15.- Feature Importance_04_06_turismo_gasto_completo_v_01

June 15, 2023

\#

CU55_Modelo agregado de estimación del gasto medio por turista ű

Citizenlab Data Science Methodology > III - Feature Engineering Domain *** > # 15.- Feature Importance

Feature Importance is the process that assigns scores to the input characteristics to a model, which indicate the relative importance of each characteristic, in order, for example, to be able to select the most important ones.

0.1 Tasks

Perform Feature importance from model coefficients
- Linear Regression Feature importance
- Logistic Regression Feature importance
    Perform Feature importance from Decision Tree
- CART Feature Importance
- Random Forest Regression Feature Importance
    Perform Feature importance from Permutation testing
    Evaluate a Logistic Regression model with feature selection

0.2 Consideraciones casos CitizenLab programados en R

- Algunas de las tareas de este proceso se han realizado en los notebooks del proceso 05 Data Collection porque eran necesarias para las tareas ETL. En esos casos, en este notebook se referencia al notebook del proceso 05 correspondiente
- Otras tareas típicas de este proceso se realizan en los notebooks del dominio IV al ser más eficiente realizarlas en el propio pipeline de modelización.
- Por tanto en los notebooks de este proceso de manera general se incluyen las comprobaciones necesarias, y comentarios si procede
- Las tareas del proceso se van a aplicar solo a los archivos que forman parte del despliegue, ya que hay muchos archivos intermedios que no procede pasar por este proceso
- El nombre de archivo del notebook hace referencia al nombre de archivo del proceso 05 al que se aplica este proceso, por eso pueden no ser correlativa la numeración
- Las comprobaciones se van a realizar teniendo en cuenta que el lenguaje utilizado en el despliegue de este caso es R

0.3   File

- Input File: CU_55_08_03_gasto_municipio.csv
- Sampled Input File: CU_55_07_03_gasto_municipio.csv
- Output File: No aplica

0.3.1   Encoding

Con la siguiente expresión se evitan problemas con el encoding al ejecutar el notebook. Es posible que deba ser eliminada o adaptada a la máquina en la que se ejecute el código.

```
In [1]: Sys.setlocale(category = "LC_ALL", locale = "es_ES.UTF-8")
```

'LC_COLLATE=es_ES.UTF-8;LC_CTYPE=es_ES.UTF-8;LC_MONETARY=es_ES.UTF-8;LC_NUMERIC=C;LC_TIME=es_ES.UTF-8'

0.4   Settings

0.4.1   Libraries to use

```
In [2]: library(readr)
        library(dplyr)
        library(tidyr)
        library(forcats)
        library(lubridate)
```

```
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



Attaching package: 'lubridate'


The following objects are masked from 'package:base':

    date, intersect, setdiff, union
```

0.4.2 Paths

```
In [3]: iPath <- "Data/Input/"
        oPath <- "Data/Output/"
```

0.5 Data Load

OPCION A: Seleccionar fichero en ventana para mayor comodidad
Data load using the {tcltk} package. Ucomment the line if using this option

```
In [4]: # file_data <- tcltk::tk_choose.files(multi = FALSE)
```

OPCION B: Especificar el nombre de archivo

```
In [5]: iFile <- "CU_55_08_03_gasto_municipio.csv"
        file_data <- paste0(iPath, iFile)

        if(file.exists(file_data)){
            cat("Se leerán datos del archivo: ", file_data)
        } else{
            warning("Cuidado: el archivo no existe.")
        }
```

```
Se leerán datos del archivo:  Data/Input/CU_55_08_03_gasto_municipio.csv
```

Data file to dataframe Usar la función adecuada según el formato de entrada (xlsx, csv, json, ...)

```
In [6]: data <- read_csv(file_data)
```

```
Rows: 50294 Columns: 10
 Column specification
Delimiter: ","
chr (5): mes, pais_orig_cod, pais_orig, mun_dest, CMUN
dbl (4): mun_dest_cod, turistas, gasto, Target
lgl (1): is_train

 Use `spec()` to retrieve the full column specification for this data.
 Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Estructura de los datos:

```
In [7]: data |> glimpse()
```

```
Rows: 50,294
Columns: 10
$ mes           <chr> "2019-08", "2021-07", "2021-07", "2022-01", "2019-08", "
$ pais_orig_cod <chr> "110", "010", "010", "000", "128", "000", "011", "126",
$ pais_orig     <chr> "Francia", "Total Europa", "Total Europa", "Total", "Rum
$ mun_dest_cod  <dbl> 28161, 28176, 28132, 28141, 28130, 28126, 28075, 28005,
```

```
$ mun_dest      <chr> "Valdemoro", "Villanueva de la Cañada", "San Martín de l
$ turistas      <dbl> 466, 1375, 465, 54, 135, 30, 285, 768, 31, 1646, 116, 36
$ CMUN          <chr> "161", "176", "132", "141", "130", "126", "075", "005",
$ gasto         <dbl> 76.360, 99.650, 99.650, 107.820, 109.210, 118.230, 118.2
$ Target        <dbl> 76.360, 99.650, 99.650, 107.820, 109.210, 118.230, 118.2
$ is_train      <lgl> TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TR
```

Muestra de los primeros datos:

In [8]: data |> slice_head(n = 5)

	mes <chr>	pais_orig_cod <chr>	pais_orig <chr>	mun_dest_cod <dbl>	mun_dest <chr>
	2019-08	110	Francia	28161	Valdemoro
A spec_tbl_df: 5 Œ 10	2021-07	010	Total Europa	28176	Villanueva de la Cañada
	2021-07	010	Total Europa	28132	San Martín de la Vega
	2022-01	000	Total	28141	Sevilla la Nueva
	2019-08	128	Rumania	28130	San Fernando de Henares

0.6 Feature importance from model coefficients

In [11]: data <- data |>
              na.omit()

0.6.1 Linear Regression Feature importance

```
In [12]: # install the necessary packages if not already installed
         if (!require(caret)) {
           install.packages('caret')
         }

         # load the necessary packages
         library(caret)

         # create the model
         set.seed(123)
         train_control <- trainControl(method = "cv", number = 5)
         linear_model <- train(Target ~ ., data = data, method = "lm",
                         trControl = train_control)

         # extract the coefficients
         coef <- summary(linear_model$finalModel)$coefficients

         # make a data frame of feature names and their corresponding coefficients
         feature_importance <- data.frame(Feature = rownames(coef), Coefficient = coef[, "Estima

         # compute the absolute value of the coefficients
         feature_importance$AbsCoefficient <- abs(feature_importance$Coefficient)
```

4

```r
# sort the features by the absolute value of their coefficients in descending order
feature_importance <- feature_importance[order(-feature_importance$AbsCoefficient), ]

# print the feature importance
print(feature_importance)
```

Loading required package: caret

Loading required package: ggplot2

Loading required package: lattice

Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in summary.lm(linear_model$finalModel):
"essentially perfect fit: summary may be unreliable"

	Feature
gasto	gasto
(Intercept)	(Intercept)
pais_orig_cod407	pais_orig_cod407
pais_orig_cod408	pais_orig_cod408
pais_orig_cod132	pais_orig_cod132
pais_orig_cod343	pais_orig_cod343
pais_orig_cod124	pais_orig_cod124
pais_orig_cod303	pais_orig_cod303
pais_orig_cod302	pais_orig_cod302
`mes2022-05`	`mes2022-05`
`mes2022-06`	`mes2022-06`
`mes2022-04`	`mes2022-04`
pais_orig_cod122	pais_orig_cod122
`mes2020-05`	`mes2020-05`
`mes2020-06`	`mes2020-06`
pais_orig_cod430	pais_orig_cod430
pais_orig_cod342	pais_orig_cod342
`mes2020-04`	`mes2020-04`
`mes2021-05`	`mes2021-05`
`mes2021-06`	`mes2021-06`

```
`mes2021-04`                           `mes2021-04`
pais_orig_cod344                       pais_orig_cod344
`mes2022-10`                           `mes2022-10`
pais_orig_cod436                       pais_orig_cod436
`mes2022-08`                           `mes2022-08`
`mes2022-07`                           `mes2022-07`
`mes2022-09`                           `mes2022-09`
pais_orig_cod109                       pais_orig_cod109
pais_orig_cod128                       pais_orig_cod128
pais_orig_cod415                       pais_orig_cod415
pais_orig_cod110                       pais_orig_cod110
`mes2020-12`                           `mes2020-12`
`mes2020-10`                           `mes2020-10`
`mes2020-11`                           `mes2020-11`
`mes2021-10`                           `mes2021-10`
pais_orig_cod301                       pais_orig_cod301
`mes2021-11`                           `mes2021-11`
`mes2020-07`                           `mes2020-07`
`mes2020-09`                           `mes2020-09`
`mes2020-08`                           `mes2020-08`
`mes2021-12`                           `mes2021-12`
`mes2019-10`                           `mes2019-10`
`mes2019-11`                           `mes2019-11`
pais_orig_cod125                       pais_orig_cod125
pais_orig_cod154                       pais_orig_cod154
pais_orig_cod115                       pais_orig_cod115
`mes2019-12`                           `mes2019-12`
pais_orig_cod107                       pais_orig_cod107
`mes2022-03`                           `mes2022-03`
`mes2022-01`                           `mes2022-01`
`mes2022-02`                           `mes2022-02`
`mes2021-03`                           `mes2021-03`
`mes2021-02`                           `mes2021-02`
`mes2021-01`                           `mes2021-01`
pais_orig_cod120                       pais_orig_cod120
pais_orig_cod340                       pais_orig_cod340
pais_orig_cod121                       pais_orig_cod121
`mes2021-08`                           `mes2021-08`
`mes2021-09`                           `mes2021-09`
`mes2021-07`                           `mes2021-07`
pais_orig_cod123                       pais_orig_cod123
pais_orig_cod103                       pais_orig_cod103
`mun_destTres Cantos`                       `mun_destTres Cantos`
`mun_destPuentes Viejas`                  `mun_destPuentes Viejas`
pais_orig_cod102                             pais_orig_cod102
`mun_destLozoyuela-Navas-Sieteiglesias` `mun_destLozoyuela-Navas-Sieteiglesias`
`mun_destOlmeda de las Fuentes`             `mun_destOlmeda de las Fuentes`
`mun_destRozas de Puerto Real`             `mun_destRozas de Puerto Real`
```

```
pais_orig_cod404                                           pais_orig_cod404
pais_orig_cod424                                           pais_orig_cod424
pais_orig_cod327                                           pais_orig_cod327
pais_orig_cod433                                           pais_orig_cod433
pais_orig_cod113                                           pais_orig_cod113
pais_orig_cod226                                           pais_orig_cod226
pais_orig_cod233                                           pais_orig_cod233
pais_orig_cod246                                           pais_orig_cod246
pais_orig_cod204                                           pais_orig_cod204
pais_orig_cod247                                           pais_orig_cod247
pais_orig_cod215                                           pais_orig_cod215
pais_orig_cod210                                           pais_orig_cod210
pais_orig_cod229                                           pais_orig_cod229
pais_orig_cod502                                           pais_orig_cod502
pais_orig_cod417                                           pais_orig_cod417
`mun_destTorremocha de Jarama`               `mun_destTorremocha de Jarama`
pais_orig_cod447                                           pais_orig_cod447
`mes2020-01`                                                       `mes2020-01`
`mun_destAtazar, El`                                       `mun_destAtazar, El`
`mun_destTorrejón de la Calzada`         `mun_destTorrejón de la Calzada`
`mun_destPiñuécar-Gandullas`                 `mun_destPiñuécar-Gandullas`
`mun_destMontejo de la Sierra`             `mun_destMontejo de la Sierra`
pais_orig_cod505                                           pais_orig_cod505
mun_destValdemorillo                                     mun_destValdemorillo
pais_orig_cod401                                           pais_orig_cod401
`mes2020-03`                                                       `mes2020-03`
`mes2020-02`                                                       `mes2020-02`
mun_destChapinería                                         mun_destChapinería
`mun_destVillanueva de Perales`           `mun_destVillanueva de Perales`
mun_destAlcobendas                                         mun_destAlcobendas
pais_orig_cod126                                           pais_orig_cod126
`mun_destRobledillo de la Jara`           `mun_destRobledillo de la Jara`
`mun_destAlcalá de Henares`                   `mun_destAlcalá de Henares`
pais_orig_cod201                                           pais_orig_cod201
mun_destNavalafuente                                     mun_destNavalafuente
mun_destCorpa                                                   mun_destCorpa
`mun_destVillaviciosa de Odón`             `mun_destVillaviciosa de Odón`
`mun_destBoadilla del Monte`                 `mun_destBoadilla del Monte`
pais_orig_cod158                                           pais_orig_cod158
`mun_destFresnedillas de la Oliva`     `mun_destFresnedillas de la Oliva`
mun_destAmbite                                                 mun_destAmbite
mun_destGetafe                                                 mun_destGetafe
`mun_destSan Agustín del Guadalix`     `mun_destSan Agustín del Guadalix`
`mun_destSoto del Real`                           `mun_destSoto del Real`
`mun_destNavarredonda y San Mamés`     `mun_destNavarredonda y San Mamés`
`mun_destPrádena del Rincón`                 `mun_destPrádena del Rincón`
mun_destFuenlabrada                                       mun_destFuenlabrada
`mun_destBerzosa del Lozoya`                 `mun_destBerzosa del Lozoya`
```

```
`mun_destBrea de Tajo`                        `mun_destBrea de Tajo`
pais_orig_cod249                                pais_orig_cod249
mun_destAlcorcón                                mun_destAlcorcón
mun_destBraojos                                  mun_destBraojos
`mun_destTorres de la Alameda`          `mun_destTorres de la Alameda`
mun_destTorrelaguna                            mun_destTorrelaguna
pais_orig_cod136                                pais_orig_cod136
`mun_destVillanueva del Pardillo`    `mun_destVillanueva del Pardillo`
`mun_destVillar del Olmo`                `mun_destVillar del Olmo`
mun_destLoeches                                  mun_destLoeches
mun_destVillamanta                              mun_destVillamanta
mun_destVillamantilla                          mun_destVillamantilla
mun_destLeganés                                  mun_destLeganés
mun_destParla                                      mun_destParla
pais_orig_cod348                                pais_orig_cod348
mun_destValdemaqueda                          mun_destValdemaqueda
mun_destValdeavero                              mun_destValdeavero
pais_orig_cod245                                pais_orig_cod245
mun_destValdepiélagos                        mun_destValdepiélagos
mun_destArroyomolinos                        mun_destArroyomolinos
pais_orig_cod341                                pais_orig_cod341
`mun_destBuitrago del Lozoya`          `mun_destBuitrago del Lozoya`
mun_destMoralzarzal                            mun_destMoralzarzal
`mun_destValverde de Alcalá`            `mun_destValverde de Alcalá`
pais_orig_cod131                                pais_orig_cod131
pais_orig_cod143                                pais_orig_cod143
`mun_destSan Fernando de Henares`    `mun_destSan Fernando de Henares`
`mun_destSan Martín de la Vega`        `mun_destSan Martín de la Vega`
pais_orig_cod347                                pais_orig_cod347
pais_orig_cod323                                pais_orig_cod323
`mun_destMolar, El`                        `mun_destMolar, El`
mun_destMeco                                          mun_destMeco
mun_destRibatejada                              mun_destRibatejada
pais_orig_cod326                                pais_orig_cod326
pais_orig_cod345                                pais_orig_cod345
`mun_destPozuelo del Rey`                `mun_destPozuelo del Rey`
`mun_destEscorial, El`                    `mun_destEscorial, El`
pais_orig_cod221                                pais_orig_cod221
`mun_destColmenar Viejo`                  `mun_destColmenar Viejo`
`mun_destSantos de la Humosa, Los`    `mun_destSantos de la Humosa, Los`
pais_orig_cod414                                pais_orig_cod414
mun_destValdelaguna                            mun_destValdelaguna
`mun_destSan Martín de Valdeiglesias`  `mun_destSan Martín de Valdeiglesias`
mun_destGalapagar                                mun_destGalapagar
pais_orig_cod409                                pais_orig_cod409
pais_orig_cod032                                pais_orig_cod032
mun_destVenturada                                mun_destVenturada
pais_orig_cod432                                pais_orig_cod432
```

```
pais_orig_cod411
pais_orig_cod420
pais_orig_cod413
pais_orig_cod321
pais_orig_cod138
`mun_destPuebla de la Sierra`
pais_orig_cod144
`mun_destVelilla de San Antonio`
pais_orig_cod157
pais_orig_cod434
pais_orig_cod239
pais_orig_cod437
mun_destTielmes
`mun_destVilla del Prado`
`mun_destPelayos de la Presa`
mun_destVillalbilla
mun_destCenicientos
pais_orig_cod501
pais_orig_cod217
pais_orig_cod319
pais_orig_cod234
`mun_destVillarejo de Salvanés`
pais_orig_cod174
pais_orig_cod230
`mun_destValdetorres de Jarama`
`mun_destValdeolmos-Alalpardo`
`mun_destHumanes de Madrid`
pais_orig_cod248
`mun_destPozuelo de Alarcón`
mun_destAnchuelo
pais_orig_cod314
pais_orig_cod426
`mun_destSevilla la Nueva`
`mun_destCadalso de los Vidrios`
mun_destValdemanco
pais_orig_cod250
pais_orig_cod050
`mun_destSan Lorenzo de El Escorial`
pais_orig_cod112
`mun_destSanta María de la Alameda`
pais_orig_cod227
`mun_destRivas-Vaciamadrid`
pais_orig_cod137
`mun_destNuevo Baztán`
pais_orig_cod213
pais_orig_cod317
mun_destRedueña
pais_orig_cod504
```

```
mun_destMadrid                              mun_destMadrid
pais_orig_cod111                            pais_orig_cod111
mun_destCanencia                            mun_destCanencia
pais_orig_cod412                            pais_orig_cod412
mun_destValdilecha                          mun_destValdilecha
pais_orig_cod146                            pais_orig_cod146
pais_orig_cod410                            pais_orig_cod410
pais_orig_cod236                            pais_orig_cod236
pais_orig_cod203                            pais_orig_cod203
`mun_destCollado Villalba`                  `mun_destCollado Villalba`
pais_orig_cod324                            pais_orig_cod324
pais_orig_cod141                            pais_orig_cod141
mun_destGascones                            mun_destGascones
pais_orig_cod142                            pais_orig_cod142
pais_orig_cod224                            pais_orig_cod224
pais_orig_cod118                            pais_orig_cod118
mun_destAlpedrete                           mun_destAlpedrete
`mun_destCubas de la Sagra`                 `mun_destCubas de la Sagra`
`mun_destÁlamo, El`                         `mun_destÁlamo, El`
mun_destNavalagamella                       mun_destNavalagamella
`mun_destRobledo de Chavela`                `mun_destRobledo de Chavela`
`mun_destBelmonte de Tajo`                  `mun_destBelmonte de Tajo`
mun_destSantorcaz                           mun_destSantorcaz
mun_destLozoya                              mun_destLozoya
pais_orig_cod403                            pais_orig_cod403
mun_destValdaracete                         mun_destValdaracete
mun_destNavalcarnero                        mun_destNavalcarnero
`mun_destHorcajuelo de la Sierra`           `mun_destHorcajuelo de la Sierra`
`mun_destColmenar del Arroyo`               `mun_destColmenar del Arroyo`
pais_orig_cod416                            pais_orig_cod416
pais_orig_cod139                            pais_orig_cod139
`mun_destSerranillos del Valle`             `mun_destSerranillos del Valle`
`mun_destVillamanrique de Tajo`             `mun_destVillamanrique de Tajo`
`mun_destVillanueva de la Cañada`           `mun_destVillanueva de la Cañada`
mun_destAlgete                              mun_destAlgete
pais_orig_cod443                            pais_orig_cod443
pais_orig_cod202                            pais_orig_cod202
pais_orig_cod421                            pais_orig_cod421
pais_orig_cod114                            pais_orig_cod114
pais_orig_cod427                            pais_orig_cod427
pais_orig_cod252                            pais_orig_cod252
`mun_destArganda del Rey`                   `mun_destArganda del Rey`
mun_destRascafría                           mun_destRascafría
mun_destTitulcia                            mun_destTitulcia
`mun_destPerales de Tajuña`                 `mun_destPerales de Tajuña`
mun_destNavacerrada                         mun_destNavacerrada
mun_destRobregordo                          mun_destRobregordo
mun_destMajadahonda                         mun_destMajadahonda
```

```
pais_orig_cod435                             pais_orig_cod435
mun_destCarabaña                             mun_destCarabaña
pais_orig_cod101                             pais_orig_cod101
pais_orig_cod104                             pais_orig_cod104
pais_orig_cod425                             pais_orig_cod425
`mun_destCamarma de Esteruelas`     `mun_destCamarma de Esteruelas`
pais_orig_cod148                             pais_orig_cod148
`mun_destManzanares el Real`         `mun_destManzanares el Real`
`mun_destTorrejón de Ardoz`           `mun_destTorrejón de Ardoz`
`mun_destMiraflores de la Sierra`   `mun_destMiraflores de la Sierra`
pais_orig_cod418                             pais_orig_cod418
pais_orig_cod147                             pais_orig_cod147
`mun_destCollado Mediano`             `mun_destCollado Mediano`
pais_orig_cod218                             pais_orig_cod218
pais_orig_cod106                             pais_orig_cod106
pais_orig_cod145                             pais_orig_cod145
mun_destPedrezuela                         mun_destPedrezuela
mun_destCoslada                             mun_destCoslada
pais_orig_cod211                             pais_orig_cod211
mun_destGriñón                               mun_destGriñón
pais_orig_cod322                             pais_orig_cod322
mun_destColmenarejo                       mun_destColmenarejo
pais_orig_cod033                             pais_orig_cod033
pais_orig_cod442                             pais_orig_cod442
mun_destPinto                                 mun_destPinto
`mun_destHorcajo de la Sierra-Aoslos`  `mun_destHorcajo de la Sierra-Aoslos`
mun_destTorrelodones                     mun_destTorrelodones
pais_orig_cod243                             pais_orig_cod243
pais_orig_cod117                             pais_orig_cod117
mun_destCercedilla                         mun_destCercedilla
mun_destAranjuez                           mun_destAranjuez
pais_orig_cod156                             pais_orig_cod156
`mun_destTorrejón de Velasco`         `mun_destTorrejón de Velasco`
`mun_destFuente el Saz de Jarama`   `mun_destFuente el Saz de Jarama`
`mun_destGarganta de los Montes`     `mun_destGarganta de los Montes`
`mun_destNavas del Rey`                   `mun_destNavas del Rey`
`mun_destHoyo de Manzanares`           `mun_destHoyo de Manzanares`
`mun_destMoraleja de Enmedio`         `mun_destMoraleja de Enmedio`
`mun_destMejorada del Campo`           `mun_destMejorada del Campo`
`mun_destCabanillas de la Sierra`   `mun_destCabanillas de la Sierra`
`mun_destSan Sebastián de los Reyes`  `mun_destSan Sebastián de los Reyes`
`mun_destSerna del Monte, La`         `mun_destSerna del Monte, La`
`mun_destParacuellos de Jarama`     `mun_destParacuellos de Jarama`
mun_destEstremera                         mun_destEstremera
mun_destCiempozuelos                     mun_destCiempozuelos
mun_destBustarviejo                       mun_destBustarviejo
mun_destBrunete                             mun_destBrunete
`mun_destAldea del Fresno`             `mun_destAldea del Fresno`
```

```
mun_destValdemoro                      mun_destValdemoro
pais_orig_cod116                       pais_orig_cod116
pais_orig_cod351                       pais_orig_cod351
`mun_destOrusco de Tajuña`          `mun_destOrusco de Tajuña`
mun_destQuijorna                       mun_destQuijorna
`mun_destBoalo, El`                  `mun_destBoalo, El`
`mun_destMorata de Tajuña`          `mun_destMorata de Tajuña`
pais_orig_cod208                       pais_orig_cod208
`mes2019-08`                          `mes2019-08`
`mun_destFresno de Torote`          `mun_destFresno de Torote`
pais_orig_cod031                       pais_orig_cod031
mun_destSomosierra                     mun_destSomosierra
pais_orig_cod499                       pais_orig_cod499
mun_destCobeña                           mun_destCobeña
mun_destVillaconejos                   mun_destVillaconejos
`mun_destFuentidueña de Tajo`      `mun_destFuentidueña de Tajo`
`mun_destRozas de Madrid, Las`    `mun_destRozas de Madrid, Las`
`mun_destMolinos, Los`              `mun_destMolinos, Los`
pais_orig_cod011                       pais_orig_cod011
`mun_destCabrera, La`                `mun_destCabrera, La`
pais_orig_cod010                       pais_orig_cod010
`mun_destDaganzo de Arriba`        `mun_destDaganzo de Arriba`
pais_orig_cod402                       pais_orig_cod402
`mun_destPezuela de las Torres`  `mun_destPezuela de las Torres`
`mun_destTalamanca de Jarama`      `mun_destTalamanca de Jarama`
`mes2019-09`                          `mes2019-09`
mun_destMóstoles                       mun_destMóstoles
pais_orig_cod135                       pais_orig_cod135
mun_destBatres                           mun_destBatres
`mun_destBecerril de la Sierra`  `mun_destBecerril de la Sierra`
`mun_destVellón, El`                  `mun_destVellón, El`
mun_destCasarrubuelos                  mun_destCasarrubuelos
mun_destPatones                          mun_destPatones
`mun_destCampo Real`                  `mun_destCampo Real`
pais_orig_cod228                       pais_orig_cod228
is_trainTRUE                              is_trainTRUE
`mun_destPinilla del Valle`        `mun_destPinilla del Valle`
pais_orig_cod020                       pais_orig_cod020
`mun_destBerrueco, El`              `mun_destBerrueco, El`
`mun_destColmenar de Oreja`        `mun_destColmenar de Oreja`
pais_orig_cod030                       pais_orig_cod030
`mun_destGuadalix de la Sierra`  `mun_destGuadalix de la Sierra`
pais_orig_cod315                       pais_orig_cod315
pais_orig_cod231                       pais_orig_cod231
pais_orig_cod040                       pais_orig_cod040
mun_destChinchón                       mun_destChinchón
pais_orig_cod350                       pais_orig_cod350
pais_orig_cod220                       pais_orig_cod220
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mun_dest_cod
mun_destGuadarrama
turistas

	Coefficient	AbsCoefficient
gasto	1.000000e+00	1.000000e+00
(Intercept)	1.500023e-12	1.500023e-12
pais_orig_cod407	9.531388e-13	9.531388e-13
pais_orig_cod408	6.826868e-13	6.826868e-13
pais_orig_cod132	6.245194e-13	6.245194e-13
pais_orig_cod343	2.982652e-13	2.982652e-13
pais_orig_cod124	2.755192e-13	2.755192e-13
pais_orig_cod303	2.341098e-13	2.341098e-13
pais_orig_cod302	2.220644e-13	2.220644e-13
`mes2022-05`	1.980046e-13	1.980046e-13
`mes2022-06`	1.975939e-13	1.975939e-13
`mes2022-04`	1.971833e-13	1.971833e-13
pais_orig_cod122	-1.788100e-13	1.788100e-13
`mes2020-05`	1.765688e-13	1.765688e-13
`mes2020-06`	1.753883e-13	1.753883e-13
pais_orig_cod430	1.745951e-13	1.745951e-13
pais_orig_cod342	1.710528e-13	1.710528e-13
`mes2020-04`	1.710219e-13	1.710219e-13
`mes2021-05`	1.634879e-13	1.634879e-13
`mes2021-06`	1.628699e-13	1.628699e-13
`mes2021-04`	1.621990e-13	1.621990e-13
pais_orig_cod344	1.559644e-13	1.559644e-13
`mes2022-10`	1.454963e-13	1.454963e-13
pais_orig_cod436	1.422493e-13	1.422493e-13
`mes2022-08`	1.416313e-13	1.416313e-13
`mes2022-07`	1.403799e-13	1.403799e-13
`mes2022-09`	1.399459e-13	1.399459e-13
pais_orig_cod109	-1.373865e-13	1.373865e-13
pais_orig_cod128	1.324804e-13	1.324804e-13
pais_orig_cod415	1.177717e-13	1.177717e-13
pais_orig_cod110	-1.160023e-13	1.160023e-13
`mes2020-12`	9.683792e-14	9.683792e-14
`mes2020-10`	9.554032e-14	9.554032e-14
`mes2020-11`	9.504938e-14	9.504938e-14
`mes2021-10`	9.281135e-14	9.281135e-14
pais_orig_cod301	9.222564e-14	9.222564e-14
`mes2021-11`	9.193031e-14	9.193031e-14
`mes2020-07`	9.122452e-14	9.122452e-14
`mes2020-09`	8.997811e-14	8.997811e-14
`mes2020-08`	8.964076e-14	8.964076e-14
`mes2021-12`	8.920636e-14	8.920636e-14
`mes2019-10`	8.884447e-14	8.884447e-14
`mes2019-11`	8.790509e-14	8.790509e-14
pais_orig_cod125	8.761933e-14	8.761933e-14

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pais_orig_cod154                              8.650750e-14    8.650750e-14
pais_orig_cod115                             -8.580903e-14    8.580903e-14
`mes2019-12`                                  8.548193e-14    8.548193e-14
pais_orig_cod107                             -8.491285e-14    8.491285e-14
`mes2022-03`                                  8.327821e-14    8.327821e-14
`mes2022-01`                                  8.295337e-14    8.295337e-14
`mes2022-02`                                  8.269542e-14    8.269542e-14
`mes2021-03`                                  7.514188e-14    7.514188e-14
`mes2021-02`                                  7.474872e-14    7.474872e-14
`mes2021-01`                                  7.189319e-14    7.189319e-14
pais_orig_cod120                              6.841746e-14    6.841746e-14
pais_orig_cod340                             -5.735419e-14    5.735419e-14
pais_orig_cod121                             -5.299039e-14    5.299039e-14
`mes2021-08`                                  4.843922e-14    4.843922e-14
`mes2021-09`                                  4.825460e-14    4.825460e-14
`mes2021-07`                                  4.678022e-14    4.678022e-14
pais_orig_cod123                              4.302493e-14    4.302493e-14
pais_orig_cod103                             -3.693480e-14    3.693480e-14
`mun_destTres Cantos`                         3.172485e-14    3.172485e-14
`mun_destPuentes Viejas`                      3.015047e-14    3.015047e-14
pais_orig_cod102                             -2.956676e-14    2.956676e-14
`mun_destLozoyuela-Navas-Sieteiglesias`       2.700781e-14    2.700781e-14
`mun_destOlmeda de las Fuentes`              -2.598507e-14    2.598507e-14
`mun_destRozas de Puerto Real`               -2.544637e-14    2.544637e-14
pais_orig_cod404                             -2.403072e-14    2.403072e-14
pais_orig_cod424                             -2.398579e-14    2.398579e-14
pais_orig_cod327                             -2.334943e-14    2.334943e-14
pais_orig_cod433                             -2.324978e-14    2.324978e-14
pais_orig_cod113                              2.204816e-14    2.204816e-14
pais_orig_cod226                             -2.182810e-14    2.182810e-14
pais_orig_cod233                             -2.181936e-14    2.181936e-14
pais_orig_cod246                             -2.179447e-14    2.179447e-14
pais_orig_cod204                             -2.177562e-14    2.177562e-14
pais_orig_cod247                             -2.168978e-14    2.168978e-14
pais_orig_cod215                             -2.151922e-14    2.151922e-14
pais_orig_cod210                             -2.145479e-14    2.145479e-14
pais_orig_cod229                              2.139955e-14    2.139955e-14
pais_orig_cod502                             -2.072050e-14    2.072050e-14
pais_orig_cod417                             -2.050403e-14    2.050403e-14
`mun_destTorremocha de Jarama`               -1.790245e-14    1.790245e-14
pais_orig_cod447                              1.733543e-14    1.733543e-14
`mes2020-01`                                 -1.352954e-14    1.352954e-14
`mun_destAtazar, El`                         -1.345304e-14    1.345304e-14
`mun_destTorrejón de la Calzada`             1.297678e-14    1.297678e-14
`mun_destPiñuécar-Gandullas`                 1.288647e-14    1.288647e-14
`mun_destMontejo de la Sierra`               -1.249593e-14    1.249593e-14
pais_orig_cod505                              1.213894e-14    1.213894e-14
mun_destValdemorillo                          1.164045e-14    1.164045e-14
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pais_orig_cod401                          1.151374e-14   1.151374e-14
`mes2020-03`                             -1.145490e-14   1.145490e-14
`mes2020-02`                             -1.097810e-14   1.097810e-14
mun_destChapinería                       -1.051300e-14   1.051300e-14
`mun_destVillanueva de Perales`           9.999816e-15   9.999816e-15
mun_destAlcobendas                       -9.838597e-15   9.838597e-15
pais_orig_cod126                         -9.741149e-15   9.741149e-15
`mun_destRobledillo de la Jara`          -9.028631e-15   9.028631e-15
`mun_destAlcalá de Henares`              -8.868132e-15   8.868132e-15
pais_orig_cod201                          8.679686e-15   8.679686e-15
mun_destNavalafuente                     -8.569918e-15   8.569918e-15
mun_destCorpa                            -8.527882e-15   8.527882e-15
`mun_destVillaviciosa de Odón`            8.451626e-15   8.451626e-15
`mun_destBoadilla del Monte`             -8.142801e-15   8.142801e-15
pais_orig_cod158                          8.136762e-15   8.136762e-15
`mun_destFresnedillas de la Oliva`       -7.936679e-15   7.936679e-15
mun_destAmbite                           -7.318108e-15   7.318108e-15
mun_destGetafe                           -7.108653e-15   7.108653e-15
`mun_destSan Agustín del Guadalix`        7.091589e-15   7.091589e-15
`mun_destSoto del Real`                   6.838919e-15   6.838919e-15
`mun_destNavarredonda y San Mamés`        6.614831e-15   6.614831e-15
`mun_destPrádena del Rincón`             -6.589327e-15   6.589327e-15
mun_destFuenlabrada                      -6.509976e-15   6.509976e-15
`mun_destBerzosa del Lozoya`             -6.482617e-15   6.482617e-15
`mun_destBrea de Tajo`                   -6.385742e-15   6.385742e-15
pais_orig_cod249                         -6.280186e-15   6.280186e-15
mun_destAlcorcón                         -6.275233e-15   6.275233e-15
mun_destBraojos                           6.245561e-15   6.245561e-15
`mun_destTorres de la Alameda`            6.110399e-15   6.110399e-15
mun_destTorrelaguna                       6.090656e-15   6.090656e-15
pais_orig_cod136                          6.054519e-15   6.054519e-15
`mun_destVillanueva del Pardillo`         5.970168e-15   5.970168e-15
`mun_destVillar del Olmo`                 5.959634e-15   5.959634e-15
mun_destLoeches                           5.844337e-15   5.844337e-15
mun_destVillamanta                        5.809977e-15   5.809977e-15
mun_destVillamantilla                    -5.799414e-15   5.799414e-15
mun_destLeganés                          -5.720684e-15   5.720684e-15
mun_destParla                            -5.604178e-15   5.604178e-15
pais_orig_cod348                          5.535770e-15   5.535770e-15
mun_destValdemaqueda                      5.515891e-15   5.515891e-15
mun_destValdeavero                        5.464974e-15   5.464974e-15
pais_orig_cod245                         -5.414903e-15   5.414903e-15
mun_destValdepiélagos                    -5.395649e-15   5.395649e-15
mun_destArroyomolinos                     5.377435e-15   5.377435e-15
pais_orig_cod341                          5.376937e-15   5.376937e-15
`mun_destBuitrago del Lozoya`            -5.366091e-15   5.366091e-15
mun_destMoralzarzal                       5.207454e-15   5.207454e-15
`mun_destValverde de Alcalá`             -5.184477e-15   5.184477e-15
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pais_orig_cod131                          5.174242e-15    5.174242e-15
pais_orig_cod143                          5.157150e-15    5.157150e-15
`mun_destSan Fernando de Henares`         5.156212e-15    5.156212e-15
`mun_destSan Martín de la Vega`           5.136978e-15    5.136978e-15
pais_orig_cod347                          5.088763e-15    5.088763e-15
pais_orig_cod323                          5.071824e-15    5.071824e-15
`mun_destMolar, El`                       5.014793e-15    5.014793e-15
mun_destMeco                              5.013733e-15    5.013733e-15
mun_destRibatejada                        5.002005e-15    5.002005e-15
pais_orig_cod326                          4.981122e-15    4.981122e-15
pais_orig_cod345                          4.939654e-15    4.939654e-15
`mun_destPozuelo del Rey`                 4.839658e-15    4.839658e-15
`mun_destEscorial, El`                    4.751352e-15    4.751352e-15
pais_orig_cod221                          4.716562e-15    4.716562e-15
`mun_destColmenar Viejo`                 -4.677600e-15    4.677600e-15
`mun_destSantos de la Humosa, Los`        4.664939e-15    4.664939e-15
pais_orig_cod414                          4.664733e-15    4.664733e-15
mun_destValdelaguna                      -4.631033e-15    4.631033e-15
`mun_destSan Martín de Valdeiglesias`     4.619885e-15    4.619885e-15
mun_destGalapagar                        -4.609919e-15    4.609919e-15
pais_orig_cod409                          4.609339e-15    4.609339e-15
pais_orig_cod032                          4.585332e-15    4.585332e-15
mun_destVenturada                         4.582421e-15    4.582421e-15
pais_orig_cod432                          4.578884e-15    4.578884e-15
pais_orig_cod411                          4.569923e-15    4.569923e-15
pais_orig_cod420                          4.540504e-15    4.540504e-15
pais_orig_cod413                          4.508758e-15    4.508758e-15
pais_orig_cod321                          4.483174e-15    4.483174e-15
pais_orig_cod138                          4.432057e-15    4.432057e-15
`mun_destPuebla de la Sierra`             4.394739e-15    4.394739e-15
pais_orig_cod144                          4.369957e-15    4.369957e-15
`mun_destVelilla de San Antonio`          4.361566e-15    4.361566e-15
pais_orig_cod157                          4.334560e-15    4.334560e-15
pais_orig_cod434                         -4.325756e-15    4.325756e-15
pais_orig_cod239                          4.287717e-15    4.287717e-15
pais_orig_cod437                          4.242342e-15    4.242342e-15
mun_destTielmes                           4.242086e-15    4.242086e-15
`mun_destVilla del Prado`                 4.206238e-15    4.206238e-15
`mun_destPelayos de la Presa`             4.181054e-15    4.181054e-15
mun_destVillalbilla                       4.127229e-15    4.127229e-15
mun_destCenicientos                       4.120636e-15    4.120636e-15
pais_orig_cod501                         -4.118660e-15    4.118660e-15
pais_orig_cod217                          4.082655e-15    4.082655e-15
pais_orig_cod319                          4.057087e-15    4.057087e-15
pais_orig_cod234                          4.004202e-15    4.004202e-15
`mun_destVillarejo de Salvanés`           3.997301e-15    3.997301e-15
pais_orig_cod174                          3.991126e-15    3.991126e-15
pais_orig_cod230                          3.970256e-15    3.970256e-15
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`mun_destValdetorres de Jarama`            3.951657e-15    3.951657e-15
`mun_destValdeolmos-Alalpardo`             3.941543e-15    3.941543e-15
`mun_destHumanes de Madrid`                3.932447e-15    3.932447e-15
pais_orig_cod248                           3.917621e-15    3.917621e-15
`mun_destPozuelo de Alarcón`              -3.894385e-15    3.894385e-15
mun_destAnchuelo                          -3.838302e-15    3.838302e-15
pais_orig_cod314                           3.831094e-15    3.831094e-15
pais_orig_cod426                           3.826800e-15    3.826800e-15
`mun_destSevilla la Nueva`                 3.812345e-15    3.812345e-15
`mun_destCadalso de los Vidrios`          -3.808306e-15    3.808306e-15
mun_destValdemanco                         3.797368e-15    3.797368e-15
pais_orig_cod250                          -3.782462e-15    3.782462e-15
pais_orig_cod050                           3.749679e-15    3.749679e-15
`mun_destSan Lorenzo de El Escorial`       3.743605e-15    3.743605e-15
pais_orig_cod112                           3.743182e-15    3.743182e-15
`mun_destSanta María de la Alameda`        3.740839e-15    3.740839e-15
pais_orig_cod227                           3.736928e-15    3.736928e-15
`mun_destRivas-Vaciamadrid`                3.731989e-15    3.731989e-15
pais_orig_cod137                           3.687214e-15    3.687214e-15
`mun_destNuevo Baztán`                     3.682150e-15    3.682150e-15
pais_orig_cod213                           3.673110e-15    3.673110e-15
pais_orig_cod317                           3.641800e-15    3.641800e-15
mun_destRedueña                            3.641207e-15    3.641207e-15
pais_orig_cod504                          -3.558154e-15    3.558154e-15
mun_destMadrid                            -3.553047e-15    3.553047e-15
pais_orig_cod111                           3.539426e-15    3.539426e-15
mun_destCanencia                          -3.518442e-15    3.518442e-15
pais_orig_cod412                           3.491612e-15    3.491612e-15
mun_destValdilecha                         3.491063e-15    3.491063e-15
pais_orig_cod146                           3.367645e-15    3.367645e-15
pais_orig_cod410                           3.298937e-15    3.298937e-15
pais_orig_cod236                           3.298514e-15    3.298514e-15
pais_orig_cod203                           3.291738e-15    3.291738e-15
`mun_destCollado Villalba`                 3.277444e-15    3.277444e-15
pais_orig_cod324                           3.250486e-15    3.250486e-15
pais_orig_cod141                           3.231173e-15    3.231173e-15
mun_destGascones                           3.193946e-15    3.193946e-15
pais_orig_cod142                           3.176564e-15    3.176564e-15
pais_orig_cod224                           3.147221e-15    3.147221e-15
pais_orig_cod118                           3.143971e-15    3.143971e-15
mun_destAlpedrete                         -3.124229e-15    3.124229e-15
`mun_destCubas de la Sagra`               -3.118097e-15    3.118097e-15
`mun_destÁlamo, El`                       -3.090847e-15    3.090847e-15
mun_destNavalagamella                      3.088518e-15    3.088518e-15
`mun_destRobledo de Chavela`               3.087642e-15    3.087642e-15
`mun_destBelmonte de Tajo`                -3.083777e-15    3.083777e-15
mun_destSantorcaz                          3.083601e-15    3.083601e-15
mun_destLozoya                             3.022280e-15    3.022280e-15
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pais_orig_cod403                              3.017139e-15    3.017139e-15
mun_destValdaracete                           3.010877e-15    3.010877e-15
mun_destNavalcarnero                          2.979666e-15    2.979666e-15
`mun_destHorcajuelo de la Sierra`             2.950627e-15    2.950627e-15
`mun_destColmenar del Arroyo`                -2.945062e-15    2.945062e-15
pais_orig_cod416                              2.917411e-15    2.917411e-15
pais_orig_cod139                              2.889318e-15    2.889318e-15
`mun_destSerranillos del Valle`               2.883449e-15    2.883449e-15
`mun_destVillamanrique de Tajo`              -2.879633e-15    2.879633e-15
`mun_destVillanueva de la Cañada`             2.839857e-15    2.839857e-15
mun_destAlgete                               -2.798937e-15    2.798937e-15
pais_orig_cod443                              2.786570e-15    2.786570e-15
pais_orig_cod202                              2.770686e-15    2.770686e-15
pais_orig_cod421                              2.765949e-15    2.765949e-15
pais_orig_cod114                              2.750564e-15    2.750564e-15
pais_orig_cod427                              2.746515e-15    2.746515e-15
pais_orig_cod252                             -2.742689e-15    2.742689e-15
`mun_destArganda del Rey`                    -2.731516e-15    2.731516e-15
mun_destRascafría                             2.709957e-15    2.709957e-15
mun_destTitulcia                             -2.700285e-15    2.700285e-15
`mun_destPerales de Tajuña`                   2.658312e-15    2.658312e-15
mun_destNavacerrada                           2.604914e-15    2.604914e-15
mun_destRobregordo                           -2.598091e-15    2.598091e-15
mun_destMajadahonda                           2.576209e-15    2.576209e-15
pais_orig_cod435                             -2.566726e-15    2.566726e-15
mun_destCarabaña                              2.556334e-15    2.556334e-15
pais_orig_cod101                              2.479349e-15    2.479349e-15
pais_orig_cod104                              2.474719e-15    2.474719e-15
pais_orig_cod425                              2.472175e-15    2.472175e-15
`mun_destCamarma de Esteruelas`              -2.439424e-15    2.439424e-15
pais_orig_cod148                              2.432449e-15    2.432449e-15
`mun_destManzanares el Real`                  2.393749e-15    2.393749e-15
`mun_destTorrejón de Ardoz`                   2.378903e-15    2.378903e-15
`mun_destMiraflores de la Sierra`             2.225261e-15    2.225261e-15
pais_orig_cod418                              2.155760e-15    2.155760e-15
pais_orig_cod147                              2.150097e-15    2.150097e-15
`mun_destCollado Mediano`                     1.989437e-15    1.989437e-15
pais_orig_cod218                              1.918729e-15    1.918729e-15
pais_orig_cod106                              1.905113e-15    1.905113e-15
pais_orig_cod145                             -1.890727e-15    1.890727e-15
mun_destPedrezuela                            1.887171e-15    1.887171e-15
mun_destCoslada                               1.861183e-15    1.861183e-15
pais_orig_cod211                              1.850583e-15    1.850583e-15
mun_destGriñón                               -1.837849e-15    1.837849e-15
pais_orig_cod322                             -1.835498e-15    1.835498e-15
mun_destColmenarejo                           1.811361e-15    1.811361e-15
pais_orig_cod033                              1.809646e-15    1.809646e-15
pais_orig_cod442                              1.746580e-15    1.746580e-15
```

```
mun_destPinto                            -1.693735e-15    1.693735e-15
`mun_destHorcajo de la Sierra-Aoslos`    -1.691586e-15    1.691586e-15
mun_destTorrelodones                     -1.676233e-15    1.676233e-15
pais_orig_cod243                         -1.652783e-15    1.652783e-15
pais_orig_cod117                          1.628035e-15    1.628035e-15
mun_destCercedilla                        1.618853e-15    1.618853e-15
mun_destAranjuez                         -1.604878e-15    1.604878e-15
pais_orig_cod156                          1.590320e-15    1.590320e-15
`mun_destTorrejón de Velasco`             1.580551e-15    1.580551e-15
`mun_destFuente el Saz de Jarama`        -1.533841e-15    1.533841e-15
`mun_destGarganta de los Montes`         -1.499691e-15    1.499691e-15
`mun_destNavas del Rey`                   1.469781e-15    1.469781e-15
`mun_destHoyo de Manzanares`             -1.459998e-15    1.459998e-15
`mun_destMoraleja de Enmedio`             1.452222e-15    1.452222e-15
`mun_destMejorada del Campo`              1.451261e-15    1.451261e-15
`mun_destCabanillas de la Sierra`        -1.387142e-15    1.387142e-15
`mun_destSan Sebastián de los Reyes`      1.375873e-15    1.375873e-15
`mun_destSerna del Monte, La`            -1.319908e-15    1.319908e-15
`mun_destParacuellos de Jarama`           1.315403e-15    1.315403e-15
mun_destEstremera                        -1.306579e-15    1.306579e-15
mun_destCiempozuelos                      1.290417e-15    1.290417e-15
mun_destBustarviejo                      -1.278876e-15    1.278876e-15
mun_destBrunete                          -1.275024e-15    1.275024e-15
`mun_destAldea del Fresno`               -1.242828e-15    1.242828e-15
mun_destValdemoro                         1.215663e-15    1.215663e-15
pais_orig_cod116                          1.210305e-15    1.210305e-15
pais_orig_cod351                          1.186067e-15    1.186067e-15
`mun_destOrusco de Tajuña`               -1.182348e-15    1.182348e-15
mun_destQuijorna                          1.159929e-15    1.159929e-15
`mun_destBoalo, El`                       1.099043e-15    1.099043e-15
`mun_destMorata de Tajuña`               -1.063652e-15    1.063652e-15
pais_orig_cod208                          9.933373e-16    9.933373e-16
`mes2019-08`                              9.727684e-16    9.727684e-16
`mun_destFresno de Torote`               -9.245952e-16    9.245952e-16
pais_orig_cod031                          8.919194e-16    8.919194e-16
mun_destSomosierra                        8.857891e-16    8.857891e-16
pais_orig_cod499                          8.773773e-16    8.773773e-16
mun_destCobeña                            8.474892e-16    8.474892e-16
mun_destVillaconejos                     -8.437004e-16    8.437004e-16
`mun_destFuentidueña de Tajo`            -8.371924e-16    8.371924e-16
`mun_destRozas de Madrid, Las`            8.296797e-16    8.296797e-16
`mun_destMolinos, Los`                    7.758026e-16    7.758026e-16
pais_orig_cod011                         -7.680194e-16    7.680194e-16
`mun_destCabrera, La`                    -7.297152e-16    7.297152e-16
pais_orig_cod010                         -7.280556e-16    7.280556e-16
`mun_destDaganzo de Arriba`              -7.045204e-16    7.045204e-16
pais_orig_cod402                          6.952706e-16    6.952706e-16
`mun_destPezuela de las Torres`           6.668149e-16    6.668149e-16
```

```
`mun_destTalamanca de Jarama`          -6.148532e-16    6.148532e-16
`mes2019-09`                           -5.976440e-16    5.976440e-16
mun_destMóstoles                       -5.595758e-16    5.595758e-16
pais_orig_cod135                       -5.536392e-16    5.536392e-16
mun_destBatres                          5.393593e-16    5.393593e-16
`mun_destBecerril de la Sierra`         5.250212e-16    5.250212e-16
`mun_destVellón, El`                   -5.238241e-16    5.238241e-16
mun_destCasarrubuelos                  -5.165058e-16    5.165058e-16
mun_destPatones                         4.438733e-16    4.438733e-16
`mun_destCampo Real`                    4.202284e-16    4.202284e-16
pais_orig_cod228                        3.794717e-16    3.794717e-16
is_trainTRUE                            3.635690e-16    3.635690e-16
`mun_destPinilla del Valle`             3.418669e-16    3.418669e-16
pais_orig_cod020                        3.363213e-16    3.363213e-16
`mun_destBerrueco, El`                  3.330207e-16    3.330207e-16
`mun_destColmenar de Oreja`            -3.240979e-16    3.240979e-16
pais_orig_cod030                        3.179765e-16    3.179765e-16
`mun_destGuadalix de la Sierra`        -3.066684e-16    3.066684e-16
pais_orig_cod315                       -2.942145e-16    2.942145e-16
pais_orig_cod231                       -2.452508e-16    2.452508e-16
pais_orig_cod040                       -9.067528e-17    9.067528e-17
mun_destChinchón                        8.543061e-17    8.543061e-17
pais_orig_cod350                       -4.253820e-17    4.253820e-17
pais_orig_cod220                       -3.768754e-17    3.768754e-17
mun_dest_cod                           -3.413476e-17    3.413476e-17
mun_destGuadarrama                     -3.209834e-17    3.209834e-17
turistas                                3.045596e-20    3.045596e-20
```

0.6.2 Logistic Regression Feature importance

No aplica

0.7 Decision Tree Feature Importance

0.7.1 CART Regression Feature Importance

```
In [13]: # install the necessary packages if not already installed
         if (!require(rpart)) {
           install.packages('rpart')
         }

         # load the necessary packages
         library(rpart)

         # fit the model
         cart_model <- rpart(Target ~ ., data = data, method = "anova")
```

```
                # compute feature importances
                importance <- as.data.frame(varImp(cart_model))

                # sort by importance
                importance <- importance[order(-importance$Overall), ]

                # print the feature importance
                print(importance)
```

[1] 5.67630735 2.62202327 2.13426807 2.13426807 0.17940331 0.07349700 0.05738885
[8] 0.00000000 0.00000000

0.7.2 CART Classification Feature Importance

No aplica

0.7.3 Random Forest Regression Feature Importance

ATENCIÓN: Este proceso es costoso en recursos.

```
In [22]: # install the necessary packages if not already installed
         if (!require(randomForest)) {
           install.packages('randomForest')
         }

         # load the necessary packages
         library(randomForest)

         # fit the model
         rf_model <- randomForest(Target ~ ., data = data, importance = TRUE)

         # get feature importances
         importance <- rf_model$importance

         # make a data frame of feature names and their corresponding importances
         feature_importance <- data.frame(Feature = rownames(importance), Importance = importanc

         # sort the features by importance in descending order
         feature_importance <- feature_importance[order(-feature_importance$Importance), ]

         # print the feature importance
         print(feature_importance)
```

```
                     Feature   Importance
gasto                  gasto 1.230075e+03
pais_orig_cod pais_orig_cod 2.379278e+02
pais_orig          pais_orig 1.543369e+02
mes                      mes 9.618383e+01
```

```
mun_dest_cod     mun_dest_cod 7.537540e+00
mun_dest          mun_dest 6.805672e+00
CMUN                  CMUN 4.384577e+00
turistas          turistas 4.053388e+00
is_train          is_train 1.930301e-02
```

In [23]: rf_model$importance

	%IncMSE	IncNodePurity
mes	9.618383e+01	3183867.92
pais_orig_cod	2.379278e+02	7095299.65
pais_orig	1.543369e+02	3684412.40
mun_dest_cod	7.537540e+00	121856.41
mun_dest	6.805672e+00	108354.79
turistas	4.053388e+00	161926.74
CMUN	4.384577e+00	114282.84
gasto	1.230075e+03	29437663.42
is_train	1.930301e-02	6391.69

A matrix: 9 Œ 2 of type dbl

0.7.4 Random Forest Classification Feature Importance

No aplica

0.8 Permutation Feature Importance

0.8.1 Permutation Feature Importance for Regression

```
In [25]: # install the necessary packages if not already installed
         if (!require(ranger)) {
           install.packages('ranger')
         }

         # load the necessary packages
         library(ranger)

         # fit the model
         rf_model <- ranger(Target ~ ., data = data, importance = 'permutation')

         # get feature importances
         importance <- data.frame(Feature = names(rf_model$variable.importance), Importance = rf

         # sort the features by importance in descending order
         importance <- importance[order(-importance$Importance), ]

         # print the feature importance
         print(importance)

                  Feature   Importance
         gasto      gasto 1.221631e+03
```

```
pais_orig_cod pais_orig_cod 2.361955e+02
pais_orig          pais_orig 1.460621e+02
mes                      mes 9.928514e+01
mun_dest            mun_dest 4.998603e+00
CMUN                    CMUN 4.874211e+00
turistas            turistas 4.586304e+00
mun_dest_cod    mun_dest_cod 4.228797e+00
is_train            is_train 2.197512e-02
```

0.8.2   Permutation Feature Importance for Classification

No aplica

0.9   Evaluating a Logistic Regression model with feature selection.

0.9.1   Evaluating with all selected features.

0.9.2   Evaluating with feature selection performed using feature importance.

Select type of Feature Importance to use
   Operation