Aprendizaje Automático con Tensorflow y R

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RStudio

Tensorflow

- Para el **aprendizaje automático y profundo**.
- Computación de alto desempeño
- Librería de código abierto
- Variedad de plataformas y dispositivos

Fuente: *https://www.tensorflow.org/*

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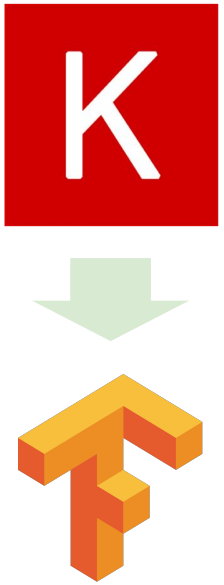
Keras

- Se integra con Tensorflow y otros
- El mismo código funciona en CPU o GPU
- Facilita el desarrollo de modelos
- Redes convolucionales y recurrentes



Fuente: *https://github.com/rstudio/keras*

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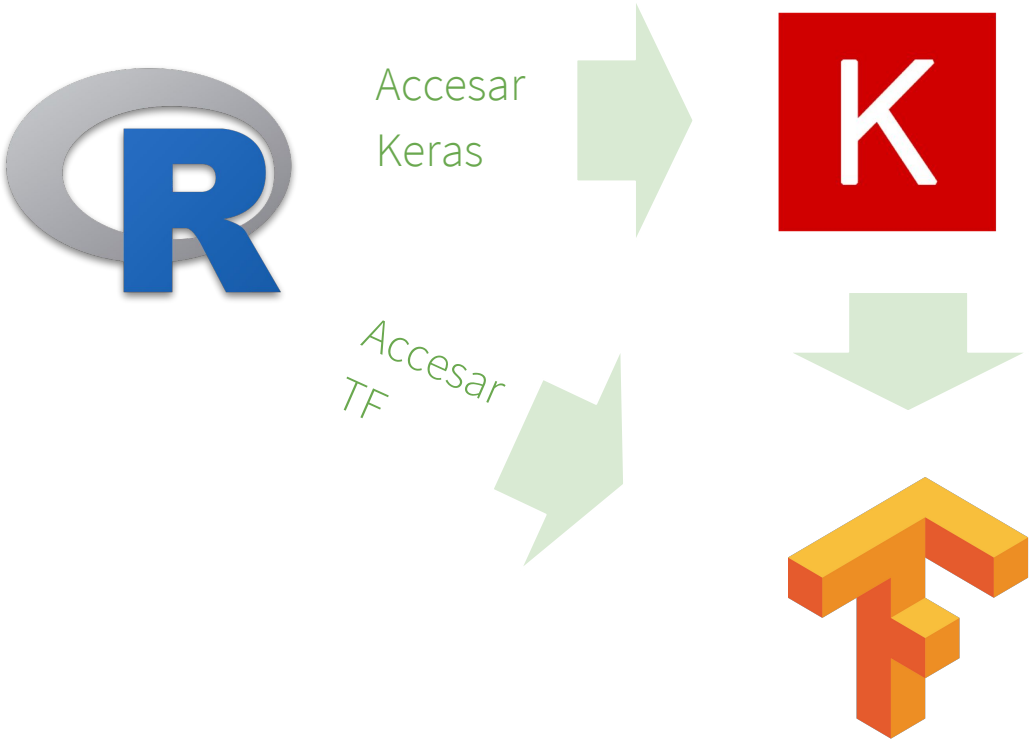
Fácil integración de R, Tensorflow y Keras



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Pero, por que...

¿  +  ?

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Aprendizaje Automático es de varios pasos

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Entrenar el modelo es solo un paso...

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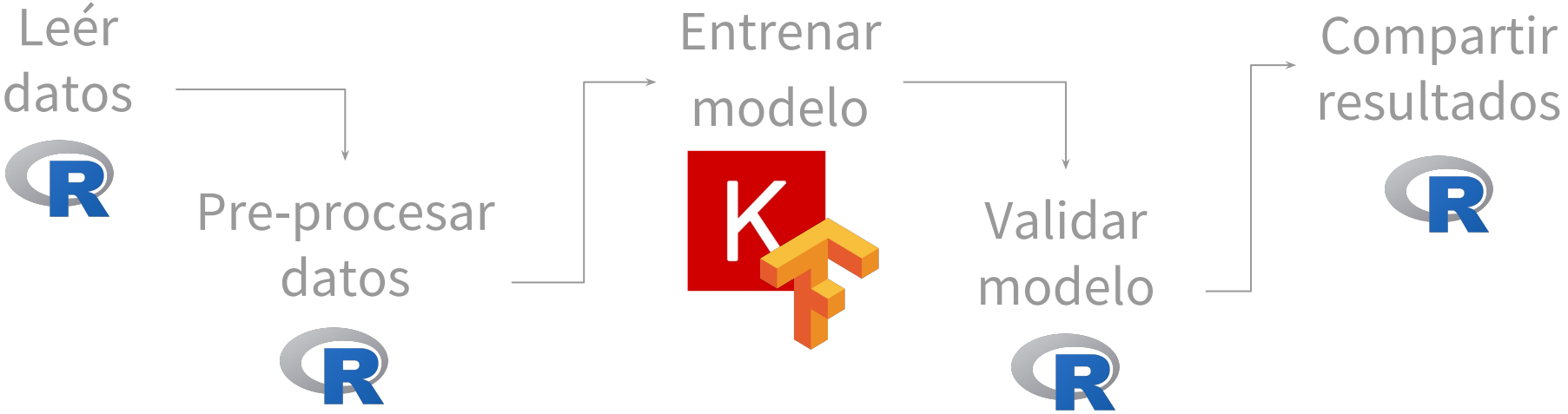
R se especializa en todos los pasos



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13 mil paquetes especializados de R

Leér datos

Pre-procesar datos

Entrenar modelo

Validar modelo

Compartir resultados

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Prediciendo pérdida de clientes

Demostración

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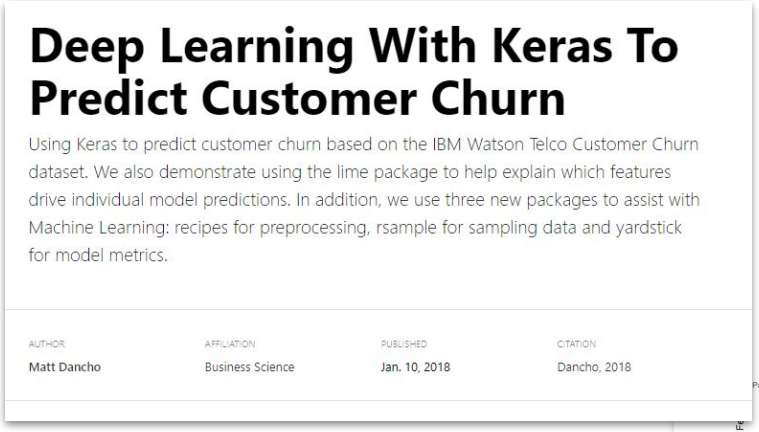
Análisis original

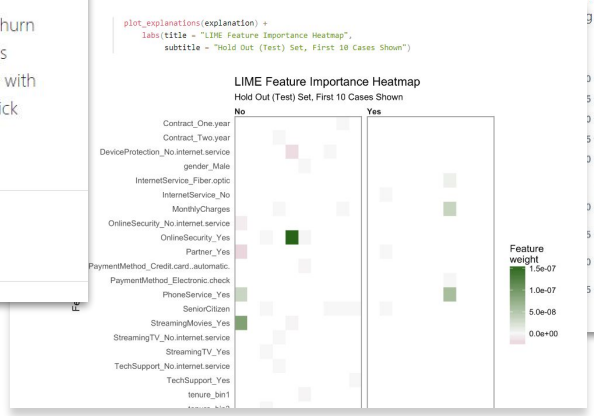
Ejemplo basado en el artículo: “**Deep Learning With Keras To Predict Customer Churn**”, publicado por **Matt Dancho**.

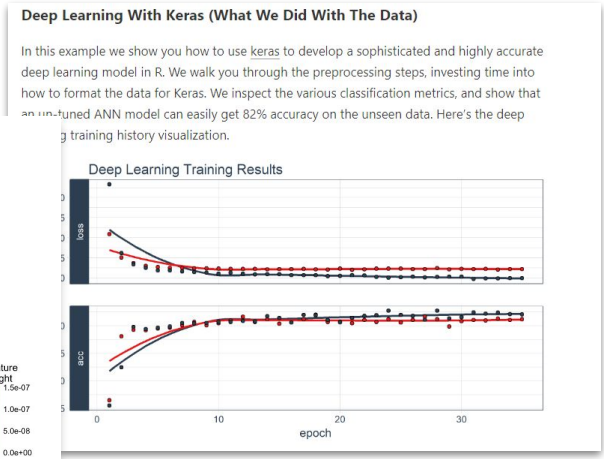


Deep Learning With Keras To Predict Customer Churn

Using Keras to predict customer churn based on the IBM Watson Telco Customer Churn dataset. We also demonstrate using the lime package to help explain which features drive individual model predictions. In addition, we use three new packages to assist with Machine Learning: recipes for preprocessing, rsample for sampling data and yardstick for model metrics.

AUTHOR	AFFILIATION	PUBLISHED	CITATION
Matt Dancho	Business Science	Jan. 10, 2018	Dancho, 2018





https://blogs.rstudio.com/tensorflow/posts/2018-01-11-keras-customer-churn/

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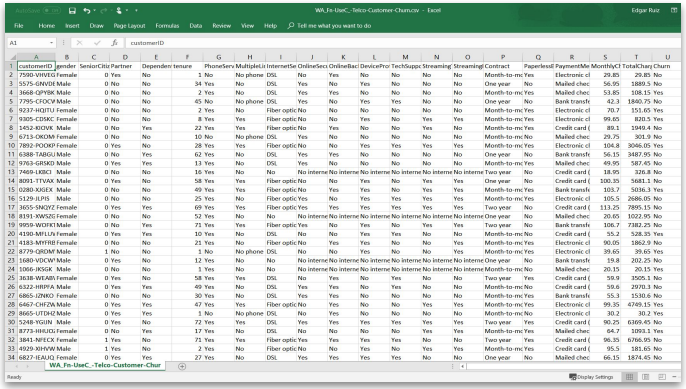
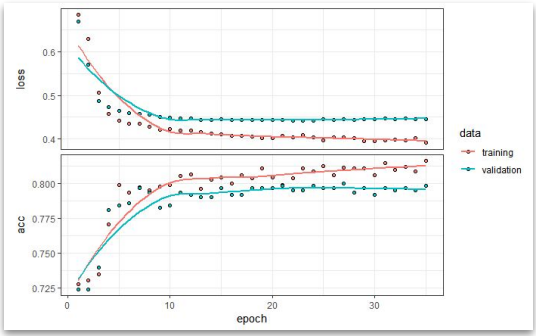
Objetivo

Analizar datos de pérdida de clientes de una **compañía de telecomunicaciones** con R, Keras y Tensorflow.





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Instale TF y Keras desde R

Instale los paquetes de R

Cargue el paquete *keras*

Instalar TF y Keras

```
install.packages("tensorflow")
install.packages("keras")

library(keras)

install_tensorflow()
install_keras()
```

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Paquetes de R para cada paso

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Leér datos

```
datos_perdimiento <- read_csv("customer_churn.csv")
```

```
# A tibble: 7,043 x 21
   customerID gender SeniorCitizen Partner Dependents tenure PhoneService
   <chr>      <chr>          <dbl> <chr>   <chr>       <dbl> <chr>
 1 7590-VHVEG Female             0 Yes     No              1 No
 2 5575-GNVDE Male               0 No      No             34 Yes
 3 3668-QPYBK Male               0 No      No              2 Yes
 4 7795-CFOCW Male               0 No      No             45 No
 5 9237-HQITU Female             0 No      No              2 Yes
 6 9305-CDSKC Female             0 No      No              8 Yes
 7 1452-KIOVK Male               0 No      Yes            22 Yes
 8 6713-OKOMC Female             0 No      No             10 No
 9 7892-POOKP Female             0 Yes     No             28 Yes
10 6388-TABGU Male               0 No      Yes            62 Yes
# ... with 7,033 more rows, and 14 more variables: MultipleLines <chr>
```

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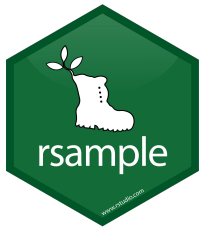
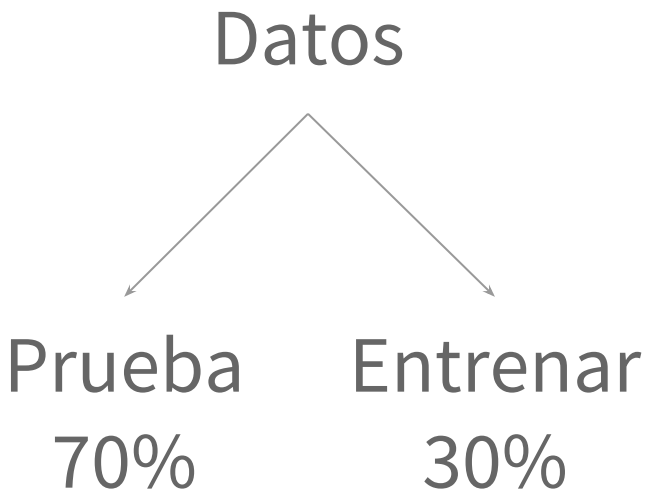


Pre-procesar - *Muestra de datos*




```
separa_datos <- initial_split(
  datos_perdimiento,
  prop = 0.3
 )

tbl_entrenar <- training(separa_datos)

tbl_prueba  <- testing(separa_datos)
```

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Pre-procesar - *La receta!*

- Remueve columnas
- Omitir NAs
- Partir en categorías
- Conversión logarítmica
- Conversión lógica
- Variables ficticias
- Centrar valores
- Escalar valores

```
receta <- tbl_entrenar %>%
  recipe(Churn ~ .) %>%
  step_rm(customerID) %>%
  step_naomit(all_outcomes(), all_predictors()) %>%
  step_discretize(tenure,options = list(cuts = 6)) %>%
  step_log(TotalCharges) %>%
  step_mutate(Churn = ifelse(Churn=="Yes", 1, 0)) %>%
  step_dummy(all_nominal(), -all_outcomes()) %>%
  step_center(all_predictors(), -all_outcomes()) %>%
  step_scale(all_predictors(), -all_outcomes()) %>%
  prep()
```

Pre-procesar - *"Cocinar" receta*

```
x_tbl_entrenar <- receta %>%
  juice(all_predictors(),
        composition = "matrix")

y_vec_entrenar <- receta %>%
  juice(all_outcomes()) %>%
  pull()
```

La muestra de **entrenamiento** es extraída

```
baked_test <- bake(receta, tbl_prueba)

x_tbl_prueba <- baked_test %>%
  select(-Churn) %>%
  as.matrix()

y_vec_prueba <- baked_test %>%
  select(Churn) %>%
  pull()
```

La porción para **prueba** is procesada

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Entrenar el modelo - *Preparación*

Capa densa

Capa de pérdida

Capa densa

Capa de pérdida

Capa densa

Compilar

```
model_keras <- keras_model_sequential() %>%
  layer_dense(units = 16,
              kernel_initializer = "uniform",
              activation = "relu",
              input_shape = ncol(x_tbl_entrenar)) %>%
  layer_dropout(rate = 0.1) %>%
  layer_dense(units = 16,
              kernel_initializer = "
              uniform", activation = "relu") %>%
  layer_dropout(rate = 0.1) %>%
  layer_dense(units = 1,
              kernel_initializer = "uniform",
              activation = "sigmoid") %>%
  compile(optimizer = 'adam',
          loss = 'binary_crossentropy',
          metrics = c('accuracy'))
```

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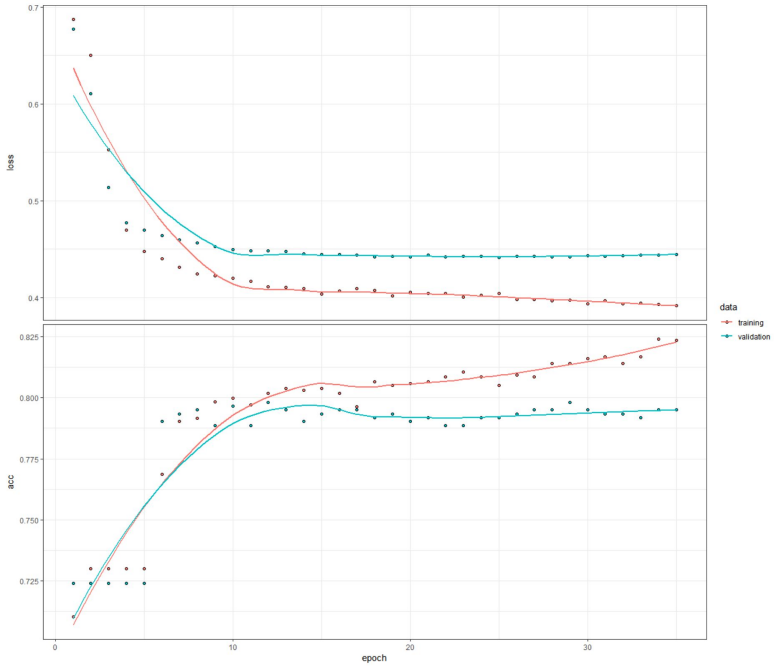
Entrenar el modelo - *Entrenar el modelo*




```
history <- fit(
  object = model_keras,
  x = x_tbl_entrenar,
  y = y_vec_entrenar,
  batch_size = 50,
  epochs = 35,
  validation_split = 0.30,
  verbose = 0
)
```

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Entrenar el modelo - *Predicciones*

```
yhat_keras_class_vec <- model_keras %>%
  predict_classes(x_tbl_prueba) %>%
  as.factor() %>%
  fct_recode(yes = "1", no = "0")
yhat_keras_prob_vec  <- model_keras %>%
  predict_proba(x_tbl_prueba) %>%
  as.vector()
test_truth <- y_vec_prueba %>%
  as.factor() %>%
  fct_recode(yes = "1", no = "0")
estimates_keras_tbl <- tibble(
  truth      = test_truth,
  estimate   = yhat_keras_class_vec,
  class_prob = yhat_keras_prob_vec)
estimates_keras_tbl
```

```
# A tibble: 4,920 x 3
   truth estimate class_prob
   <fct> <fct>          <dbl>
 1 no    yes          0.765
 2 yes   no           0.368
 3 yes   yes          0.749
 4 yes   yes          0.782
 5 no    yes          0.565
 6 no    no           0.106
 7 yes   yes          0.579
 8 no    no           0.00366
 9 no    no           0.221
10 no    no           0.0118
# ... with 4,910 more rows
```

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Validar modelo - *Mediciones*

```
           Truth
Prediction   no  yes
       no  3205  547
       yes  420  748
```

```
# A tibble: 2 x 3
  .metric  .estimator .estimate
  <chr>    <chr>          <dbl>
1 accuracy binary         0.803
2 kap      binary         0.477
```

```
# A tibble: 1 x 3
  .metric .estimator .estimate
  <chr>   <chr>          <dbl>
1 roc_auc binary         0.843
```

```
# A tibble: 2 x 3
  .metric   .estimator .estimate
  <chr>     <chr>          <dbl>
1 precision binary         0.640
2 recall    binary         0.578
```

```
# A tibble: 1 x 3
  .metric .estimator .estimate
  <chr>   <chr>          <dbl>
1 f_meas  binary         0.607
```

```
conf_mat(estimates_keras_tbl,
         truth, estimate)
metrics(estimates_keras_tbl,
        truth, estimate)
roc_auc(estimates_keras_tbl,
        truth, class_prob)
estimates_keras_tbl %>%
  precision(truth, estimate) %>%
  bind_rows(estimates_keras_tbl %>%
              recall(truth, estimate))
f_meas(estimates_keras_tbl,
       truth, estimate, beta = 1)
```

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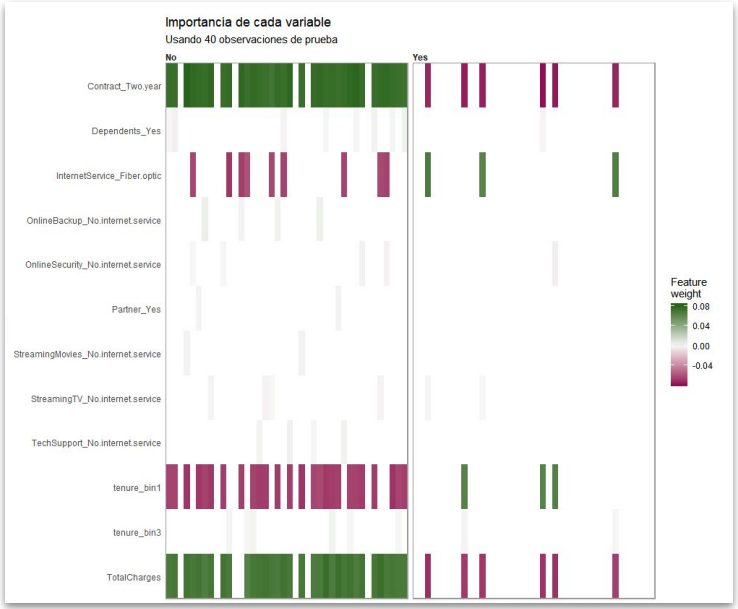
Validar modelo - *Valores significantes*




```
explainer <- x_tbl_entrenar %>%
  as_tibble() %>%
  lime(model_keras, bin_continuous = FALSE)

explanation <-  x_tbl_entrenar %>%
  as.data.frame() %>%
  head(40) %>%
  lime::explain(
    explainer = explainer, n_labels = 1,
    N_features = 4, kernel_width = 0.5)
```

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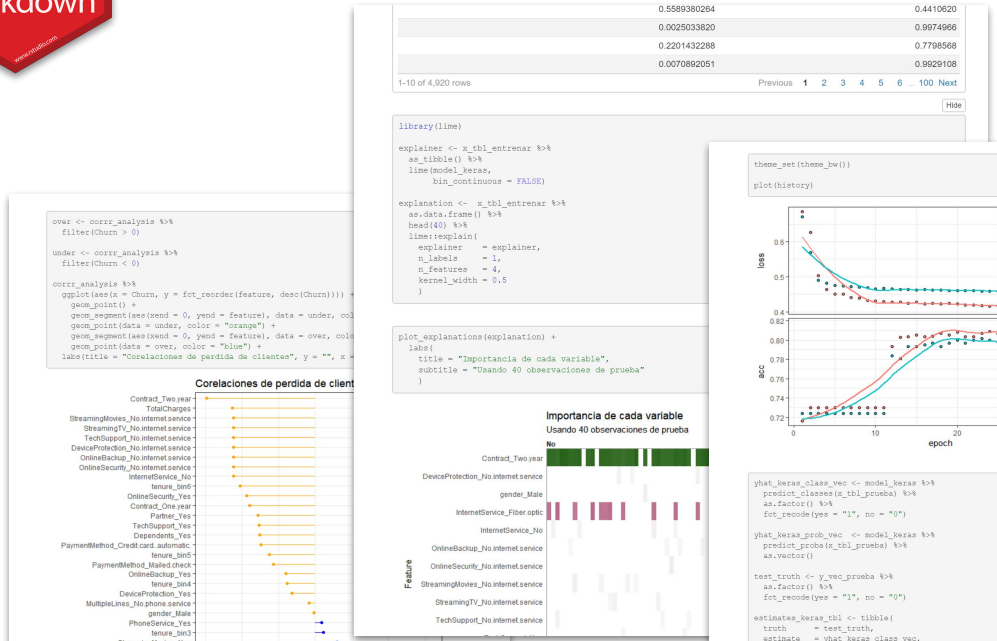
Compartir resultados - *Reportes*



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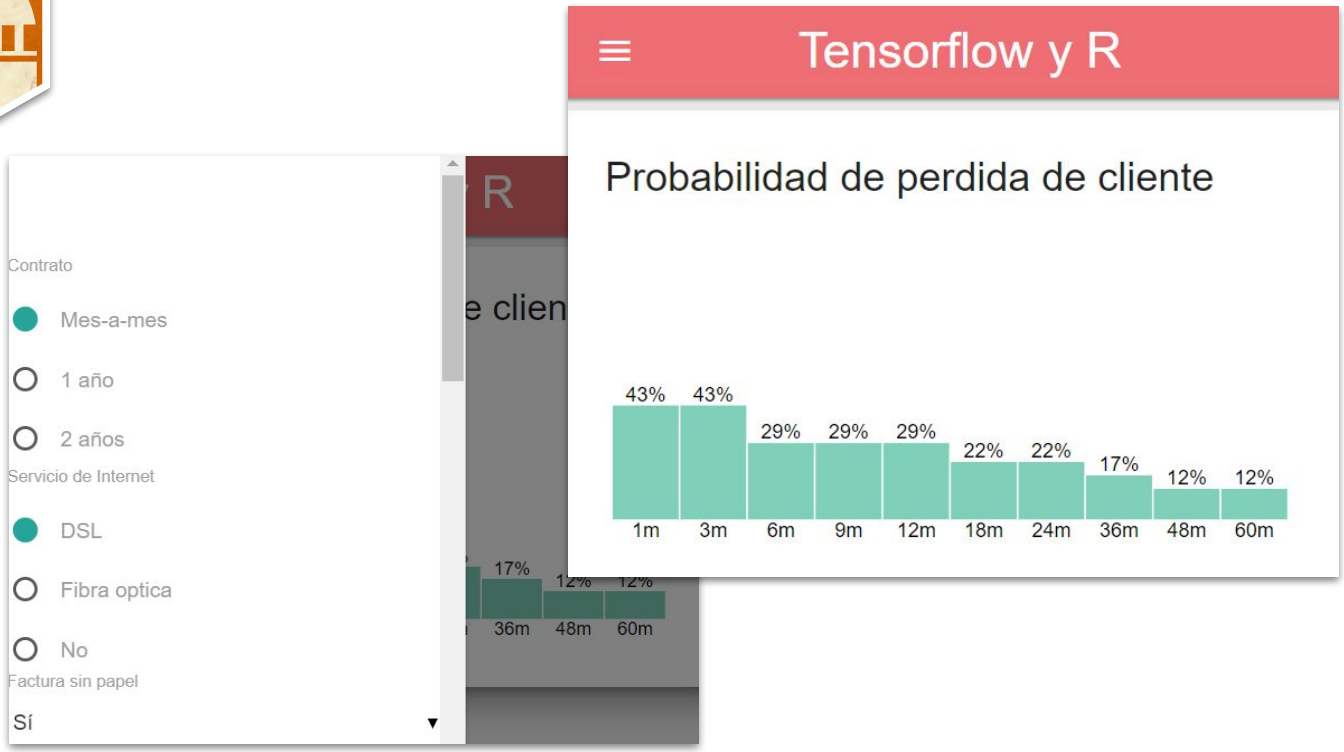
Compartir resultados - *Aplicación*



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