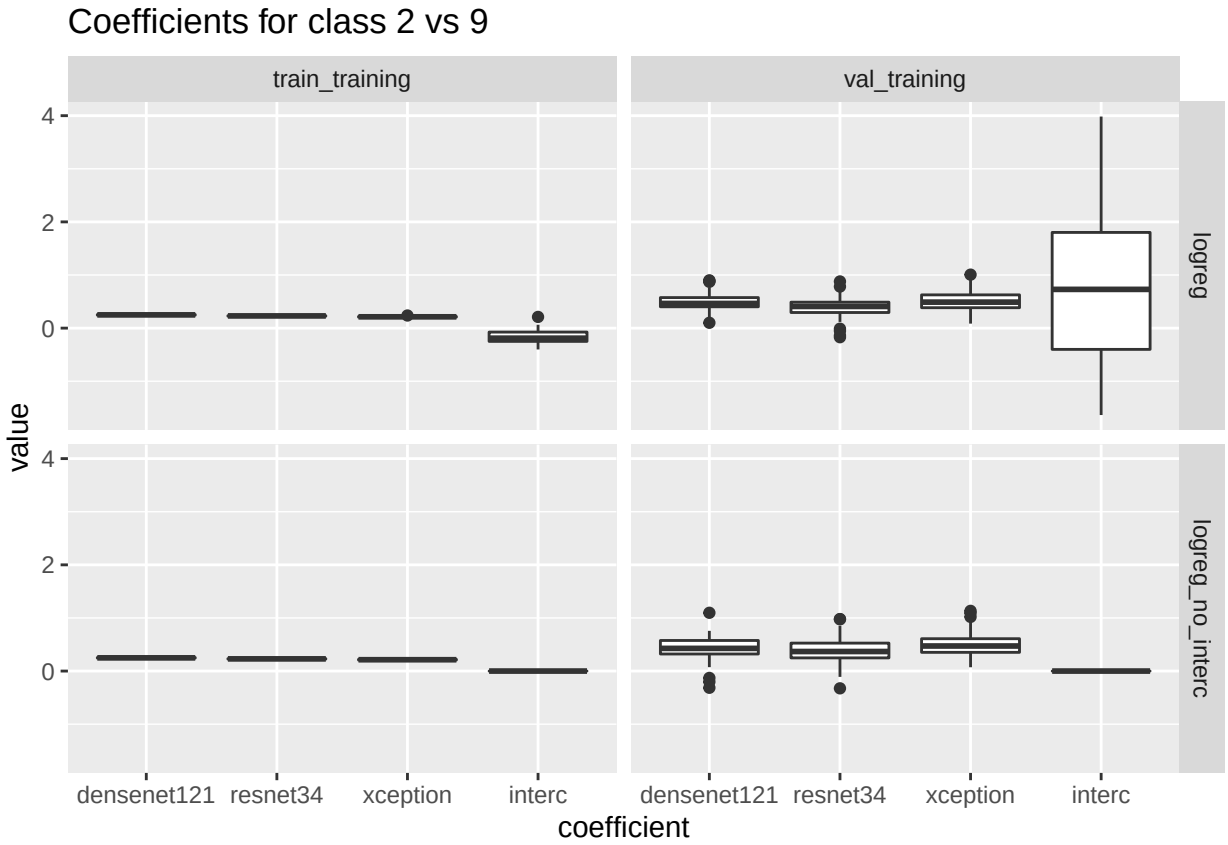

Coefficients for class 2 vs 4
train_training
val_training
logreg
logreg_no_interc
value
0
−2
−4
densenet121
resnet34
xception
interc
coefficient

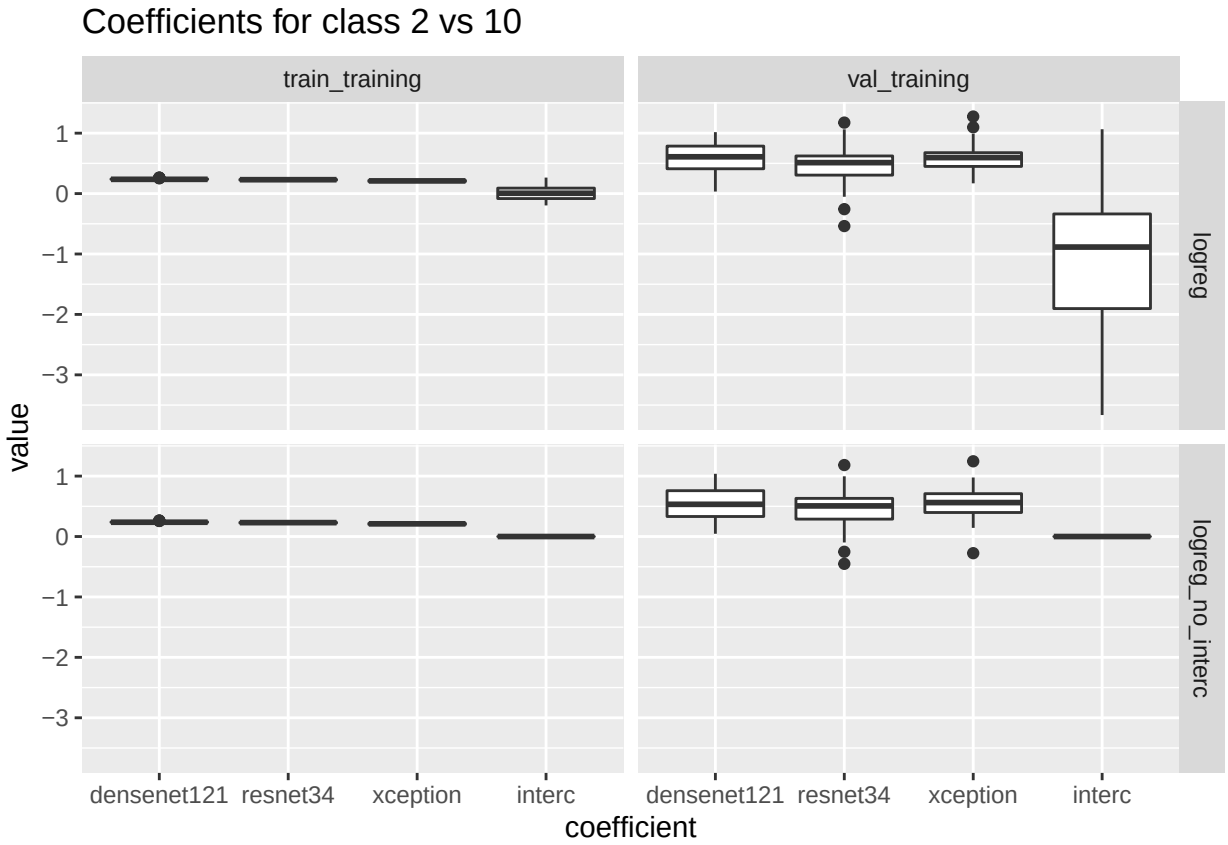

Coefficients for class 2 vs 5
train_training
val_training
logreg
logreg_no_interc
value
0
−2
−4
densenet121
resnet34
xception
interc
coefficient

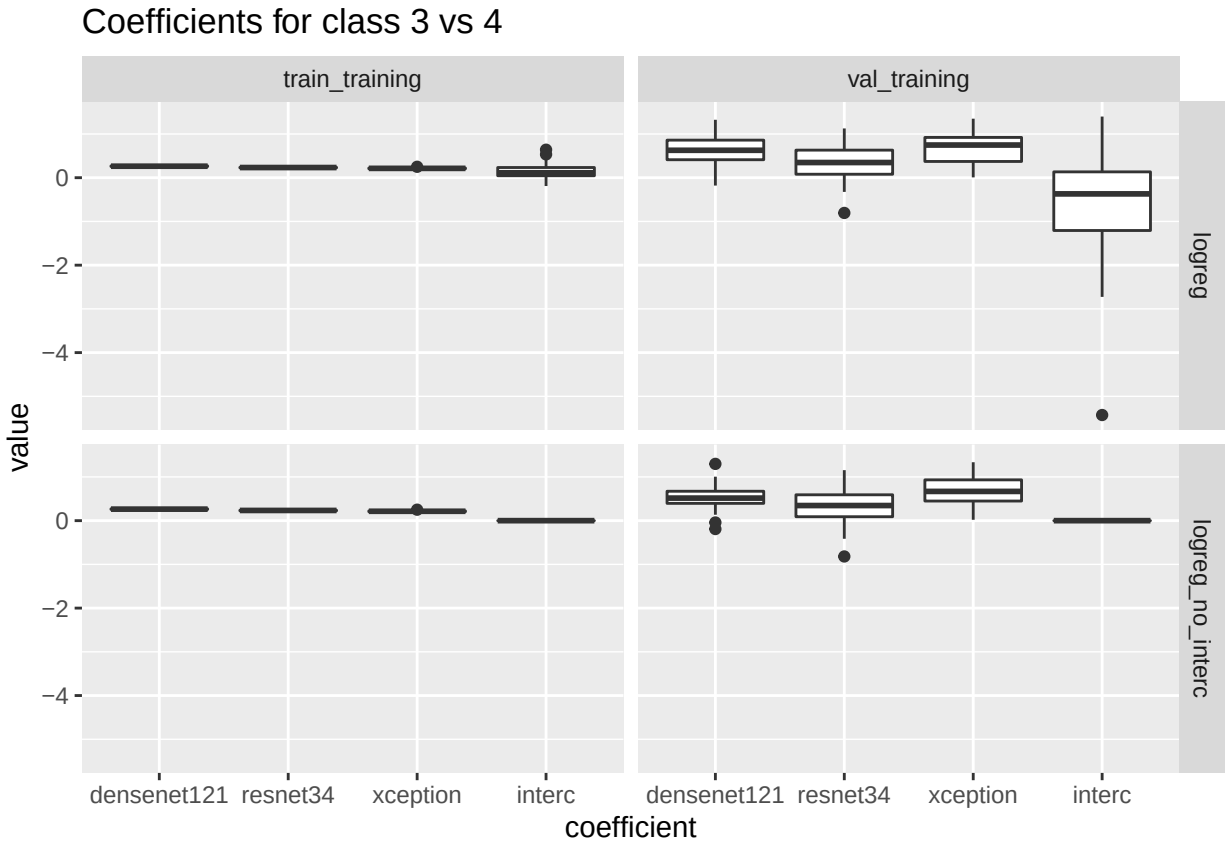

Coefficients for class 2 vs 6
train_training
val_training
logreg
logreg_no_interc
value
2
0
−2
−4
densenet121
resnet34
xception
interc
coefficient

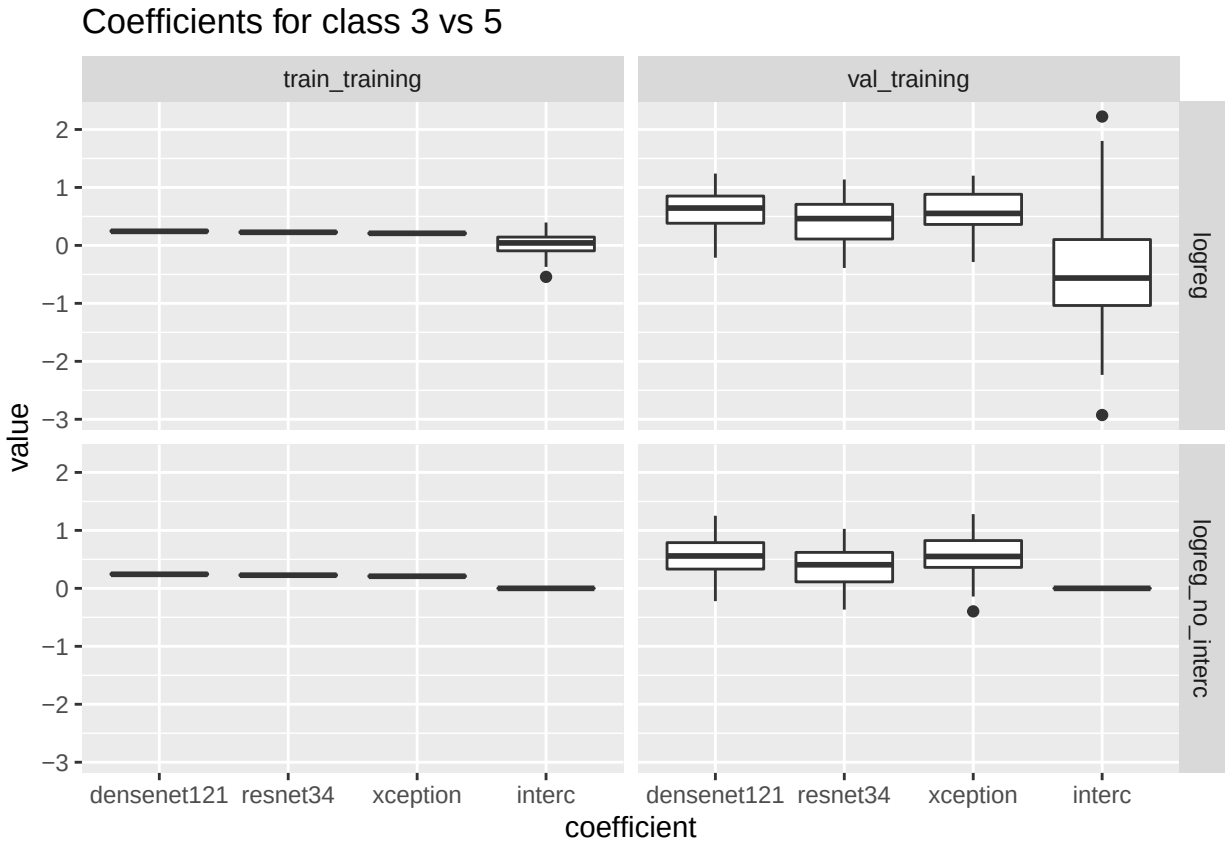

Coefficients for class 2 vs 7
train_training
val_training
logreg
logreg_no_interc
value
2
0
−2
densenet121
resnet34
xception
interc
coefficient

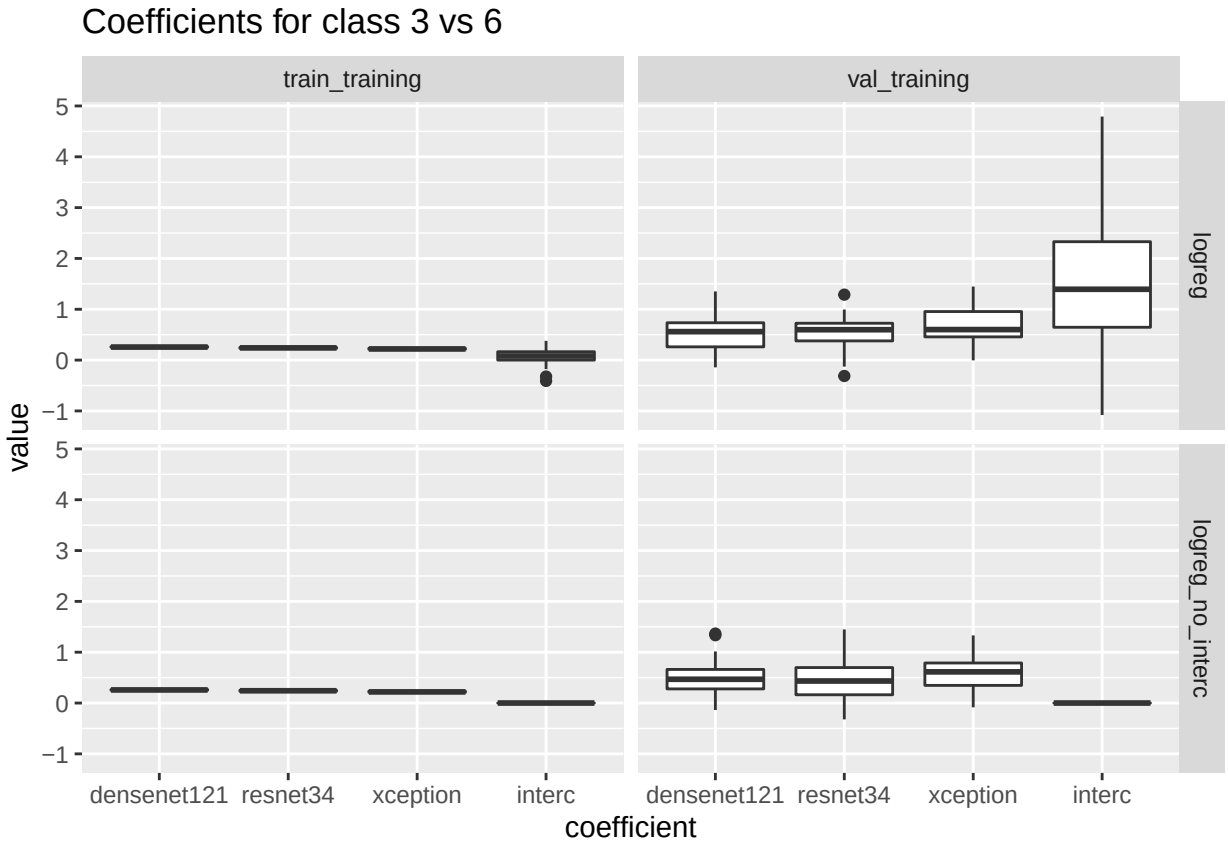

Coefficients for class 2 vs 8
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

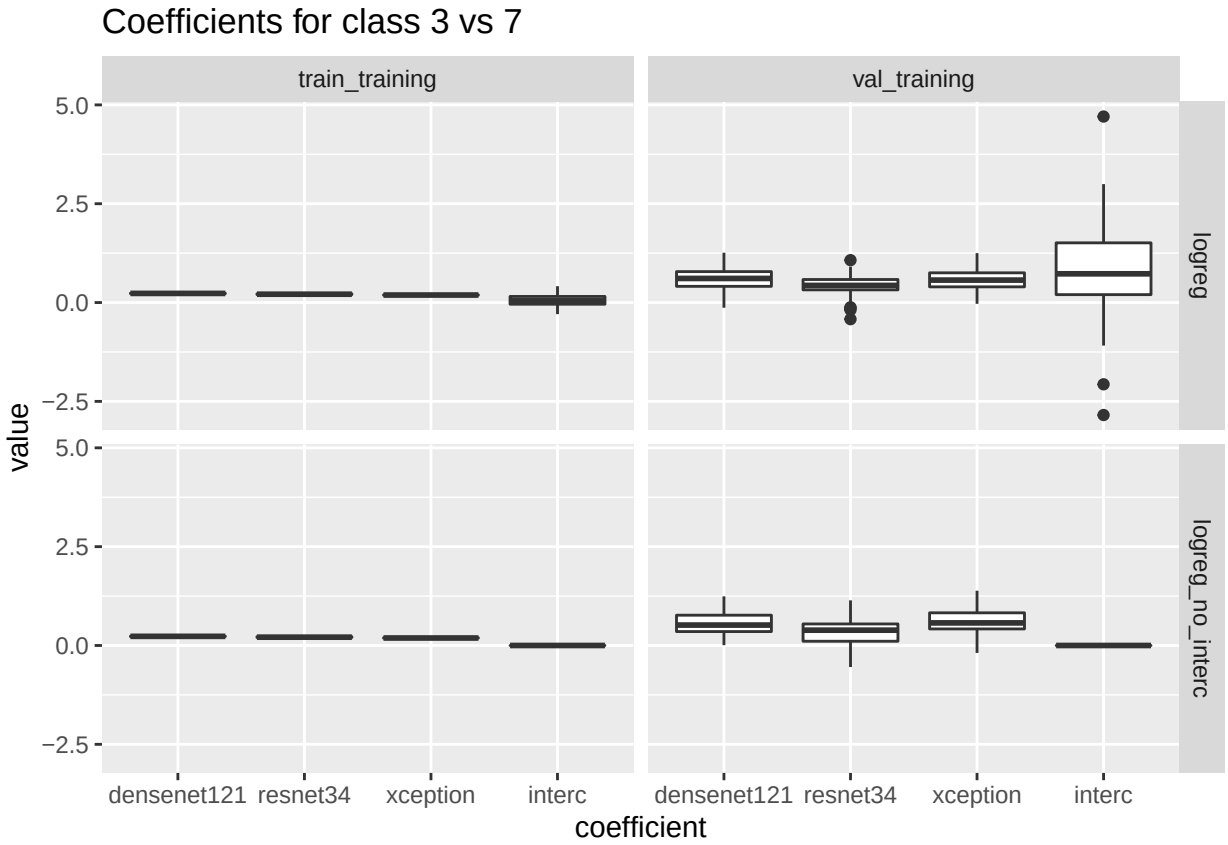

Coefficients for class 2 vs 9
train_training
val_training
logreg
logreg_no_interc
value
4
2
0
densenet121
resnet34
xception
interc
coefficient

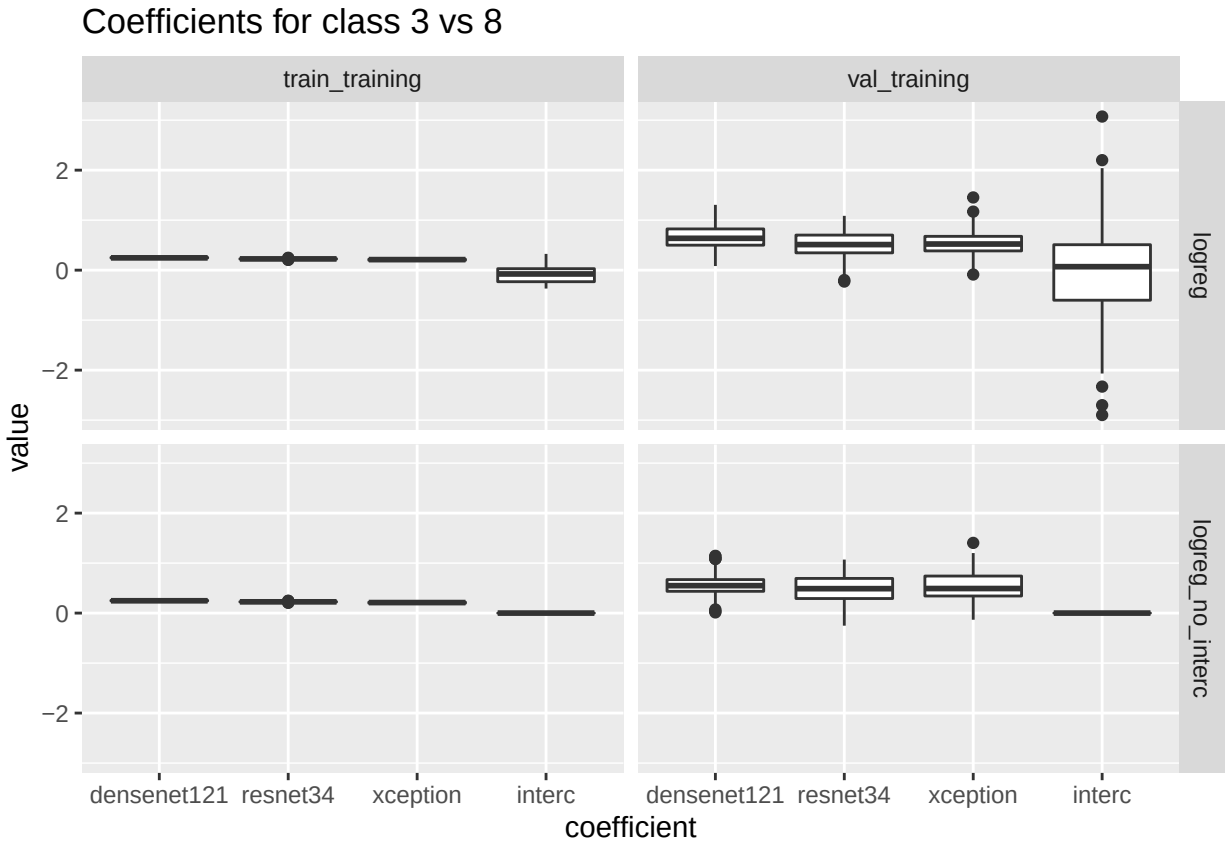

Coefficients for class 2 vs 10
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
−3
densenet121
resnet34
xception
interc
coefficient

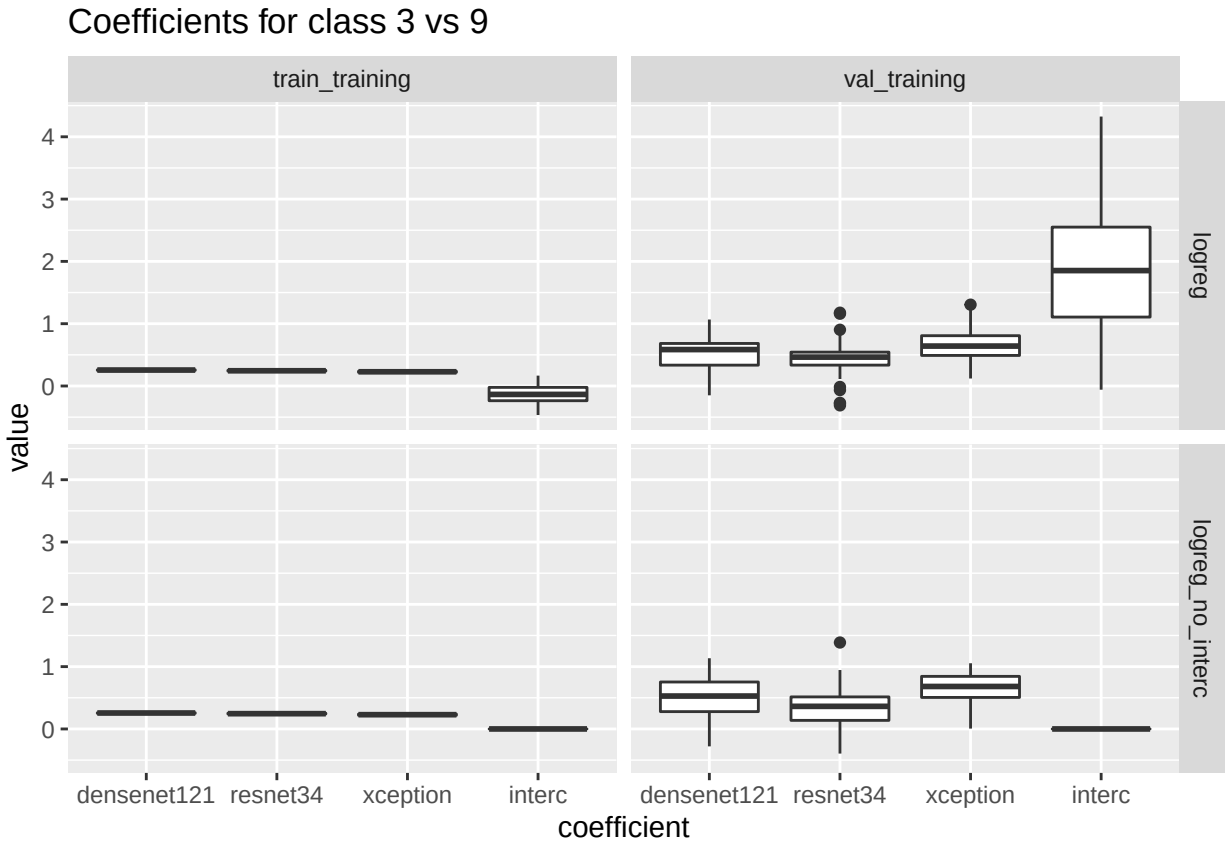

Coefficients for class 3 vs 4
train_training
val_training
logreg
logreg_no_interc
value
0
−2
−4
densenet121
resnet34
xception
interc
coefficient

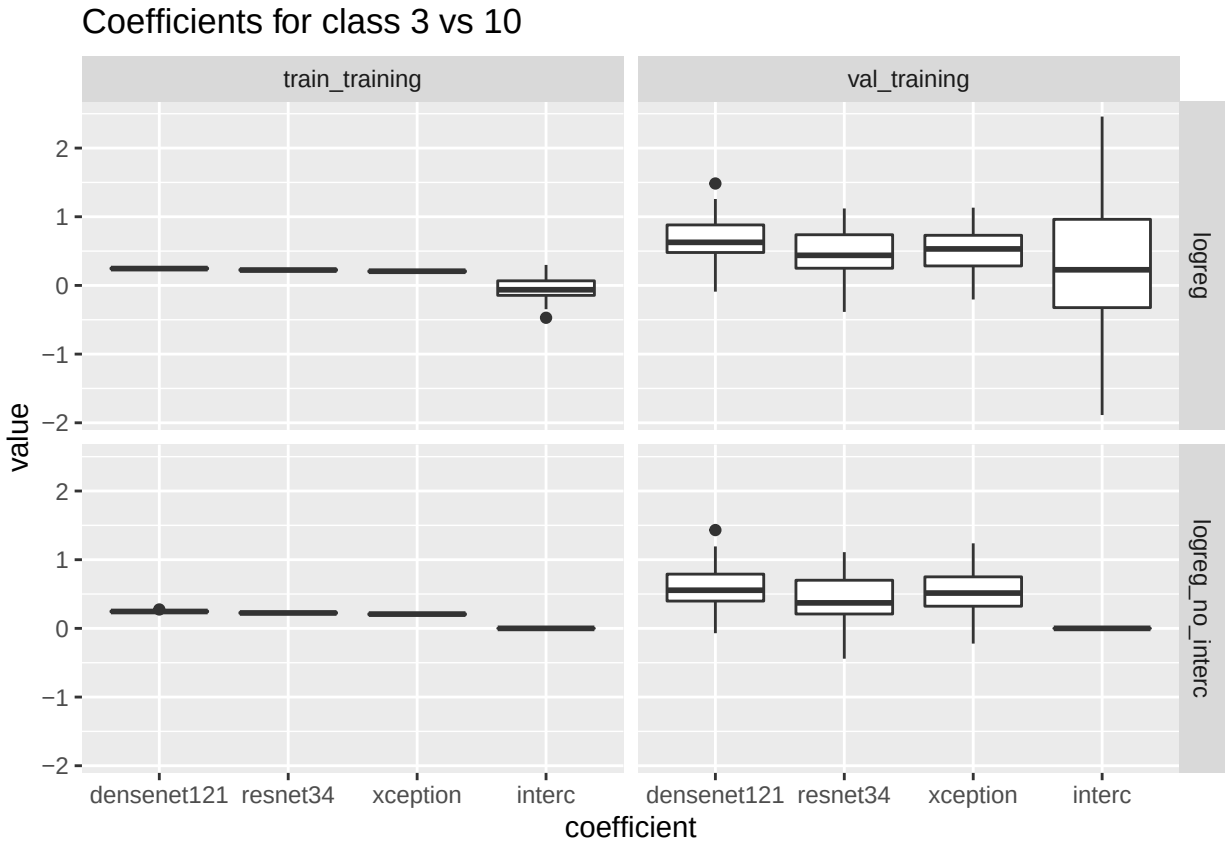

Coefficients for class 3 vs 5
train_training
val_training
logreg
logreg_no_interc
value
2
1
0
−1
−2
−3
densenet121
resnet34
xception
interc
coefficient

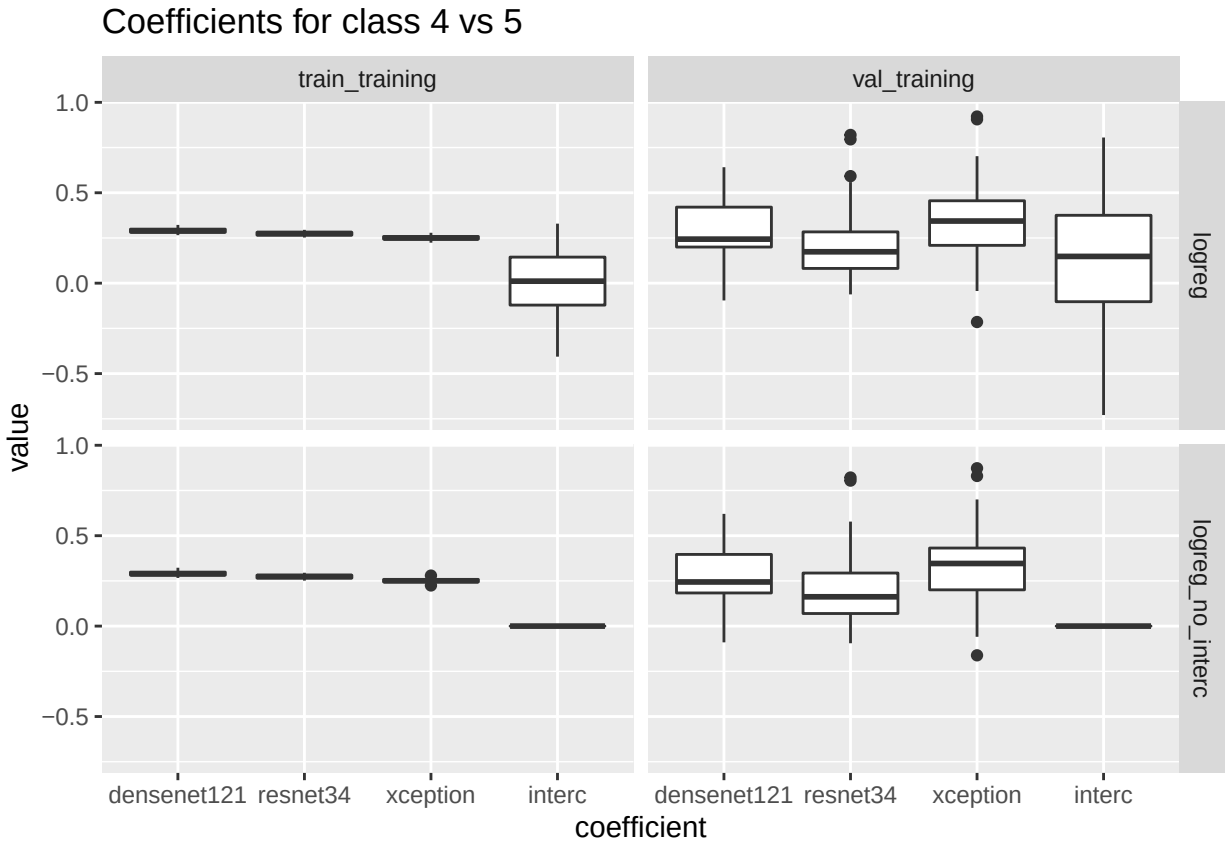

Coefficients for class 3 vs 6
train_training
val_training
logreg
logreg_no_interc
value
5
4
3
2
1
0
−1
densenet121
resnet34
xception
interc
coefficient

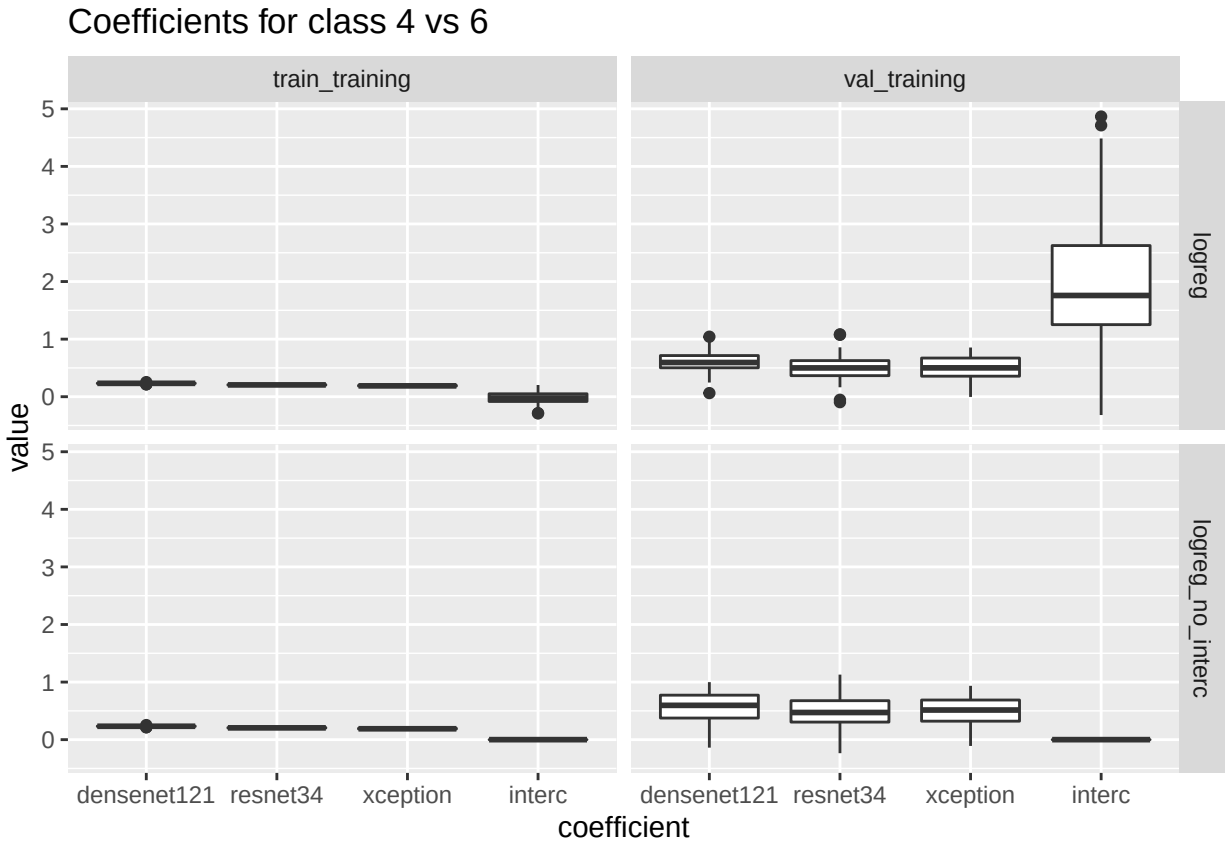

Coefficients for class 3 vs 7
train_training
val_training
logreg
logreg_no_interc
value
5.0
2.5
0.0
−2.5
densenet121
resnet34
xception
interc
coefficient

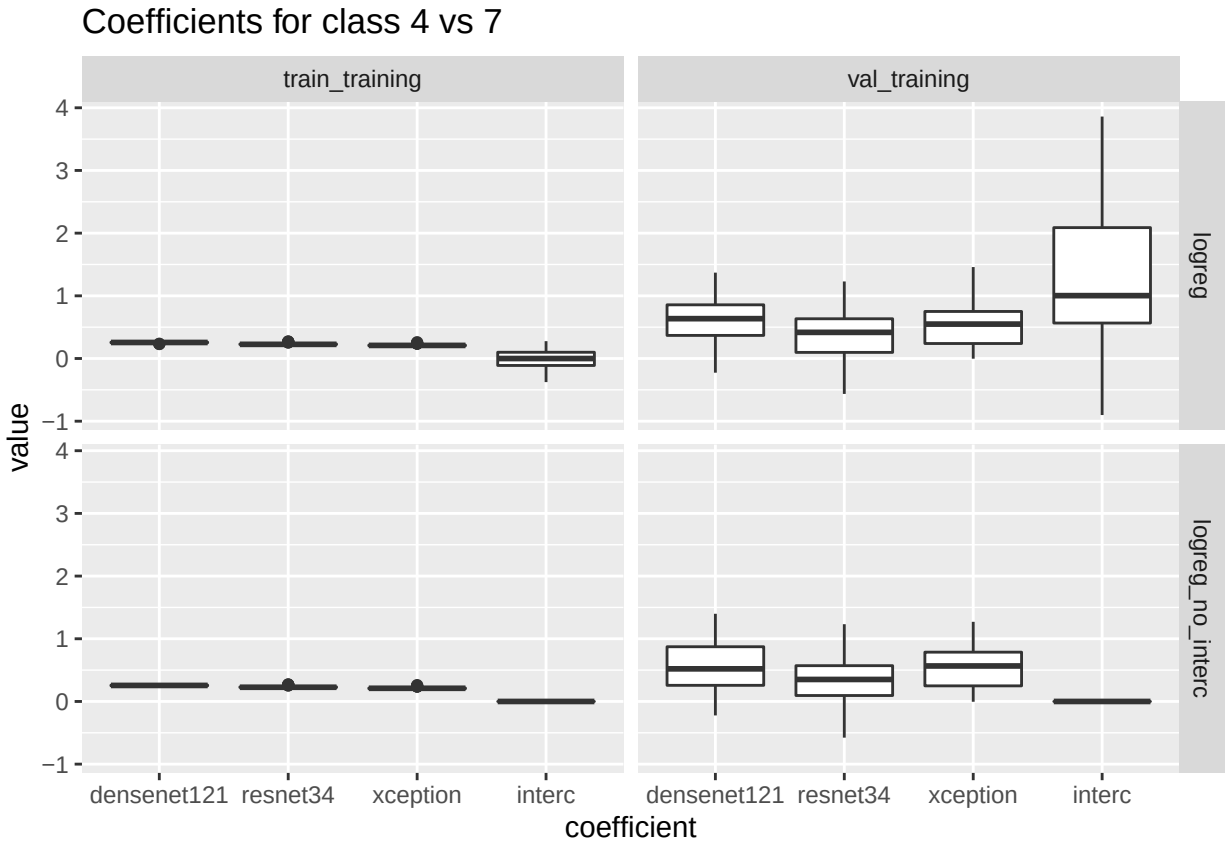

Coefficients for class 3 vs 8
train_training
val_training
logreg
logreg_no_interc
value
2
0
−2
densenet121
resnet34
xception
interc
coefficient

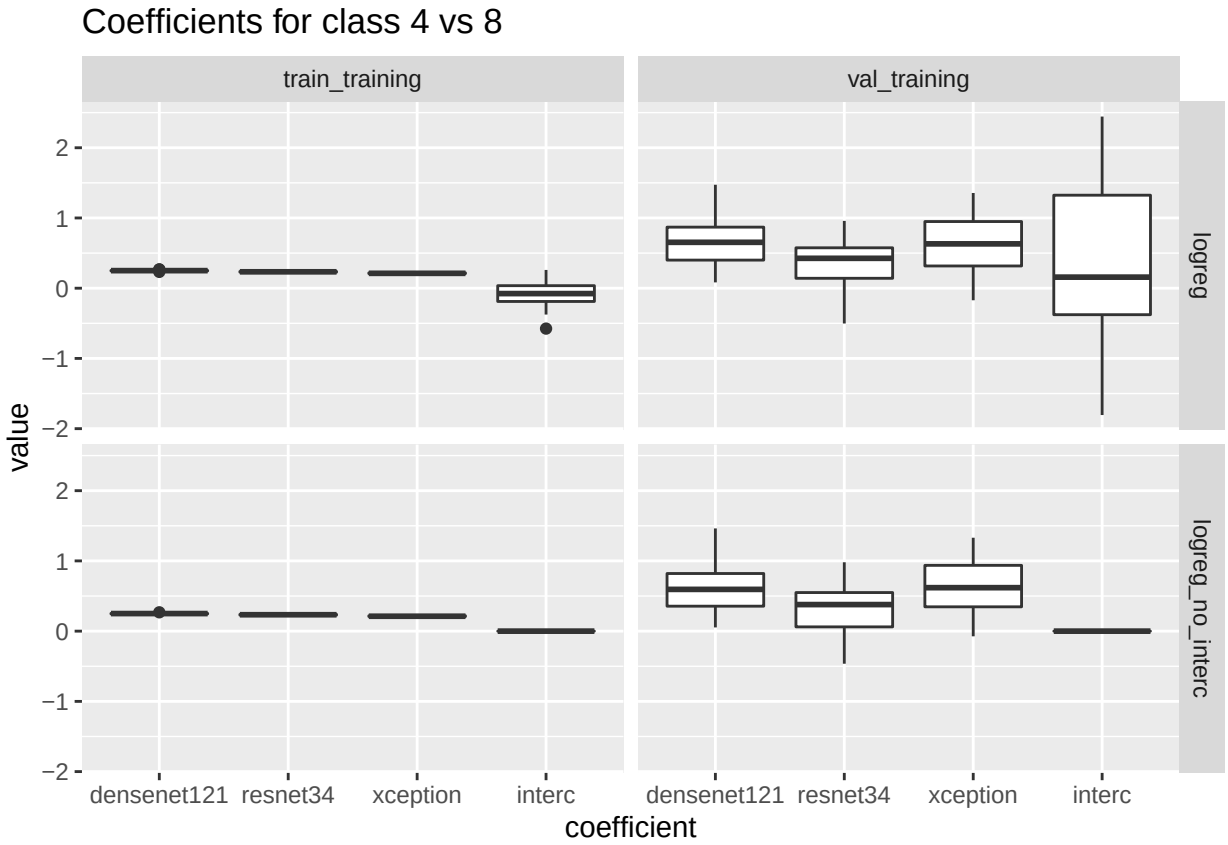

Coefficients for class 3 vs 9
train_training
val_training
logreg
logreg_no_interc
value
4
3
2
1
0
densenet121
resnet34
xception
interc
coefficient

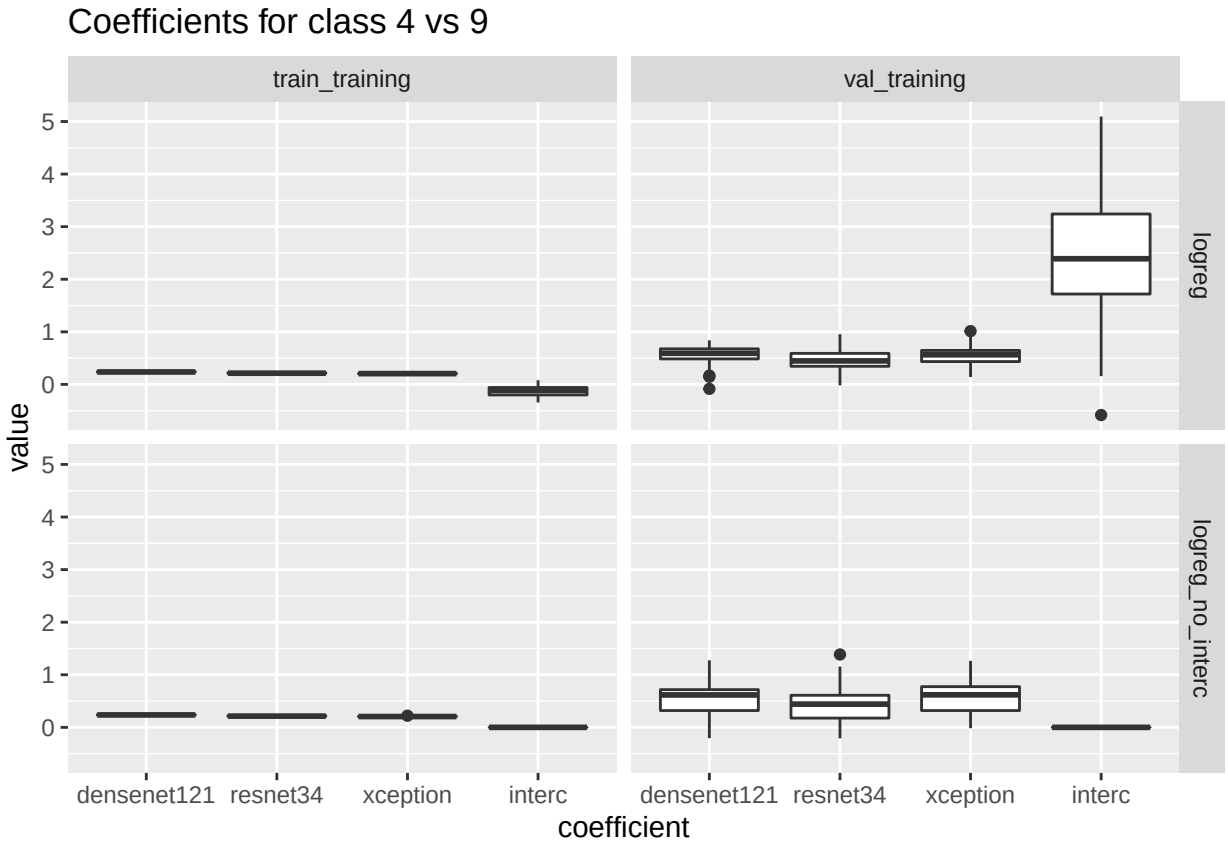

Coefficients for class 3 vs 10
train_training
val_training
logreg
logreg_no_interc
value
2
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

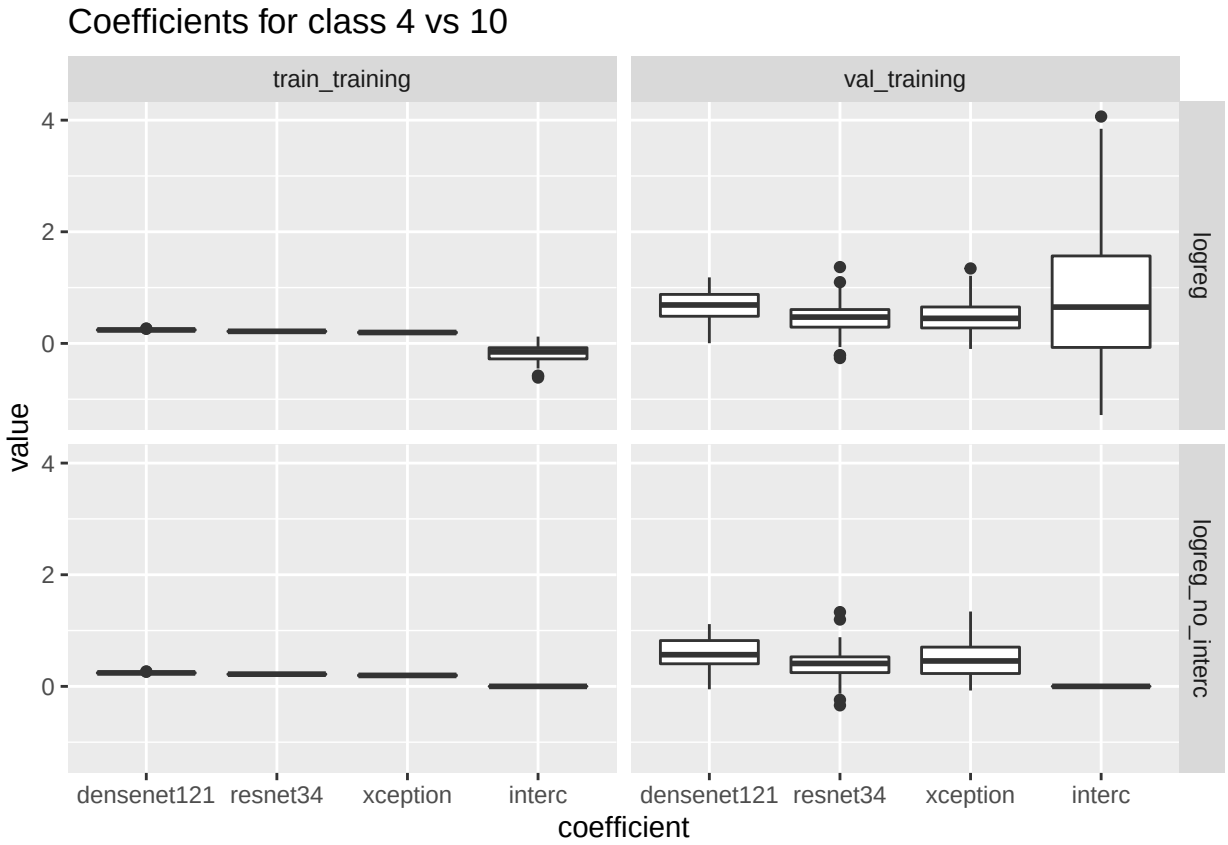

Coefficients for class 4 vs 5
train_training
val_training
logreg
logreg_no_interc
value
1.0
0.5
0.0
−0.5
densenet121
resnet34
xception
interc
coefficient

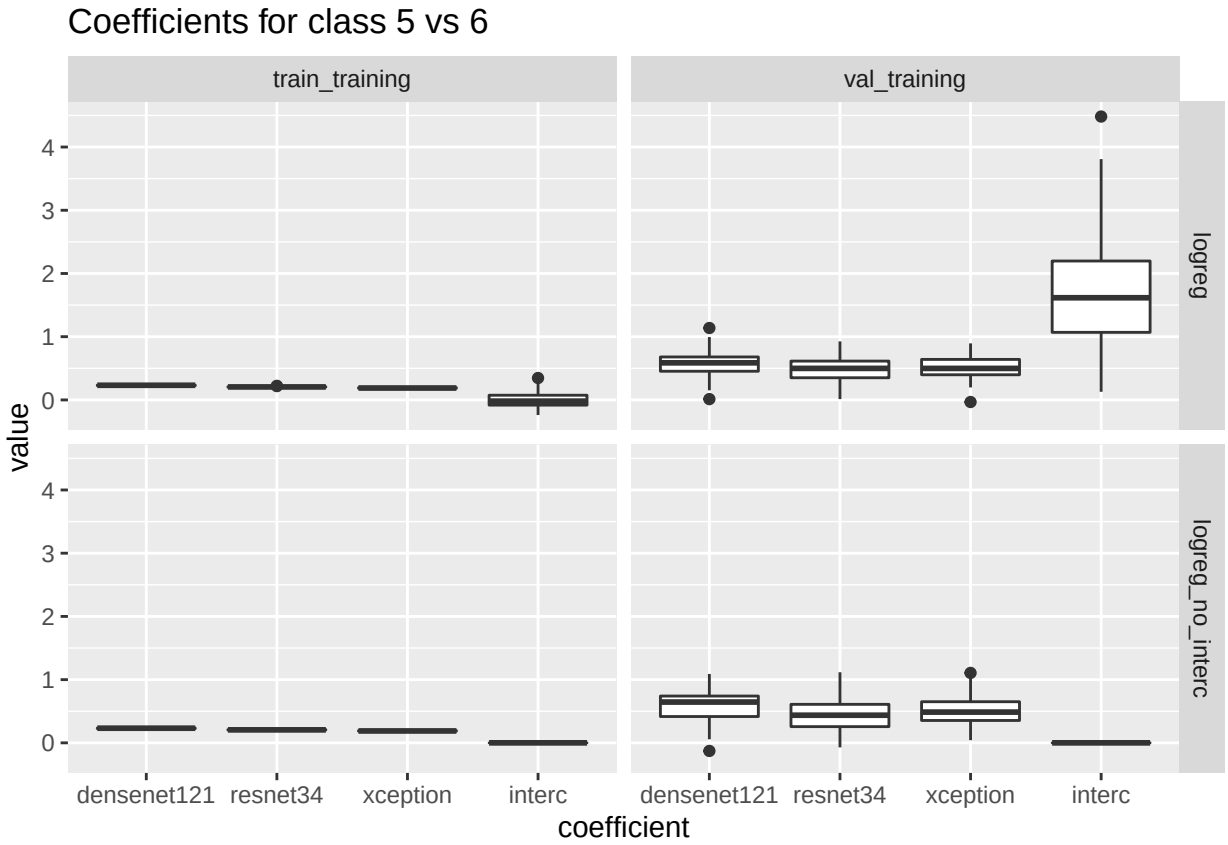

Coefficients for class 4 vs 6
train_training
val_training
logreg
logreg_no_interc
value
coefficient
densenet121
resnet34
xception
interc
0
1
2
3
4
5

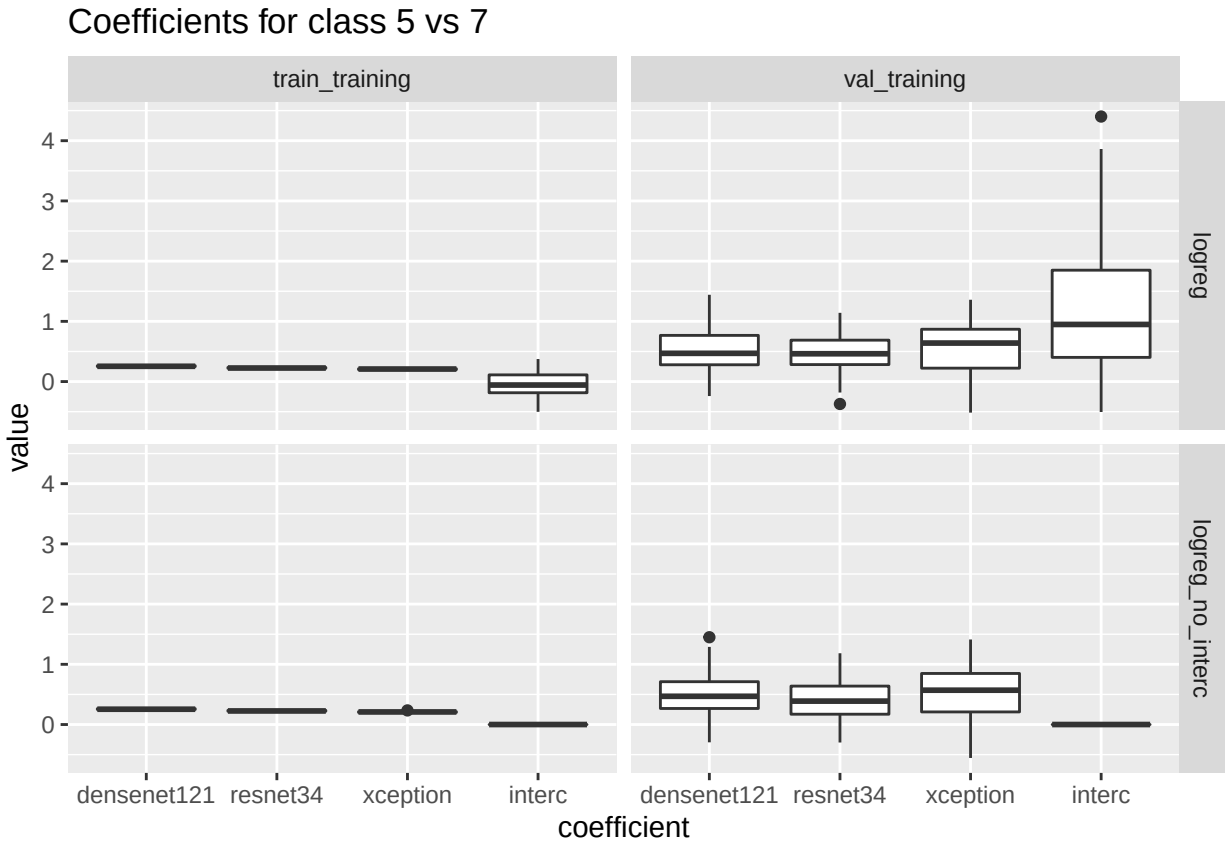

Coefficients for class 4 vs 7
train_training
val_training
logreg
logreg_no_interc
value
4
3
2
1
0
−1
densenet121
resnet34
xception
interc
coefficient

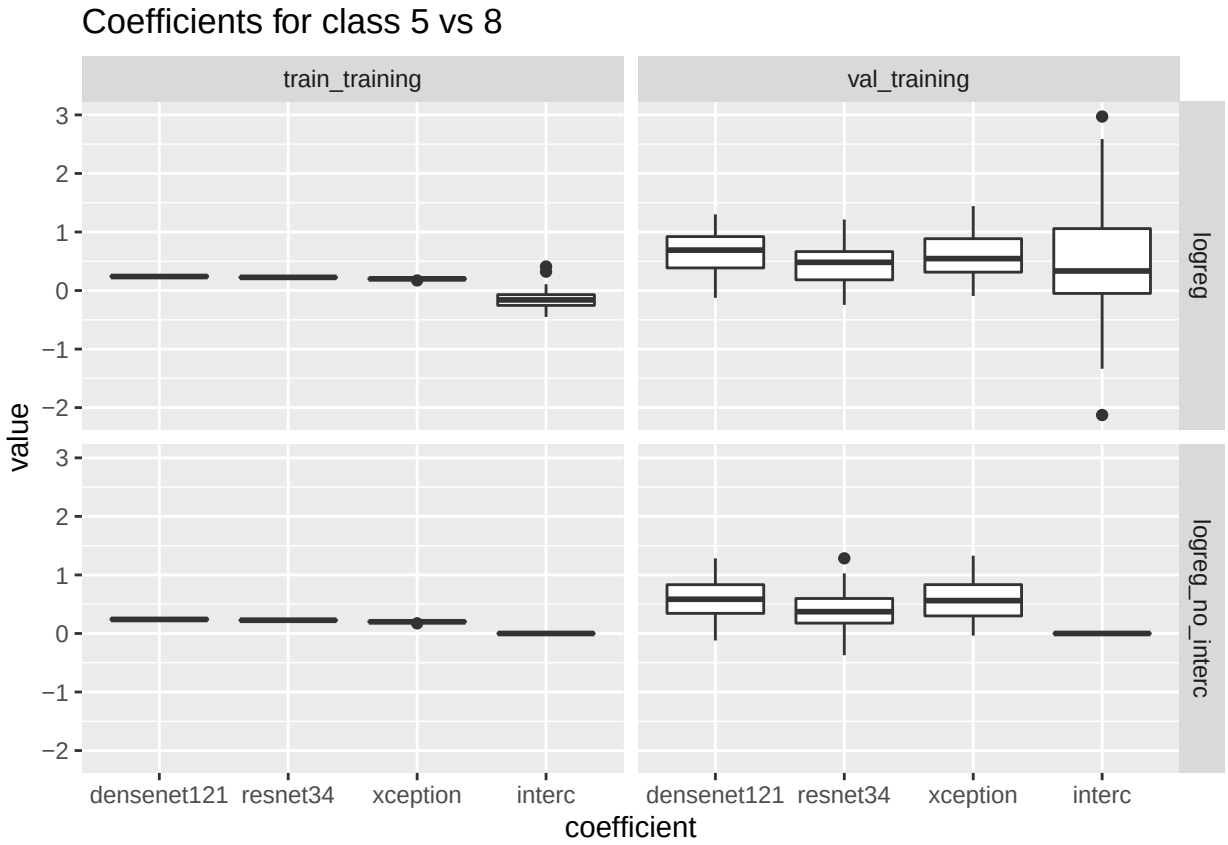

Coefficients for class 4 vs 8
train_training
val_training
logreg
logreg_no_interc
value
2
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

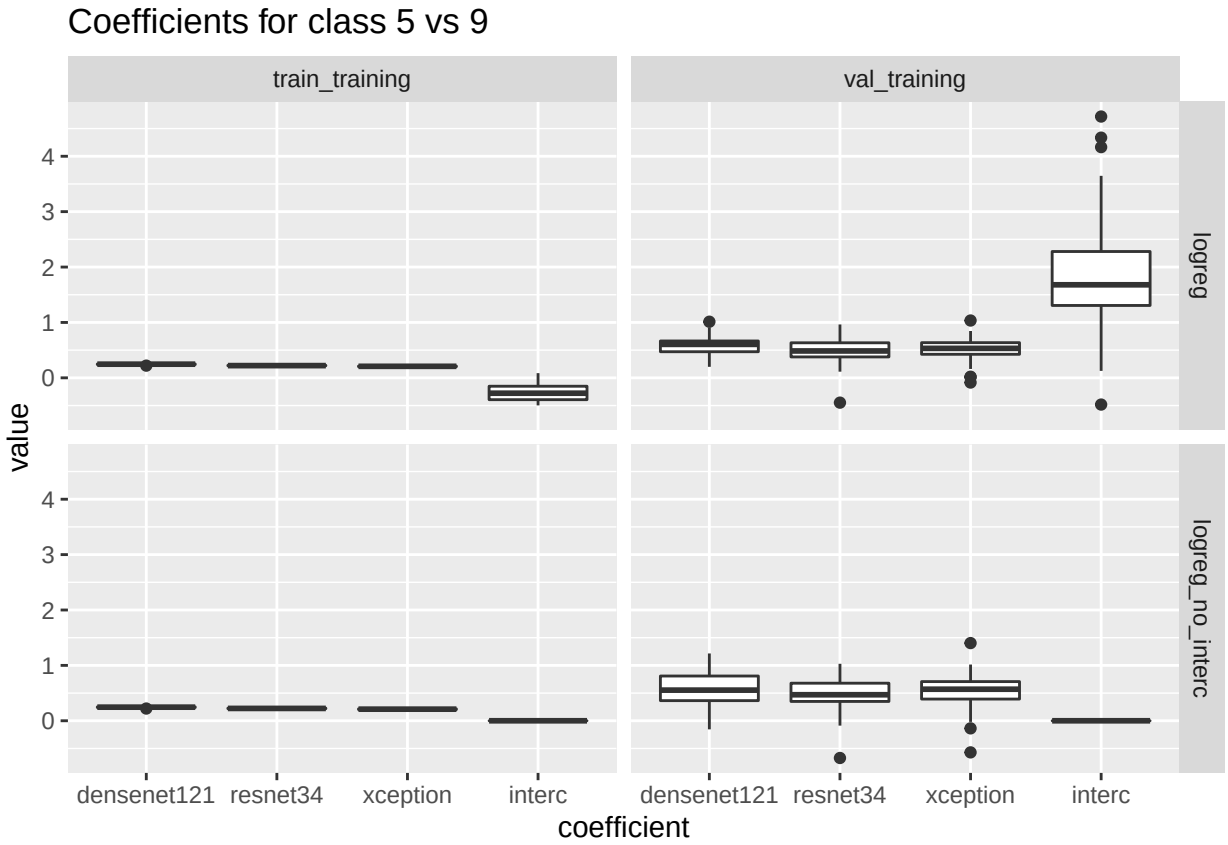

Coefficients for class 4 vs 9
train_training
val_training
logreg
logreg_no_interc
value
5
4
3
2
1
0
densenet121
resnet34
xception
interc
coefficient

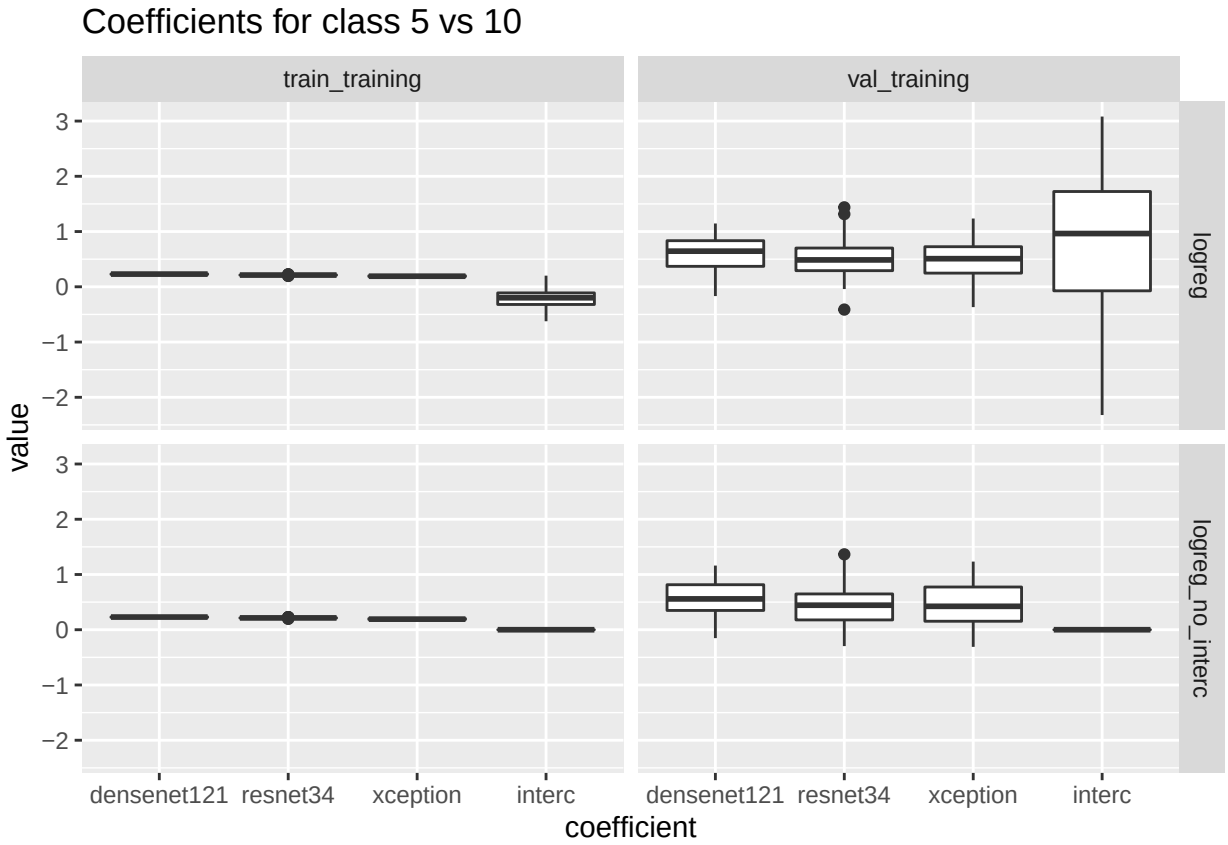

Coefficients for class 4 vs 10
train_training
val_training
logreg
logreg_no_interc
value
4
2
0
densenet121
resnet34
xception
interc
coefficient

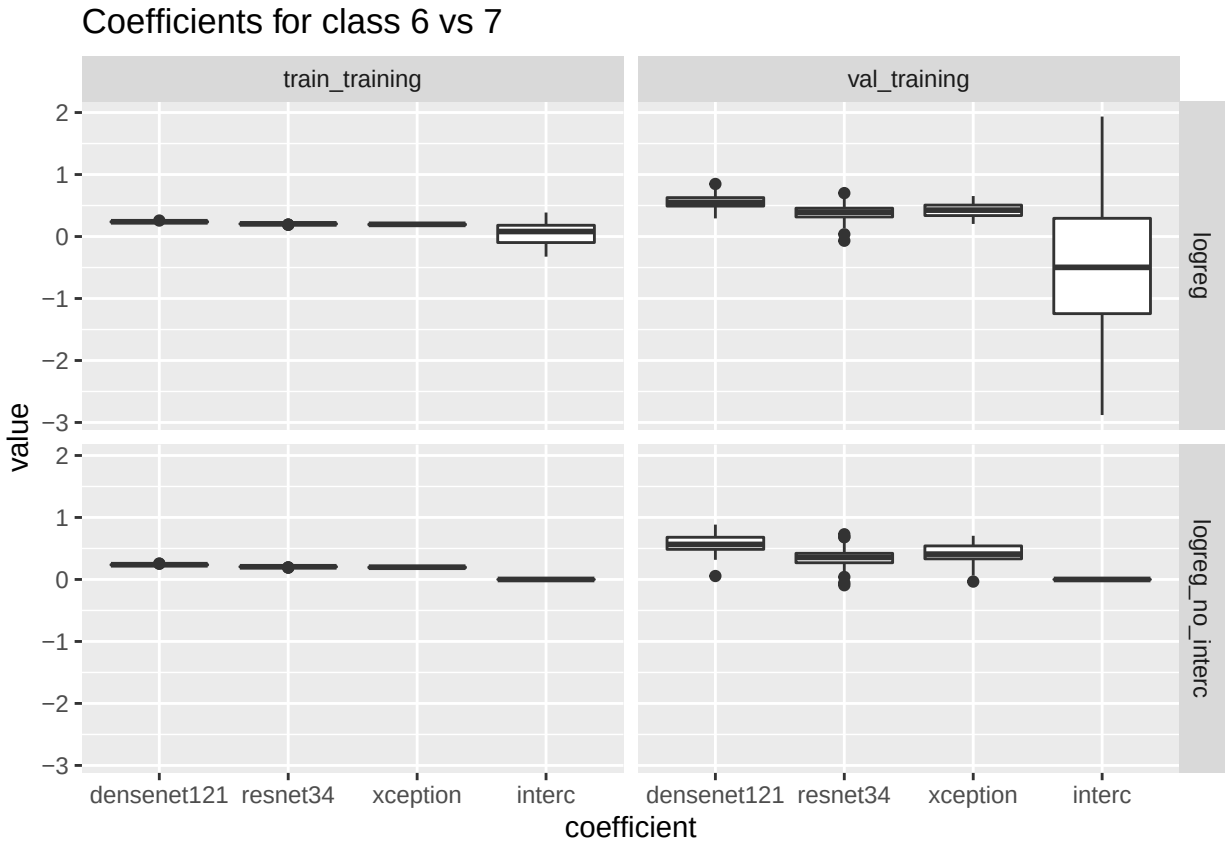

Coefficients for class 5 vs 6
train_training
val_training
logreg
logreg_no_interc
value
coefficient
densenet121
resnet34
xception
interc
0
1
2
3
4

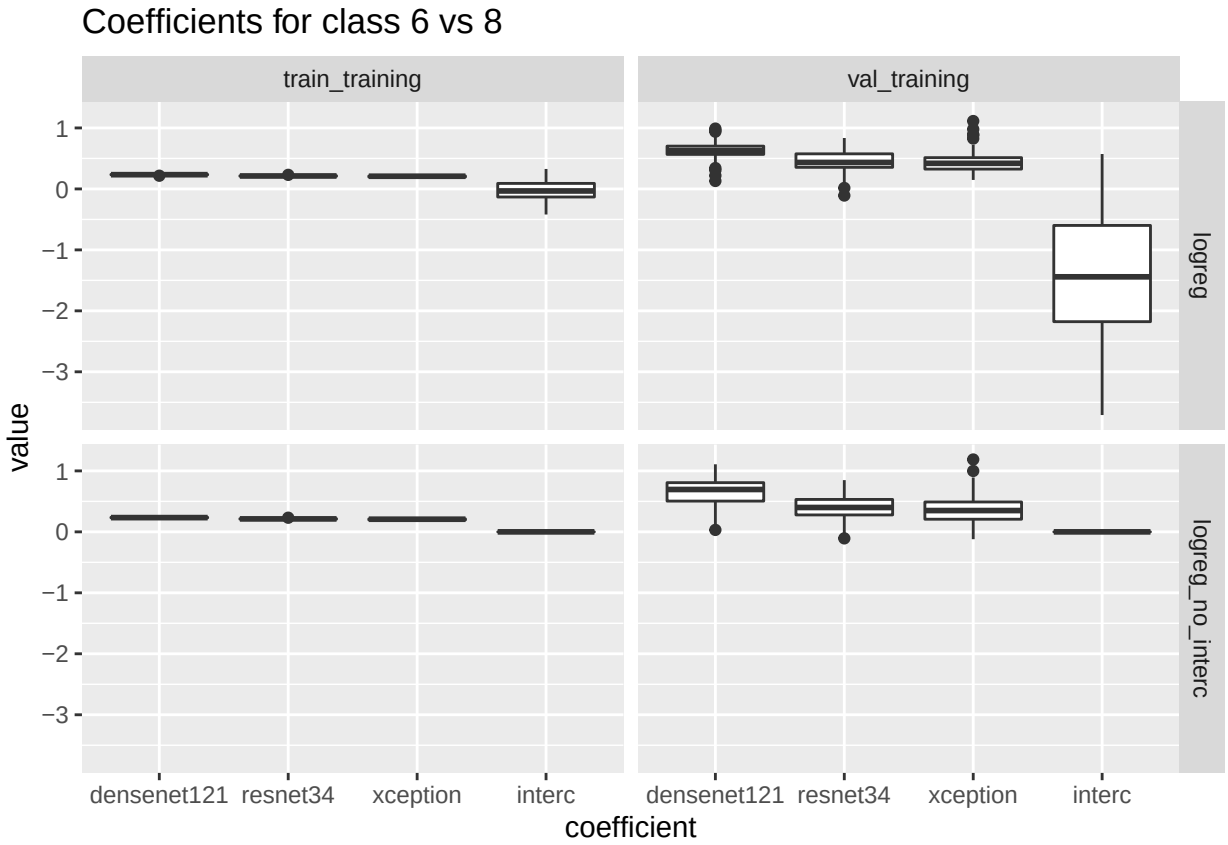

Coefficients for class 5 vs 7
train_training
val_training
logreg
logreg_no_interc
value
4
3
2
1
0
densenet121
resnet34
xception
interc
coefficient

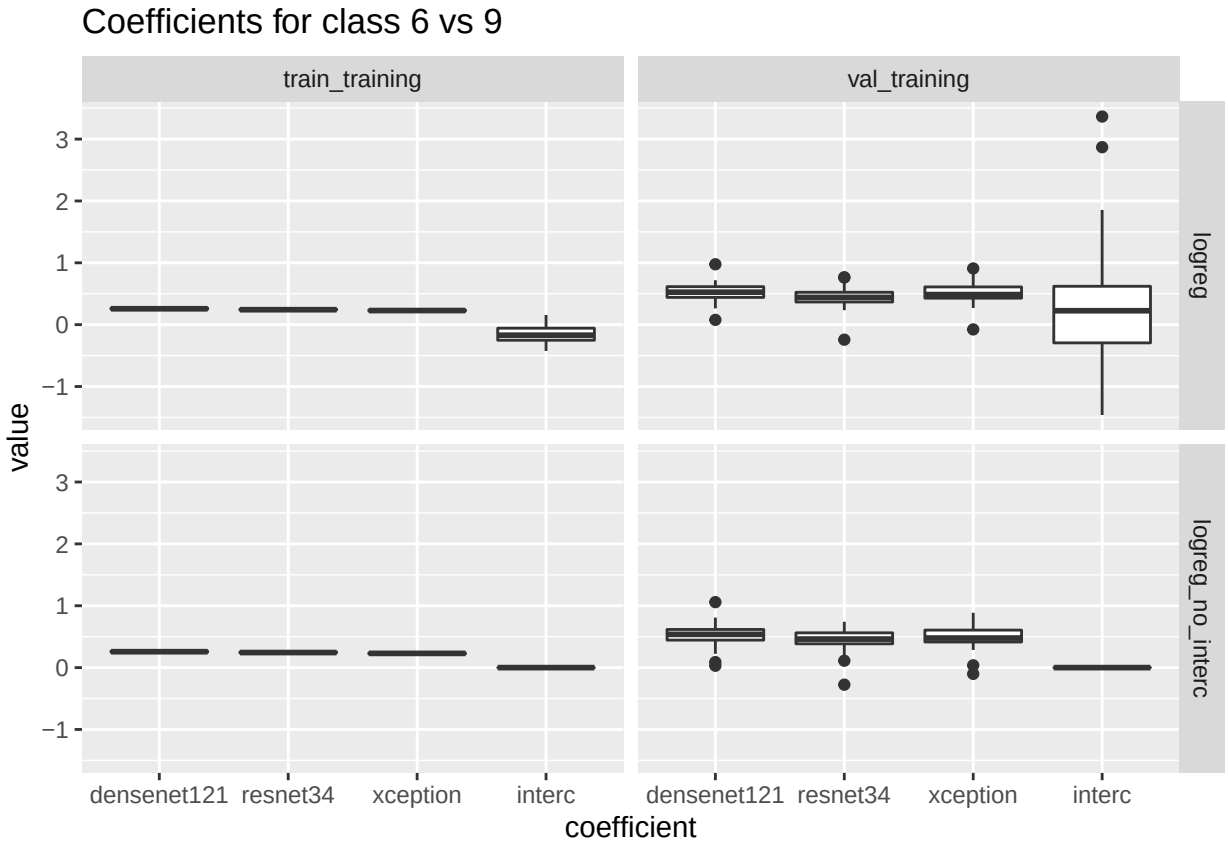

Coefficients for class 5 vs 8
train_training
val_training
logreg
logreg_no_interc
value
3
2
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

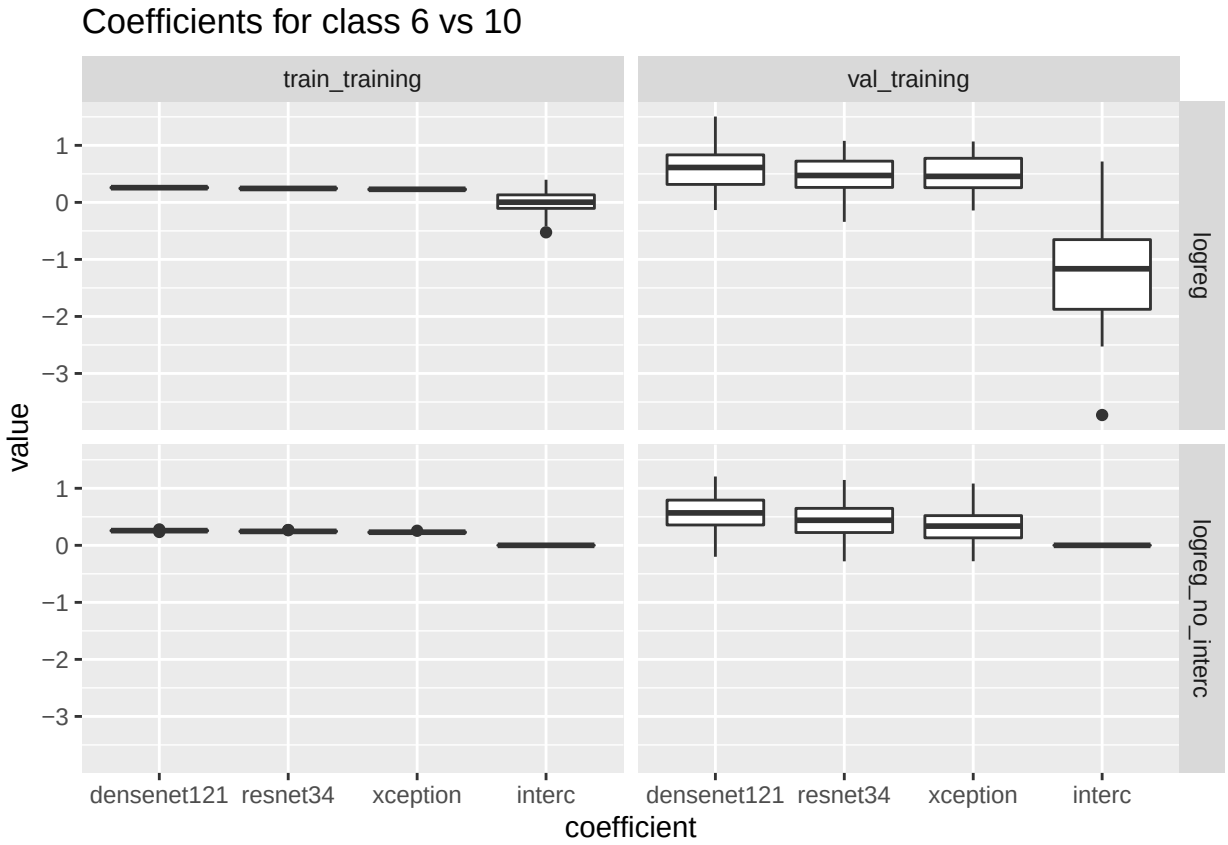

Coefficients for class 5 vs 9
train_training
val_training
logreg
logreg_no_interc
value
4
3
2
1
0
densenet121
resnet34
xception
interc
coefficient

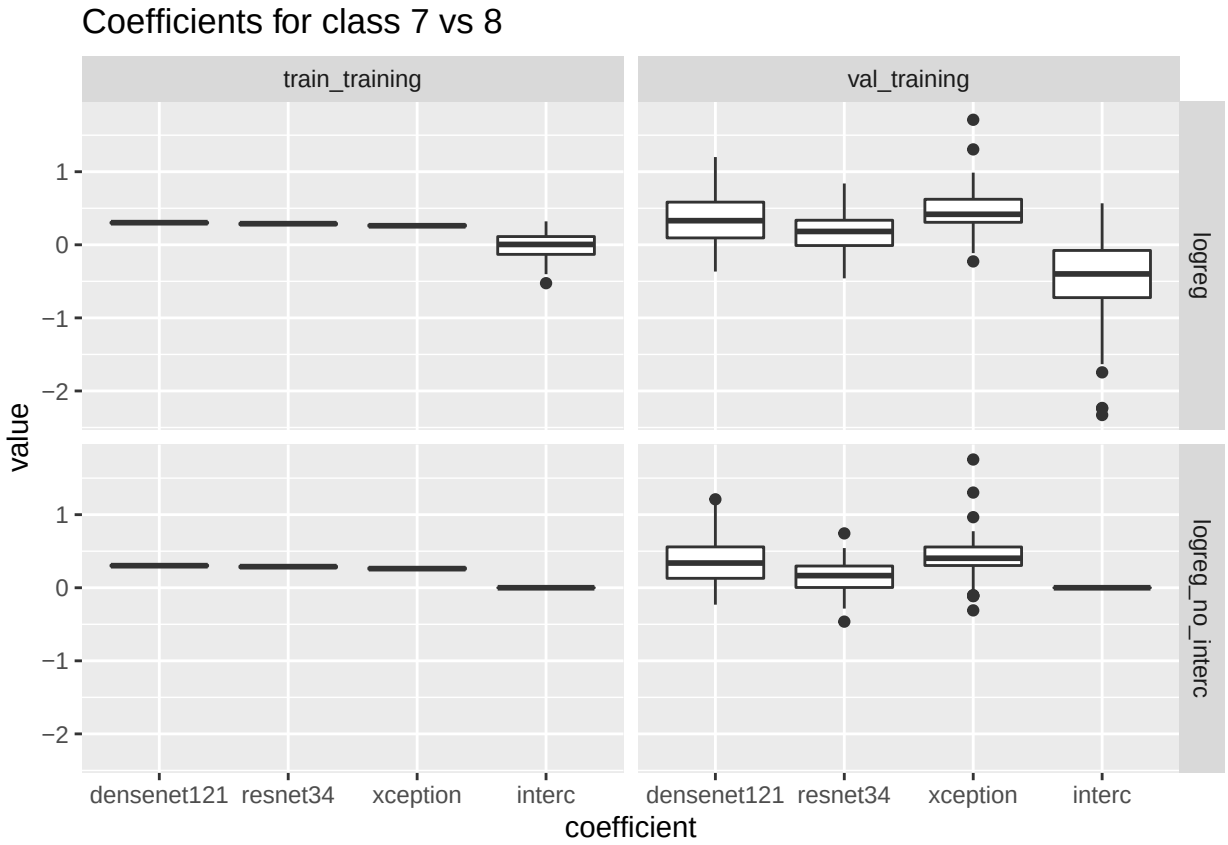

Coefficients for class 5 vs 10
train_training
val_training
logreg
logreg_no_interc
value
3
2
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient

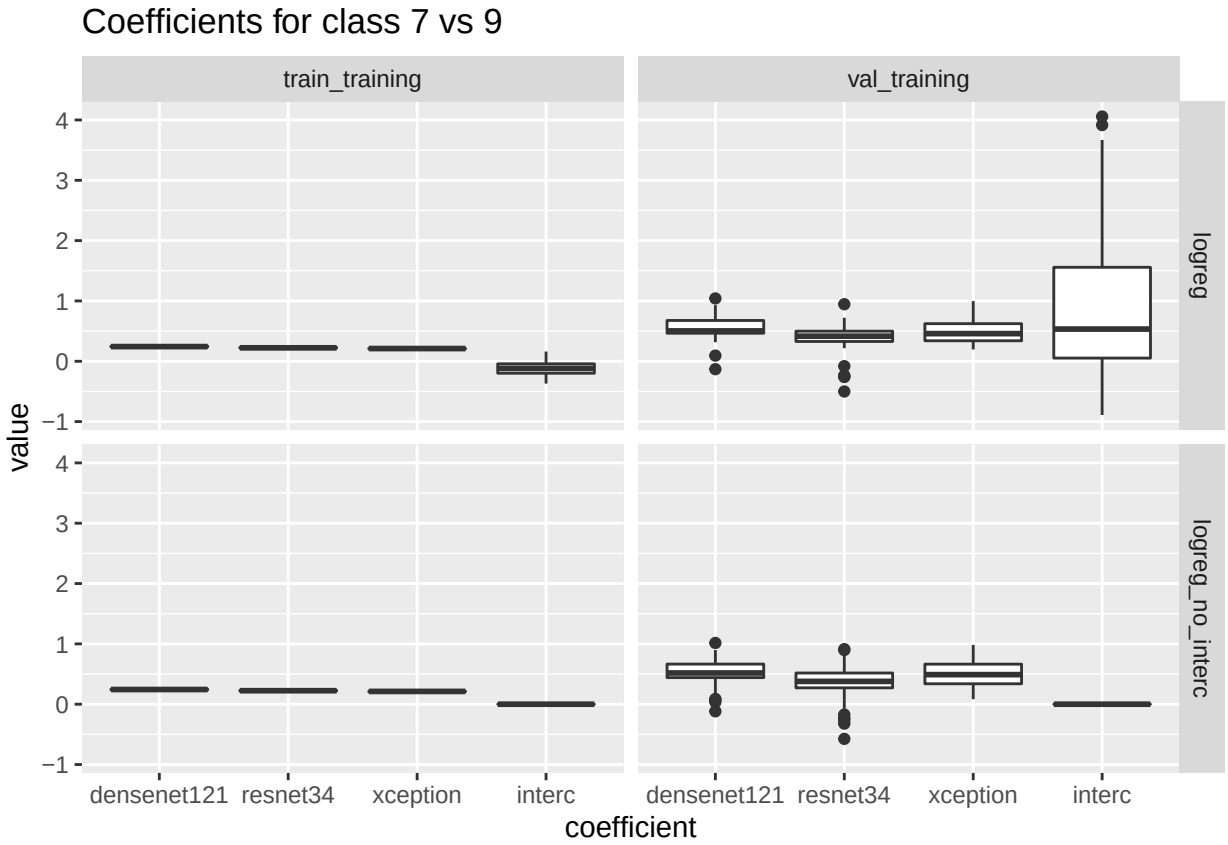

Coefficients for class 6 vs 7
train_training
val_training
logreg
logreg_no_interc
value
2
1
0
−1
−2
−3
densenet121
resnet34
xception
interc
coefficient

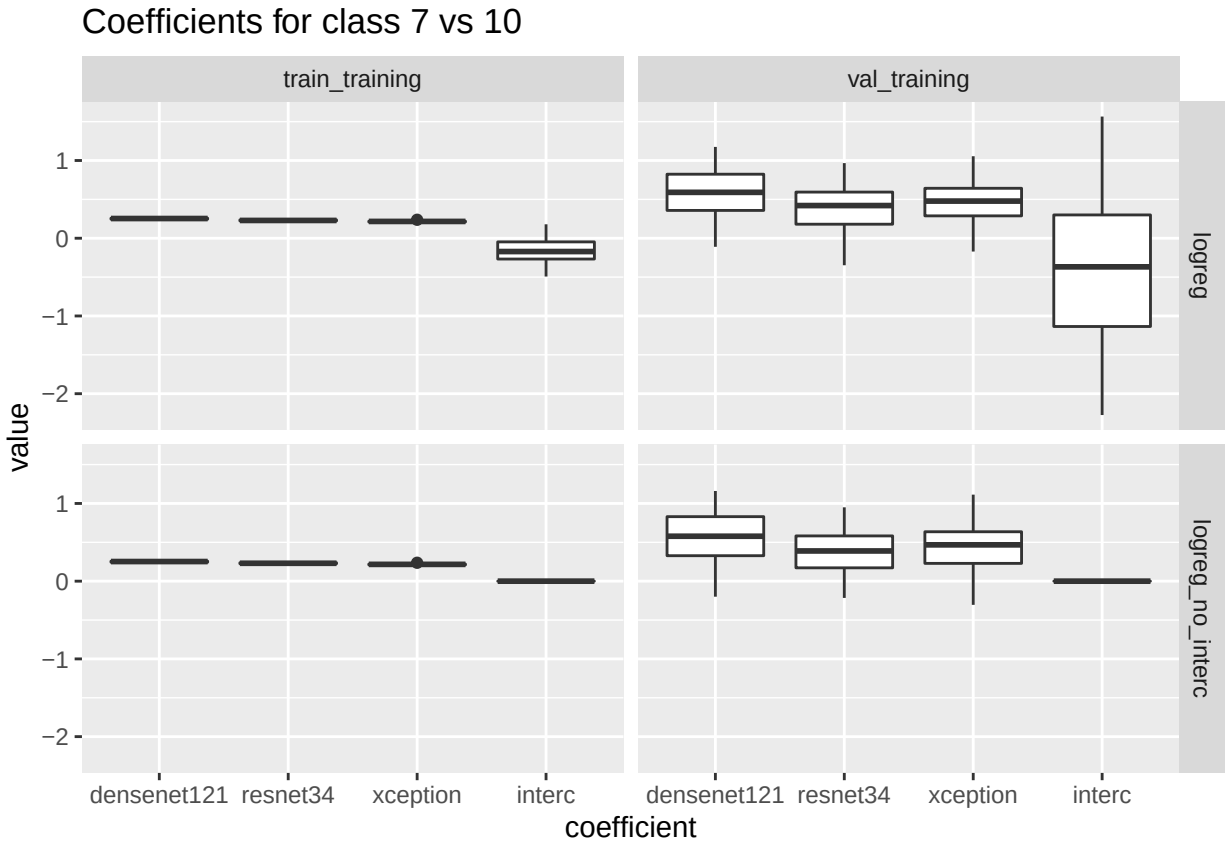

Coefficients for class 6 vs 8
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
−3
densenet121
resnet34
xception
interc
coefficient

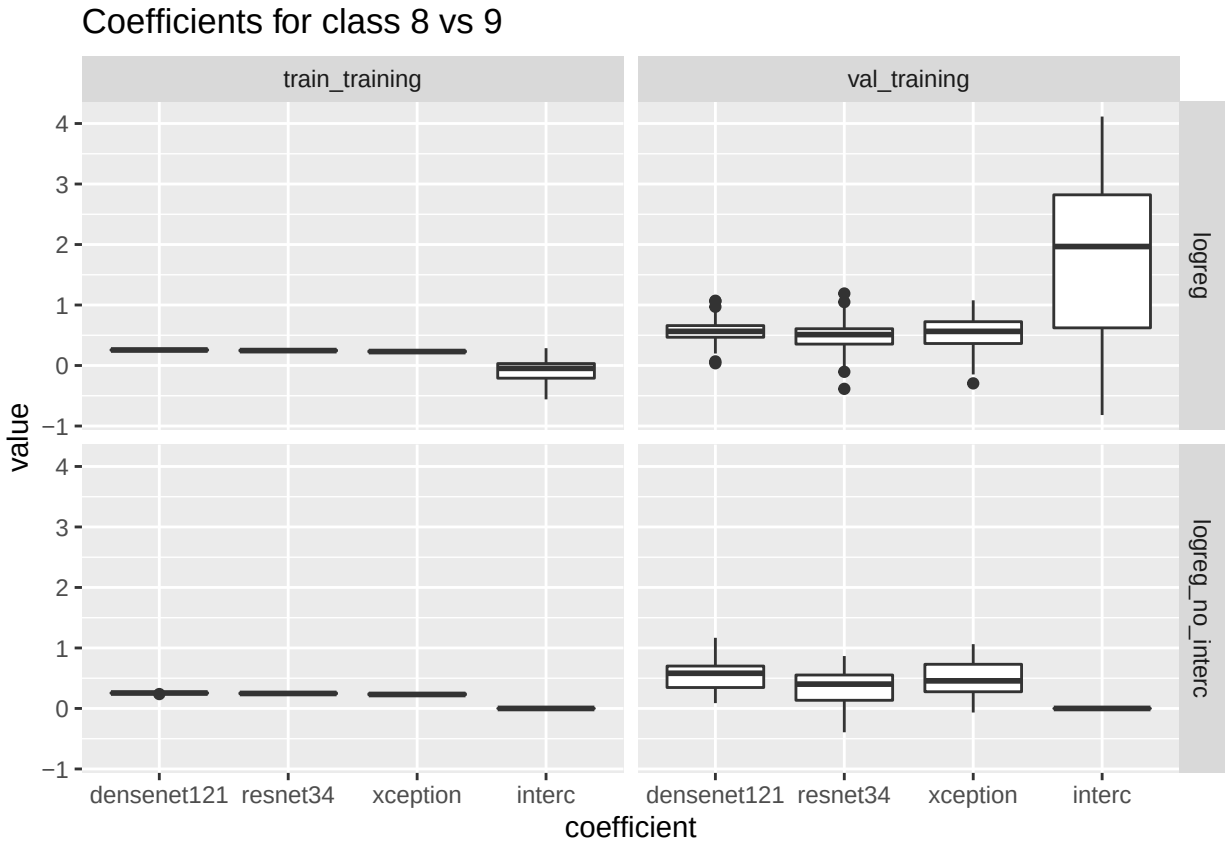

Coefficients for class 6 vs 9
train_training
val_training
logreg
logreg_no_interc
value
3
2
1
0
−1
densenet121
resnet34
xception
interc
coefficient

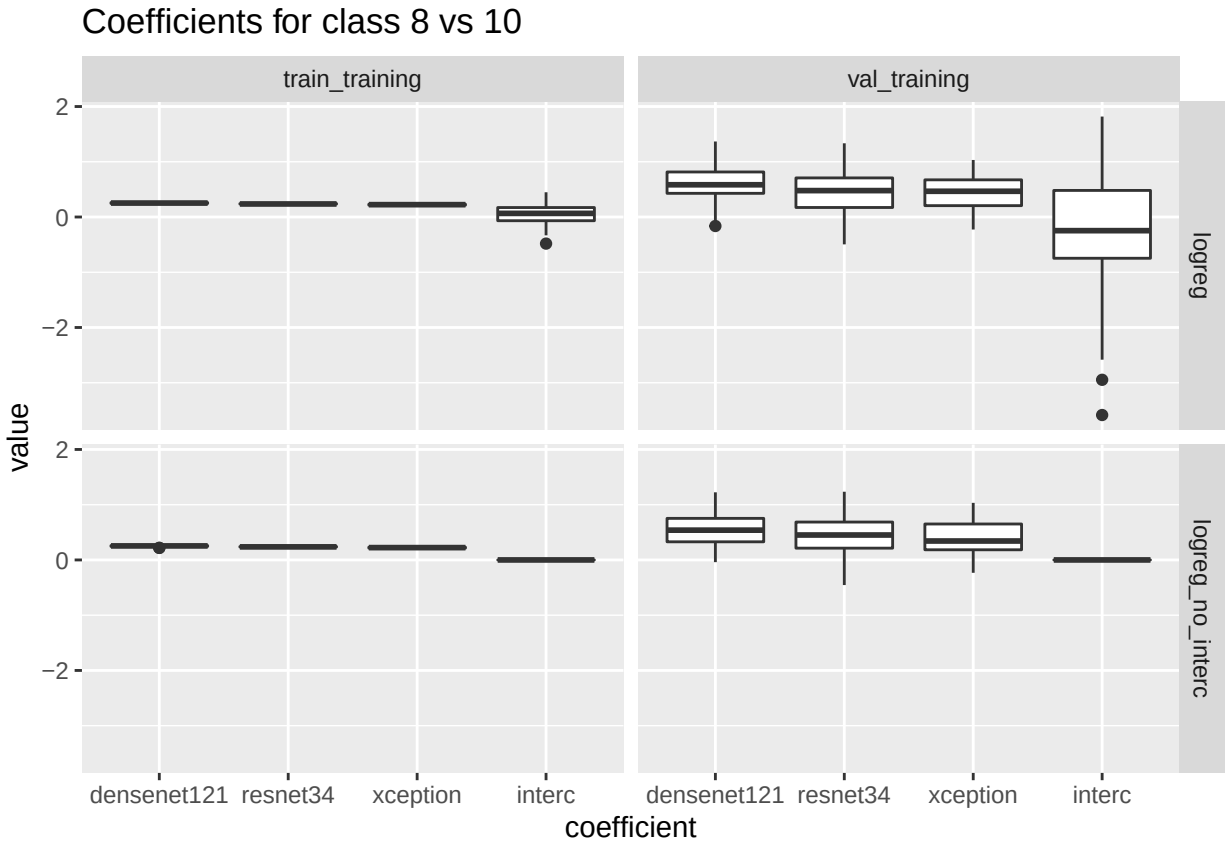

Coefficients for class 6 vs 10
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
−3
densenet121
resnet34
xception
interc
coefficient

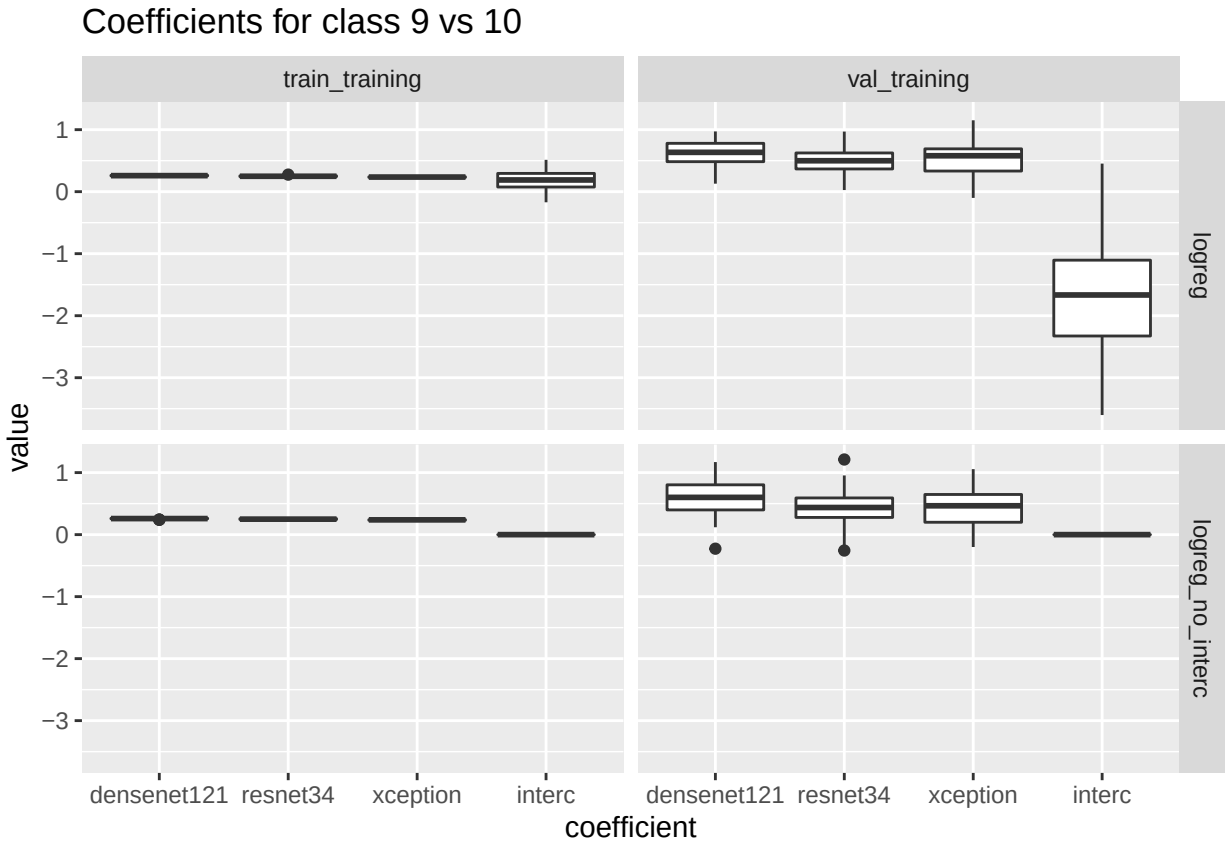

Coefficients for class 7 vs 8
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 7 vs 9
train_training
val_training
logreg
logreg_no_interc
value
4
3
2
1
0
−1
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 7 vs 10
train_training
val_training
logreg
logreg_no_interc
value
1
0
−1
−2
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 8 vs 9
train_training
val_training
logreg
logreg_no_interc
value
4
3
2
1
0
−1
densenet121
resnet34
xception
interc
coefficient


Coefficients for class 8 vs 10
train_training
val_training
logreg
logreg_no_interc
value
2
0
−2
densenet121
resnet34
xception
interc
coefficient



In case of lda train_training coefficients tend to have higher variance, in case of logreg it seem to be the oposite, val_training coefficients have higher variance.

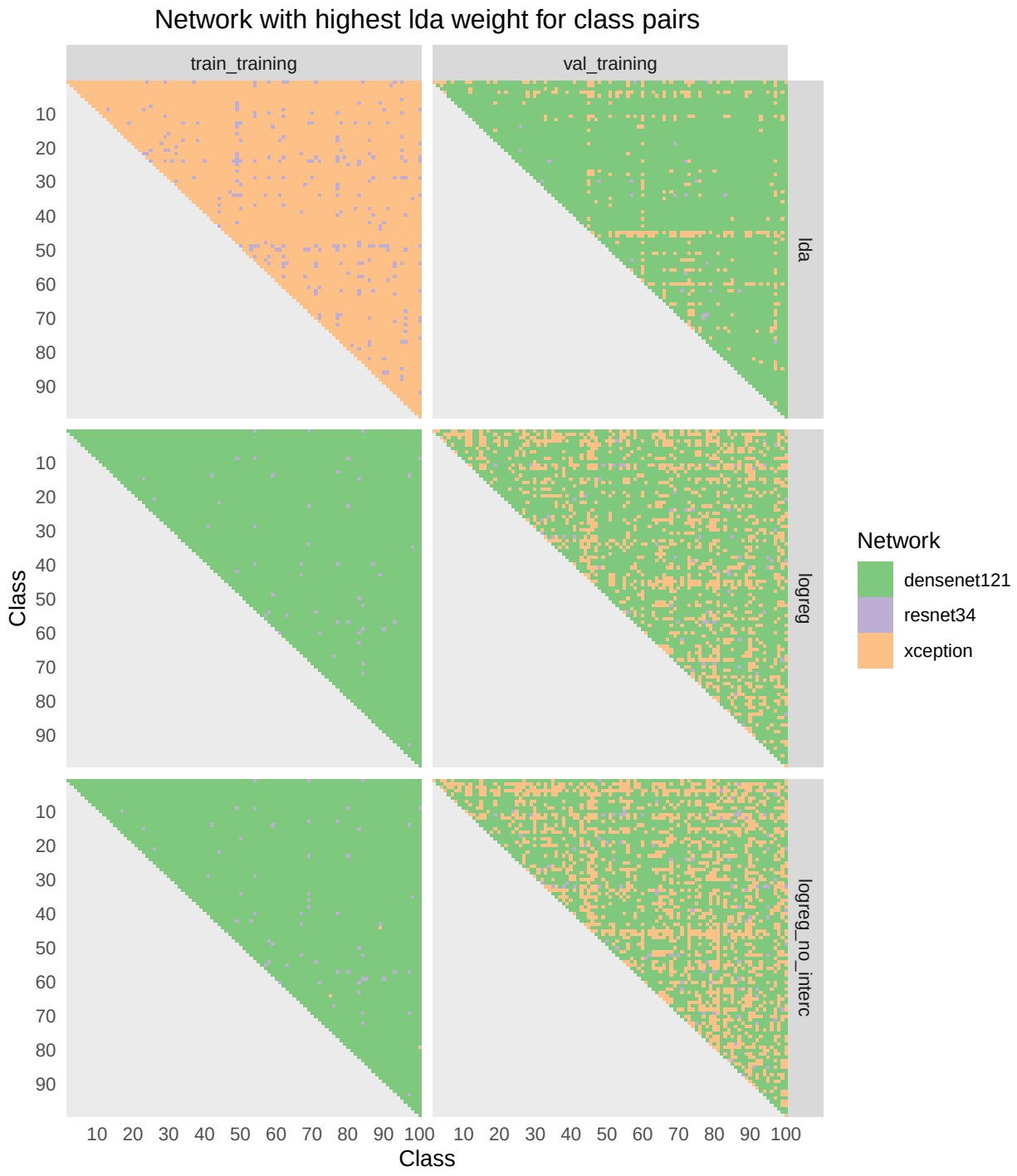
```
avg_combiner_coefs <- combiner_coefs %>% filter(coefficient != "interc") %>% group_by(class1, class2, pr
```

```
## `summarise()` has grouped output by 'class1', 'class2', 'precision', 'train_type', 'coefficient'. You
```

```
avg_combiner_c_w <- pivot_wider(avg_combiner_coefs, names_from = coefficient, values_from = value)
avg_combiner_c_w[, c("class1", "class2")] <- lapply(avg_combiner_c_w[, c("class1", "class2")], as.factor
avg_combiner_c_w$top_net <- factor(c("densenet121", "resnet34", "xception")[max.col(as.matrix(avg_combin
```

```
coefs_grid <- ggplot(avg_combiner_c_w, aes(x=class2, y=class1, fill=top_net)) +
  geom_raster() +
  scale_fill_brewer(type="qual") +
  facet_grid(cols=vars(train_type), rows=vars(combining_method)) +
  scale_y_discrete(limits=rev, breaks=seq(0, 100, 10)) +
  scale_x_discrete(breaks=seq(0, 100, 10)) +
  guides(fill=guide_legend(title="Network")) +
  xlab("Class") +
  ylab("Class") +
  ggtitle("Network with highest lda weight for class pairs") +
  theme(plot.title = element_text(hjust = 0.5),
        axis.ticks = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())
```

```
coefs_grid
```


Network with highest lda weight for class pairs
train_training
val_training
lda
logreg
logreg_no_interc
Class
10 20 30 40 50 60 70 80 90
10 20 30 40 50 60 70 80 90 100
Class
Network
densenet121
resnet34
xception