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> library(tidyverse)
— Attaching packages — tidyverse 1.2.1 —
✓ ggplot2 3.2.1   ✓ purrr 0.3.2
✓ tibble 2.1.3    ✓ dplyr 0.8.3
✓ tidyr 0.8.3     ✓ stringr 1.4.0
✓ readr 1.3.1     ✓ forcats 0.4.0
— Conflicts — tidyverse_conflicts() —
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag() masks stats::lag()
> library(dslabs)
> if(!exists("mnist")) mnist <- read_mnist()
> names(mnist)
[1] "train" "test"
> class(mnist)
[1] "list"
> class(mnist$train)
[1] "list"
> names(mnist$train)
[1] "images" "labels"
> class(mnist$train$images)
[1] "matrix"
> dim(mnist$train$images)
[1] 60000 784
> class(mnist$train$labels)
[1] "integer"
> dim(as.matrix(mnist$train$labels))
[1] 60000 1
>
>
>
> x <- mnist$train$images[1:1000,]
> y <- mnist$train$labels[1:1000]
> dim(x)
[1] 1000 784
> dim(as.matrix(y))
[1] 1000 1
> length(x[,1])
[1] 1000
> length(x[1,])
[1] 784
>
>
> x[3,]
[1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[19] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[37] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[55] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[73] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[91] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[109] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[127] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[145] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 67 232
[163] 39 0 0 0 0 0 0 0 0 0 0 62 81 0 0 0 0 0
[181] 0 0 0 0 0 0 0 0 0 120 180 39 0 0 0 0 0 0
[199] 0 0 126 163 0 0 0 0 0 0 0 0 0 0 0 0 0 2
[217] 153 210 40 0 0 0 0 0 0 0 0 0 220 163 0 0 0 0
[235] 0 0 0 0 0 0 0 0 0 0 27 254 162 0 0 0 0 0
[253] 0 0 0 0 222 163 0 0 0 0 0 0 0 0 0 0 0 0
[271] 0 183 254 125 0 0 0 0 0 0 0 0 0 46 245 163 0 0
[289] 0 0 0 0 0 0 0 0 0 0 0 198 254 56 0 0 0 0
[307] 0 0 0 0 0 120 254 163 0 0 0 0 0 0 0 0 0 0
[325] 0 0 23 231 254 29 0 0 0 0 0 0 0 0 0 159 254 120
[343] 0 0 0 0 0 0 0 0 0 0 0 163 254 216 16 0 0 0
[361] 0 0 0 0 0 0 0 159 254 67 0 0 0 0 0 0 0 0
[379] 0 14 86 178 248 254 91 0 0 0 0 0 0 0 0 0 159

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[397] 254 85 0 0 0 47 49 116 144 150 241 243 234 179 241 252 40 0
[415] 0 0 0 0 0 0 0 0 0 150 253 237 207 207 207 253 254 250
[433] 240 198 143 91 28 5 233 250 0 0 0 0 0 0 0 0 0 0
[451] 0 0 119 177 177 177 177 177 98 56 0 0 0 0 0 102 254 220
[469] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[487] 0 0 0 0 0 0 0 169 254 137 0 0 0 0 0 0 0 0
[505] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 169
[523] 254 57 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[541] 0 0 0 0 0 0 0 0 0 169 254 57 0 0 0 0 0 0
[559] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[577] 0 169 255 94 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[595] 0 0 0 0 0 0 0 0 0 0 169 254 96 0 0 0 0 0
[613] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[631] 0 0 0 169 254 153 0 0 0 0 0 0 0 0 0 0 0 0
[649] 0 0 0 0 0 0 0 0 0 0 0 0 169 255 153 0 0
[667] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[685] 0 0 0 0 0 96 254 153 0 0 0 0 0 0 0 0 0 0
[703] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[721] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[739] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[757] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
[775] 0 0 0 0 0 0 0 0 0 0

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>
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> grid <- matrix(x[3,], 28, 28)
```

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> grid
```

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[,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
[1,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[2,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[3,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[4,] 0 0 0 0 0 0 0 0 0 0 46 120 159
[5,] 0 0 0 0 0 0 62 126 220 222 245 254 254
[6,] 0 0 0 0 0 0 81 163 163 163 163 163 120
[7,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[8,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[9,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[10,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[11,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[12,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[13,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[14,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[15,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[16,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[17,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[18,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[19,] 0 0 0 0 0 0 0 0 0 0 0 23 163
[20,] 0 0 0 0 0 0 0 2 27 183 198 231 254
[21,] 0 0 0 0 0 67 120 153 254 254 254 254 216
[22,] 0 0 0 0 0 232 180 210 162 125 56 29 16
[23,] 0 0 0 0 0 39 39 40 0 0 0 0 0
[24,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[25,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[26,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[27,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[28,] 0 0 0 0 0 0 0 0 0 0 0 0 0
[,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
[1,] 0 0 0 0 0 0 0 0 0 0 0 0
[2,] 0 0 0 0 0 0 0 0 0 0 0 0
[3,] 0 0 0 0 0 0 0 0 0 0 0 0
[4,] 159 159 150 0 0 0 0 0 0 0 0 0
[5,] 254 254 253 119 0 0 0 0 0 0 0 0
[6,] 67 85 237 177 0 0 0 0 0 0 0 0
[7,] 0 0 207 177 0 0 0 0 0 0 0 0
[8,] 0 0 207 177 0 0 0 0 0 0 0 0
[9,] 0 0 207 177 0 0 0 0 0 0 0 0

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[10,]	0	47	253	177	0	0	0	0	0	0	0	0
[11,]	0	49	254	98	0	0	0	0	0	0	0	0
[12,]	0	116	250	56	0	0	0	0	0	0	0	0
[13,]	0	144	240	0	0	0	0	0	0	0	0	0
[14,]	0	150	198	0	0	0	0	0	0	0	0	0
[15,]	0	241	143	0	0	0	0	0	0	0	0	0
[16,]	14	243	91	0	0	0	0	0	0	0	0	0
[17,]	86	234	28	0	0	0	0	0	0	0	0	0
[18,]	178	179	5	102	169	169	169	169	169	169	169	96
[19,]	248	241	233	254	254	254	254	255	254	254	255	254
[20,]	254	252	250	220	137	57	57	94	96	153	153	153
[21,]	91	40	0	0	0	0	0	0	0	0	0	0
[22,]	0	0	0	0	0	0	0	0	0	0	0	0
[23,]	0	0	0	0	0	0	0	0	0	0	0	0
[24,]	0	0	0	0	0	0	0	0	0	0	0	0
[25,]	0	0	0	0	0	0	0	0	0	0	0	0
[26,]	0	0	0	0	0	0	0	0	0	0	0	0
[27,]	0	0	0	0	0	0	0	0	0	0	0	0
[28,]	0	0	0	0	0	0	0	0	0	0	0	0

	[,26]	[,27]	[,28]
[1,]	0	0	0
[2,]	0	0	0
[3,]	0	0	0
[4,]	0	0	0
[5,]	0	0	0
[6,]	0	0	0
[7,]	0	0	0
[8,]	0	0	0
[9,]	0	0	0
[10,]	0	0	0
[11,]	0	0	0
[12,]	0	0	0
[13,]	0	0	0
[14,]	0	0	0
[15,]	0	0	0
[16,]	0	0	0
[17,]	0	0	0
[18,]	0	0	0
[19,]	0	0	0
[20,]	0	0	0
[21,]	0	0	0
[22,]	0	0	0
[23,]	0	0	0
[24,]	0	0	0
[25,]	0	0	0
[26,]	0	0	0
[27,]	0	0	0
[28,]	0	0	0

>

>

> image1 <- image(1:28, 1:28, grid)

> image2 <- image(1:28, 1:28, grid[,28:1])

>