target_creation

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Load all data

```
qs::qread("accuracies_1_2021-11-04_1.qs") -> accuracies1
qs::qread("accuracies_2_2021-11-05_1.qs") -> accuracies2
qs::qread("../data/M_all_features.qs") -> feature_df
```

```
library(magrittr)
accuracies <- dplyr::bind_rows(accuracies1, accuracies2) %>%
  as.data.frame() %>%
  dplyr::select_if(~ !all(is.na(.x))) %>%
  dplyr::select_if(~ !all(.x == .x[1])) %>%
  tidyr::drop_na() %>%
  dplyr::filter( .model !=  "<environment>")
```

```
accuracy_ranks <- accuracies %>%
  dplyr::mutate(dplyr::across(where(is.numeric), abs)) %>%
  dplyr::group_by( key ) %>%
  dplyr::mutate(dplyr::across(where(is.numeric), dplyr::min_rank)) %>%
  dplyr::ungroup() %>%
  dplyr::mutate( avg_rank = rowMeans( dplyr::across(where(is.numeric))) )
```

Winner takes all: (best method is taken as a label, and no probabilistic voodoo is done)

```
winner_takes_all <- accuracy_ranks %>%
  dplyr::group_by(key) %>%
  dplyr::filter(avg_rank == min(avg_rank)) %>%
  dplyr::select( .model, key) %>%
  dplyr::ungroup()
```

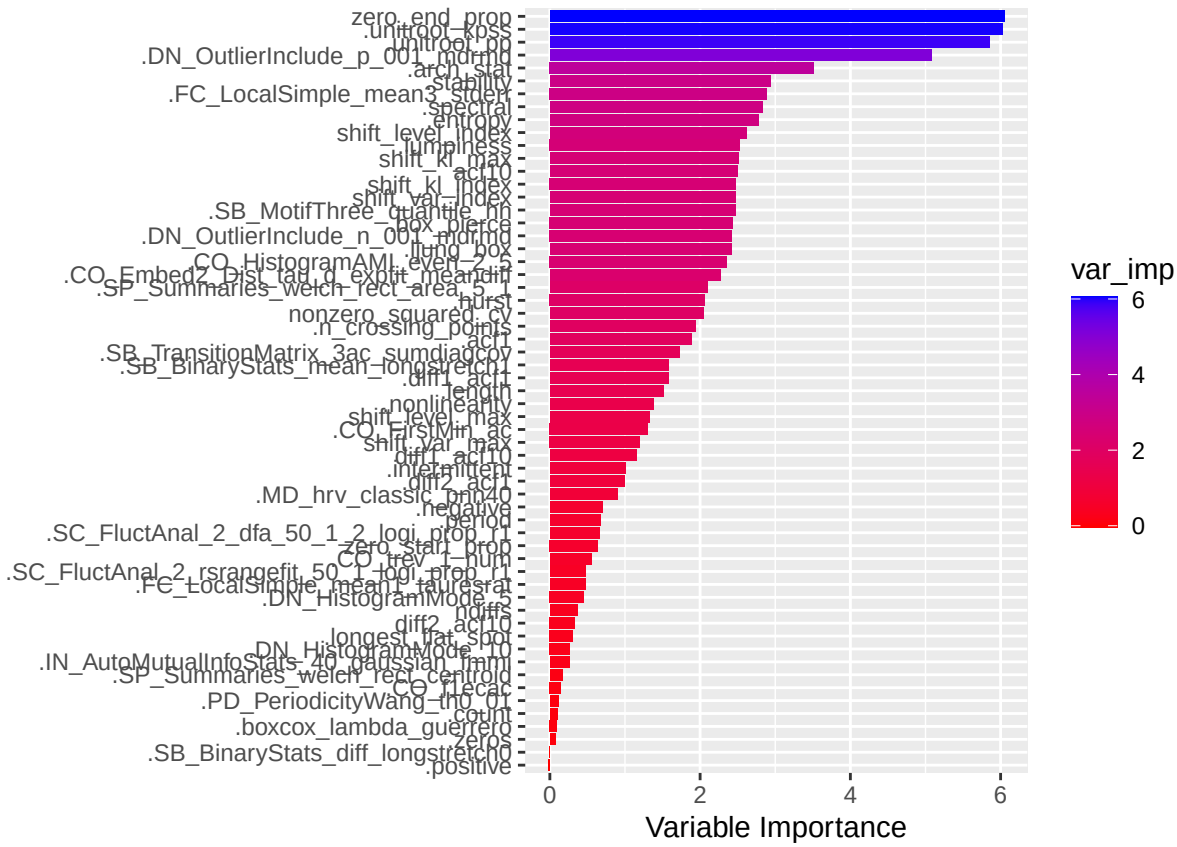
Fit model on this data:

```
soothsayer_data <- winner_takes_all %>%
  dplyr::full_join(feature_df, by = c("key" = "keys")) %>%
  dplyr::select_if(~ !all(is.na(.x))) %>%
  dplyr::select_if(~ !all(.x == .x[1])) %>%
  tidyr::drop_na() %>%
  dplyr::mutate(sample_type = sample(c("train", "test"),
    length(key),
    replace = TRUE,
    prob = c(0.7, 0.3)
  ))

soothsayer_train <- soothsayer_data %>%
  dplyr::filter(sample_type == "train") %>%
```

```
  dplyr::select(-sample_type) %>%
  dplyr::select(-key)
soothsayer_test <- soothsayer_data %>%
  dplyr::filter(sample_type == "test") %>%
  dplyr::select(-sample_type)

ranger_x <- soothsayer_train %>%
  dplyr::select(-.model) %>%
  as.matrix()
ranger_y <- soothsayer_train %>%
  dplyr::select(.model) %>%
  unlist() %>%
  as.factor()

soothsayer_model <- ranger::ranger(
  x = ranger_x,
  y = ranger_y,
  num.trees = 2000,
  probability = TRUE
)

soothsayer_model_importance <- ranger::ranger(
  x = ranger_x,
  y = ranger_y,
  num.trees = 2000,
  importance = 'impurity_corrected',
  probability = TRUE
)
```

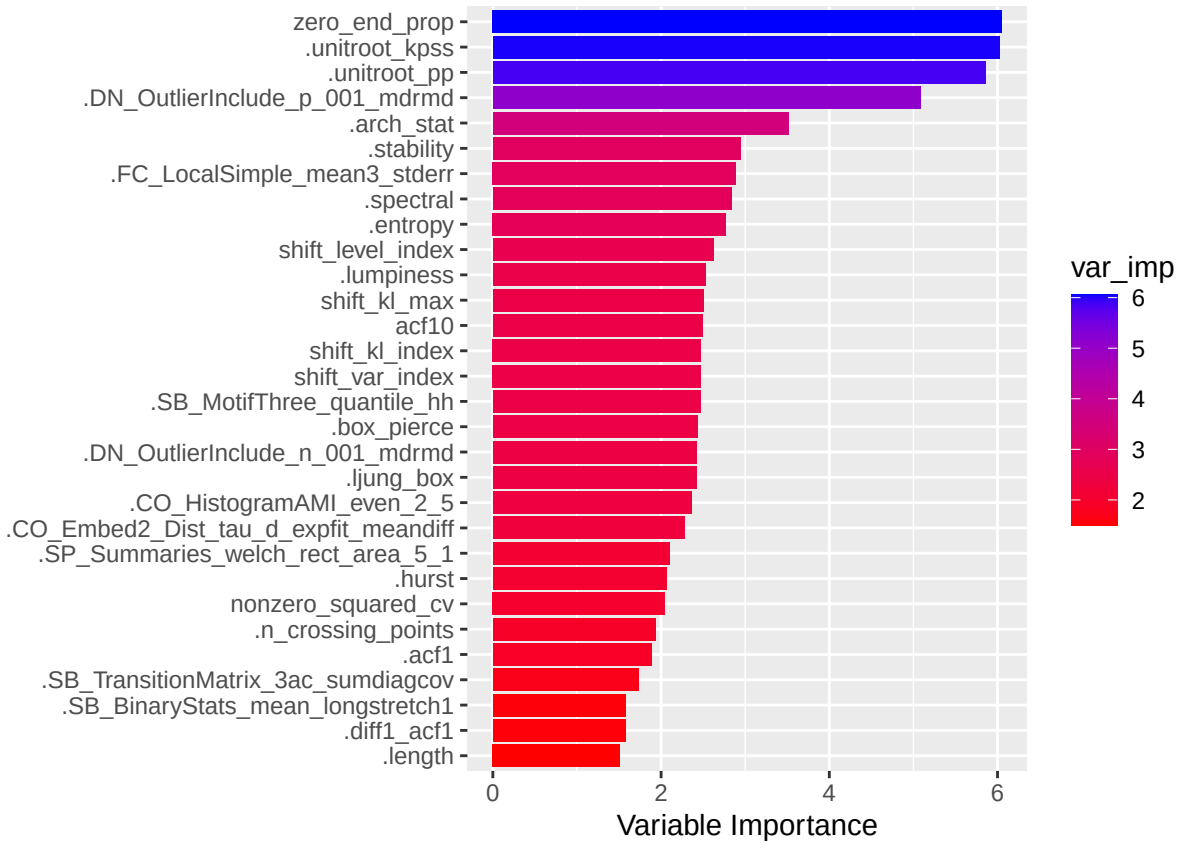
Before we go on, lets look at which variables the model actually uses (pruning could prove useful):

```
variable_importances <- soothsayer_model_importance[["variable.importance"]]
# rescale so they sum to 100
variable_importances <- (variable_importances/sum(variable_importances)) * 100
df <- data.frame( var_imp = variable_importances, var = names(variable_importances) )

ggplot2::ggplot(df, ggplot2::aes( x = reorder(var,var_imp),
                                  y = var_imp,
                                  fill = var_imp )
                ) +
      ggplot2::geom_bar(stat="identity", position="dodge") +
      ggplot2::coord_flip()+
      ggplot2::ylab("Variable Importance")+
      ggplot2::xlab("")+
      ggplot2::scale_fill_gradient(low="red", high="blue")
```



Pretty, but not super readable - what about top 20?

```
df %>%
  dplyr::arrange(dplyr::desc(var_imp)) %>%
  .[1:30,] %>%
  ggplot2::ggplot( ggplot2::aes( x = reorder(var,var_imp),
                                 y = var_imp,
                                 fill = var_imp )
                   ) +
      ggplot2::geom_bar(stat="identity", position="dodge") +
      ggplot2::coord_flip()+
      ggplot2::ylab("Variable Importance")+
      ggplot2::xlab("")+
      ggplot2::scale_fill_gradient(low="red", high="blue")
```



Interesting. Most of these are either features from **feasts** or from **Catch22**.

```
preds <- predict(soothsayer_model, soothsayer_test %>%
  dplyr::select(-c(".model", "key")) %>%
  as.matrix(), type = "response")

selected_models <- preds[["predictions"]] %>%
  as.data.frame() %>% dplyr::rowwise() %>%
  dplyr::mutate( best = which.max(dplyr::across())) %>%
  dplyr::ungroup() %>%
  dplyr::mutate( selected_model = colnames(preds[["predictions"]])[best] ) %>%
  dplyr::select( selected_model ) %>%
  dplyr::bind_cols( soothsayer_test ) %>%
  dplyr::select( c("selected_model", "key") )

matches <- accuracies %>%
  dplyr::right_join( selected_models, by = "key" )
```

Are we better than just fitting any individual model to all series?

```
check_against_model <- function( acc_data, model, metric = "RMSE" ) {

  model_acc <- acc_data %>%
    dplyr::filter( .model == model  ) %>%
    dplyr::select( tidyselect::all_of(c("key", metric)))

  selected_acc <- acc_data %>%
    dplyr::filter( .model == selected_model ) %>%
```

```
    dplyr::select(  tidyselect::all_of(c("key", metric)) )

  colnames(selected_acc)[ colnames(selected_acc) == metric ] <- paste0("selected_",metric)

  dplyr::full_join(model_acc, selected_acc, key = "key")
}

performance_vs_single_model <- purrr::map( c("ar", "arima", "croston", "ets", "nnetar", "theta"),
            function( model_name ){
              check_against_model(matches, model_name) %>%
                dplyr::mutate( ratio = RMSE/selected_RMSE) %>%
                # deliberately remove high ratios
                dplyr::filter( ratio < quantile(ratio, probs = 0.99, na.rm = TRUE) &
                               ratio < 10) %>%
                dplyr::summarise( mean_ratio = mean(ratio, na.rm = TRUE)) %>%
                dplyr::mutate( model_name = model_name )
            }) %>%
  dplyr::bind_rows()
```

```
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
```

We get the performance against each individual model: The ratio is the RMSE of a given model, vs our model (averaged). Thus, numbers > 1 are good, numbers < 1 are bad, etc.

```
knitr::kable(performance_vs_single_model)
```

mean_ratio	model_name
1.356499	ar
1.168466	arima
1.661413	croston
1.191124	ets
1.415721	nnetar
1.316115	theta

So we pretty much beat any single model individually (cool!). Maybe that changes with different metrics, or we can do even better.

How often do we do better, and how often do we do worse, though?

```
better_or_worse_than_single_model <- purrr::map( c("ar", "arima", "croston", "ets", "nnetar", "theta"),
            function( model_name ){
              check_against_model(matches, model_name) %>%
                dplyr::mutate( ratio = RMSE/selected_RMSE) %>%
                dplyr::filter( !is.na(ratio) ) %>%
                dplyr::summarise( worse = sum(ratio < 1)/length(ratio),
                                  better_or_equal = sum(ratio >= 1)/length(ratio)) %>%
                dplyr::mutate( model_name = model_name )
            }) %>%
  dplyr::bind_rows()
```

```
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
## Joining, by = "key"
```

```
knitr::kable(better_or_worse_than_single_model, digits = 2)
```

worse	better_or_equal	model_name
0.23	0.77	ar
0.31	0.69	arima
0.28	0.72	croston
0.37	0.63	ets
0.28	0.72	nnetar
0.27	0.73	theta

So even against **fable::ETS** we are still better about 76.7453932, 68.7349107, 72.2187105, 63.3268952, 71.5375723, 73.0378578% of the time. But how do we measure up to the **best** model for any particular time series, if we take this as a ratio of RMSE again?

```
check_against_best_model <- function( acc_data, metric = "RMSE" ) {

  model_acc <- acc_data %>%
    dplyr::select( tidyselect::all_of(c(metric,"key"))) %>%
    dplyr::group_by(key) %>%
    dplyr::mutate(ranking = dplyr::across(where(is.numeric), dplyr::min_rank)) %>%
    dplyr::filter(ranking == 1) %>%
    dplyr::ungroup() %>%
    dplyr::select( tidyselect::all_of(c(metric, "key")))

  selected_acc <- acc_data %>%
    dplyr::filter( .model == selected_model ) %>%
    dplyr::select(  tidyselect::all_of(c("key", metric)) )

  colnames(selected_acc)[ colnames(selected_acc) == metric ] <- paste0("selected_",metric)

  dplyr::full_join(model_acc, selected_acc, key = "key")
}

performance_vs_best_model <-
              check_against_best_model(matches) %>%
                dplyr::mutate( ratio = RMSE/selected_RMSE)
```

```
## Joining, by = "key"
```

```
knitr::kable(dplyr::summarise( performance_vs_best_model, mean_ratio = mean(ratio, na.rm = TRUE)) )
```

mean_ratio
0.8642782

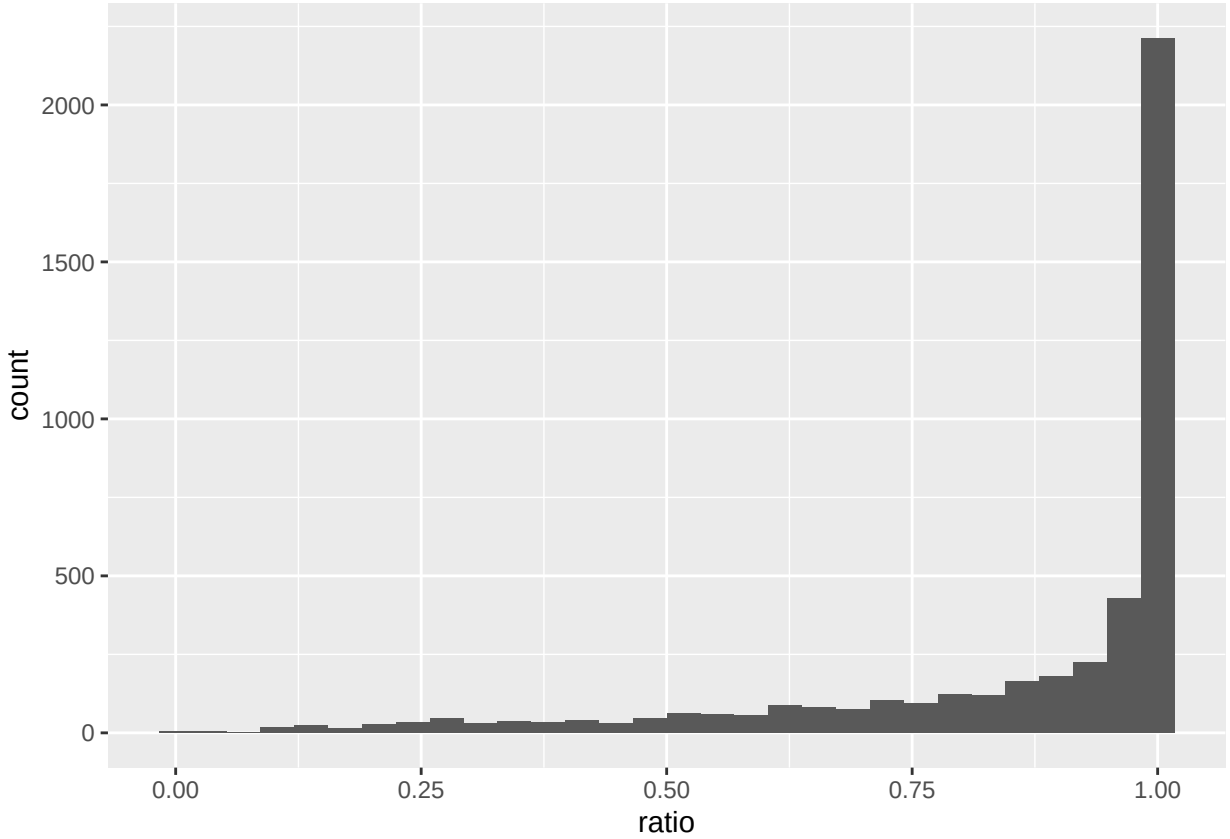
Here we see that we are some 0.864278208718872% worse (on average) than the absolute best. What is the rough distribution here? (Note that if we always picked the best model, we would get a ratio of 1 - the lower

we are, the worse.)

```
performance_vs_best_model %>%
  ggplot2::ggplot( ggplot2::aes(x = ratio)) +
  ggplot2::geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 35 rows containing non-finite values (stat_bin).
```



That looks like we pick the best model (or close to it) quite often - lets check:

```
performance_vs_best_model %>%
  dplyr::summarise( picked_almost_best = sum(ratio > 0.95, na.rm = TRUE)/length(na.omit(ratio)),
                    picked_best = sum(ratio == 1, na.rm = TRUE)/length(na.omit(ratio))) %>%
  knitr::kable()
```

picked_almost_best	picked_best
0.5877743	0.3640842

So we pick close to the best model about % of the time, and the absolute best model about 38% of the time.

How often do we fail (i.e. how often do we pick a model with a RMSE more than 20% worse than the best one) ?

```
bad <- performance_vs_best_model %>%
  dplyr::summarise( picked_bad = sum(ratio < 0.8, na.rm = TRUE)/length(na.omit(ratio)))
```

```
  knitr::kable(bad)
```

picked_bad
0.2451858

What are the scales for the series where we fail?

```
ordered <- performance_vs_best_model %>%
  dplyr::filter( ratio < 0.8  ) %>%
  dplyr::select( key, RMSE, selected_RMSE, ratio ) %>%
  dplyr::arrange( dplyr::desc(selected_RMSE) )
  knitr::kable(ordered)
```

key	RMSE	selected_RMSE	ratio
M4_9738	2.735562e+08	2.333234e+09	0.1172434
M4_9714	7.462330e+04	9.527516e+08	0.0000783
M4_9906	4.545848e+06	1.505360e+08	0.0301977
M4_9858	3.331803e+07	1.198829e+08	0.2779215
M4_9619	5.488418e+07	8.684024e+07	0.6320132
M4_9682	4.738150e+07	6.675637e+07	0.7097675
M4_9977	6.366614e+06	6.193055e+07	0.1028025
M4_9696	1.057207e+07	1.360350e+07	0.7771578
M4_9750	8.814041e+06	1.310845e+07	0.6723938
M4_9677	9.838431e+04	1.264443e+06	0.0778084
M4_9636	1.019638e+05	7.380172e+05	0.1381590
M4_9764	1.263556e+05	6.429312e+05	0.1965306
N0813	3.251632e+02	4.173625e+05	0.0007791
YAB3	1.810578e+05	3.910924e+05	0.4629540
M4_2204	1.271969e+05	3.695156e+05	0.3442261
M4_7945	8.561825e+04	3.570918e+05	0.2397654
M4_9780	1.228769e+05	2.964681e+05	0.4144693
M4_9576	4.501696e+03	1.624016e+05	0.0277195
YAI6	4.097255e+04	1.532508e+05	0.2673561
M4_9912	1.014035e+05	1.356488e+05	0.7475445
M4_7835	7.968733e+04	1.187698e+05	0.6709391
M4_9789	4.898215e+04	1.152991e+05	0.4248269
M4_9580	6.578752e+04	1.075550e+05	0.6116637
M4_9962	6.965323e+04	9.550525e+04	0.7293131
M4_3153	5.083325e+04	7.545830e+04	0.6736602
M4_9987	3.370211e+04	7.250055e+04	0.4648532
M4_3308	4.009511e+04	6.977722e+04	0.5746161
M4_9886	1.086288e+04	5.817402e+04	0.1867307
M4_9938	3.662282e+04	5.563813e+04	0.6582324
M4_9828	2.922929e+04	4.843360e+04	0.6034919
M4_3310	3.202024e+04	4.809011e+04	0.6658384
M4_9827	1.787108e+04	4.428805e+04	0.4035193
YAM30	2.821227e+04	4.109257e+04	0.6865541
M4_7991	2.735977e+04	4.094624e+04	0.6681875
M4_9834	2.071024e+04	3.790795e+04	0.5463298
M4_9988	4.669811e+03	3.687938e+04	0.1266239
M4_2761	1.763303e+04	3.679334e+04	0.4792451
M4_9594	1.919416e+04	3.159147e+04	0.6075743

key	RMSE	selected_RMSE	ratio
M4_9946	1.007666e+04	2.927401e+04	0.3442188
M4_3155	1.370098e+04	2.509021e+04	0.5460689
M4_4250	1.089544e+04	2.307551e+04	0.4721645
M4_9882	1.201896e+04	2.206938e+04	0.5445987
M4_3557	1.041371e+04	2.049462e+04	0.5081193
M4_3456	1.000450e+04	2.016603e+04	0.4961064
M4_9722	7.399164e+03	1.995334e+04	0.3708234
M4_9863	8.376618e+03	1.951827e+04	0.4291680
M4_3157	9.456363e+03	1.616029e+04	0.5851603
M4_7117	1.049082e+04	1.599658e+04	0.6558164
M4_7311	6.328831e+03	1.257468e+04	0.5032997
M4_9732	7.322602e+03	1.161857e+04	0.6302500
M4_7976	6.191364e+03	1.140303e+04	0.5429577
N1388	2.307792e+03	1.042021e+04	0.2214727
M4_2803	7.050511e+03	1.028264e+04	0.6856713
M4_2765	6.986238e+03	9.782582e+03	0.7141507
M4_7100	4.936582e+03	8.476088e+03	0.5824128
M4_3137	1.529260e+03	8.320196e+03	0.1838009
M4_2189	4.200068e+03	7.808484e+03	0.5378852
N1386	1.115307e+03	7.643810e+03	0.1459099
M4_9566	4.481673e+03	7.221905e+03	0.6205667
M4_9566	4.481673e+03	7.221905e+03	0.6205667
M4_9566	4.481673e+03	7.221905e+03	0.6205667
M4_9566	4.481673e+03	7.221905e+03	0.6205667
N1399	1.611397e+03	7.175096e+03	0.2245820
M4_3719	4.375617e+03	6.828771e+03	0.6407620
M4_3551	3.922181e+03	5.690978e+03	0.6891928
M4_3905	3.818252e+03	5.539938e+03	0.6892227
M4_7081	1.460204e+03	4.800013e+03	0.3042083
M4_7905	2.420431e+03	4.787388e+03	0.5055848
M4_9873	2.210073e+03	4.613062e+03	0.4790902
N0159	3.588460e+03	4.544350e+03	0.7896530
M4_3818	2.511968e+03	4.525366e+03	0.5550862
M4_7050	1.020290e+03	4.191124e+03	0.2434407
M4_7103	3.021759e+03	4.182660e+03	0.7224492
M4_3494	2.664242e+03	3.356479e+03	0.7937608
N1389	1.634486e+03	3.293741e+03	0.4962401
N2833	1.325757e+03	3.153873e+03	0.4203585
N0557	2.165060e+03	3.053184e+03	0.7091155
N1124	1.530369e+03	3.025910e+03	0.5057550
N1444	2.241366e+03	2.992404e+03	0.7490185
M4_3717	2.217912e+03	2.965212e+03	0.7479776
M4_3717	2.217912e+03	2.965212e+03	0.7479776
M4_3717	2.217912e+03	2.965212e+03	0.7479776
M4_3717	2.217912e+03	2.965212e+03	0.7479776
N2480	1.141314e+03	2.941286e+03	0.3880322
MNI148	2.019410e+03	2.880948e+03	0.7009531
M4_7179	2.210109e+03	2.792375e+03	0.7914801
M4_6578	1.836334e+03	2.717863e+03	0.6756537
N0798	2.117611e+03	2.714484e+03	0.7801155
N0339	1.208825e+03	2.696301e+03	0.4483271
N0988	7.681297e+02	2.631776e+03	0.2918674

key	RMSE	selected_RMSE	ratio
M4_3444	1.945733e+03	2.624019e+03	0.7415088
N1331	1.917906e+03	2.499224e+03	0.7674006
M4_2563	3.968675e+02	2.425457e+03	0.1636259
N2867	1.739359e+03	2.424799e+03	0.7173209
M4_3407	1.722476e+03	2.421179e+03	0.7114203
N0346	9.759780e+02	2.395043e+03	0.4074991
N1820	1.573082e+03	2.380020e+03	0.6609532
N0186	1.213883e+03	2.326434e+03	0.5217784
M4_2705	7.891328e+02	2.282738e+03	0.3456957
N0802	3.458176e+02	2.270333e+03	0.1523202
N0350	1.206004e+03	2.231954e+03	0.5403354
N0926	1.539386e+03	2.187112e+03	0.7038439
N2661	5.560037e+02	2.158331e+03	0.2576082
M4_7588	1.256503e+03	2.100137e+03	0.5982958
N1555	7.856441e+02	2.084853e+03	0.3768343
M4_7571	1.520669e+03	2.081781e+03	0.7304655
M4_3560	6.828463e+02	1.995285e+03	0.3422299
MRB30	1.340586e+03	1.977942e+03	0.6777680
M4_7613	1.560684e+03	1.975540e+03	0.7900036
M4_7501	1.110177e+03	1.901397e+03	0.5838744
M4_2766	1.313848e+03	1.885899e+03	0.6966694
M4_2679	6.527719e+02	1.882914e+03	0.3466816
MRM4	5.907217e+02	1.876923e+03	0.3147288
N0573	4.011244e+02	1.814885e+03	0.2210192
M4_2605	1.353988e+03	1.786333e+03	0.7579707
N2662	1.088333e+03	1.724031e+03	0.6312724
N0191	1.175659e+03	1.646256e+03	0.7141408
N0394	1.082589e+03	1.646118e+03	0.6576620
N2159	5.231511e+02	1.635612e+03	0.3198503
M4_7097	1.150293e+03	1.607187e+03	0.7157182
M4_3817	2.211194e+02	1.603581e+03	0.1378910
N0770	6.178412e+02	1.601826e+03	0.3857104
M4_9511	9.904110e+02	1.546769e+03	0.6403097
N1401	6.203781e+02	1.535760e+03	0.4039550
M4_7138	1.183337e+03	1.483428e+03	0.7977045
N0824	7.721915e+02	1.482711e+03	0.5207971
N0382	7.587185e+02	1.480708e+03	0.5124026
YAM24	1.095539e+03	1.447260e+03	0.7569744
M4_3825	3.882924e+02	1.443935e+03	0.2689127
N0348	9.023211e+02	1.436104e+03	0.6283116
N1286	6.841889e+02	1.408493e+03	0.4857597
N2745	8.044253e+02	1.405849e+03	0.5721989
N0931	8.858970e+02	1.403188e+03	0.6313458
N1197	1.588490e+02	1.379791e+03	0.1151254
N1513	7.408940e+02	1.367914e+03	0.5416234
M4_7395	9.239508e+02	1.319309e+03	0.7003293
N1893	9.583355e+02	1.269960e+03	0.7546189
N1981	5.947882e+02	1.212542e+03	0.4905298
N0187	9.096187e+02	1.207330e+03	0.7534134
N0187	9.096187e+02	1.207330e+03	0.7534134
N0187	9.096187e+02	1.207330e+03	0.7534134
N0187	9.096187e+02	1.207330e+03	0.7534134

key	RMSE	selected_RMSE	ratio
N0876	4.523352e+02	1.202454e+03	0.3761765
MNM25	8.766445e+02	1.187083e+03	0.7384861
MNM25	8.766445e+02	1.187083e+03	0.7384861
MNM25	8.766445e+02	1.187083e+03	0.7384861
MNM25	8.766445e+02	1.187083e+03	0.7384861
N0692	5.802040e+02	1.176558e+03	0.4931369
N0697	8.685615e+02	1.155592e+03	0.7516159
N2204	5.749625e+02	1.136534e+03	0.5058911
N0867	7.029133e+02	1.104171e+03	0.6365985
MNM29	7.940769e+02	1.097487e+03	0.7235412
N0993	6.926717e+02	1.092106e+03	0.6342528
M4_3691	7.036134e+02	1.075553e+03	0.6541874
N0761	7.554936e+02	1.070022e+03	0.7060543
M4_4977	5.114905e+02	1.065928e+03	0.4798547
N1851	2.804152e+02	1.055102e+03	0.2657706
MNI9	5.912095e+02	1.047076e+03	0.5646288
M4_7649	4.739504e+02	1.024436e+03	0.4626453
N1829	5.843647e+02	1.011478e+03	0.5777335
N0582	3.949000e+02	9.917372e+02	0.3981902
N0633	3.137262e+02	9.893694e+02	0.3170971
M4_7598	6.634420e+02	9.798832e+02	0.6770623
M4_7002	7.767018e+02	9.785439e+02	0.7937322
M4_7595	7.138766e+02	9.714912e+02	0.7348256
M4_9608	6.302851e+02	9.538961e+02	0.6607481
N1866	3.597231e+02	9.505992e+02	0.3784172
N1943	4.920174e+02	9.500117e+02	0.5179066
N0176	1.954306e+02	9.368075e+02	0.2086134
N0685	2.287407e+02	9.365331e+02	0.2442419
N1300	3.346784e+02	9.211198e+02	0.3633386
N2476	5.311636e+02	9.184558e+02	0.5783224
MRB4	4.967614e+02	8.935489e+02	0.5559421
N2536	5.784849e+02	8.918109e+02	0.6486632
QRG17	4.550558e+02	8.911864e+02	0.5106180
N1937	6.279969e+02	8.859209e+02	0.7088634
N0209	2.454648e+02	8.789660e+02	0.2792654
N0168	5.479150e+02	8.725684e+02	0.6279336
N0660	5.461885e+01	8.674364e+02	0.0629658
N2145	6.284429e+02	8.591616e+02	0.7314607
N2123	4.651632e+02	8.582756e+02	0.5419741
N1024	5.932875e+02	8.564139e+02	0.6927580
MNM11	3.060854e+02	8.494624e+02	0.3603284
N0424	4.098033e+02	8.486561e+02	0.4828850
M4_7069	3.956996e+02	8.443673e+02	0.4686344
N1306	5.298821e+02	8.435333e+02	0.6281697
M4_2416	6.304734e+02	8.264425e+02	0.7628763
N2737	5.397919e+02	8.085652e+02	0.6675923
N0309	6.120383e+02	8.064537e+02	0.7589255
N0529	1.793140e+02	8.053437e+02	0.2226553
N1894	2.920433e+02	7.932280e+02	0.3681706
M4_6515	5.163023e+02	7.897756e+02	0.6537329
N0363	5.308744e+02	7.786487e+02	0.6817893
N2089	5.669132e+02	7.747092e+02	0.7317755

key	RMSE	selected_RMSE	ratio
M4_7023	5.974686e+02	7.559362e+02	0.7903690
N0707	3.193442e+02	7.532067e+02	0.4239795
M4_3519	5.631467e+02	7.473213e+02	0.7535537
MNI118	2.163774e+02	7.470552e+02	0.2896404
N0157	5.162185e+02	7.454373e+02	0.6925042
N2547	5.497230e+02	7.447504e+02	0.7381305
N0467	2.703371e+02	7.445787e+02	0.3630739
N1452	5.638013e+02	7.437661e+02	0.7580358
M4_2025	2.654888e+02	7.367622e+02	0.3603453
M4_3515	4.805508e+02	7.334529e+02	0.6551898
N2097	3.981233e+02	7.299896e+02	0.5453822
N0533	3.017778e+02	7.240362e+02	0.4167994
N1321	5.702117e+02	7.178612e+02	0.7943202
N0653	3.106543e+02	7.176221e+02	0.4328941
M4_7063	5.542111e+02	7.140751e+02	0.7761244
N0466	5.401917e+02	7.125872e+02	0.7580710
N0844	4.820240e+02	7.044981e+02	0.6842090
N1501	5.213230e+02	7.029854e+02	0.7415845
N2489	5.450186e+02	7.015446e+02	0.7768838
N2130	4.624486e+02	7.011084e+02	0.6595965
N2482	3.437535e+02	6.910982e+02	0.4974019
M4_3875	2.568780e+02	6.910025e+02	0.3717469
M4_2136	3.706547e+02	6.784944e+02	0.5462899
N1970	1.600174e+02	6.702472e+02	0.2387439
N1183	3.958442e+02	6.644070e+02	0.5957856
N1183	3.958442e+02	6.644070e+02	0.5957856
N1183	3.958442e+02	6.644070e+02	0.5957856
N1183	3.958442e+02	6.644070e+02	0.5957856
MNM35	5.031851e+02	6.616114e+02	0.7605448
N0462	2.373979e+02	6.570425e+02	0.3613129
N1881	4.658494e+02	6.461334e+02	0.7209803
N1064	3.605012e+02	6.444476e+02	0.5593957
N1689	4.856915e+02	6.383699e+02	0.7608308
M4_7025	5.040040e+02	6.363827e+02	0.7919826
N2614	3.864361e+02	6.334662e+02	0.6100343
N1710	4.200587e+02	6.315346e+02	0.6651397
M4_7124	4.852645e+02	6.282118e+02	0.7724537
N1327	4.970131e+02	6.251534e+02	0.7950258
N0238	7.345777e+01	6.249015e+02	0.1175510
N1850	4.160205e+02	6.230121e+02	0.6677568
N1133	1.664843e+02	6.218906e+02	0.2677067
N1385	4.705316e+02	6.217940e+02	0.7567323
M4_6814	1.247457e+02	6.212650e+02	0.2007931
N1826	3.451920e+02	6.161356e+02	0.5602533
M4_3731	3.444246e+02	6.135797e+02	0.5613363
N0904	1.206148e+02	6.040359e+02	0.1996815
N1167	3.205847e+02	5.936952e+02	0.5399820
N1235	3.133833e+02	5.926347e+02	0.5287968
N0705	3.322432e+02	5.923524e+02	0.5608877
N0370	3.822993e+02	5.878718e+02	0.6503107
N1116	1.993368e+02	5.872470e+02	0.3394428
N1945	4.094258e+02	5.762202e+02	0.7105370

key	RMSE	selected_RMSE	ratio
N2461	4.033595e+02	5.755617e+02	0.7008102
N0381	2.081385e+02	5.753969e+02	0.3617303
N1570	3.728923e+02	5.746103e+02	0.6489483
M4_9013	1.354326e+02	5.745234e+02	0.2357304
N1254	1.280879e+02	5.526416e+02	0.2317739
M4_7664	3.765086e+02	5.513599e+02	0.6828727
QRI1	3.849994e+02	5.463857e+02	0.7046294
N1129	1.237050e+02	5.456978e+02	0.2266915
N0198	2.839057e+02	5.444750e+02	0.5214302
N0496	3.978886e+02	5.433273e+02	0.7323185
N0496	3.978886e+02	5.433273e+02	0.7323185
N0496	3.978886e+02	5.433273e+02	0.7323185
N0496	3.978886e+02	5.433273e+02	0.7323185
QND19	3.515817e+02	5.430801e+02	0.6473846
N0899	2.063036e+02	5.374959e+02	0.3838236
N2091	2.053232e+02	5.328729e+02	0.3853138
N1156	4.081706e+02	5.235095e+02	0.7796815
M4_2635	5.664082e+01	5.209869e+02	0.1087183
M4_2635	5.664082e+01	5.209869e+02	0.1087183
M4_2635	5.664082e+01	5.209869e+02	0.1087183
M4_2635	5.664082e+01	5.209869e+02	0.1087183
N1725	2.508268e+02	5.168554e+02	0.4852941
N0854	3.370713e+02	5.162304e+02	0.6529474
MRB15	3.260198e+02	5.156204e+02	0.6322865
N0428	3.032096e+02	4.985183e+02	0.6082216
N0682	1.306663e+02	4.932453e+02	0.2649114
M4_6633	1.269440e+02	4.909331e+02	0.2585770
N1148	5.895981e+01	4.891575e+02	0.1205334
M4_2030	3.302682e+02	4.819592e+02	0.6852618
N2869	2.389648e+02	4.810332e+02	0.4967741
N0294	1.645560e+02	4.780261e+02	0.3442406
MNI22	1.381691e+02	4.758550e+02	0.2903597
N1363	2.838104e+02	4.722661e+02	0.6009544
N0593	3.147376e+02	4.660166e+02	0.6753785
N2484	3.584683e+02	4.646508e+02	0.7714789
N0611	3.084081e+02	4.541363e+02	0.6791090
N0994	3.231617e+02	4.530507e+02	0.7133014
M4_7436	1.618159e+01	4.514357e+02	0.0358447
N0618	3.084648e+02	4.493495e+02	0.6864698
N0226	2.659980e+02	4.488446e+02	0.5926282
M4_6996	3.352099e+02	4.475163e+02	0.7490452
N2188	2.353166e+02	4.472855e+02	0.5260993
N2856	1.152449e+02	4.465219e+02	0.2580945
N1996	3.139463e+02	4.450149e+02	0.7054736
N0272	1.276049e+02	4.411322e+02	0.2892667
N1757	3.362288e+02	4.404580e+02	0.7633617
N2196	2.369171e+02	4.383472e+02	0.5404782
N0501	1.800781e+02	4.310022e+02	0.4178125
N2555	3.285002e+02	4.302167e+02	0.7635691
M4_3814	2.143285e+02	4.252308e+02	0.5040286
N2443	2.315830e+02	4.235344e+02	0.5467869
MRI3	2.213463e+02	4.216430e+02	0.5249612

key	RMSE	selected_RMSE	ratio
N0308	3.311794e+02	4.209421e+02	0.7867574
N2648	2.372799e+02	4.183591e+02	0.5671680
M4_2016	3.056998e+02	4.153177e+02	0.7360625
M4_6659	2.953396e+02	4.144319e+02	0.7126374
N1253	1.192298e+02	4.140836e+02	0.2879367
N2172	1.930141e+02	4.130475e+02	0.4672928
N1858	2.797687e+02	4.122727e+02	0.6786012
YAM28	1.346874e+02	4.018856e+02	0.3351387
N0601	3.075074e+02	3.982140e+02	0.7722164
N0651	1.651920e+02	3.919404e+02	0.4214723
N2168	1.229748e+02	3.913035e+02	0.3142696
M4_7630	2.792988e+02	3.883084e+02	0.7192705
N1244	2.862658e+02	3.853839e+02	0.7428069
M4_7035	2.553284e+02	3.833073e+02	0.6661192
M4_4336	2.518881e+02	3.822694e+02	0.6589282
M4_6503	1.696878e+02	3.817414e+02	0.4445098
N1305	2.562359e+02	3.762581e+02	0.6810111
N0166	4.033495e+01	3.755605e+02	0.1073993
N1876	2.072656e+02	3.754406e+02	0.5520596
N0505	1.058247e+02	3.745878e+02	0.2825096
M4_2805	1.384089e+02	3.736512e+02	0.3704228
N2928	1.910606e+02	3.736198e+02	0.5113771
N1123	2.963975e+02	3.715180e+02	0.7978012
N2394	2.781278e+02	3.693777e+02	0.7529632
N0497	2.284993e+02	3.651326e+02	0.6257982
N2434	2.262227e+02	3.641212e+02	0.6212839
N2114	2.629616e+02	3.610100e+02	0.7284052
M4_7068	2.409470e+02	3.594584e+02	0.6703058
N0859	4.875613e+01	3.577329e+02	0.1362920
N2551	7.159906e+01	3.575599e+02	0.2002436
N2551	7.159906e+01	3.575599e+02	0.2002436
N2551	7.159906e+01	3.575599e+02	0.2002436
N2551	7.159906e+01	3.575599e+02	0.2002436
N2364	2.161484e+02	3.575191e+02	0.6045785
M4_2528	2.084783e+02	3.564664e+02	0.5848470
M4_7251	1.358966e+02	3.552541e+02	0.3825335
N1718	1.460523e+02	3.546816e+02	0.4117842
M4_7030	1.620178e+02	3.545026e+02	0.4570286
YAI21	2.176383e+02	3.527559e+02	0.6169659
N1812	2.539943e+02	3.511665e+02	0.7232872
M4_6979	1.932201e+02	3.473594e+02	0.5562542
N0515	2.715707e+02	3.432740e+02	0.7911193
QNG24	1.970709e+02	3.426994e+02	0.5750548
MNI136	1.350277e+02	3.386905e+02	0.3986757
N1190	1.767686e+02	3.364393e+02	0.5254102
M4_3240	6.110452e+01	3.339184e+02	0.1829924
M4_2198	7.566818e+01	3.317502e+02	0.2280878
M4_6513	2.592025e+02	3.304437e+02	0.7844072
N0536	2.168239e+02	3.304421e+02	0.6561629
M4_7627	9.130145e+01	3.281475e+02	0.2782330
M4_7626	1.623067e+02	3.258425e+02	0.4981139
N0287	8.602851e+01	3.205088e+02	0.2684123

key	RMSE	selected_RMSE	ratio
M4_6640	1.524351e+02	3.166937e+02	0.4813330
M4_2466	3.397510e+01	3.156629e+02	0.1076310
M4_3865	1.848732e+02	3.129440e+02	0.5907548
N2170	2.011018e+02	3.110858e+02	0.6464513
N1025	1.640371e+02	3.101621e+02	0.5288755
M4_4515	8.835013e+01	3.096042e+02	0.2853648
N2471	2.234363e+02	3.047907e+02	0.7330810
N2769	1.989252e+02	3.040193e+02	0.6543175
N2504	1.596211e+02	3.034079e+02	0.5260942
M4_6737	1.643078e+02	3.017705e+02	0.5444793
N1957	2.051078e+02	3.000608e+02	0.6835542
N2541	1.560272e+02	2.960446e+02	0.5270394
N1395	1.532343e+02	2.916759e+02	0.5253582
N1288	1.325369e+02	2.900415e+02	0.4569583
N0258	1.075611e+02	2.890454e+02	0.3721253
N1482	1.536184e+02	2.851980e+02	0.5386377
N0518	1.270078e+02	2.825213e+02	0.4495513
M4_3350	1.492375e+02	2.816753e+02	0.5298211
N1140	7.206200e+01	2.789430e+02	0.2583395
M4_3919	2.032626e+02	2.734427e+02	0.7433463
MNM28	1.747331e+02	2.685974e+02	0.6505392
N1735	2.133325e+02	2.684098e+02	0.7948015
N1270	6.391100e+01	2.676707e+02	0.2387672
M4_6546	1.885339e+02	2.672861e+02	0.7053637
N1810	1.882123e+02	2.651269e+02	0.7098952
N1031	1.745128e+02	2.632887e+02	0.6628194
N1031	1.745128e+02	2.632887e+02	0.6628194
N1031	1.745128e+02	2.632887e+02	0.6628194
N1031	1.745128e+02	2.632887e+02	0.6628194
N2734	1.303349e+02	2.622209e+02	0.4970423
N0251	1.618254e+02	2.619265e+02	0.6178276
M4_2806	1.835920e+02	2.561320e+02	0.7167866
N2135	1.953724e+02	2.516073e+02	0.7764974
N1997	7.415692e+01	2.474961e+02	0.2996287
M4_3609	1.487866e+02	2.397030e+02	0.6207123
M4_7752	1.703000e+02	2.331598e+02	0.7304002
N0689	1.359012e+02	2.326544e+02	0.5841335
N2763	1.483240e+02	2.324544e+02	0.6380776
M4_3936	1.765262e+02	2.319117e+02	0.7611786
N1392	1.738481e+02	2.302170e+02	0.7551489
N0438	1.443231e+02	2.300296e+02	0.6274109
M4_2666	1.253488e+02	2.293020e+02	0.5466537
M4_7853	1.681363e+02	2.272833e+02	0.7397651
N0792	1.526681e+02	2.252379e+02	0.6778082
M4_4374	1.141730e+02	2.231196e+02	0.5117123
M4_6599	1.744652e+02	2.221215e+02	0.7854491
N1058	1.107262e+02	2.211985e+02	0.5005742
N2448	9.376101e+01	2.186512e+02	0.4288155
N0286	7.416937e+01	2.162872e+02	0.3429207
N1514	1.325265e+02	2.119219e+02	0.6253556
N0939	1.254062e+02	2.115959e+02	0.5926682
M4_4180	1.531448e+02	2.104657e+02	0.7276471

key	RMSE	selected_RMSE	ratio
M4_9271	4.652508e+01	2.084902e+02	0.2231523
M4_3788	3.228267e+01	2.071923e+02	0.1558102
M4_2485	6.372709e+01	2.057942e+02	0.3096641
N1924	6.648086e+01	2.057867e+02	0.3230571
N1245	1.004244e+02	2.023653e+02	0.4962533
N1245	1.004244e+02	2.023653e+02	0.4962533
N1245	1.004244e+02	2.023653e+02	0.4962533
N1245	1.004244e+02	2.023653e+02	0.4962533
M4_9272	1.247138e+02	2.003223e+02	0.6225658
N2026	1.466531e+02	1.999573e+02	0.7334223
M4_7106	1.553155e+02	1.998641e+02	0.7771054
N1175	1.345573e+02	1.978707e+02	0.6800262
M4_2483	7.877312e+01	1.971470e+02	0.3995653
M4_7919	1.254274e+02	1.955599e+02	0.6413756
M4_2537	3.574792e+01	1.940969e+02	0.1841756
N2936	4.604327e+01	1.885810e+02	0.2441565
N2891	1.230396e+02	1.872963e+02	0.6569251
N2442	8.924879e+01	1.870505e+02	0.4771375
N2743	1.228487e+02	1.851613e+02	0.6634688
QNI12	4.810458e+01	1.819056e+02	0.2644481
QNI12	4.810458e+01	1.819056e+02	0.2644481
QNI12	4.810458e+01	1.819056e+02	0.2644481
QNI12	4.810458e+01	1.819056e+02	0.2644481
M4_3175	1.305222e+02	1.811154e+02	0.7206579
N1204	1.309280e+02	1.807662e+02	0.7242950
N1194	1.142558e+02	1.788377e+02	0.6388798
N0950	6.559269e+01	1.779325e+02	0.3686381
M4_4189	6.200358e+00	1.756075e+02	0.0353080
M4_6877	9.412997e+01	1.736334e+02	0.5421189
N1184	1.273097e+02	1.732408e+02	0.7348714
M4_6762	3.528376e+01	1.724869e+02	0.2045590
M4_9199	1.060822e+02	1.716033e+02	0.6181825
M4_9222	1.348252e+02	1.713877e+02	0.7866676
MNB17	1.046178e+02	1.699806e+02	0.6154687
M4_6592	9.063344e+01	1.683907e+02	0.5382329
M4_2220	4.510281e+01	1.669981e+02	0.2700797
M4_2700	1.253048e+02	1.656495e+02	0.7564457
N2564	1.237680e+02	1.640893e+02	0.7542724
N0944	1.286774e+02	1.631520e+02	0.7886967
M4_6587	7.493930e+01	1.604781e+02	0.4669753
N2812	8.568061e+01	1.602567e+02	0.5346460
M4_2669	8.419741e+01	1.579759e+02	0.5329764
N1271	7.444330e+01	1.556417e+02	0.4782991
N1236	8.093795e+01	1.547007e+02	0.5231908
MNG12	9.802377e+01	1.541807e+02	0.6357721
M4_9105	3.889156e+01	1.536734e+02	0.2530794
N2485	7.193251e+01	1.515046e+02	0.4747876
N2524	9.539619e+01	1.513353e+02	0.6303633
N1056	4.129308e+01	1.491853e+02	0.2767906
N1056	4.129308e+01	1.491853e+02	0.2767906
N1056	4.129308e+01	1.491853e+02	0.2767906
N1056	4.129308e+01	1.491853e+02	0.2767906

key	RMSE	selected_RMSE	ratio
M4_6653	1.177969e+02	1.490915e+02	0.7900981
M4_6718	1.076899e+02	1.487464e+02	0.7239830
N0893	9.727734e+01	1.458830e+02	0.6668173
M4_3388	7.428828e+01	1.447667e+02	0.5131587
M4_2188	1.093736e+02	1.430952e+02	0.7643412
N2954	1.456914e+01	1.412948e+02	0.1031117
N2954	1.456914e+01	1.412948e+02	0.1031117
N2954	1.456914e+01	1.412948e+02	0.1031117
N2954	1.456914e+01	1.412948e+02	0.1031117
N3003	6.304454e+01	1.398195e+02	0.4508993
N2023	1.005903e+02	1.369432e+02	0.7345403
N2898	6.954023e+01	1.368282e+02	0.5082301
N2382	3.083954e+01	1.362922e+02	0.2262752
N2884	2.548906e+01	1.362871e+02	0.1870247
M4_7929	7.899885e+01	1.359416e+02	0.5811235
M4_4230	1.051874e+02	1.356227e+02	0.7755879
M4_3705	4.809841e+01	1.351754e+02	0.3558223
N2408	4.230337e+01	1.350465e+02	0.3132503
M4_4056	2.982281e+01	1.340743e+02	0.2224350
M4_6826	9.721703e+01	1.337411e+02	0.7269044
M4_6826	9.721703e+01	1.337411e+02	0.7269044
M4_6826	9.721703e+01	1.337411e+02	0.7269044
M4_6826	9.721703e+01	1.337411e+02	0.7269044
N2219	5.640635e+01	1.334862e+02	0.4225632
N2303	4.609249e+01	1.316500e+02	0.3501139
M4_7867	3.900562e+01	1.309825e+02	0.2977927
M4_4652	3.219731e+01	1.301496e+02	0.2473869
M4_4451	5.759755e+01	1.295506e+02	0.4445950
N0430	1.008112e+02	1.281650e+02	0.7865737
N2923	5.358694e+01	1.267727e+02	0.4227010
N0852	5.087540e+01	1.262962e+02	0.4028260
M4_7215	8.905504e+01	1.254571e+02	0.7098447
N2844	8.481289e+01	1.245019e+02	0.6812176
M4_3387	6.083973e+01	1.243570e+02	0.4892344
MNI71	7.927594e+01	1.242245e+02	0.6381669
M4_2460	8.041490e+01	1.236681e+02	0.6502479
M4_6761	3.438063e+01	1.234921e+02	0.2784035
N1047	4.307092e+01	1.227143e+02	0.3509854
M4_2480	4.267763e+01	1.212871e+02	0.3518728
N0471	5.495453e+01	1.204358e+02	0.4562971
N2942	3.442382e+01	1.199199e+02	0.2870568
N1711	9.226056e+01	1.185416e+02	0.7782970
N0957	3.058340e+01	1.178804e+02	0.2594443
M4_2637	7.298052e+01	1.174017e+02	0.6216307
M4_6763	5.537466e+01	1.171381e+02	0.4727297
M4_6654	7.345514e+01	1.154402e+02	0.6363046
M4_4806	5.231918e+01	1.143346e+02	0.4575971
N2424	5.955520e+01	1.139230e+02	0.5227672
M4_7547	3.705547e+01	1.117591e+02	0.3315655
M4_4946	5.002758e+01	1.103210e+02	0.4534729
N2313	5.383736e+01	1.082034e+02	0.4975571
N1117	5.960722e+01	1.052471e+02	0.5663552

key	RMSE	selected_RMSE	ratio
M4_6516	5.592080e+01	1.028703e+02	0.5436051
M4_6934	7.415364e+01	1.019325e+02	0.7274780
N1774	6.850686e+01	9.879677e+01	0.6934119
N1865	5.958444e+01	9.866843e+01	0.6038856
N2270	7.049792e+01	9.745180e+01	0.7234132
N2999	1.332068e+01	9.688579e+01	0.1374885
M4_9190	5.573316e+01	9.679388e+01	0.5757922
M4_2445	6.002434e+01	9.657879e+01	0.6215065
M4_9089	3.097945e+01	9.553555e+01	0.3242714
M4_7478	6.558111e+01	9.422466e+01	0.6960079
YAG8	1.810747e+01	9.273028e+01	0.1952703
N2727	6.169216e+01	9.193901e+01	0.6710118
M4_3323	2.942102e+01	9.113018e+01	0.3228461
N0963	5.511438e+01	9.110775e+01	0.6049363
N1847	5.109354e+01	9.107510e+01	0.5610045
M4_7926	4.245096e+01	9.102324e+01	0.4663749
N2817	4.566397e+01	9.029926e+01	0.5056960
MRC31	3.699493e+01	8.922149e+01	0.4146415
M4_2452	5.774003e+01	8.912487e+01	0.6478554
M4_9212	6.459754e+01	8.792488e+01	0.7346901
M4_4995	3.840866e+01	8.746538e+01	0.4391299
QNF3	5.101478e+01	8.574751e+01	0.5949418
M4_2003	4.077588e+01	8.548418e+01	0.4769991
N2220	4.940580e+01	8.515068e+01	0.5802162
M4_3709	5.416548e+01	8.425248e+01	0.6428948
N2319	5.235494e+01	8.148945e+01	0.6424751
N1369	6.316150e+01	7.975690e+01	0.7919252
M4_6859	4.783314e+01	7.710028e+01	0.6204016
M4_6859	4.783314e+01	7.710028e+01	0.6204016
M4_6859	4.783314e+01	7.710028e+01	0.6204016
M4_6859	4.783314e+01	7.710028e+01	0.6204016
M4_3988	3.484560e+01	7.658170e+01	0.4550120
M4_9248	4.706772e+01	7.649696e+01	0.6152887
QND17	2.574242e+01	7.555349e+01	0.3407178
N2703	3.832702e+01	7.369154e+01	0.5201007
M4_4255	3.683191e+01	7.334301e+01	0.5021870
M4_6768	4.248571e+01	7.312205e+01	0.5810246
M4_4887	3.691499e+01	7.281301e+01	0.5069834
N2585	9.853521e+00	6.988062e+01	0.1410051
N2716	3.610833e+01	6.787343e+01	0.5319951
N2248	5.126228e+01	6.767046e+01	0.7575281
N2223	3.271610e+01	6.515812e+01	0.5021031
N2688	3.737878e+01	6.503203e+01	0.5747749
M4_9348	4.507842e+01	6.421642e+01	0.7019767
M4_7067	4.518484e+01	6.421625e+01	0.7036356
M4_7067	4.518484e+01	6.421625e+01	0.7036356
M4_7067	4.518484e+01	6.421625e+01	0.7036356
M4_7067	4.518484e+01	6.421625e+01	0.7036356
N2940	3.712504e+01	6.341877e+01	0.5853951
M4_9088	1.060918e+01	6.235495e+01	0.1701417
QRM1	3.424549e+01	6.181324e+01	0.5540155
M4_6745	1.271215e+01	6.154617e+01	0.2065465

key	RMSE	selected_RMSE	ratio
M4_9450	1.887486e+01	6.007611e+01	0.3141824
M4_9192	4.119348e+01	5.983187e+01	0.6884873
N2890	8.217646e+00	5.831078e+01	0.1409284
N2913	1.784657e+01	5.785362e+01	0.3084780
N2428	3.828946e+01	5.659865e+01	0.6765083
M4_7322	3.657760e+01	5.628052e+01	0.6499159
M4_4007	6.932876e+00	5.627314e+01	0.1232004
N2943	2.106429e+01	5.613296e+01	0.3752571
M4_3766	3.496002e+01	5.597522e+01	0.6245625
M4_7920	4.279081e+01	5.596422e+01	0.7646100
MNI6	4.239320e+01	5.595015e+01	0.7576960
M4_7997	2.967471e+01	5.580195e+01	0.5317862
N2246	2.917150e+01	5.365709e+01	0.5436653
N1028	3.270389e+01	5.306336e+01	0.6163176
M4_3562	3.814622e+01	5.260390e+01	0.7251595
M4_2497	3.612185e+01	5.188311e+01	0.6962159
M4_2069	4.040739e+01	5.170474e+01	0.7815027
QNB8	2.600855e+01	5.120048e+01	0.5079746
M4_2018	2.495485e+01	5.085885e+01	0.4906688
M4_9778	1.533136e+01	5.054203e+01	0.3033388
N2238	3.913472e+01	5.053059e+01	0.7744759
M4_4992	3.437682e+01	5.049669e+01	0.6807737
M4_3380	2.473021e+01	5.029420e+01	0.4917109
N2997	3.640676e+01	4.998048e+01	0.7284196
M4_6924	3.740806e+01	4.969054e+01	0.7528206
M4_9398	7.373198e+00	4.949711e+01	0.1489622
MND59	3.701586e+01	4.915435e+01	0.7530536
M4_2360	3.054651e+01	4.904721e+01	0.6227982
M4_2657	1.589366e+01	4.781861e+01	0.3323739
N2294	1.602528e+01	4.776582e+01	0.3354967
M4_2042	1.988411e+01	4.774286e+01	0.4164834
MNI89	2.684064e+01	4.529953e+01	0.5925148
N0940	2.762041e+01	4.461840e+01	0.6190362
M4_8537	1.256277e+01	4.461398e+01	0.2815882
YAG20	9.249245e+00	4.421968e+01	0.2091658
M4_2450	1.689178e+01	4.385831e+01	0.3851445
M4_9249	2.906122e+01	4.329784e+01	0.6711932
M4_4824	2.610956e+00	4.289684e+01	0.0608659
N2700	1.344688e+01	4.235892e+01	0.3174509
M4_4974	3.099944e+01	4.221821e+01	0.7342670
M4_2078	1.077779e+01	4.153252e+01	0.2595024
M4_3241	2.989502e+01	4.060680e+01	0.7362073
N2228	2.364684e+01	3.991566e+01	0.5924202
M4_6920	2.629757e+01	3.989397e+01	0.6591866
M4_9268	3.112070e+01	3.908449e+01	0.7962417
M4_3934	2.911648e+01	3.898271e+01	0.7469075
MNB72	2.840026e+01	3.786782e+01	0.7499840
M4_9408	1.830302e+01	3.730549e+01	0.4906254
M4_3960	1.972177e+01	3.711459e+01	0.5313750
N2829	8.368733e+00	3.701073e+01	0.2261164
M4_7203	1.336464e+01	3.652806e+01	0.3658733
N2669	2.113409e+01	3.627963e+01	0.5825332

key	RMSE	selected_RMSE	ratio
MND21	5.244455e+00	3.619290e+01	0.1449029
M4_4554	2.052813e+01	3.614554e+01	0.5679299
YAD7	2.656479e+01	3.613819e+01	0.7350890
M4_2376	2.623303e+01	3.613530e+01	0.7259669
M4_9354	2.071315e+01	3.613408e+01	0.5732303
M4_2345	2.057933e+01	3.605827e+01	0.5707242
M4_9494	1.512496e+01	3.581161e+01	0.4223478
MNC16	4.429106e+00	3.551909e+01	0.1246965
N2278	2.533941e+01	3.550628e+01	0.7136601
N1240	7.317162e+00	3.520408e+01	0.2078498
M4_3847	1.191284e+01	3.517387e+01	0.3386845
M4_2656	1.813675e+01	3.515034e+01	0.5159764
M4_3223	2.075826e+01	3.503103e+01	0.5925677
N1374	2.216850e+01	3.485199e+01	0.6360756
MRG13	6.569445e+00	3.376085e+01	0.1945876
M4_6724	2.594792e+01	3.356488e+01	0.7730676
N2910	2.501247e+01	3.280705e+01	0.7624114
MNI39	2.043103e+01	3.161636e+01	0.6462171
N1883	1.637553e+01	3.158157e+01	0.5185155
M4_4825	9.751923e+00	3.127803e+01	0.3117819
M4_4815	9.588536e+00	3.096518e+01	0.3096554
M4_9024	1.990102e+01	3.025446e+01	0.6577881
M4_3663	2.065005e+01	2.999761e+01	0.6883900
M4_9434	2.108567e+01	2.994641e+01	0.7041134
M4_9469	2.116583e+01	2.975817e+01	0.7112611
M4_2365	1.801484e+01	2.965058e+01	0.6075714
N2809	1.426925e+01	2.917218e+01	0.4891390
M4_3661	1.727602e+01	2.882556e+01	0.5993300
M4_7948	1.963418e+01	2.799601e+01	0.7013207
M4_3324	1.152722e+01	2.787093e+01	0.4135931
M4_9401	1.606345e+01	2.755862e+01	0.5828828
M4_8447	1.777050e+01	2.726975e+01	0.6516561
M4_4905	6.974068e+00	2.717534e+01	0.2566322
M4_3938	1.667782e+01	2.714622e+01	0.6143699
M4_4310	1.793863e+01	2.706553e+01	0.6627853
M4_9482	1.854008e+01	2.639428e+01	0.7024281
M4_2476	7.792861e+00	2.609035e+01	0.2986875
M4_2587	1.518391e+01	2.607523e+01	0.5823118
M4_9207	1.860467e+01	2.604647e+01	0.7142876
M4_11	1.329246e+01	2.570705e+01	0.5170745
N0968	1.364517e+01	2.516675e+01	0.5421904
N2824	1.778538e+01	2.509420e+01	0.7087448
N2960	1.022662e+01	2.501732e+01	0.4087816
M4_2698	1.345686e+01	2.477902e+01	0.5430748
QRC4	1.173269e+01	2.476851e+01	0.4736940
M4_4297	1.930673e+01	2.439651e+01	0.7913729
M4_4748	1.649069e+01	2.375049e+01	0.6943306
M4_2638	1.611849e+01	2.374437e+01	0.6788343
M4_4347	9.183596e+00	2.351453e+01	0.3905498
M4_8314	1.815443e+01	2.337820e+01	0.7765539
M4_4859	1.261569e+01	2.249505e+01	0.5608205
M4_9264	7.717648e+00	2.226214e+01	0.3466715

key	RMSE	selected_RMSE	ratio
M4_3774	1.606794e+01	2.220706e+01	0.7235511
MRC14	1.389586e+01	2.215819e+01	0.6271207
M4_6993	1.464613e+01	2.196985e+01	0.6666471
M4_4380	2.733229e+00	2.191764e+01	0.1247045
M4_9030	4.807212e+00	2.142033e+01	0.2244228
M4_9084	8.458200e+00	2.123661e+01	0.3982840
M4_2636	1.420679e+01	2.074008e+01	0.6849918
M4_9440	1.125558e+01	2.058797e+01	0.5467063
M4_2473	8.228812e+00	2.028311e+01	0.4056976
M4_2991	1.249865e+01	2.017093e+01	0.6196368
M4_2054	1.495881e+01	1.996944e+01	0.7490850
M4_8217	5.993449e+00	1.996266e+01	0.3002330
M4_7429	1.566645e+01	1.995168e+01	0.7852198
M4_9984	1.520461e+01	1.965731e+01	0.7734837
M4_9377	1.184372e+01	1.882627e+01	0.6291062
M4_2853	9.649871e+00	1.876631e+01	0.5142124
M4_9380	1.406960e+01	1.859856e+01	0.7564887
M4_7750	1.469069e+01	1.855646e+01	0.7916752
M4_2885	1.374228e+01	1.810471e+01	0.7590441
M4_9252	6.342750e+00	1.788960e+01	0.3545496
M4_9126	1.394598e+01	1.776705e+01	0.7849348
M4_8448	9.719775e+00	1.770359e+01	0.5490285
MRI10	1.099444e+01	1.760114e+01	0.6246437
M4_3603	1.216721e+01	1.728771e+01	0.7038070
N2695	1.204949e+01	1.704639e+01	0.7068647
M4_3645	8.288474e+00	1.687830e+01	0.4910727
M4_8294	1.317508e+01	1.666046e+01	0.7907992
M4_17	8.822320e+00	1.643315e+01	0.5368613
M4_8872	1.175017e+01	1.640911e+01	0.7160758
M4_2982	1.086681e+01	1.639352e+01	0.6628721
M4_9114	3.807438e+00	1.613981e+01	0.2359036
QND1	8.877898e+00	1.600258e+01	0.5547792
M4_3836	1.042276e+01	1.568167e+01	0.6646459
M4_4337	4.454606e+00	1.558605e+01	0.2858073
MNI130	4.045705e+00	1.554557e+01	0.2602481
M4_7184	9.810744e+00	1.544691e+01	0.6351267
QNC21	4.734295e+00	1.538967e+01	0.3076282
M4_9315	8.102089e+00	1.532478e+01	0.5286921
M4_4680	2.288025e+00	1.489398e+01	0.1536207
M4_9318	5.049753e+00	1.486929e+01	0.3396094
M4_8949	9.510929e+00	1.467374e+01	0.6481597
M4_9404	1.130116e+01	1.453784e+01	0.7773618
M4_3658	6.019450e+00	1.431057e+01	0.4206296
M4_2066	7.224734e+00	1.408958e+01	0.5127716
M4_5994	9.441832e+00	1.369956e+01	0.6892069
M4_8465	1.087673e+01	1.361987e+01	0.7985934
MNC46	3.600293e+00	1.351851e+01	0.2663233
M4_9072	1.014840e+01	1.346978e+01	0.7534196
M4_9447	9.896064e+00	1.346560e+01	0.7349143
M4_8454	9.393147e+00	1.278205e+01	0.7348704
M4_4412	8.053342e+00	1.275049e+01	0.6316104
M4_4841	3.278361e+00	1.269765e+01	0.2581864

key	RMSE	selected_RMSE	ratio
M4_4840	4.441917e+00	1.242830e+01	0.3574034
M4_7043	5.315087e+00	1.234355e+01	0.4305965
M4_8621	4.871619e+00	1.225905e+01	0.3973895
M4_8743	8.858660e+00	1.221363e+01	0.7253095
M4_3063	3.536947e+00	1.189037e+01	0.2974633
M4_6891	5.988841e+00	1.187338e+01	0.5043922
M4_9127	2.645751e+00	1.184188e+01	0.2234232
M4_8476	8.909820e+00	1.146990e+01	0.7768000
MNM1	4.293753e+00	1.132950e+01	0.3789889
MNI74	8.466824e+00	1.120073e+01	0.7559174
M4_9342	4.929581e+00	1.114910e+01	0.4421506
M4_9042	8.778159e+00	1.114858e+01	0.7873793
M4_3258	3.937830e+00	1.102774e+01	0.3570841
M4_9467	4.347207e+00	1.090848e+01	0.3985163
M4_7968	6.729361e+00	1.079960e+01	0.6231123
M4_6953	7.902584e+00	1.070851e+01	0.7379721
QRG4	5.450528e+00	1.066430e+01	0.5111004
M4_2532	4.779328e+00	1.064814e+01	0.4488414
M4_2630	6.302360e+00	1.060138e+01	0.5944847
M4_8247	8.006744e+00	1.054685e+01	0.7591599
M4_2182	3.570559e+00	1.047944e+01	0.3407203
QRC5	5.852125e+00	1.039651e+01	0.5628932
MNG35	5.086176e+00	1.028802e+01	0.4943786
M4_7785	6.644260e+00	1.020057e+01	0.6513615
M4_9129	4.571155e+00	1.012437e+01	0.4515001
M4_9001	2.617854e+00	1.010607e+01	0.2590378
M4_2056	7.311304e+00	1.003411e+01	0.7286448
M4_2536	7.106967e+00	1.001695e+01	0.7094939
M4_2339	2.539193e+00	9.934290e+00	0.2555988
M4_7961	3.392676e+00	9.917625e+00	0.3420855
MRC28	7.276041e+00	9.885359e+00	0.7360421
M4_9436	4.907663e+00	9.774611e+00	0.5020826
M4_8584	3.779212e+00	9.619194e+00	0.3928824
M4_8396	5.383576e+00	9.466278e+00	0.5687109
M4_3110	4.785778e+00	9.344045e+00	0.5121741
M4_2064	4.722380e+00	9.146197e+00	0.5163216
M4_2660	5.544285e+00	9.002503e+00	0.6158604
M4_9021	4.140481e+00	8.967406e+00	0.4617256
M4_9406	5.113645e+00	8.730260e+00	0.5857380
M4_7756	5.220153e+00	8.701321e+00	0.5999265
M4_9017	2.482562e+00	8.510498e+00	0.2917058
M4_8972	6.691118e+00	8.451440e+00	0.7917134
M4_8124	6.022747e+00	8.436193e+00	0.7139176
M4_8419	6.580986e+00	8.428335e+00	0.7808169
M4_2468	5.484135e+00	8.241337e+00	0.6654424
M4_9322	3.567198e+00	8.210929e+00	0.4344452
M4_2338	2.743689e+00	8.051990e+00	0.3407467
M4_2181	3.705522e+00	7.971046e+00	0.4648728
M4_8762	5.760627e+00	7.925489e+00	0.7268481
M4_2581	2.082415e+00	7.887679e+00	0.2640085
YAG5	5.207286e+00	7.885617e+00	0.6603523
M4_8742	4.353940e+00	7.879833e+00	0.5525422

key	RMSE	selected_RMSE	ratio
M4_8692	3.091599e+00	7.803450e+00	0.3961836
M4_2995	5.144334e+00	7.801645e+00	0.6593909
M4_7802	6.131554e+00	7.752389e+00	0.7909245
M4_8151	2.063345e+00	7.704485e+00	0.2678109
M4_8996	5.536543e+00	7.490691e+00	0.7391232
M4_9360	5.408454e+00	7.375334e+00	0.7333164
M4_9083	5.301829e+00	7.355320e+00	0.7208155
M4_5876	3.764275e+00	7.242779e+00	0.5197280
M4_4225	5.027199e+00	7.138494e+00	0.7042380
QND26	1.121644e+00	7.088550e+00	0.1582332
M4_9223	4.796948e+00	7.064398e+00	0.6790313
M4_8408	4.434938e+00	6.823653e+00	0.6499360
M4_9795	5.351546e+00	6.789393e+00	0.7882215
N0390	5.281909e+00	6.725964e+00	0.7853015
M4_8620	2.931318e+00	6.683283e+00	0.4386045
M4_4284	3.782925e+00	6.672845e+00	0.5669133
MRG22	3.815439e+00	6.668547e+00	0.5721545
M4_8987	5.252992e+00	6.654983e+00	0.7893322
M4_9049	4.198439e+00	6.648806e+00	0.6314575
M4_6908	5.051957e+00	6.629156e+00	0.7620815
M4_4702	3.975080e+00	6.620018e+00	0.6004636
M4_3886	4.929267e+00	6.605087e+00	0.7462834
M4_2210	1.436658e+00	6.579158e+00	0.2183651
MNG36	5.195941e+00	6.519336e+00	0.7970046
M4_8030	4.511581e+00	6.369839e+00	0.7082724
M4_8803	1.573211e+00	6.359050e+00	0.2473971
M4_8578	3.572003e+00	6.351760e+00	0.5623643
MNC6	3.270386e+00	6.225906e+00	0.5252867
M4_8763	4.788542e+00	6.216494e+00	0.7702962
M4_9025	4.051708e+00	6.164630e+00	0.6572508
QND24	3.780401e+00	6.157606e+00	0.6139401
M4_6419	4.508628e+00	6.104780e+00	0.7385406
M4_8907	2.898275e+00	6.104713e+00	0.4747603
M4_8966	2.767751e+00	6.066316e+00	0.4562490
MNI154	2.992025e+00	6.049400e+00	0.4945986
M4_9157	4.205779e+00	5.866538e+00	0.7169097
M4_3982	2.579082e+00	5.696666e+00	0.4527353
M4_5267	4.391142e+00	5.687218e+00	0.7721073
M4_8992	3.415746e+00	5.593394e+00	0.6106750
M4_5976	6.672304e-01	5.583651e+00	0.1194972
M4_3295	3.001148e+00	5.526903e+00	0.5430071
M4_3062	3.465959e+00	5.484723e+00	0.6319297
M4_2049	3.718268e+00	5.472006e+00	0.6795073
QRG15	1.265592e+00	5.442637e+00	0.2325328
M4_8468	3.571879e+00	5.429690e+00	0.6578422
M4_2857	4.127974e+00	5.392793e+00	0.7654612
M4_8295	2.804436e+00	5.382719e+00	0.5210074
M4_2170	3.341355e+00	5.362761e+00	0.6230662
M4_2851	2.699839e+00	5.286391e+00	0.5107149
M4_8103	3.163924e+00	5.218822e+00	0.6062525
M4_2065	3.209334e+00	5.210352e+00	0.6159533
M4_3677	4.151960e+00	5.204660e+00	0.7977390

key	RMSE	selected_RMSE	ratio
M4_8978	4.027745e+00	5.187874e+00	0.7763768
M4_8185	3.472427e+00	5.160735e+00	0.6728552
M4_4775	1.528289e+00	5.135064e+00	0.2976184
M4_9059	3.270569e+00	5.121325e+00	0.6386177
M4_4359	3.507321e+00	5.081168e+00	0.6902587
M4_2668	3.633180e+00	5.077184e+00	0.7155896
M4_8201	3.092045e+00	5.069907e+00	0.6098820
M4_8417	3.473280e+00	5.051907e+00	0.6875185
M4_4679	1.810488e+00	5.030011e+00	0.3599372
M4_8146	3.749007e+00	4.969376e+00	0.7544222
M4_8588	2.956617e+00	4.881509e+00	0.6056769
M4_3776	1.284722e+00	4.824331e+00	0.2663006
M4_2388	3.572974e+00	4.817024e+00	0.7417390
M4_3752	2.471550e+00	4.757578e+00	0.5194976
M4_8115	2.755390e+00	4.663360e+00	0.5908593
M4_8061	1.942835e+00	4.537088e+00	0.4282118
M4_2825	1.682134e+00	4.488867e+00	0.3747347
M4_8059	2.182358e+00	4.478249e+00	0.4873239
M4_8147	2.563657e+00	4.454328e+00	0.5755428
M4_8873	2.707341e+00	4.429562e+00	0.6111984
MNG8	1.619940e+00	4.399885e+00	0.3681778
M4_8165	2.411174e+00	4.399553e+00	0.5480496
QRC18	3.423317e+00	4.383656e+00	0.7809273
M4_8007	3.150299e+00	4.365071e+00	0.7217062
M4_8168	2.956793e+00	4.187740e+00	0.7060593
M4_7046	3.005333e+00	4.165453e+00	0.7214899
M4_3885	2.495537e+00	4.155288e+00	0.6005691
YAG26	3.128391e+00	4.136064e+00	0.7563690
M4_4808	2.778609e+00	4.120881e+00	0.6742756
M4_3170	2.770717e+00	4.081638e+00	0.6788248
M4_8605	2.551084e+00	4.078087e+00	0.6255591
M4_3132	2.179160e+00	4.059032e+00	0.5368670
M4_8215	3.076304e+00	4.045303e+00	0.7604632
M4_3590	3.128213e+00	4.034372e+00	0.7753903
M4_8835	3.013548e+00	3.966063e+00	0.7598338
M4_2682	1.958272e+00	3.880750e+00	0.5046118
M4_4177	6.400955e-01	3.833530e+00	0.1669729
M4_2959	2.464569e+00	3.767722e+00	0.6541272
M4_5256	1.788854e+00	3.741399e+00	0.4781245
M4_8196	2.351684e+00	3.718868e+00	0.6323655
M4_8156	2.440764e+00	3.703831e+00	0.6589837
M4_9460	4.716884e-01	3.699846e+00	0.1274887
M4_4444	1.761297e+00	3.672965e+00	0.4795300
M4_8517	2.885592e+00	3.655403e+00	0.7894044
M4_4382	1.000000e+00	3.624212e+00	0.2759220
M4_8006	2.293535e+00	3.622407e+00	0.6331522
M4_3130	1.645149e+00	3.619960e+00	0.4544660
M4_8425	1.896295e+00	3.525875e+00	0.5378226
M4_5210	2.756842e+00	3.483261e+00	0.7914543
M4_3263	2.675343e+00	3.460735e+00	0.7730563
M4_6345	2.596017e+00	3.439736e+00	0.7547141
M4_8123	2.482774e+00	3.363189e+00	0.7382202

key	RMSE	selected_RMSE	ratio
M4_4176	4.208273e-01	3.350486e+00	0.1256019
M4_8202	1.172870e+00	3.340310e+00	0.3511262
M4_8668	2.617404e+00	3.330938e+00	0.7857858
M4_5696	4.189544e-01	3.292530e+00	0.1272439
M4_2431	1.975469e+00	3.252352e+00	0.6073970
M4_8016	1.006413e+00	3.246894e+00	0.3099617
M4_8831	2.041877e+00	3.238767e+00	0.6304488
M4_9763	1.774117e+00	3.190992e+00	0.5559767
M4_5798	1.272777e+00	3.165272e+00	0.4021067
M4_2878	2.272373e+00	3.132628e+00	0.7253889
M4_2926	1.158024e+00	3.116627e+00	0.3715631
M4_5970	1.237611e+00	3.107343e+00	0.3982859
M4_3819	1.577292e+00	3.076873e+00	0.5126283
M4_8875	2.077889e+00	3.048418e+00	0.6816287
M4_5763	2.166355e+00	3.006726e+00	0.7205031
M4_8094	1.889916e+00	2.966022e+00	0.6371889
M4_4726	2.115722e+00	2.930446e+00	0.7219797
M4_3842	7.757604e-01	2.893815e+00	0.2680753
M4_8021	1.839469e+00	2.856458e+00	0.6439687
M4_8547	2.217768e+00	2.856135e+00	0.7764927
M4_3606	2.191826e+00	2.821380e+00	0.7768631
M4_3050	2.031028e+00	2.807305e+00	0.7234796
M4_3050	2.031028e+00	2.807305e+00	0.7234796
M4_3050	2.031028e+00	2.807305e+00	0.7234796
M4_3050	2.031028e+00	2.807305e+00	0.7234796
M4_3289	1.768322e+00	2.774691e+00	0.6373040
M4_2788	6.396152e-01	2.542216e+00	0.2515975
M4_2340	1.160280e+00	2.522803e+00	0.4599172
M4_2981	1.811339e+00	2.457303e+00	0.7371246
MRC18	1.319540e+00	2.443419e+00	0.5400385
M4_4226	3.759271e-01	2.424475e+00	0.1550550
M4_4226	3.759271e-01	2.424475e+00	0.1550550
M4_4226	3.759271e-01	2.424475e+00	0.1550550
M4_4226	3.759271e-01	2.424475e+00	0.1550550
M4_3260	1.184913e+00	2.382662e+00	0.4973061
M4_3728	9.656879e-01	2.377833e+00	0.4061209
M4_9976	1.719122e+00	2.340874e+00	0.7343934
M4_2103	1.518427e+00	2.337349e+00	0.6496367
M4_2931	1.640967e+00	2.329966e+00	0.7042878
M4_3587	1.421321e+00	2.293972e+00	0.6195894
M4_4471	4.877492e-01	2.268009e+00	0.2150561
M4_4543	8.310735e-01	2.266855e+00	0.3666196
M4_4258	7.318676e-01	2.258426e+00	0.3240610
QRG8	1.276271e+00	2.248765e+00	0.5675430
M4_3797	7.308102e-01	2.238627e+00	0.3264547
M4_2233	8.254168e-01	2.153769e+00	0.3832430
MNB55	1.262563e+00	2.145422e+00	0.5884915
QND18	1.099537e+00	2.126399e+00	0.5170888
M4_3695	1.190947e+00	2.106227e+00	0.5654408
M4_4254	6.482450e-01	2.098775e+00	0.3088684
M4_2235	5.583414e-01	2.070948e+00	0.2696067
M4_2176	1.292027e+00	2.069581e+00	0.6242939

key	RMSE	selected_RMSE	ratio
M4_2237	6.813253e-01	1.990082e+00	0.3423605
M4_4545	7.905132e-01	1.963475e+00	0.4026092
M4_3670	7.443118e-01	1.912888e+00	0.3891037
M4_4224	6.444157e-01	1.897115e+00	0.3396818
M4_8109	1.476998e+00	1.895237e+00	0.7793211
M4_2241	8.756478e-01	1.878965e+00	0.4660267
M4_5172	1.293659e+00	1.829762e+00	0.7070094
M4_8674	9.600045e-01	1.826415e+00	0.5256224
M4_3656	1.352928e+00	1.818073e+00	0.7441545
M4_8661	1.142588e+00	1.817923e+00	0.6285127
M4_8661	1.142588e+00	1.817923e+00	0.6285127
M4_8661	1.142588e+00	1.817923e+00	0.6285127
M4_8661	1.142588e+00	1.817923e+00	0.6285127
M4_4190	1.195002e+00	1.780118e+00	0.6713050
M4_8192	1.164330e+00	1.732792e+00	0.6719389
M4_2779	1.302366e+00	1.729838e+00	0.7528832
M4_2127	1.335479e+00	1.717299e+00	0.7776625
M4_8008	1.317926e+00	1.694743e+00	0.7776554
M4_8398	1.249398e+00	1.632741e+00	0.7652151
M4_5453	1.257326e+00	1.625700e+00	0.7734055
M4_9524	5.887105e-01	1.621253e+00	0.3631206
YAG21	9.546007e-01	1.608563e+00	0.5934494
M4_3203	1.189089e+00	1.574172e+00	0.7553744
M4_9096	1.235434e+00	1.555096e+00	0.7944425
M4_8380	1.212023e+00	1.549368e+00	0.7822690
QND39	8.056326e-01	1.535765e+00	0.5245807
M4_4401	1.190238e+00	1.517794e+00	0.7841897
M4_6120	1.001045e+00	1.471663e+00	0.6802138
M4_3746	1.031807e+00	1.446911e+00	0.7131099
MND74	1.012982e+00	1.434581e+00	0.7061173
M4_2421	8.810564e-01	1.422143e+00	0.6195272
M4_4142	7.263116e-01	1.421749e+00	0.5108577
M4_4566	1.315580e-01	1.421449e+00	0.0925520
M4_4481	1.129677e+00	1.417684e+00	0.7968470
M4_4733	2.784430e-02	1.417301e+00	0.0196460
M4_4555	3.045456e-01	1.405372e+00	0.2167010
M4_3544	7.733121e-01	1.387610e+00	0.5572978
M4_4886	1.003238e+00	1.370554e+00	0.7319949
M4_7956	1.024853e+00	1.368704e+00	0.7487764
M4_4178	2.456093e-01	1.363276e+00	0.1801611
M4_2098	5.445337e-01	1.327487e+00	0.4101990
M4_4282	5.773503e-01	1.211292e+00	0.4766400
QND8	2.792848e-01	1.200755e+00	0.2325909
M4_4523	8.150096e-01	1.173982e+00	0.6942267
M4_2401	4.262123e-01	1.163938e+00	0.3661814
M4_2401	4.262123e-01	1.163938e+00	0.3661814
M4_2401	4.262123e-01	1.163938e+00	0.3661814
M4_2401	4.262123e-01	1.163938e+00	0.3661814
M4_3826	1.885362e-01	1.159892e+00	0.1625464
M4_2796	8.164966e-01	1.130213e+00	0.7224268
M4_4835	3.214777e-01	1.129559e+00	0.2846047
M4_4897	4.846603e-01	1.117869e+00	0.4335574

key	RMSE	selected_RMSE	ratio
M4_5964	7.760801e-01	1.098185e+00	0.7066933
M4_3730	6.828296e-01	1.092788e+00	0.6248511
M4_5343	5.795576e-01	1.084659e+00	0.5343223
M4_5754	7.220151e-01	1.078947e+00	0.6691849
M4_3262	6.556290e-01	1.017542e+00	0.6443265
M4_4710	7.244262e-01	1.015612e+00	0.7132907
M4_3487	2.986847e-01	1.003830e+00	0.2975450
M4_5261	6.567889e-01	1.003766e+00	0.6543248
M4_3582	6.164220e-01	9.732293e-01	0.6333780
M4_4377	5.868286e-01	9.711926e-01	0.6042350
M4_4541	4.009619e-01	9.689568e-01	0.4138079
M4_4339	3.280625e-01	9.632044e-01	0.3405949
M4_2298	7.464138e-01	9.595905e-01	0.7778462
M4_5026	7.230852e-01	9.366735e-01	0.7719714
M4_4941	3.235478e-01	9.163843e-01	0.3530700
M4_4305	6.681076e-01	8.611795e-01	0.7758052
M4_9822	5.844704e-01	8.579522e-01	0.6812388
M4_8080	6.450456e-01	8.557317e-01	0.7537942
M4_8141	6.463357e-01	8.416035e-01	0.7679813
M4_2046	5.554071e-01	8.385248e-01	0.6623621
M4_3167	1.954017e-01	7.897482e-01	0.2474228
M4_6324	1.203250e-02	7.622682e-01	0.0157851
M4_5720	5.034608e-01	7.515334e-01	0.6699113
MND43	4.669047e-01	7.391692e-01	0.6316615
M4_4294	3.182465e-01	7.210543e-01	0.4413627
M4_3068	1.000000e-01	7.123314e-01	0.1403841
M4_4355	0.000000e+00	6.695217e-01	0.0000000
M4_6247	3.820977e-01	6.653005e-01	0.5743235
M4_3741	1.921879e-01	6.595056e-01	0.2914121
M4_6143	4.000010e-01	6.566431e-01	0.6091605
M4_5538	4.563586e-01	6.464197e-01	0.7059788
M4_4360	9.208630e-02	6.426476e-01	0.1432920
M4_6292	4.201034e-01	6.401005e-01	0.6563084
M4_2300	2.684399e-01	6.251578e-01	0.4293955
MNG34	1.795583e-01	6.167577e-01	0.2911327
M4_3966	3.613906e-01	6.111492e-01	0.5913296
M4_5200	3.532594e-01	5.866799e-01	0.6021331
M4_4129	3.857143e-01	5.861560e-01	0.6580403
M4_4785	3.601803e-01	5.640761e-01	0.6385315
M4_3672	3.095634e-01	5.637316e-01	0.5491327
M4_4649	4.133199e-01	5.478185e-01	0.7544833
M4_4245	2.996696e-01	5.231000e-01	0.5728725
M4_4123	2.721655e-01	5.217242e-01	0.5216655
M4_3070	3.962028e-01	4.966740e-01	0.7977121
M4_6085	3.739161e-01	4.849730e-01	0.7710039
M4_6446	2.807565e-01	4.819592e-01	0.5825316
MNI163	1.552002e-01	4.816496e-01	0.3222264
M4_4319	3.427604e-01	4.309458e-01	0.7953677
M4_4329	3.221773e-01	4.082483e-01	0.7891701
M4_3064	1.200193e-01	3.990010e-01	0.3007995
M4_2782	2.788461e-01	3.812323e-01	0.7314335
M4_4937	9.044060e-02	3.749798e-01	0.2411879

key	RMSE	selected_RMSE	ratio
M4_4769	9.999340e-02	3.612555e-01	0.2767941
M4_4935	1.270176e-01	3.598463e-01	0.3529773
M4_5075	2.747678e-01	3.519240e-01	0.7807590
M4_4200	6.817230e-02	3.455901e-01	0.1972634
M4_4833	2.710944e-01	3.438437e-01	0.7884234
M4_4469	1.474200e-03	3.390000e-01	0.0043486
M4_3546	2.482958e-01	3.315445e-01	0.7489064
M4_4828	6.943760e-02	3.301124e-01	0.2103451
M4_5119	2.327496e-01	3.175766e-01	0.7328926
M4_2420	1.408528e-01	3.098410e-01	0.4545971
M4_4856	1.678744e-01	2.909464e-01	0.5769944
M4_6182	7.433260e-02	2.883147e-01	0.2578174
M4_1958	1.486944e-01	2.792686e-01	0.5324424
M4_3276	2.042670e-01	2.784902e-01	0.7334801
M4_6477	1.960378e-01	2.755793e-01	0.7113662
M4_803	1.863560e-01	2.698845e-01	0.6905029
M4_9857	2.035265e-01	2.634702e-01	0.7724838
M4_2315	1.241186e-01	2.531724e-01	0.4902533
M4_9737	4.206100e-02	2.262761e-01	0.1858837
M4_9791	1.667497e-01	2.112972e-01	0.7891714
M4_4	1.244418e-01	2.037185e-01	0.6108517
M4_2356	1.225069e-01	1.953131e-01	0.6272335
M4_5068	1.449844e-01	1.936222e-01	0.7488004
M4_2304	1.350017e-01	1.926136e-01	0.7008938
M4_761	1.426075e-01	1.910113e-01	0.7465918
M4_1246	1.262085e-01	1.798927e-01	0.7015769
M4_5015	1.399805e-01	1.777297e-01	0.7876035
M4_4605	1.023597e-01	1.603400e-01	0.6383917
M4_5718	3.244410e-02	1.374331e-01	0.2360722
M4_4562	9.108320e-02	1.258716e-01	0.7236198
M4_4595	5.032340e-02	1.227846e-01	0.4098508
M4_2023	8.173320e-02	1.178343e-01	0.6936280
M4_4522	0.000000e+00	1.169809e-01	0.0000000
M4_40	8.820250e-02	1.132942e-01	0.7785259
M4_4683	8.995720e-02	1.125081e-01	0.7995614
M4_67	3.398000e-02	1.057769e-01	0.3212421
M4_752	7.157940e-02	9.495410e-02	0.7538315
M4_874	5.569970e-02	7.027250e-02	0.7926241
M4_3274	5.009940e-02	6.514640e-02	0.7690275
M4_2275	3.706860e-02	5.899150e-02	0.6283709
M4_2294	3.744410e-02	4.981790e-02	0.7516206
M4_1540	3.831850e-02	4.954710e-02	0.7733748
M4_640	3.622850e-02	4.540200e-02	0.7979506
M4_1381	3.291500e-02	4.420400e-02	0.7446166
M4_186	3.455220e-02	4.349780e-02	0.7943430
M4_186	3.455220e-02	4.349780e-02	0.7943430
M4_186	3.455220e-02	4.349780e-02	0.7943430
M4_186	3.455220e-02	4.349780e-02	0.7943430
M4_159	2.995980e-02	4.105690e-02	0.7297150
M4_76	2.725070e-02	3.746760e-02	0.7273134
M4_545	2.721710e-02	3.613040e-02	0.7533013
MND20	6.155800e-03	3.485000e-02	0.1766366

key	RMSE	selected_RMSE	ratio
M4_3823	2.111420e-02	3.268100e-02	0.6460711
M4_396	1.900740e-02	2.959740e-02	0.6421993
M4_154	2.287060e-02	2.909150e-02	0.7861601
M4_675	1.060030e-02	2.881510e-02	0.3678715
M4_1876	1.384840e-02	2.514980e-02	0.5506375
M4_56	1.927840e-02	2.502110e-02	0.7704857
M4_1028	1.794060e-02	2.257970e-02	0.7945452
M4_515	1.488390e-02	1.907180e-02	0.7804166
M4_612	1.258790e-02	1.681870e-02	0.7484447
M4_849	1.169360e-02	1.473190e-02	0.7937586
M4_2626	2.504500e-03	1.122950e-02	0.2230281
M4_1914	4.001100e-03	5.409100e-03	0.7397042
M4_87	2.050300e-03	2.609700e-03	0.7856488
M4_31	6.248000e-04	1.041500e-03	0.5999273
M4_31	6.248000e-04	1.041500e-03	0.5999273
M4_31	6.248000e-04	1.041500e-03	0.5999273
M4_31	6.248000e-04	1.041500e-03	0.5999273

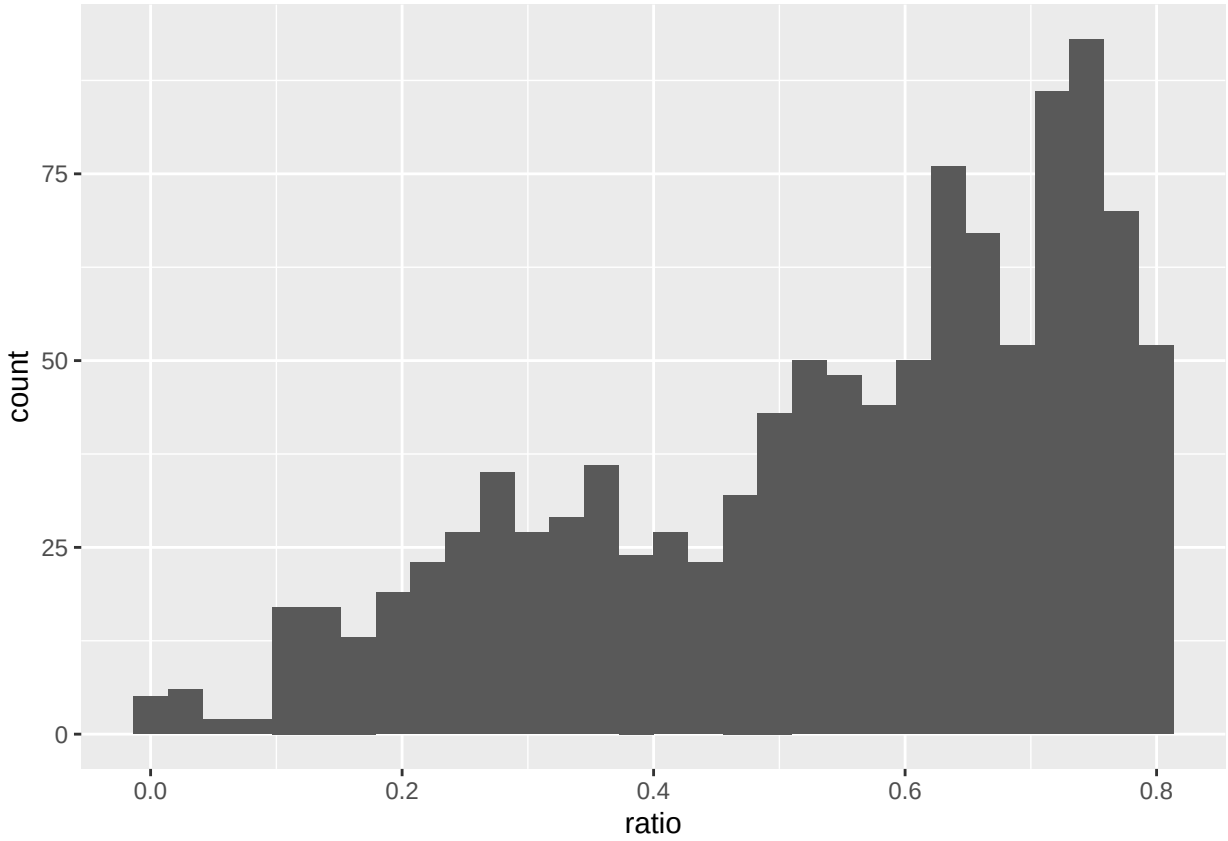
How many series are we looking at? 1095

What the heck happened with series M4_9738? Perhaps it makes sense to try to explain the discrepancies.

About 24.5185849% of the time - unfortunate. Just how bad are these picks, and where do they tend to cluster?

```
performance_vs_best_model %>%
  dplyr::filter( ratio < 0.8 ) %>%
  ggplot2::ggplot( ggplot2::aes(x = ratio)) +
  ggplot2::geom_histogram()
```

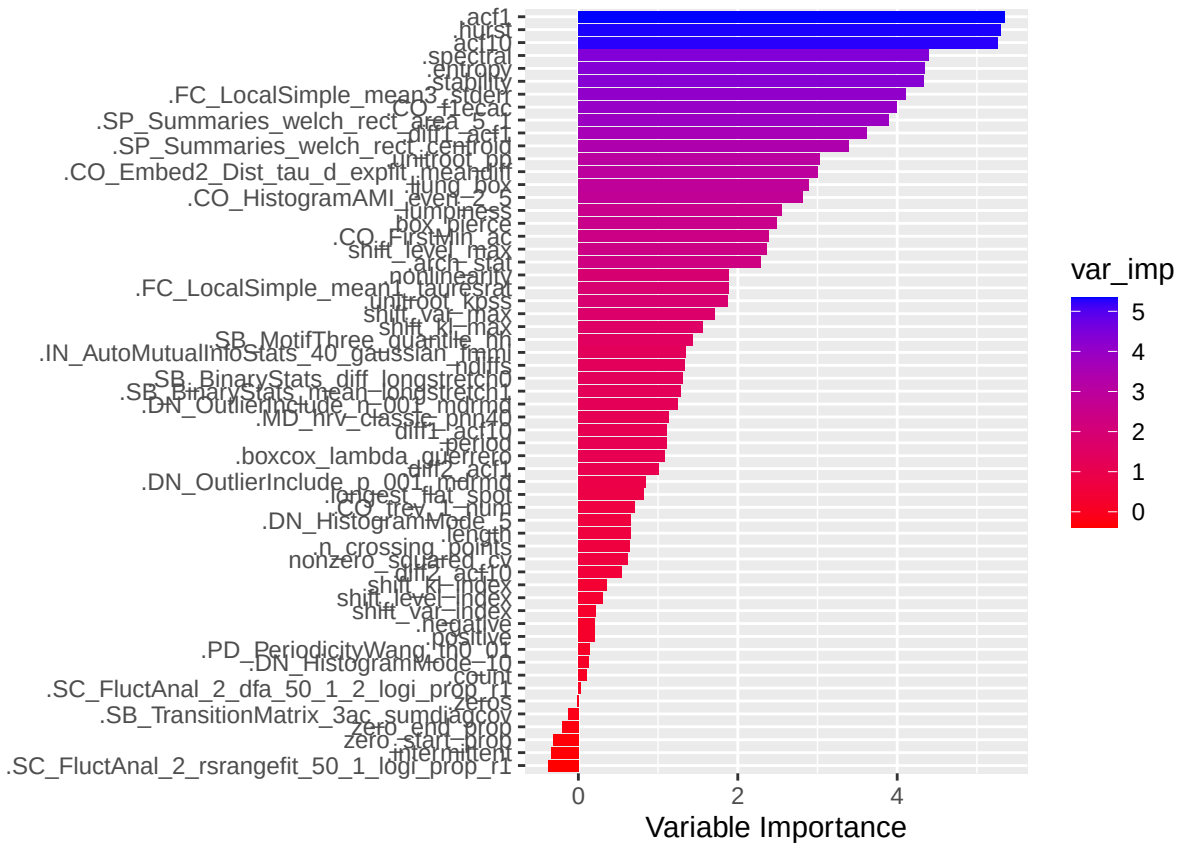
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Can we possibly model the ratios based on the features?

```
ratio_model <- performance_vs_best_model %>%
  dplyr::select( key, ratio ) %>%
  dplyr::left_join(feature_df, by = c("key" = "keys")) %>%
  dplyr::select( - c("key")) %>%
  dplyr::select_if(~ !all(is.na(.x))) %>%
  dplyr::select_if(~ !all(.x == .x[1])) %>%
  na.omit

ratio_importances <- ranger::ranger( y = dplyr::select(ratio_model, ratio) %>% unlist,
                                     x = dplyr::select(ratio_model, -ratio) %>% as.matrix,
                                     num.trees = 2000,
                                     importance = 'impurity_corrected'
                                    )
variable_importances <- ratio_importances[["variable.importance"]]
# rescale so they sum to 100
variable_importances <- (variable_importances/sum(variable_importances)) * 100
df <- data.frame( var_imp = variable_importances, var = names(variable_importances) )

ggplot2::ggplot(df, ggplot2::aes( x = reorder(var,var_imp),
                                  y = var_imp,
                                  fill = var_imp )
                ) +
      ggplot2::geom_bar(stat="identity", position="dodge") +
      ggplot2::coord_flip()+
      ggplot2::ylab("Variable Importance")+
```

```
      ggplot2::xlab("")+
      ggplot2::scale_fill_gradient(low="red", high="blue")
```



Huh, so perhaps we can learn more from the data (seeing that the variable importances dont seem to be random).

TODO:

Podium counts: (3 best methods get re-sampled probabilistically)

```
podium_counts <- accuracy_ranks %>%
  dplyr::group_by(key) %>%
  dplyr::arrange( avg_rank ) %>%
  dplyr::slice_head(n = 3) %>%
  dplyr::select(.model, key) %>%
  dplyr::ungroup()
```