HW9_Zhengzhi

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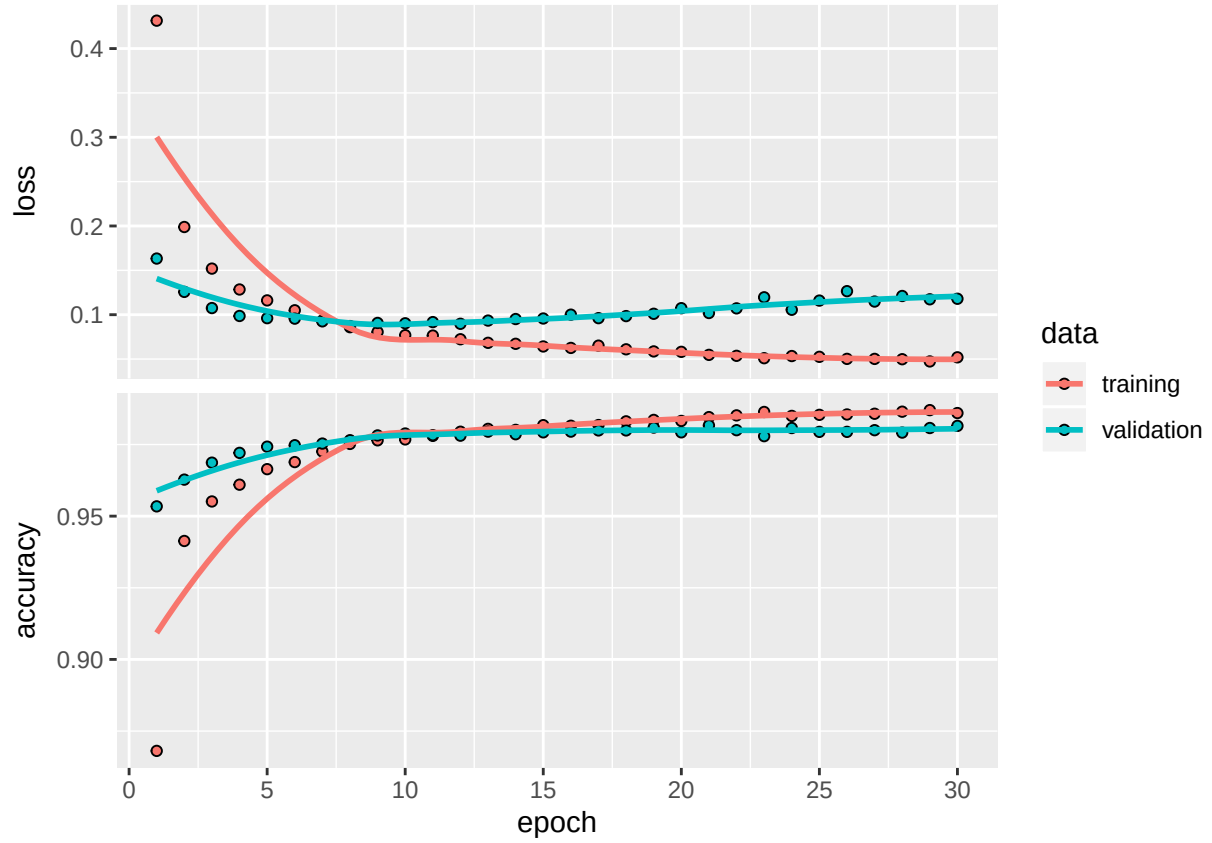
```
library(keras)
mnist <- dataset_mnist()
x_train <- mnist$train$x
y_train <- mnist$train$y
x_test <- mnist$test$x
y_test <- mnist$test$y
# reshape
x_train <- array_reshape(x_train, c(nrow(x_train), 784))
x_test <- array_reshape(x_test, c(nrow(x_test), 784))
# rescale
x_train <- x_train / 255
x_test <- 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_shape = 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] 0.1089825
##
## $accuracy
## [1] 0.9816
```

```
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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##  [5985] 1 5 4 0 7 6 0 1 7 0 6 8 9 5 1 7 9 8 6 0 8 1 7 7 1 3 2 5 1 4 2 0 0 7
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##  [6087] 4 5 6 7 8 9 1 2 6 5 3 0 7 0 4 1 4 3 6 7 2 3 1 2 1 2 9 6 0 1 3 0 2 7
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##  [9079] 8 9 0 1 2 3 4 5 6 7 8 9 1 6 8 9 9 0 1 2 4 4 3 7 4 4 4 0 3 8 7 5 8 2
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##  [9249] 7 1 9 6 9 4 9 9 6 7 1 2 5 3 7 8 0 1 2 4 5 6 7 8 9 0 1 3 4 5 6 7 5 0
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##  [9419] 8 7 8 2 3 9 6 0 6 5 5 3 3 3 9 8 1 1 0 6 1 0 0 6 2 1 1 3 2 7 7 8 8 7
##  [9453] 8 4 6 0 2 0 7 0 3 6 8 7 1 5 9 9 3 7 2 4 9 4 3 6 2 2 5 3 2 5 5 9 4 1
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##  [9929] 4 7 0 1 9 2 8 7 8 2 6 0 6 5 3 3 3 9 1 4 0 6 1 0 0 6 2 1 1 7 7 8 4 6
##  [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)
```

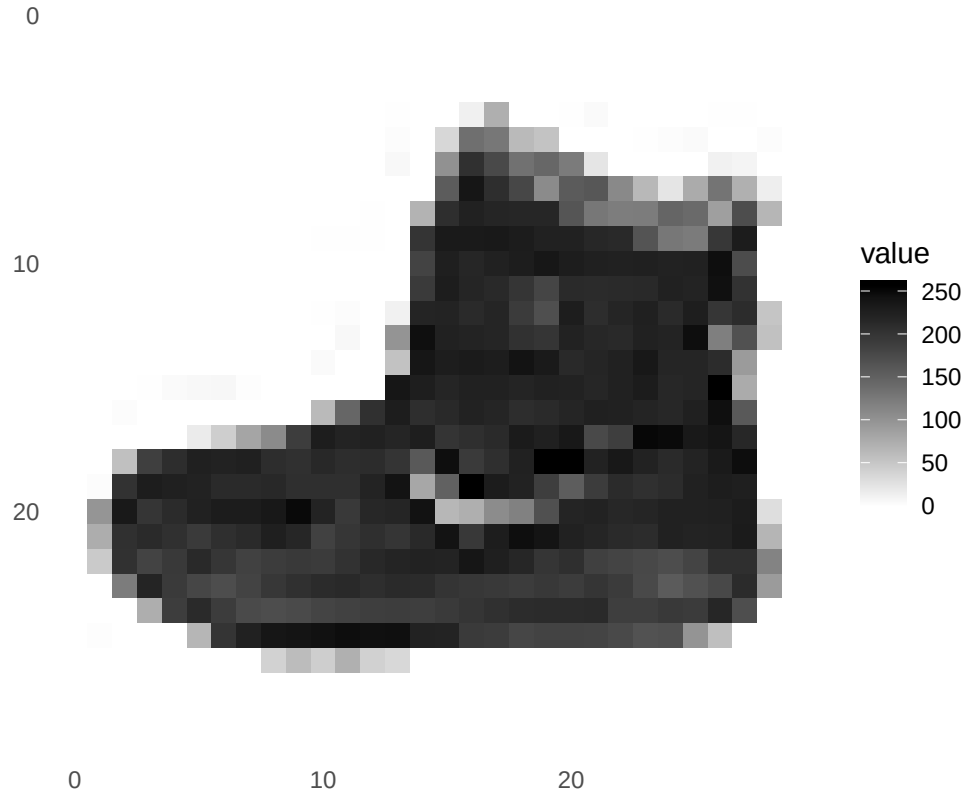
```
## [1] 60000
```

```
library(tidyr)
library(ggplot2)

image_1 <- as.data.frame(train_images[1, , ])
colnames(image_1) <- seq_len(ncol(image_1))
```

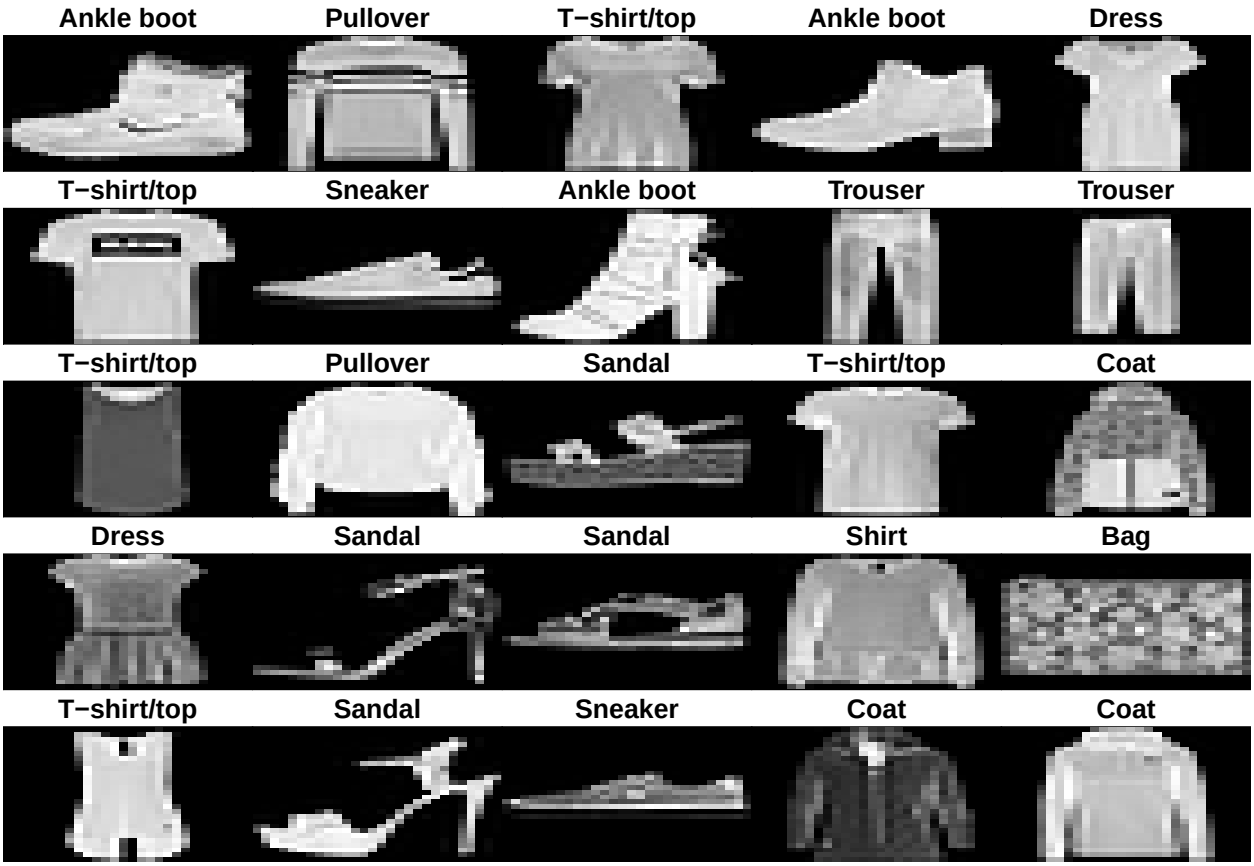
```
image_1$y <- seq_len(nrow(image_1))
image_1 <- gather(image_1, "x", "value", -y)
image_1$x <- as.integer(image_1$x)

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: 0.33883
```

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

```
## Test accuracy: 0.879
```

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