Counterfactual Testing Associational Model

```
# clear the working space
rm(list = ls())

library(here)
library(stats) # need this to calculate Mahalanobis Distance
library(parallel) # parallelize
library(dplyr)
library(FNN)
library(cluster)
library(ggplot2)
library(rpart)
library(caret)
```

Counterfactual Data Input

```
# we need the renaming function for cleaning
melor_2015 <- read.csv(here("data", "clustered_M15_CF_data.csv"))
```

Counterfactual

Importing trained models

```
# Read the .rds models
base_reg <- readRDS(here("associational XGBOOST", "damage_fit_reg_base.rds"))
trunc_reg <- readRDS(here("associational XGBOOST", "trunc_damage_fit_reg.rds"))
clas_model  <- readRDS(here("associational XGBOOST", "ass_XGBOOST_class.rds"))
```

Counterfactual predictions

```
source(here("R", "ass_hurdle_function.R"))

# setting threshold for classification step
threshold = 0.30

preds <- ass_hurdle_function(df = melor_2015, ass_clas_model = clas_model,
  ass_base_model = base_reg, ass_trunc_model = trunc_reg ,threshold = threshold)
```

```r
# append the results to the counterfactual dataset
melor_2015  <- melor_2015 %>%
    mutate(damage_preds = preds)
```

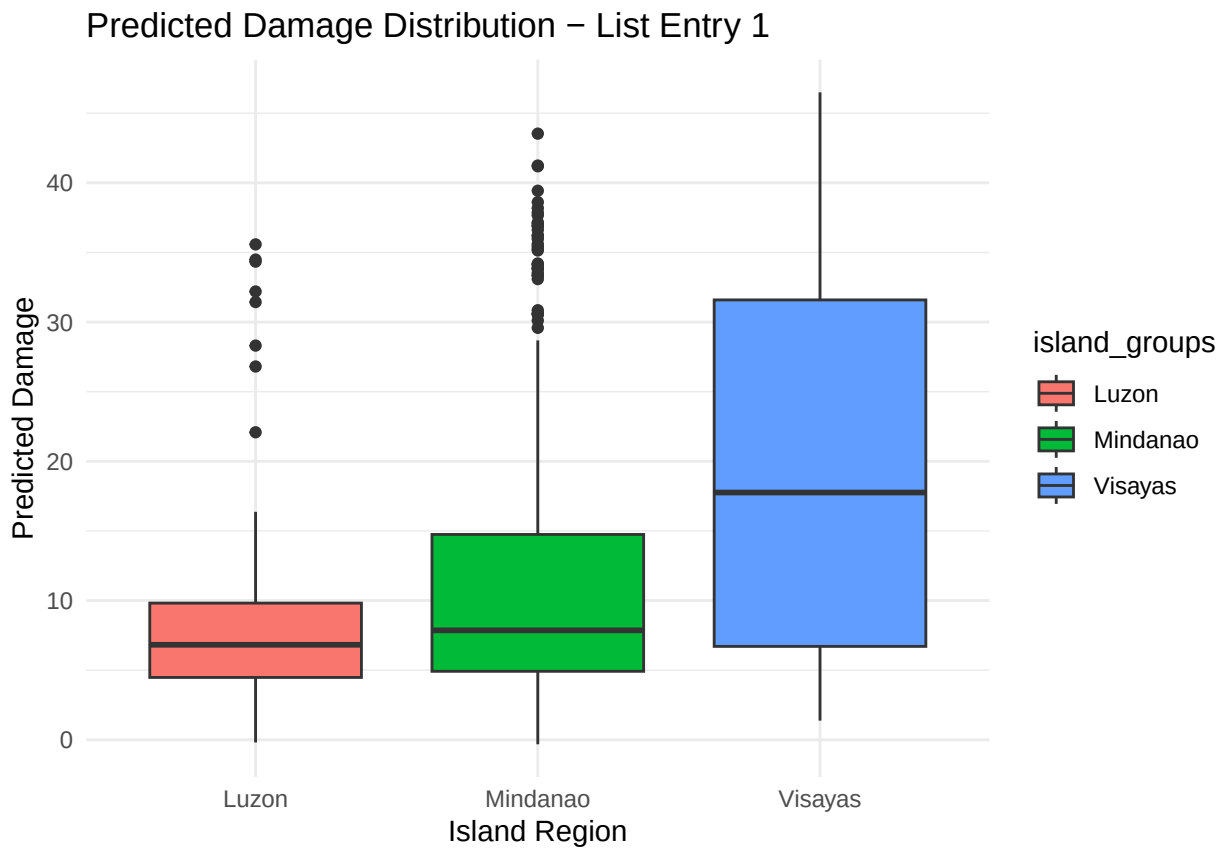
Counterfactual results

```r
# convert the Cluster column to factor
melor_2015$Cluster <- as.factor(melor_2015$Cluster)

# extract cluster_levels
cluster_levels <- levels(melor_2015$Cluster)

# Source function: counterfactual_results
source(here("R", "counterfactual_results.R"))


cf_results <- counterfactual_results(cf_data = melor_2015,
                                     cluster_levels = cluster_levels)
```

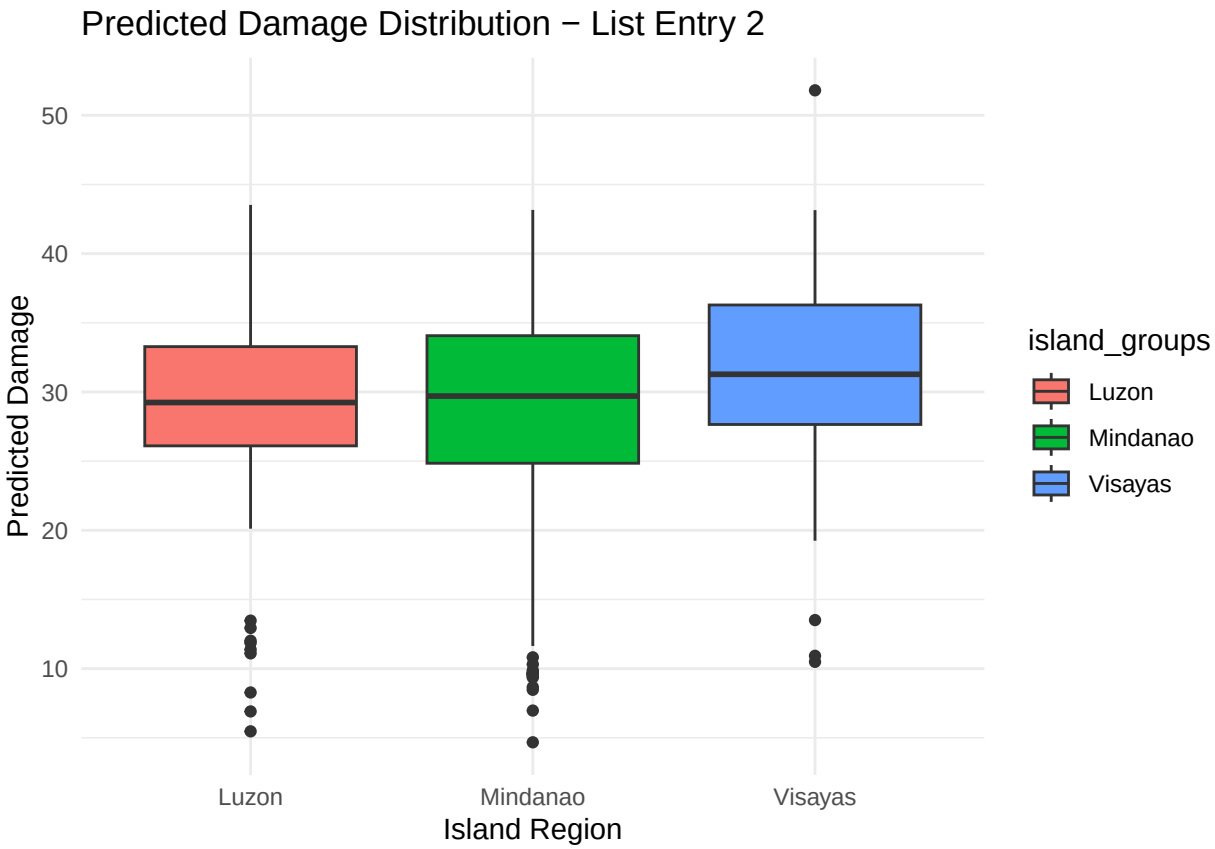
```
## currently evaluating cluster: 1currently evaluating cluster: 2currently evaluating cluster: 4current
```

```r
# Check the list to confirm plots are stored
print(cf_results$plots)
```

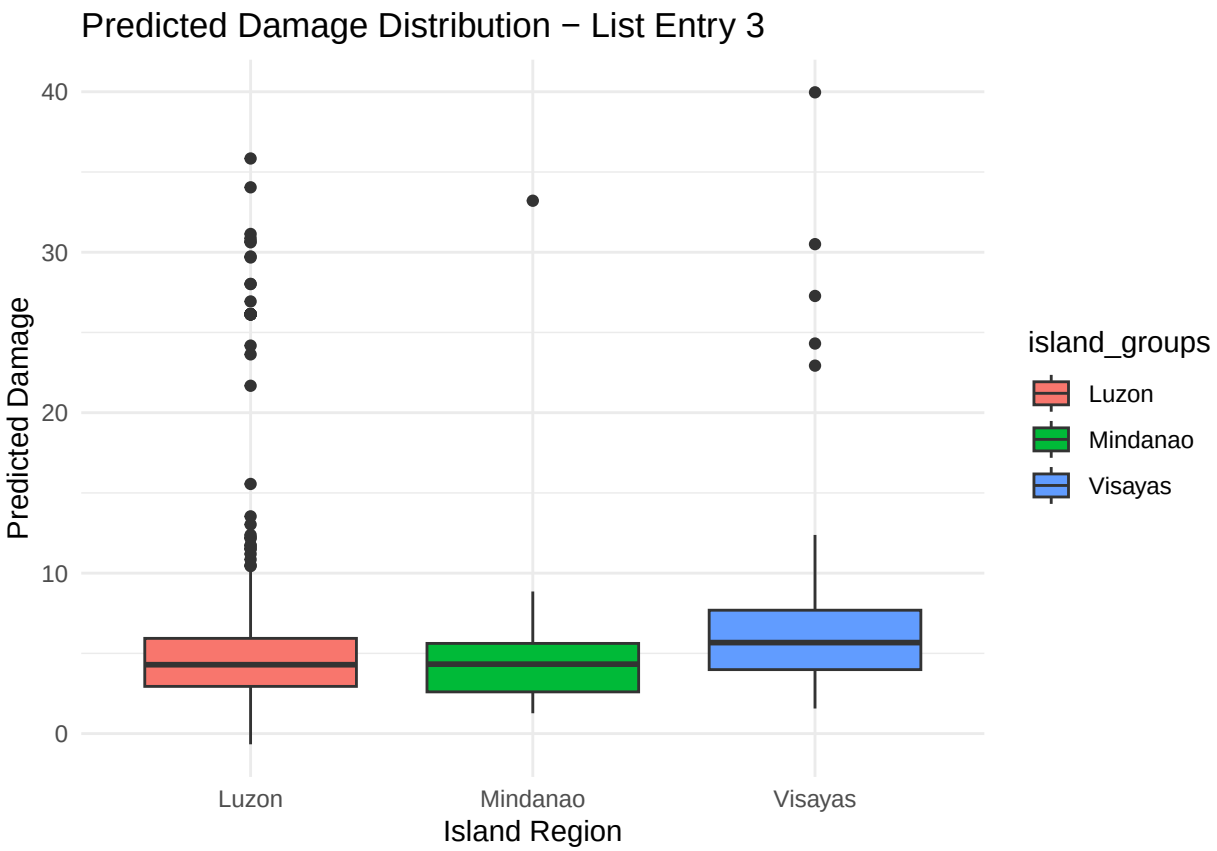
```
## [[1]]
```


Predicted Damage Distribution − List Entry 1
Predicted Damage
0
10
20
30
40
Luzon
Mindanao
Visayas
Island Region
island_groups
Luzon
Mindanao
Visayas

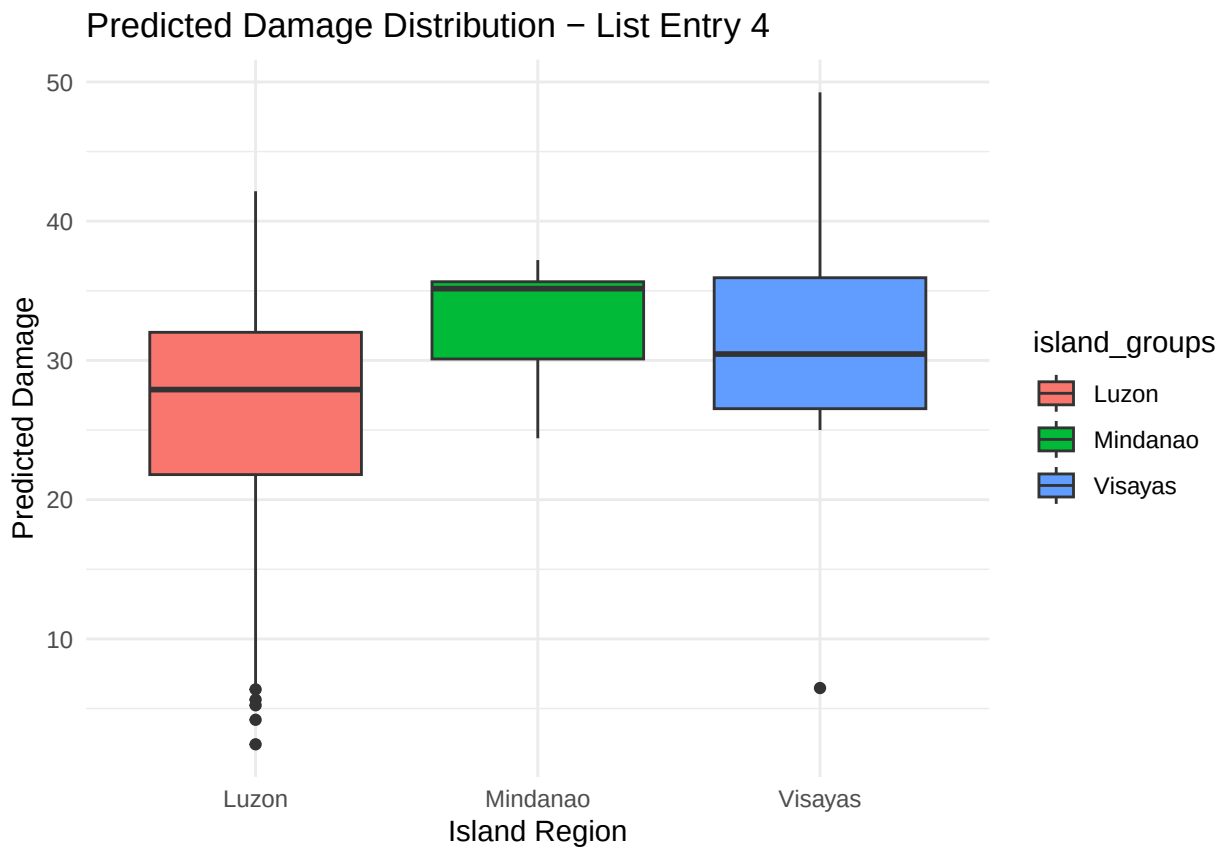
```
##
## [[2]]
```


Predicted Damage Distribution − List Entry 2
Predicted Damage
50
40
30
20
10
Luzon
Mindanao
Visayas
Island Region
island_groups
Luzon
Mindanao
Visayas

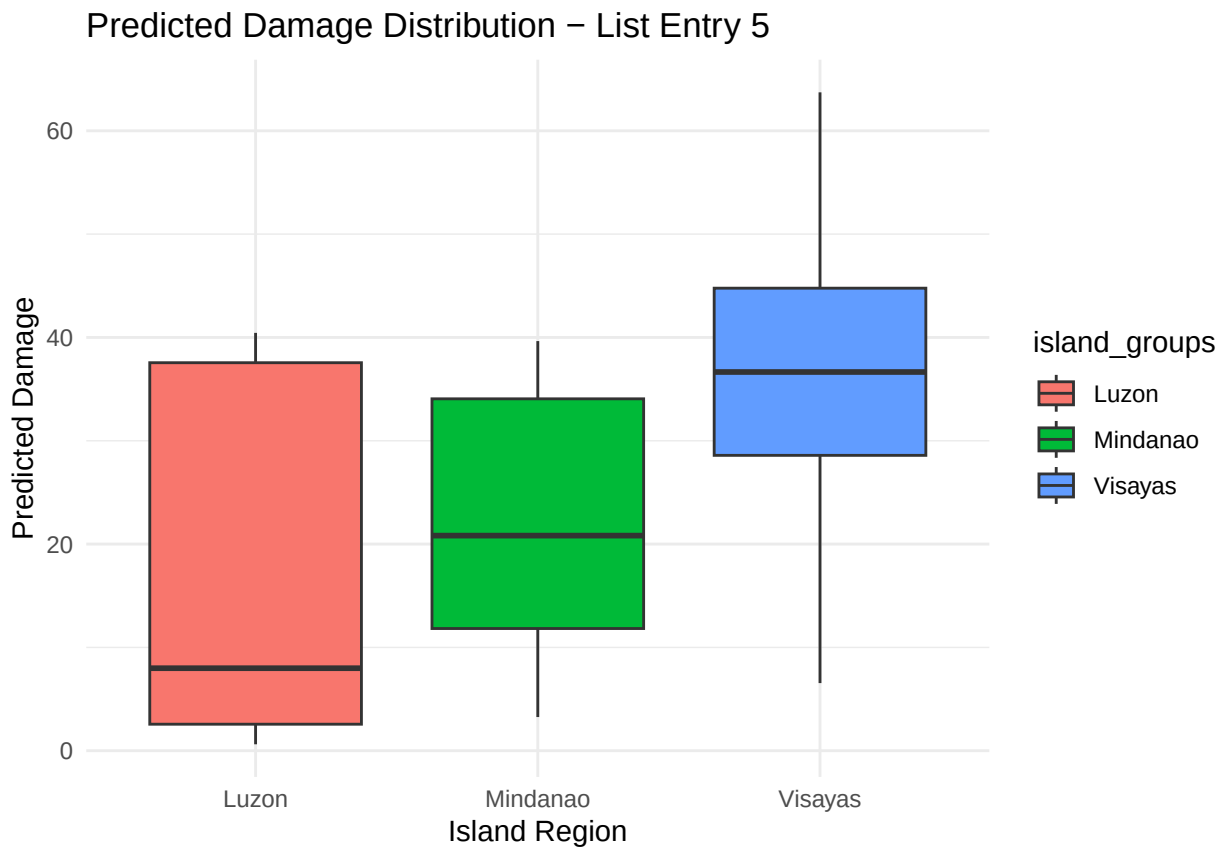
```
##
## [[3]]
```


Predicted Damage Distribution − List Entry 3
Predicted Damage
40
30
20
10
0
Luzon
Mindanao
Visayas
Island Region
island_groups
Luzon
Mindanao
Visayas

```
##
## [[4]]
```


Predicted Damage Distribution − List Entry 4
Predicted Damage
50
40
30
20
10
Luzon
Mindanao
Visayas
Island Region
island_groups
Luzon
Mindanao
Visayas

```
##
## [[5]]
```




```
print(cf_results$median)
```

```
## [[1]]
## # A tibble: 3 x 2
##   island_groups median_damage
##   <chr>                 <dbl>
## 1 Luzon                  6.82
## 2 Mindanao               7.86
## 3 Visayas               17.8
##
## [[2]]
## # A tibble: 3 x 2
##   island_groups median_damage
##   <chr>                 <dbl>
## 1 Luzon                  29.2
## 2 Mindanao               29.7
## 3 Visayas                31.3
##
## [[3]]
## # A tibble: 3 x 2
##   island_groups median_damage
##   <chr>                 <dbl>
## 1 Luzon                  4.29
## 2 Mindanao               4.33
## 3 Visayas                5.67
```

```
##
## [[4]]
## # A tibble: 3 x 2
##   island_groups median_damage
##   <chr>                 <dbl>
## 1 Luzon                  27.9
## 2 Mindanao               35.2
## 3 Visayas                30.5
##
## [[5]]
## # A tibble: 3 x 2
##   island_groups median_damage
##   <chr>                 <dbl>
## 1 Luzon                  7.99
## 2 Mindanao              20.8
## 3 Visayas               36.7
```

```
print(cf_results$averages)
```

```
## [[1]]
## # A tibble: 3 x 2
##   island_groups mean_damage
##   <chr>               <dbl>
## 1 Luzon                9.31
## 2 Mindanao            12.5
## 3 Visayas             19.6
##
## [[2]]
## # A tibble: 3 x 2
##   island_groups mean_damage
##   <chr>               <dbl>
## 1 Luzon                28.3
## 2 Mindanao             27.9
## 3 Visayas              30.8
##
## [[3]]
## # A tibble: 3 x 2
##   island_groups mean_damage
##   <chr>               <dbl>
## 1 Luzon                5.72
## 2 Mindanao             6.01
## 3 Visayas              7.87
##
## [[4]]
## # A tibble: 3 x 2
##   island_groups mean_damage
##   <chr>               <dbl>
## 1 Luzon                26.0
## 2 Mindanao             32.9
## 3 Visayas              31.7
##
## [[5]]
## # A tibble: 3 x 2
##   island_groups mean_damage
```

```
##   <chr>               <dbl>
## 1 Luzon                18.8
## 2 Mindanao             22.3
## 3 Visayas              35.3
```

Output the counterfactual predictions

Saving the counterfactual predictions for mapping differences between this associational model with in QGIS.

```
# prep

CF_output <- melor_2015 %>%
  select(Mun_Code, damage_preds) %>%
  rename(ass_CF_M15 = damage_preds)

write.csv2(CF_output, file = here("associational XGBOOST", "ass_CF_M15.csv"))
```

OLD CODE