HW9_XU

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```
#install.packages("devtools")
library(devtools)
```

```
## Loading required package: usethis
```

```
#devtools::install_github("rstudio/keras")
library(keras)
install_keras()
```

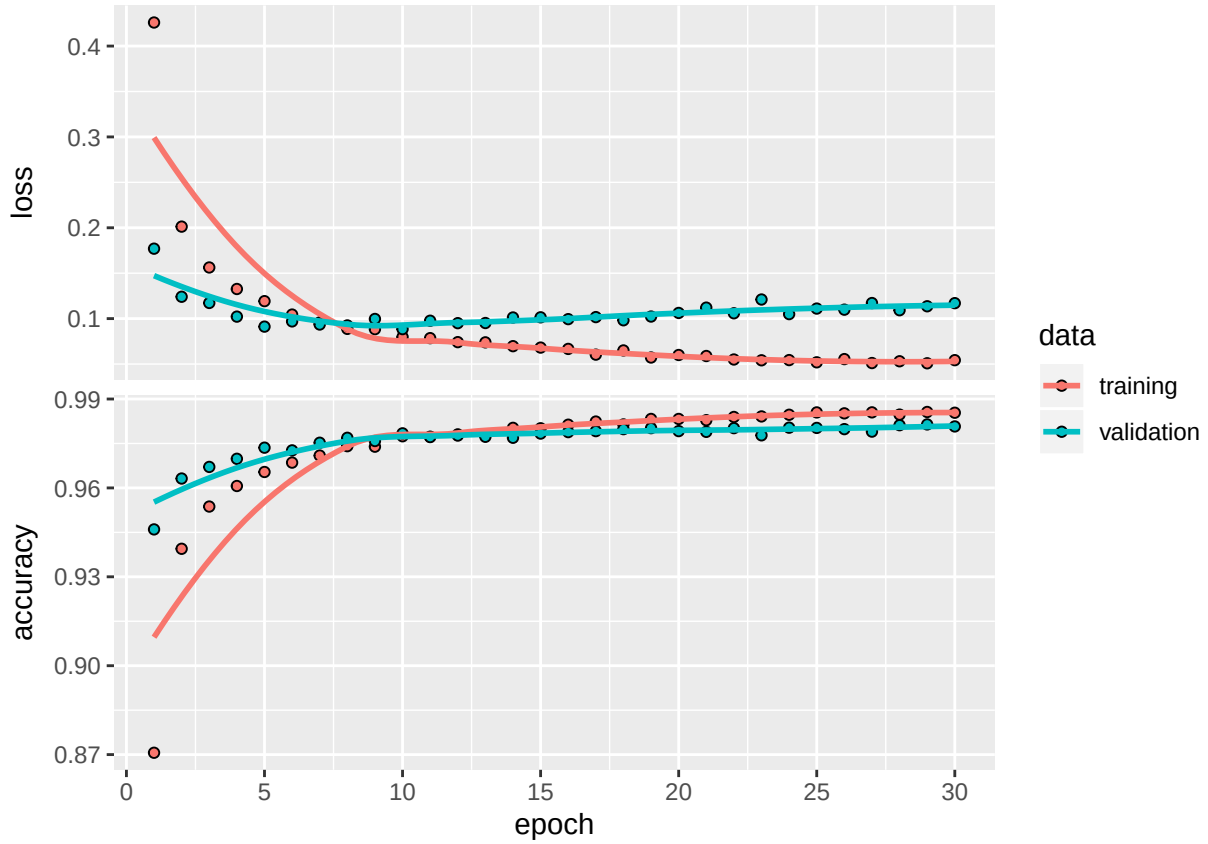
```
##
## Installation complete.
```

```
mnist<-dataset_mnist()
x_train<-mnist$train$x
y_train<-mnist$train$y
x_test<-mnist$test$x
y_test<-mnist$test$y
x_train<-array_reshape(x_train,c(nrow(x_train),784))
x_test<-array_reshape(x_test,c(nrow(x_test),784))
x_train<-x_train/255
x_test<-x_test/255
y_train<-to_categorical(y_train,10)
y_test<-to_categorical(y_test,10)
model<-keras_model_sequential()
model%>%
  layer_dense(units=256,activation="relu",input_shap=c(784))%>%
  layer_dropout(rate=0.4)%>%
  layer_dense(units=128,activation="relu")%>%
  layer_dropout(rate=0.3)%>%
  layer_dense(units=10,activation="softmax")
summary(model)
```

```
## Model: "sequential"
## _________________________________________________________________________
## Layer (type)                 Output Shape              Param #
## =========================================================================
## dense (Dense)                (None, 256)               200960
## _________________________________________________________________________
## dropout (Dropout)            (None, 256)               0
## _________________________________________________________________________
## dense_1 (Dense)              (None, 128)               32896
## _________________________________________________________________________
## dropout_1 (Dropout)          (None, 128)               0
## _________________________________________________________________________
## dense_2 (Dense)              (None, 10)                1290
## =========================================================================
## Total params: 235,146
## Trainable params: 235,146
## Non-trainable params: 0
```

```
## ________________________________________________________________________________
```

```
model%>%compile(
  loss="categorical_crossentropy",
  optimizer=optimizer_rmsprop(),
  metrics=c("accuracy")
)
  history<-model%>%fit(
    x_train,y_train,
    epochs=30,batch_size=128,
    validation_split=0.2
  )
plot(history)
```




```
model %>% evaluate(x_test, y_test)
```

```
## $loss
## [1] 0.1111397
##
## $accuracy
## [1] 0.981
```

```
model %>% predict_classes(x_test)
```

```
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##  [35] 7 2 7 1 2 1 1 7 4 2 3 5 1 2 4 4 6 3 5 5 6 0 4 1 9 5 7 8 9 3 7 4 6 4
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##  [9963] 0 7 0 3 6 8 7 1 5 2 4 9 4 3 6 4 1 7 2 6 6 0 1 2 3 4 5 6 7 8 9 0 1 2
##  [9997] 3 4 5 6
```

```
fashion_mnist <- dataset_fashion_mnist()
c(train_images, train_labels) %<-% fashion_mnist$train
c(test_images, test_labels) %<-% fashion_mnist$test
class_names = c('T-shirt/top',
                'Trouser',
                'Pullover',
                'Dress',
                'Coat',
                'Sandal',
                'Shirt',
                'Sneaker',
                'Bag',
                'Ankle boot')
dim(train_images)
```

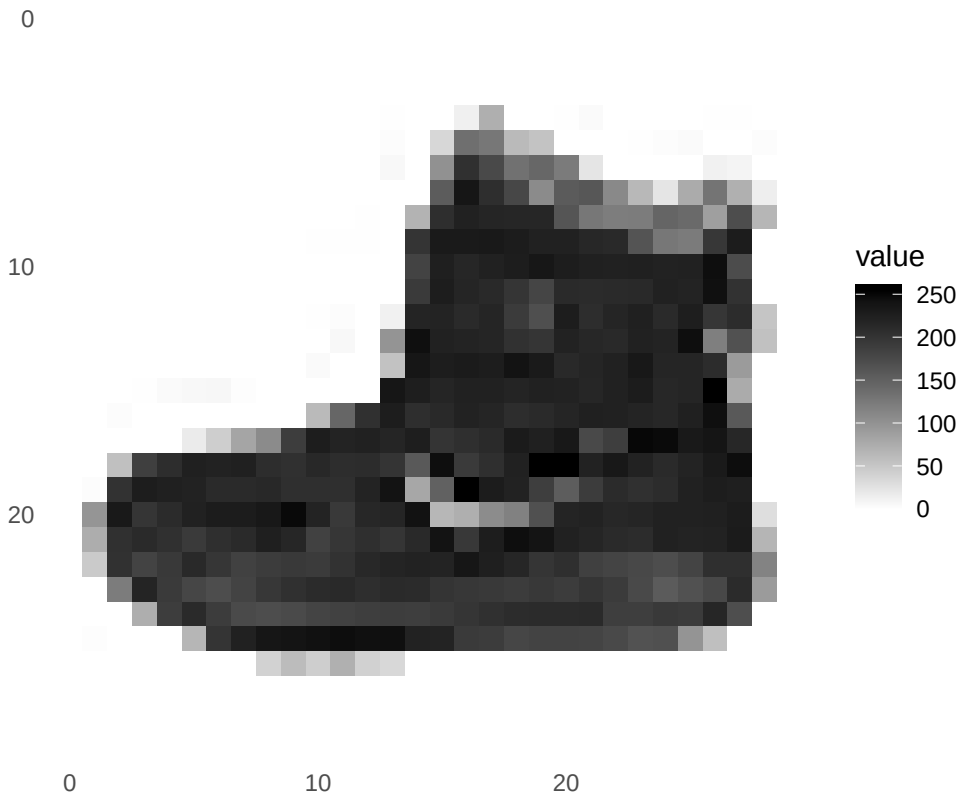
```
## [1] 60000    28    28
```

```
dim(train_labels)
```

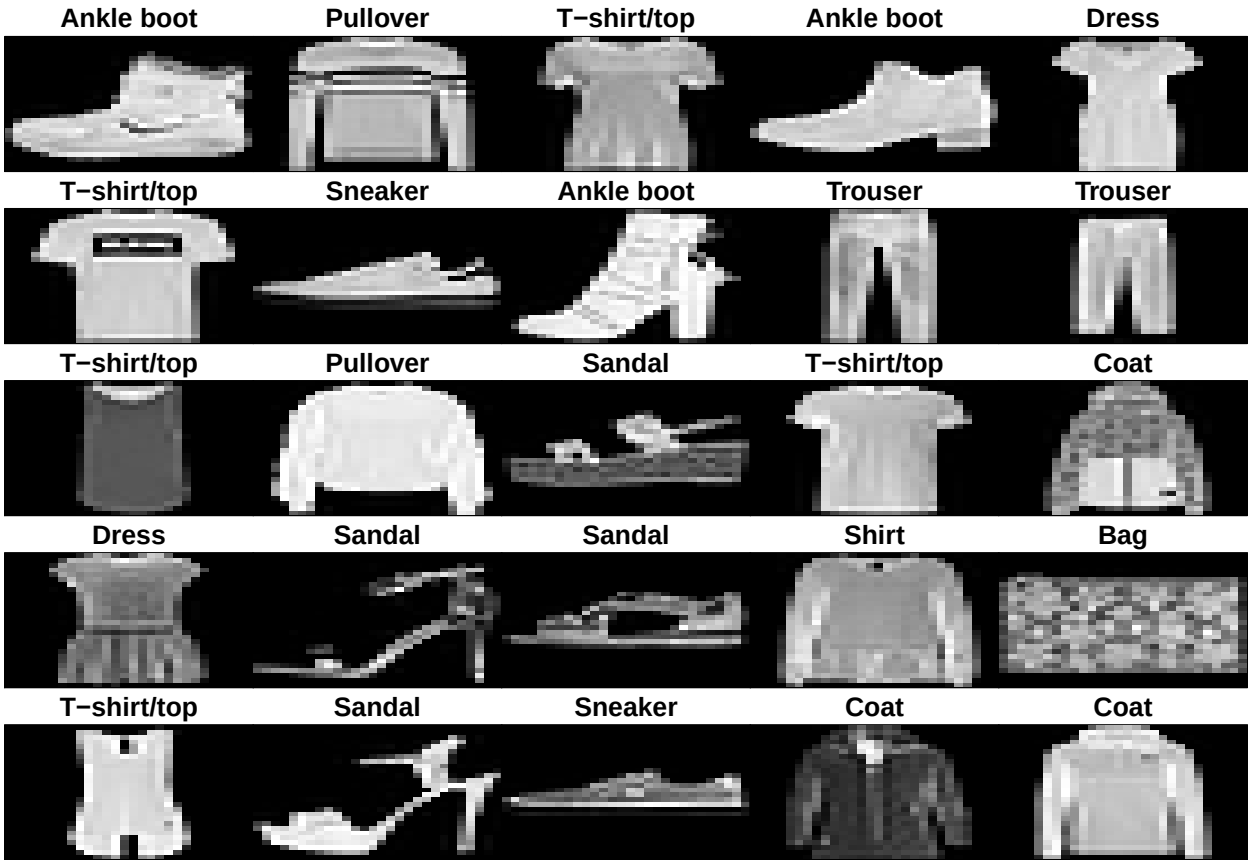
```
## [1] 60000
```

```
library(tidyr)
library(ggplot2)
image_1 <- as.data.frame(train_images[1, , ])
colnames(image_1) <- seq_len(ncol(image_1))
image_1$y <- seq_len(nrow(image_1))
image_1 <- gather(image_1, "x", "value", -y)
image_1$x <- as.integer(image_1$x)
ggplot(image_1, aes(x = x, y = y, fill = value)) +
  geom_tile() +
  scale_fill_gradient(low = "white", high = "black", na.value = NA) +
  scale_y_reverse() +
  theme_minimal() +
  theme(panel.grid = element_blank())   +
  theme(aspect.ratio = 1) +
```

```
  xlab("") +
  ylab("")
```




```
train_images <- train_images / 255
test_images <- test_images / 255
par(mfcol=c(5,5))
par(mar=c(0, 0, 1.5, 0), xaxs='i', yaxs='i')
for (i in 1:25) {
  img <- train_images[i, , ]
  img <- t(apply(img, 2, rev))
  image(1:28, 1:28, img, col = gray((0:255)/255), xaxt = 'n', yaxt = 'n',
        main = paste(class_names[train_labels[i] + 1]))
}
```




```
model <- keras_model_sequential()
model %>%
  layer_flatten(input_shape = c(28, 28)) %>%
  layer_dense(units = 128, activation = 'relu') %>%
  layer_dense(units = 10, activation = 'softmax')
model %>% compile(
  optimizer = 'adam',
  loss = 'sparse_categorical_crossentropy',
  metrics = c('accuracy')
)
model %>% fit(train_images, train_labels, epochs = 5)
score <- model %>% evaluate(test_images, test_labels)
cat('Test loss:', score$loss, "\n")
```

```
## Test loss: 0.3370938
```

```
cat('Test accuracy:', score$acc, "\n")
```

```
## Test accuracy: 0.8787
```

```
predictions <- model %>% predict(test_images)
```