# Aprendizaje Automático con Tensorflow y R

Edgar Ruiz


edgararuiz


theotheredgar


edgararuiz

RStudio

# Tensorflow

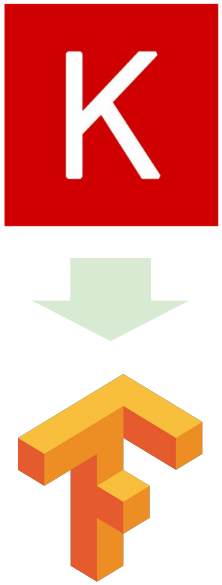
- Aprendizaje automático y profundo.
- Computación de alto desempeño
- Librería de código abierto
- Variedad de plataformas y dispositivos

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

RStudio

# Keras

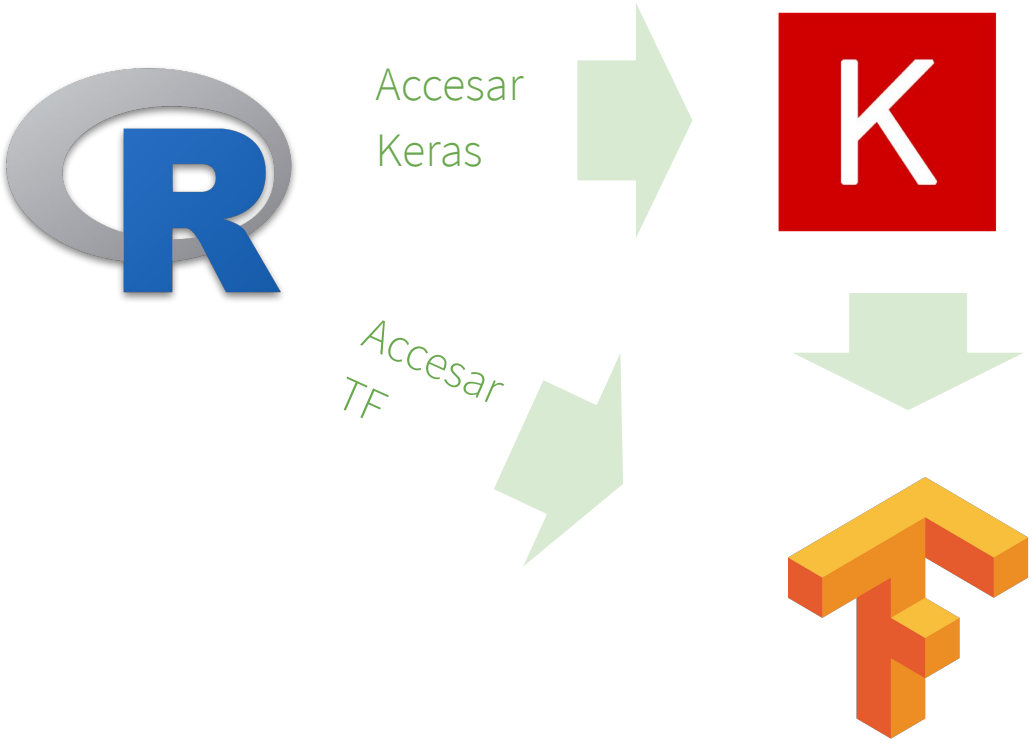
- Facilita el desarrollo de modelos
- Se integra con Tensorflow y otros
- El mismo código funciona en CPU o GPU
- Redes convolucionales y recurrentes



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

RStudio®

# Fácil integración de R, Tensorflow y Keras




RStudio

# Pero, por que...

¿  +  ?

# Aprendizaje Automático es de varios pasos

# Entrenar el modelo es solo un paso...


RStudio

# R se especializa en todos los pasos


RStudio

# 13 mil paquetes especializados de R

Leér datos


Pre-procesar datos


Entrenar modelo


Validar modelo


Compartir resultados


RStudio

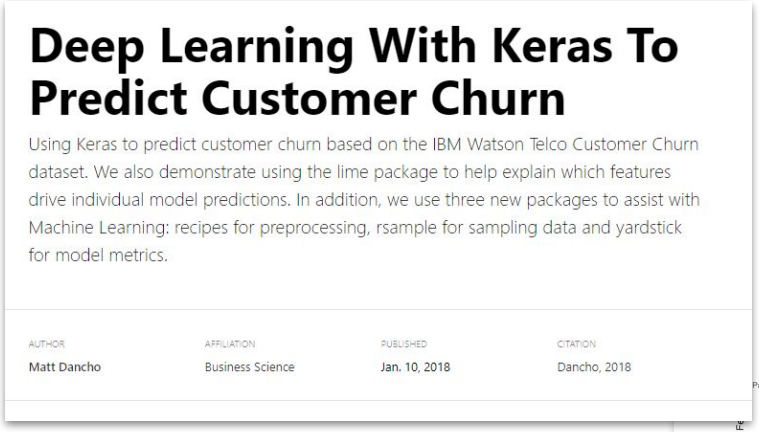
# Prediciendo pérdida de clientes

Demostración

RStudio

# Análisis original

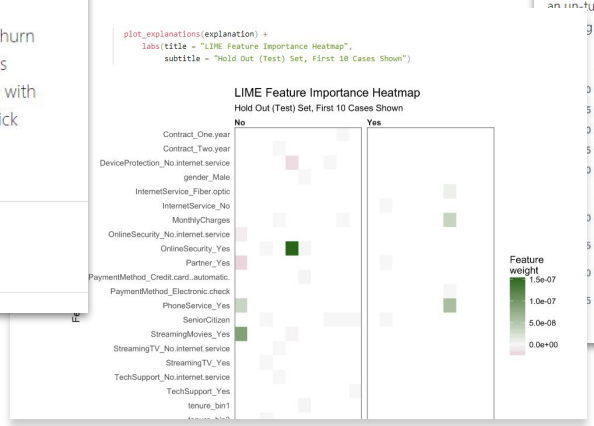
Ejemplo basado en el artículo: “**Deep Learning With Keras To Predict Customer Churn**”, publicado por **Matt Dancho**.

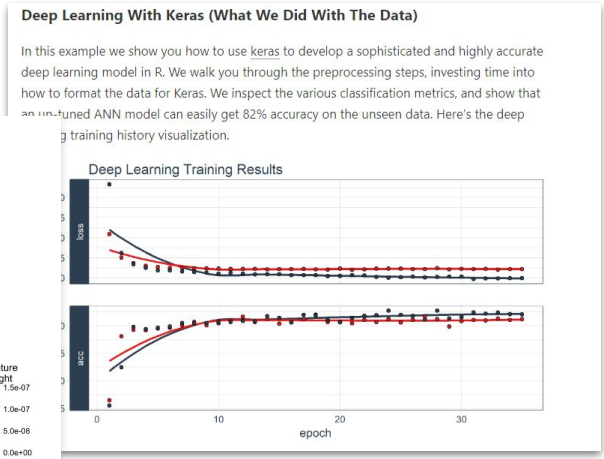


## Deep Learning With Keras To Predict Customer Churn

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 |



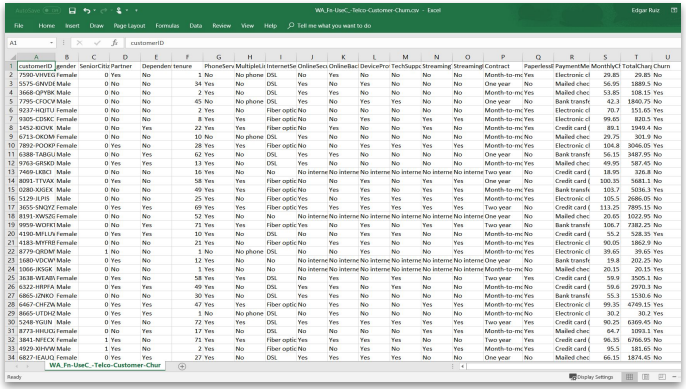



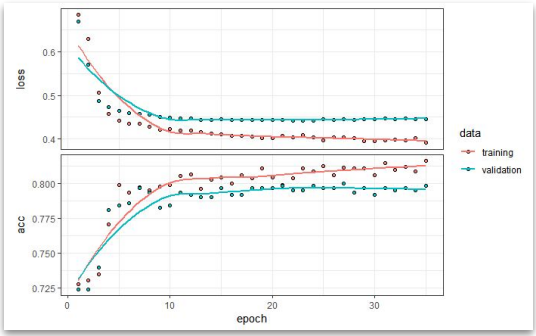

https://blogs.rstudio.com/tensorflow/posts/2018-01-11-keras-customer-churn/

RStudio®

# Objetivo

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




RStudio®

# Instale TF y Keras desde R

Instale los paquetes de R

Cargue el paquete *keras*

Instalar TF y Keras

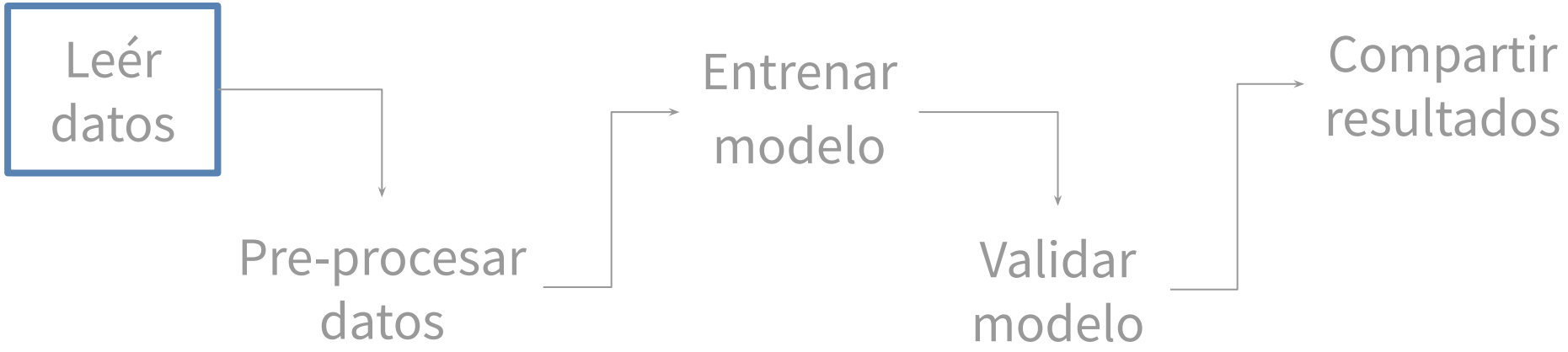
```
install.packages("tensorflow")
install.packages("keras")

library(keras)

install_tensorflow()
install_keras()
```

RStudio

# Paquetes de R para cada paso


RStudio

# Progreso




RStudio

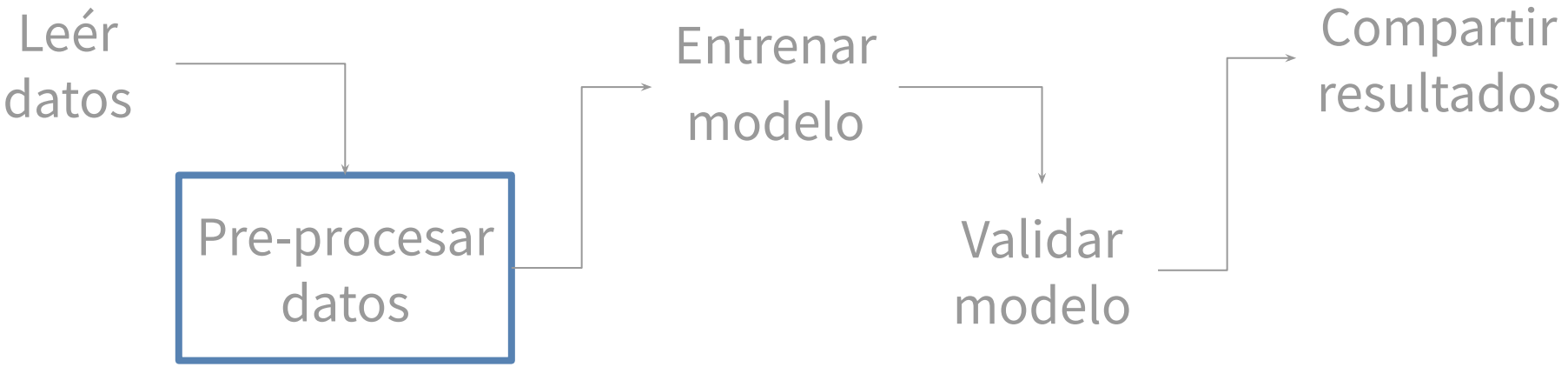

# Leér datos

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

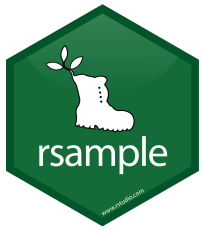
```
# A tibble: 7,043 x 21
   customerID gender SeniorCitizen Partner Dependents tenure PhoneService
   <chr>      <chr>          <dbl> <chr>   <chr>       <dbl> <chr>
 1 7590-VHVEG Female             0 Yes     No              1 No
 2 5575-GNVDE Male               0 No      No             34 Yes
 3 3668-QPYBK 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>
```

RStudio

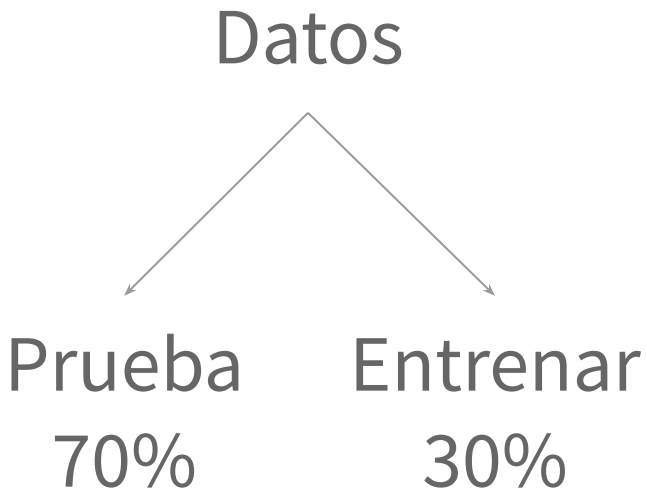
# Progreso




RStudio




# Pre-procesar - *Muestra de datos*




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

tbl_entrenar <- training(separa_datos)

tbl_prueba  <- testing(separa_datos)
```

RStudio


# 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()
```

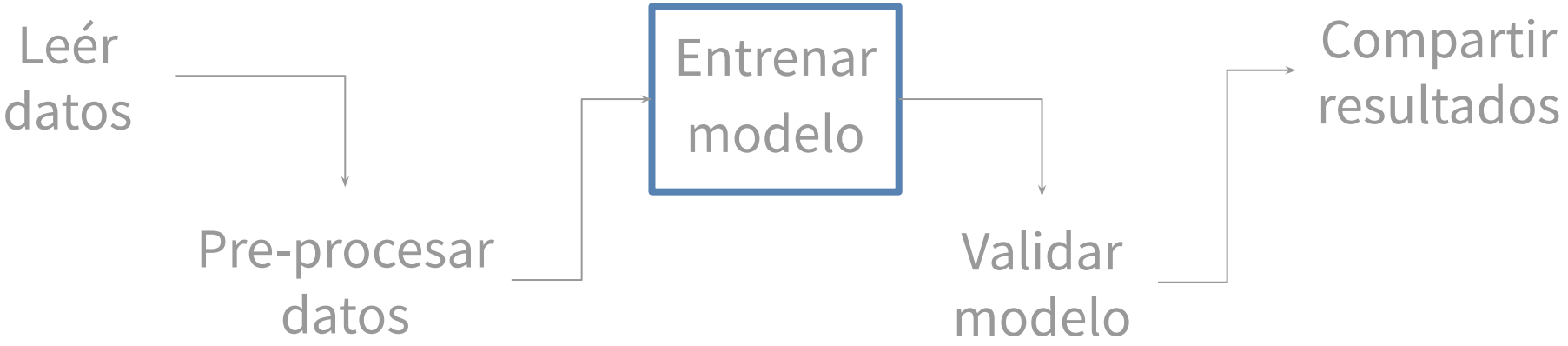
La muestra de **entrenamiento** es extraída

```
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

RStudio

# Progreso




RStudio

# Entrenar el modelo - *Preparación*

Capa densa

Capa de pérdida

Capa densa

Capa de pérdida

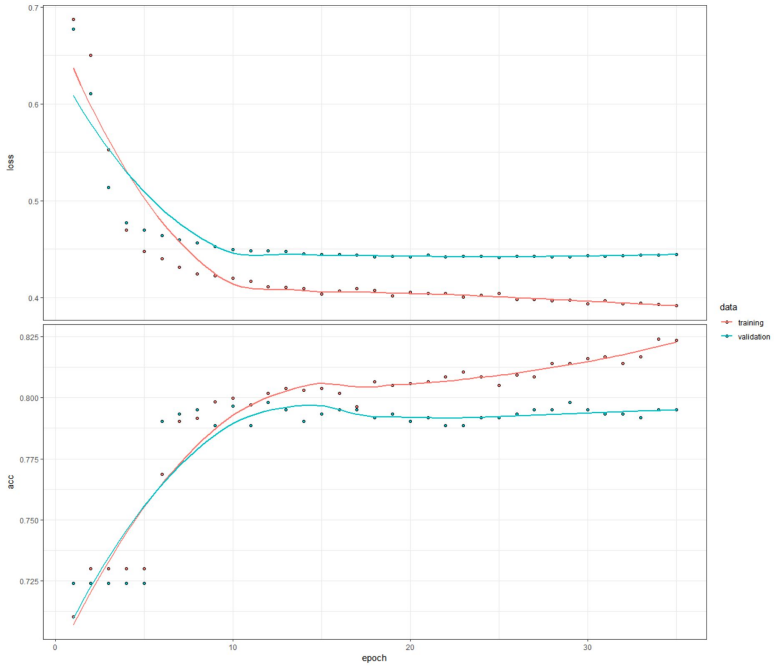
Capa densa

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'))
```

RStudio

# 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
)
```

RStudio

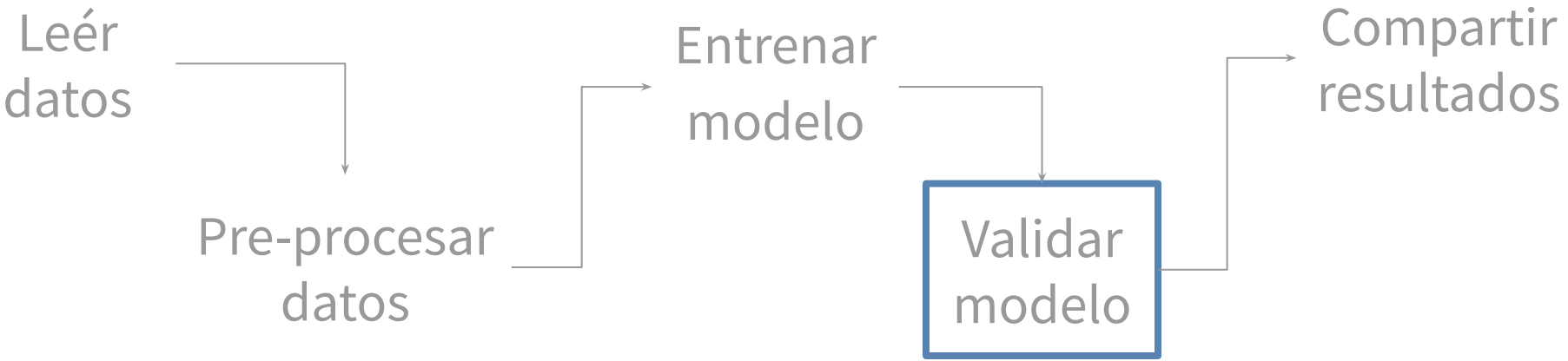
# Entrenar el modelo - *Predicciones*

```
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
```

RStudio

# Progreso




RStudio


# 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
```

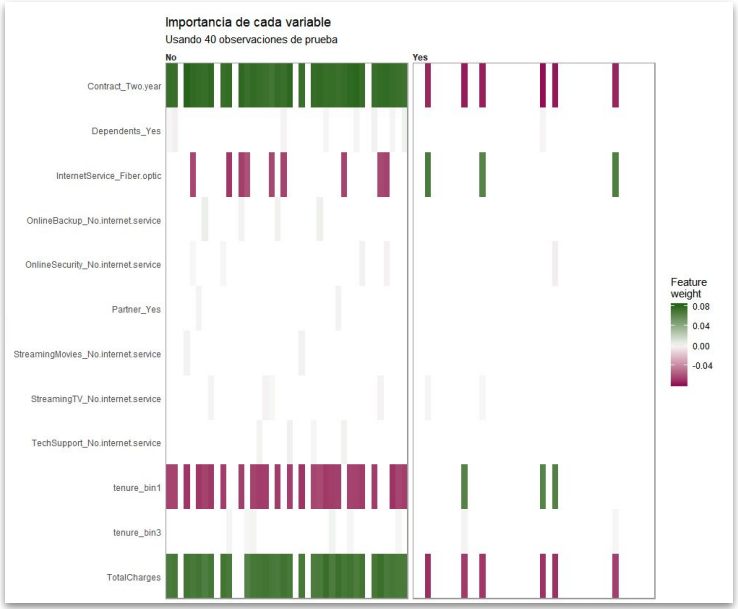
```
# A tibble: 2 x 3
  .metric   .estimator .estimate
  <chr>     <chr>          <dbl>
1 precision binary         0.640
2 recall    binary         0.578
```

```
# 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)
```

RStudio

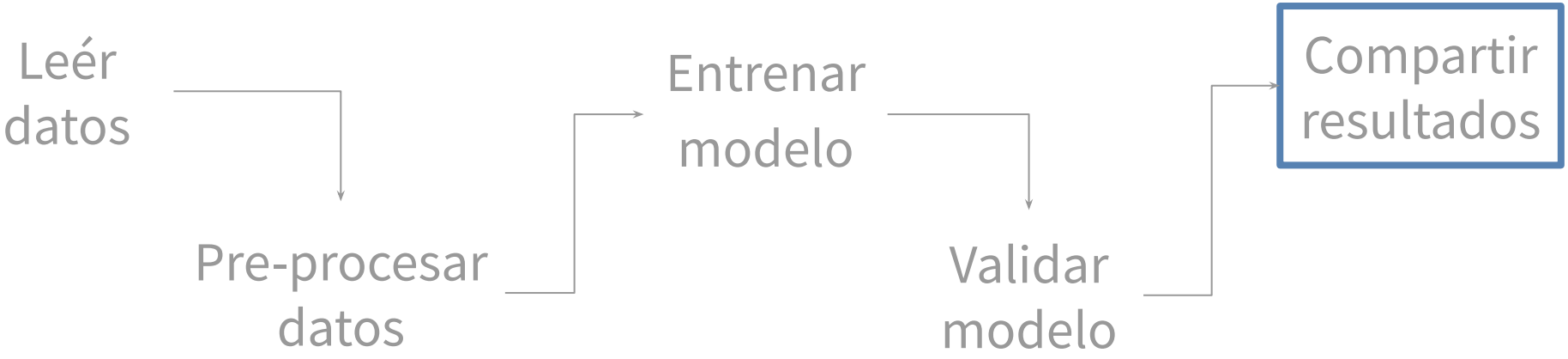
# Validar modelo - *Valores significativos*



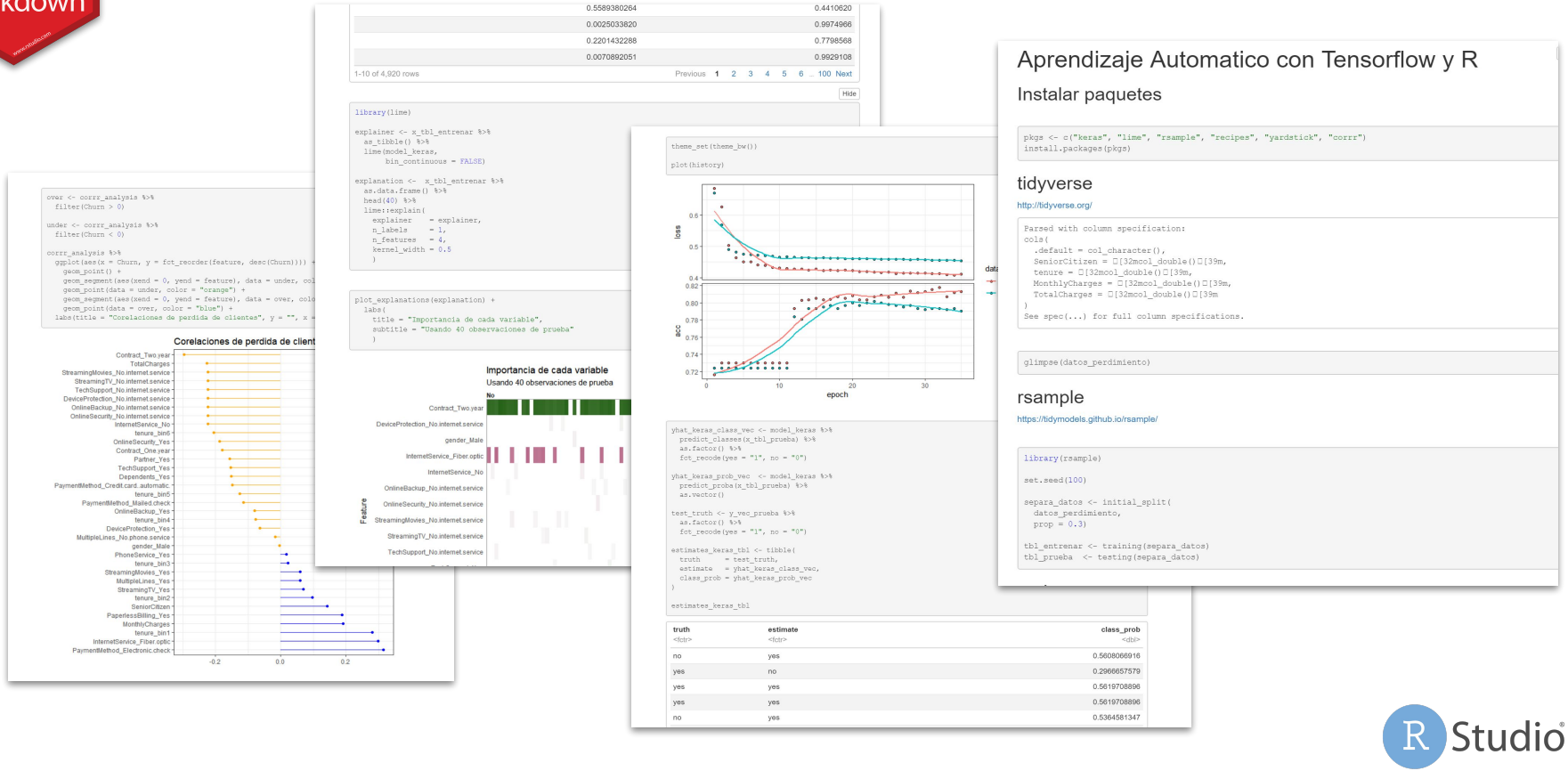

```
explainer <- x_tbl_entrenar %>%
  as_tibble() %>%
  lime(model_keras, bin_continuous = FALSE)

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

RStudio

# Progreso

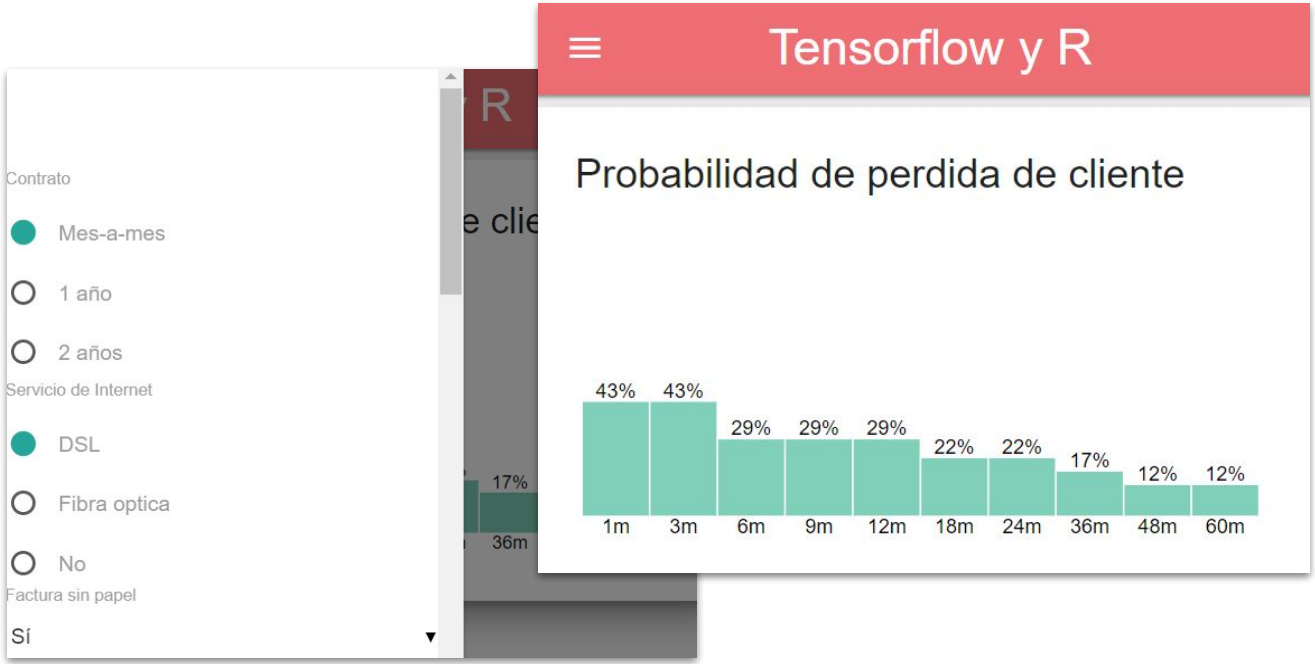


# Compartir resultados - *Reportes*




RStudio®

# Compartir resultados - *Aplicación*



# Demostración

# ¡Pruébalo en tu teléfono!

rstd.io/clientes

RStudio®

# ¡Gracias por su atención!

bit.ly/r-tensorflow

RStudio