Counterfactuals: Fixed storm surge, landslide and building typologies

title: "Counterfactual Adjusted Causal Model" author: "Brain K. Masinde" output: pdf_document: default html_document: df_print: paged —

```
# 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

```
# Loading the counterfactuals
low_melor_2015 <- read.csv(here("data", "low_melor15_CF_data.csv"))

high_melor_2015 <- read.csv(here("data", "high_melor15_CF_data.csv"))
```

Importing trained models

```
# Import trained BASE models
#   From folder: adjusted SCM/new base models

base_models_list <- list()

# base models file path
base_file_path <- here("adjusted SCM/new base models")
base_wind_model <- readRDS(file.path(base_file_path,
                                     "dec_base_wind_model_tuned.rds"))
base_rain_model <- readRDS(here("adjusted SCM/new base models",
                                "dec_base_rain_model_tuned.rds"))

base_class_full_model <- readRDS(file.path(base_file_path,
```

```
                                    "damage_fit_class_full.rds"))
base_reg_model <- readRDS(file.path(base_file_path,
                                    "base_reg_model.rds"))

base_models_list <- list("base_wind_model" = base_wind_model,
                         "base_rain_model" = base_rain_model,
                         "base_class_full_model" = base_class_full_model,
                         "base_reg_model" = base_reg_model)
```

```
# Import trained Truncated models
#   From folder: adjusted SCM/new trunc models

# empty list
trunc_models_list <- list()

trunc_file_path <- here("adjusted SCM/new trunc models")

trunc_wind_model <- readRDS(file.path(trunc_file_path,
                                      "trunc_wind_model_tuned.rds"))
trunc_rain_model <- readRDS(here("adjusted SCM/new trunc models",
                                 "dec_trunc_rain_model_tuned.rds"))

trunc_reg_model <- readRDS(file.path(trunc_file_path,
                                     "trunc_reg_model.rds"))

trunc_models_list <- list("trunc_wind_model" = trunc_wind_model,
                          "trunc_rain_model" = trunc_rain_model,
                         "trunc_reg_model" = trunc_reg_model)
```

Counterfactual predictions

```
# calling hurdle function
source(here("R", "adj_hurdle_function.R"))


low_adj_counterfactual_hurdle_preds  <- adj_hurdle_function(df = low_melor_2015,
                                                scm_models_base = base_models_list,
                                                scm_models_high = trunc_models_list,
                                                threshold = 0.3 # threshold in train/test models is 0.35
                                                )

high_adj_counterfactual_hurdle_preds  <- adj_hurdle_function(df = high_melor_2015,
                                                scm_models_base = base_models_list,
                                                scm_models_high = trunc_models_list,
                                                threshold = 0.3 # threshold in train/test models is 0.35
                                                )
```

Low vulnerability

```
# append the results to the counterfactual dataset
low_melor_2015  <- low_melor_2015 %>%
    mutate(damage_preds = low_adj_counterfactual_hurdle_preds)
```

```
# Get the first row for each level of C
low_first_rows <- low_melor_2015 %>%
  group_by(island_groups) %>%
  slice(1) %>%
  ungroup()

# Print the values from column B labeled with the level from C
for (i in 1:nrow(low_first_rows)) {
  cat(paste(low_first_rows$island_groups[i], ":", low_first_rows$damage_preds[i], "\n"))
}
```

```
## Luzon : 10.0740575790405
## Mindanao : 19.1388511657715
## Visayas : 30.6387519836426
```

High vulnerability

```
# append the results to the counterfactual dataset
high_melor_2015  <- high_melor_2015 %>%
    mutate(damage_preds =high_adj_counterfactual_hurdle_preds)
```

```
# Get the first row for each level of C
high_first_rows <- high_melor_2015 %>%
  group_by(island_groups) %>%
  slice(1) %>%
  ungroup()

# Print the values from column B labeled with the level from C
for (i in 1:nrow(high_first_rows)) {
  cat(paste(high_first_rows$island_groups[i], ":", high_first_rows$damage_preds[i], "\n"))
}
```

```
## Luzon : 13.8299589157104
## Mindanao : 37.0136833190918
## Visayas : 33.514102935791
```