

PCA

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```
knitr::opts_chunk$set(echo = TRUE)
library(plotly)
library(h2o)
h2o.init()

## Connection successful!
##
## R is connected to the H2O cluster:
##   H2O cluster uptime:      3 days 12 hours
##   H2O cluster version:    3.10.0.8
##   H2O cluster version age: 7 months and 25 days !!!
##   H2O cluster name:       H2O_started_from_R_Matty_uze688
##   H2O cluster total nodes: 1
##   H2O cluster total memory: 3.05 GB
##   H2O cluster total cores: 8
##   H2O cluster allowed cores: 2
##   H2O cluster healthy:    TRUE
##   H2O Connection ip:      localhost
##   H2O Connection port:    54321
##   H2O Connection proxy:   NA
##   R Version:              R version 3.3.2 (2016-10-31)
```

R Markdown

Reading the data and loading into h2o

```
data <- read.csv("usps_ch.txt",header = FALSE)
data <- data[,1:ncol(data)-1] #there is a ',' in the end of each line
lab <- read.csv("usps_val.txt",header = FALSE)
colnames(lab) <- c('lab')
labeled_data <- cbind(data,lab)
#write.csv(data,"usps.csv",append = FALSE,col.names = TRUE,quote = FALSE,row.names = FALSE)
usps_data <- as.h2o(data,'usps')
```

```
##
|
|
|
|=====| 100%
```

Whole dataset Cumulative proportions

Options

Principal components analysis of an H2O data frame.(from doc) `pca_method = c("GramSVD", "Power", "Randomized", "GLRM")` `transform = c("NONE", "DEMEAN", "DESCALE", "STANDARDIZE")`(default NONE) `max_iterations = 1000` (default)

```

wholeres<-h2o.prcomp(training_frame=usps_data, x=1:256, k=256, compute_metrics = TRUE)

##
|
|
|
|=====| 80%
|
|=====| 100%

params <- as.data.frame(wholeres@model$importance)
cumul_prop <- params["Cumulative Proportion",]
row.names(cumul_prop) <- c("all")
allres <- data.frame(x=1:length(cumul_prop["all",]),cumprop=t(cumul_prop["all",]),label="all",stringsAsFactors=FALSE)

par <- params["Cumulative Proportion",]
row.names(par) <- c("all")
allnum <- data.frame(x=1:length(par["all",]),y=t(par["all",]),label="Cumulative Proportion")
par <- params["Proportion of Variance",]
row.names(par) <- c("all")
allnum <- rbind(allnum,data.frame(x=1:length(par["all",]),y=t(par["all",]),label="Proportion of Variance"))
par <- params["Standard deviation",]
row.names(par) <- c("all")
allnum <- rbind(allnum,data.frame(x=1:length(par["all",]),y=logb(t(par["all",]),base = 10),label="Log Standard Deviation"))

plot_ly(allnum,x=~x, y=~all, color = ~label) %>% add_lines()

```

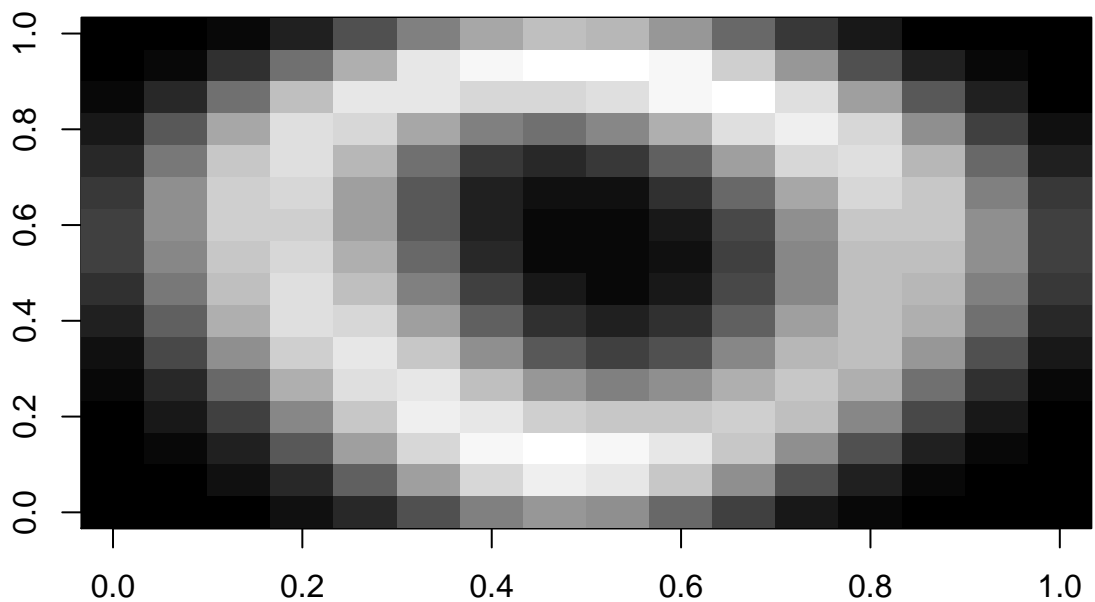
Each number separately

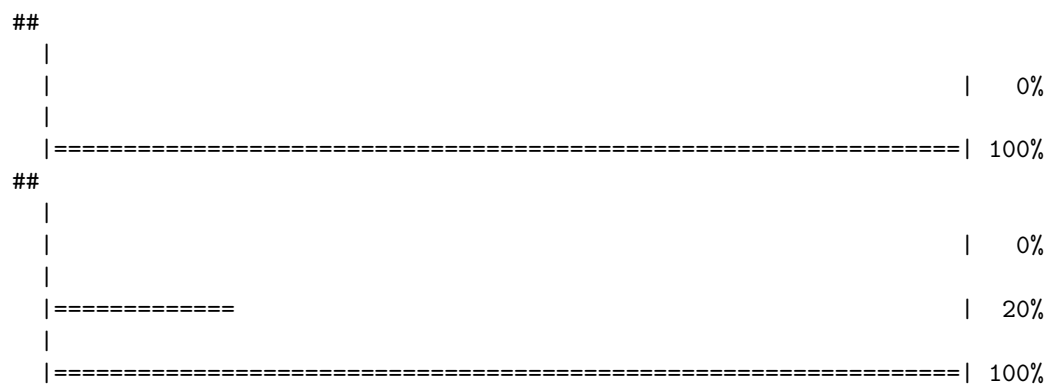
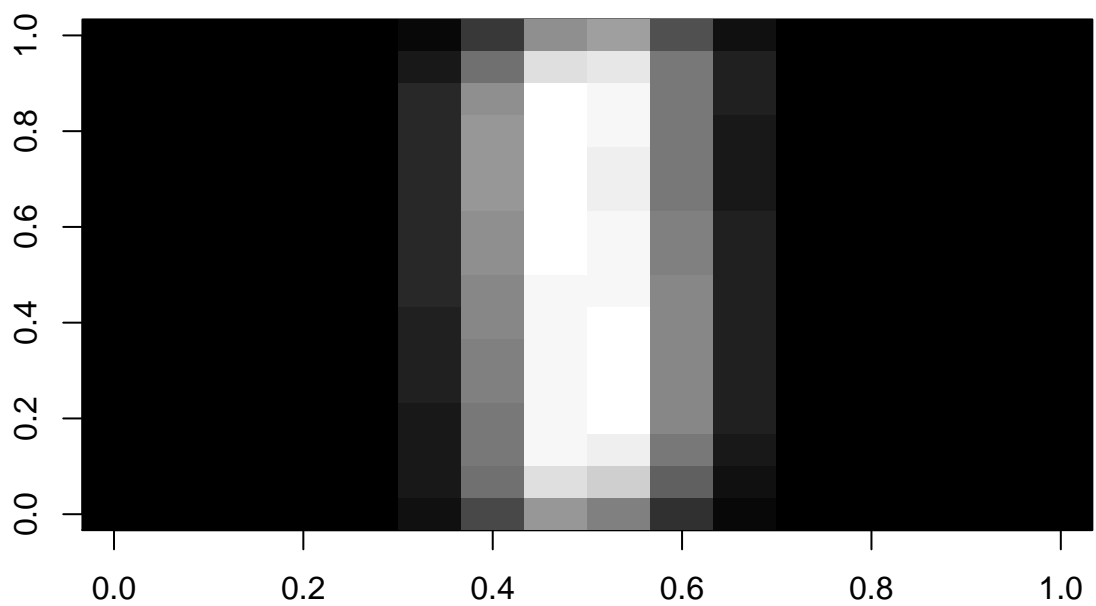
```

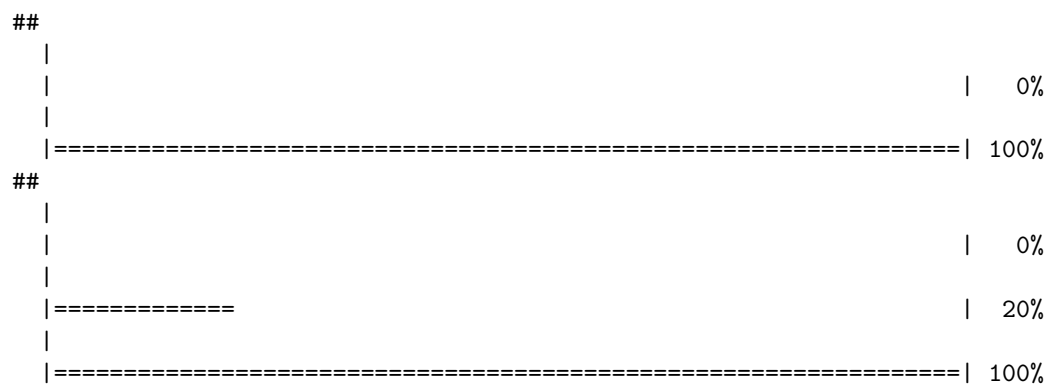
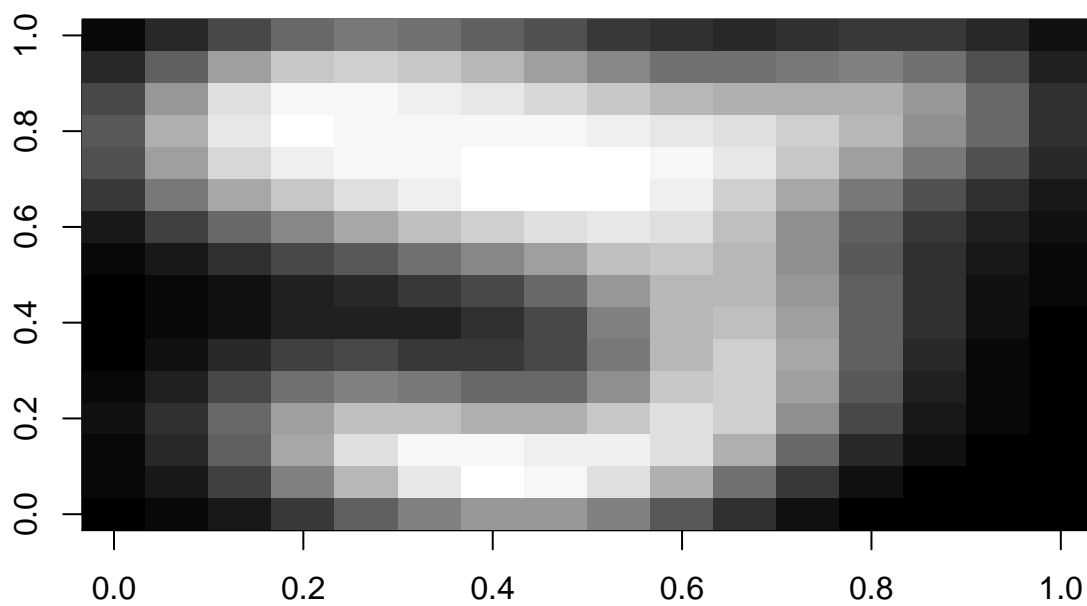
for(i in 0:9){
  numdata <- labeled_data[labeled_data$lab == i,]
  dfname <- paste('usps_',i,sep = "")
  part_data <- as.h2o(numdata,dfname)
  pcares <- h2o.prcomp(training_frame=part_data, x=1:256, k=256, compute_metrics = TRUE,ignore_const_cols=TRUE)
  params2 <- as.data.frame(pcares@model$importance)
  c_prop <- params2["Cumulative Proportion",]
  row.names(c_prop) <- c("all")
  cumul_prop <- rbind(cumul_prop,c_prop)
  numres <- data.frame(x=1:length(c_prop["all",]),cumprop=t(c_prop["all",]),label=dfname)
  allres <- rbind(allres,numres)
  image(matrix(pcares@model$eigenvectors$pc1,nrow=16), col = gray(0:32 / 32))
}

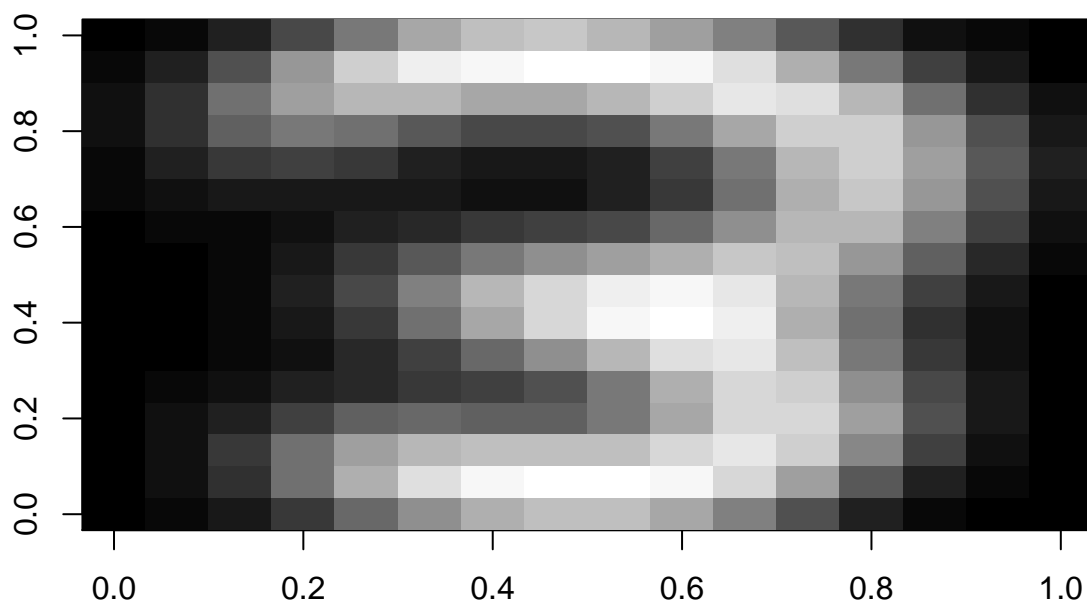
##
|
|
|
|=====| 100%
##
|
|
|
|=====| 0%

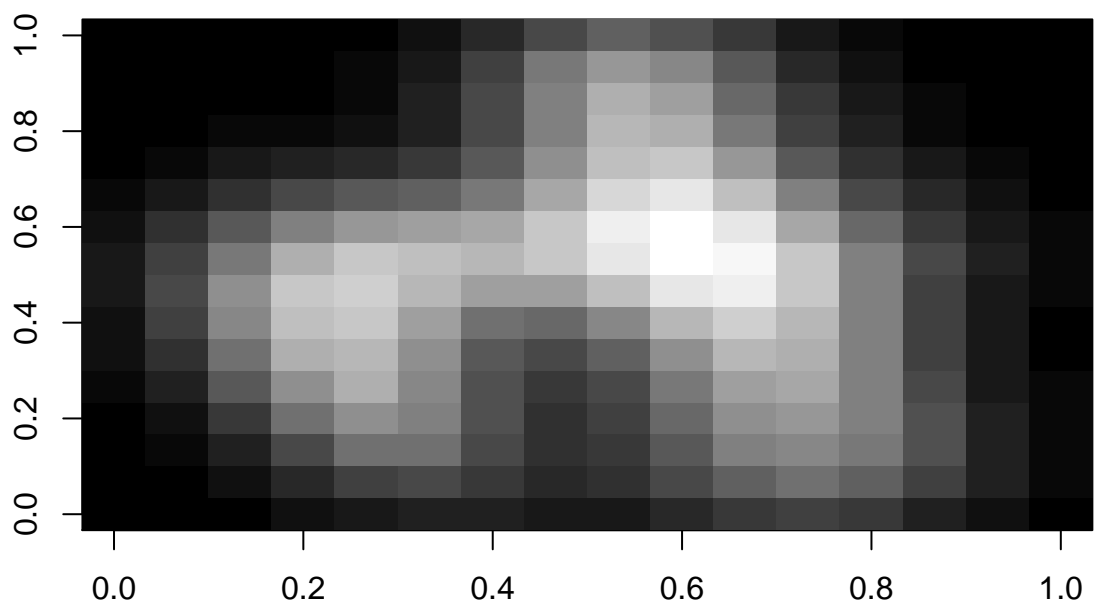
```

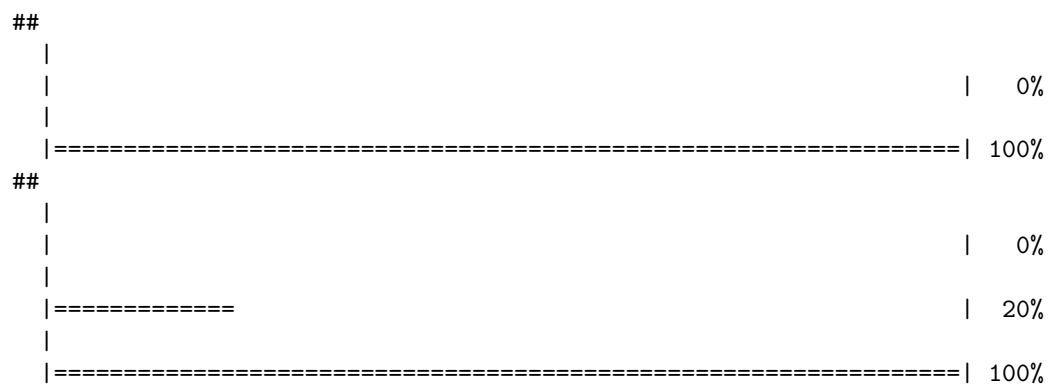
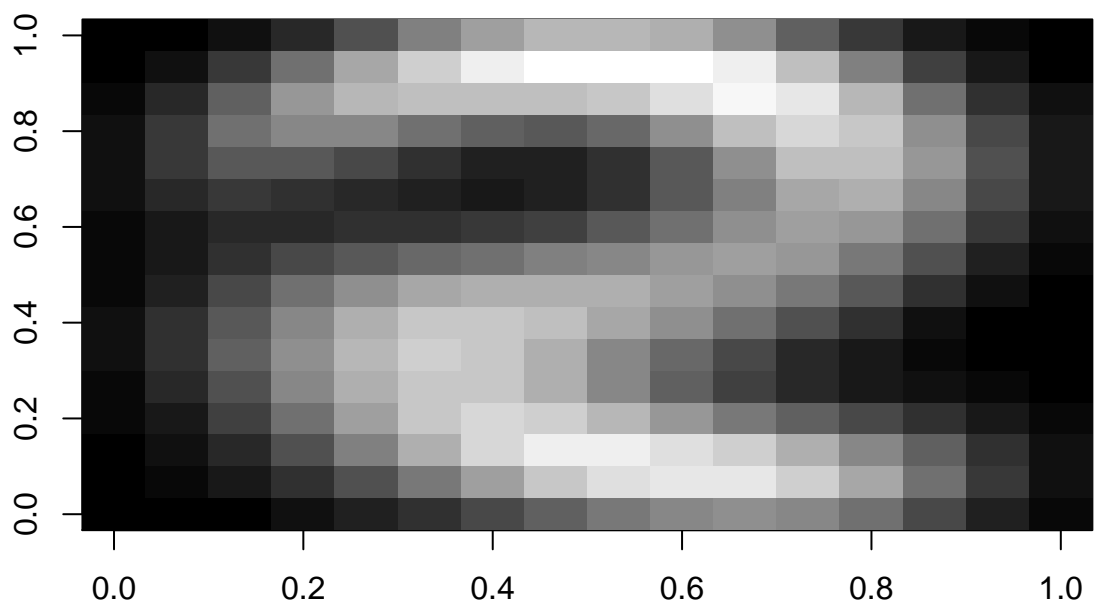


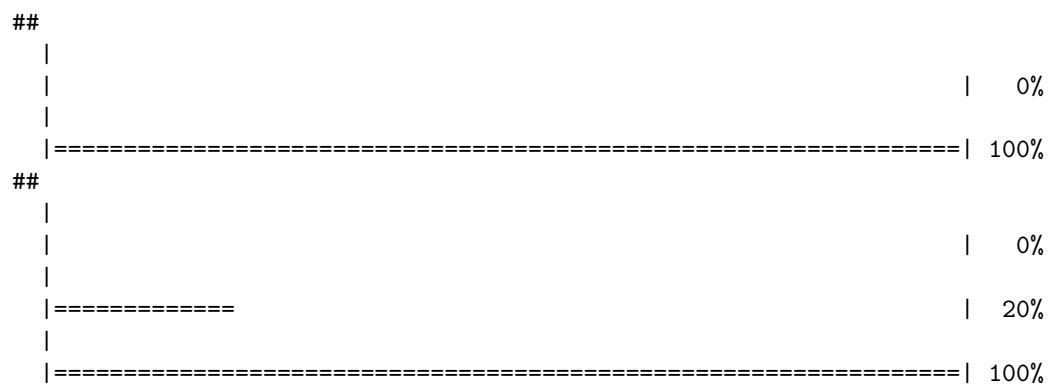
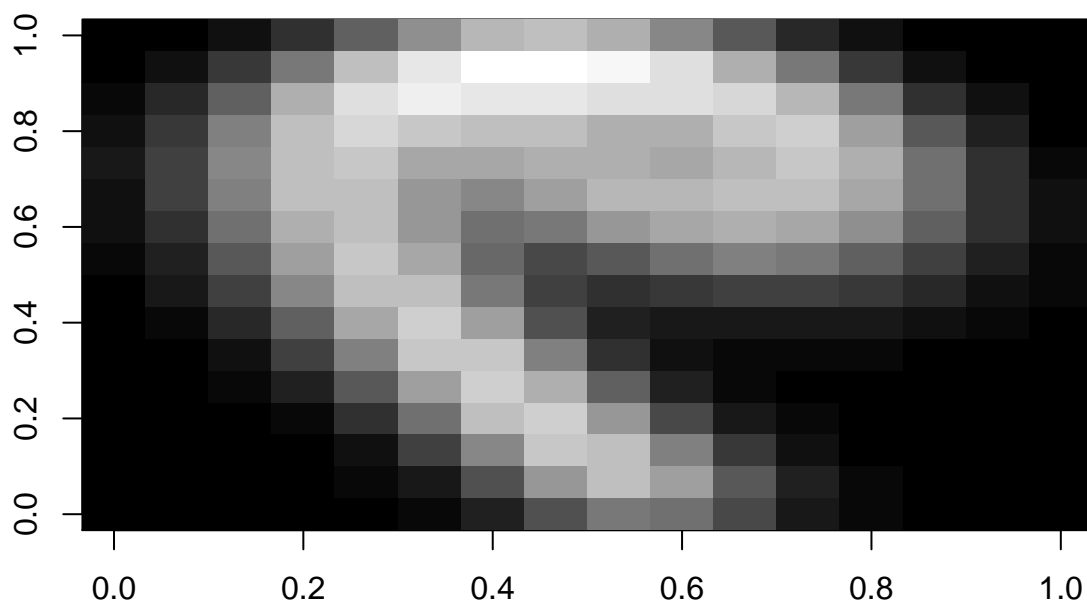


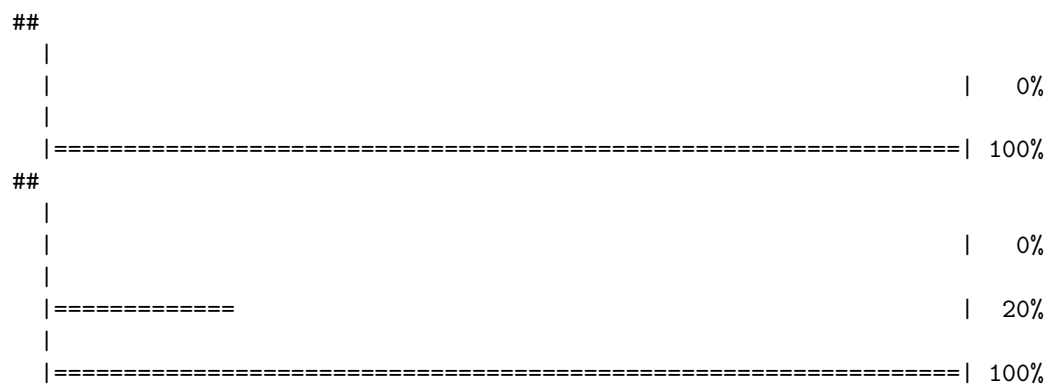
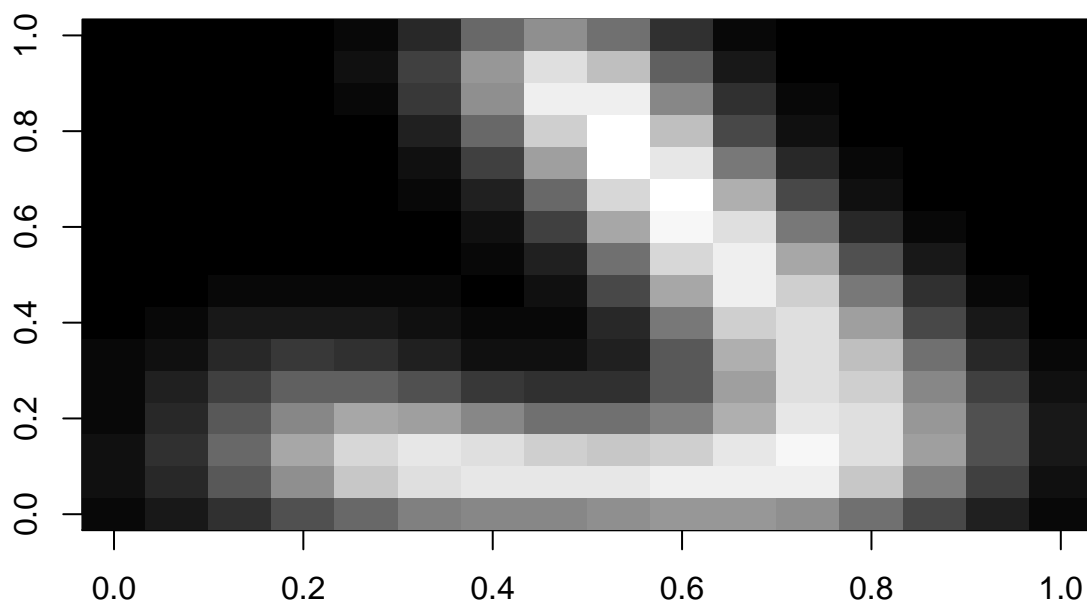


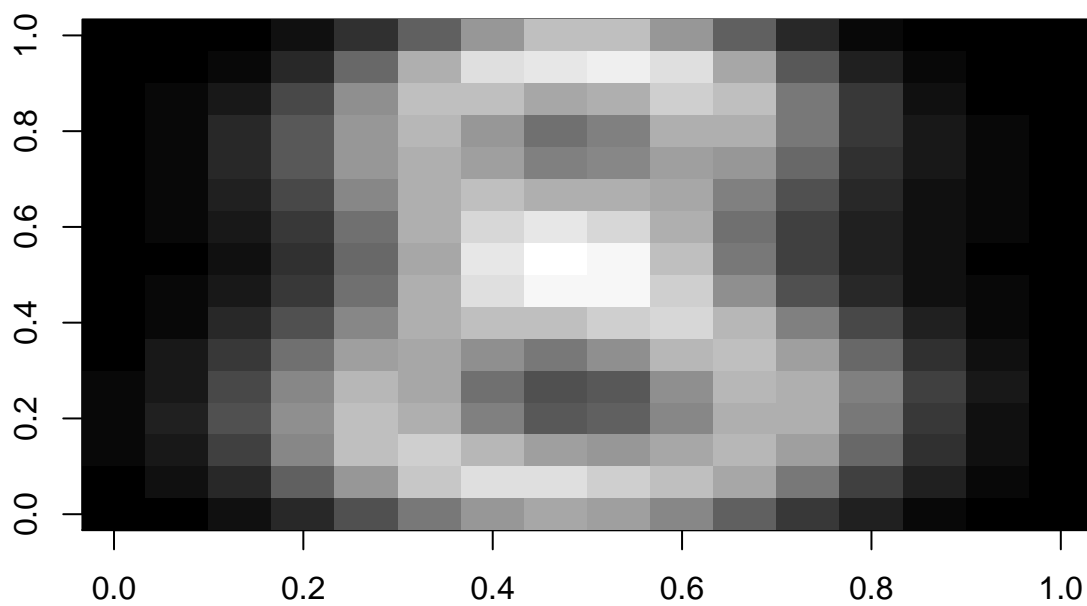


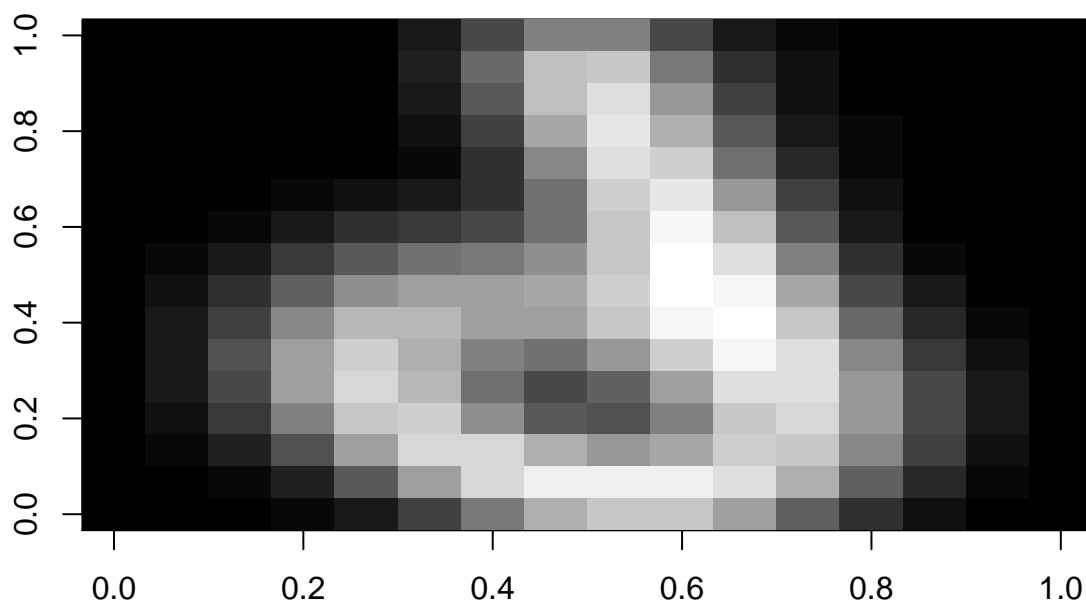












```
plot_ly(allres,x=~x,y=~all,color=~label)%>%add_lines()
```

```
summary(wholeres)
```

```
## Model Details:
## =====
##
## H20DimReductionModel: pca
## Model Key: PCA_model_R_1496351452008_48
## Importance of components:
##
```

	pc1	pc2	pc3	pc4
## Standard deviation	1274.244990	464.901006	348.192752	275.355291
## Proportion of Variance	0.629631	0.083811	0.047013	0.029401
## Cumulative Proportion	0.629631	0.713442	0.760455	0.789856

```
##
```

	pc5	pc6	pc7	pc8
## Standard deviation	266.379566	234.243032	206.933140	190.812392
## Proportion of Variance	0.027516	0.021277	0.016605	0.014119
## Cumulative Proportion	0.817372	0.838649	0.855254	0.869373

```
##
```

	pc9	pc10	pc11	pc12
## Standard deviation	179.007905	165.831496	161.606414	150.475354
## Proportion of Variance	0.012426	0.010664	0.010127	0.008780
## Cumulative Proportion	0.881799	0.892462	0.902590	0.911370

```
##
```

	pc13	pc14	pc15	pc16
## Standard deviation	133.837194	127.067289	120.947457	114.528384
## Proportion of Variance	0.006946	0.006261	0.005672	0.005086
## Cumulative Proportion	0.918316	0.924577	0.930250	0.935336

```
##
```

	pc17	pc18	pc19	pc20	pc21
--	------	------	------	------	------

## Standard deviation	111.146195	104.260473	99.559564	95.553429	94.014504
## Proportion of Variance	0.004790	0.004215	0.003844	0.003541	0.003427
## Cumulative Proportion	0.940126	0.944342	0.948185	0.951726	0.955153
##	pc22	pc23	pc24	pc25	pc26
## Standard deviation	89.776840	82.961567	81.159907	78.549222	72.698557
## Proportion of Variance	0.003125	0.002669	0.002554	0.002393	0.002049
## Cumulative Proportion	0.958279	0.960948	0.963502	0.965894	0.967944
##	pc27	pc28	pc29	pc30	pc31
## Standard deviation	70.951298	65.533636	64.894571	63.995619	62.489143
## Proportion of Variance	0.001952	0.001665	0.001633	0.001588	0.001514
## Cumulative Proportion	0.969896	0.971561	0.973194	0.974782	0.976297
##	pc32	pc33	pc34	pc35	pc36
## Standard deviation	59.042552	57.364689	56.125212	54.101502	53.085600
## Proportion of Variance	0.001352	0.001276	0.001222	0.001135	0.001093
## Cumulative Proportion	0.977648	0.978925	0.980146	0.981281	0.982374
##	pc37	pc38	pc39	pc40	pc41
## Standard deviation	50.503584	49.527218	47.773459	46.980314	46.053683
## Proportion of Variance	0.000989	0.000951	0.000885	0.000856	0.000822
## Cumulative Proportion	0.983363	0.984314	0.985199	0.986055	0.986877
##	pc42	pc43	pc44	pc45	pc46
## Standard deviation	42.304105	41.730306	39.608456	38.828366	37.202680
## Proportion of Variance	0.000694	0.000675	0.000608	0.000585	0.000537
## Cumulative Proportion	0.987571	0.988247	0.988855	0.989440	0.989976
##	pc47	pc48	pc49	pc50	pc51
## Standard deviation	36.165489	35.437391	34.839084	33.689939	32.468130
## Proportion of Variance	0.000507	0.000487	0.000471	0.000440	0.000409
## Cumulative Proportion	0.990484	0.990971	0.991441	0.991881	0.992290
##	pc52	pc53	pc54	pc55	pc56
## Standard deviation	31.990247	30.801097	29.967805	29.027644	27.889147
## Proportion of Variance	0.000397	0.000368	0.000348	0.000327	0.000302
## Cumulative Proportion	0.992687	0.993055	0.993403	0.993730	0.994031
##	pc57	pc58	pc59	pc60	pc61
## Standard deviation	27.050286	26.235012	25.742545	25.601171	25.132786
## Proportion of Variance	0.000284	0.000267	0.000257	0.000254	0.000245
## Cumulative Proportion	0.994315	0.994582	0.994839	0.995093	0.995338
##	pc62	pc63	pc64	pc65	pc66
## Standard deviation	24.433313	23.275377	22.897983	22.142775	21.992126
## Proportion of Variance	0.000231	0.000210	0.000203	0.000190	0.000188
## Cumulative Proportion	0.995570	0.995780	0.995983	0.996173	0.996361
##	pc67	pc68	pc69	pc70	pc71
## Standard deviation	20.856347	20.192318	19.807985	19.183744	18.714317
## Proportion of Variance	0.000169	0.000158	0.000152	0.000143	0.000136
## Cumulative Proportion	0.996529	0.996687	0.996840	0.996982	0.997118
##	pc72	pc73	pc74	pc75	pc76
## Standard deviation	17.907908	17.396736	17.039673	16.953954	15.986280
## Proportion of Variance	0.000124	0.000117	0.000113	0.000111	0.000099
## Cumulative Proportion	0.997242	0.997360	0.997472	0.997584	0.997683
##	pc77	pc78	pc79	pc80	pc81
## Standard deviation	15.842540	15.600678	15.408810	14.986807	14.906695
## Proportion of Variance	0.000097	0.000094	0.000092	0.000087	0.000086
## Cumulative Proportion	0.997780	0.997875	0.997967	0.998054	0.998140
##	pc82	pc83	pc84	pc85	pc86
## Standard deviation	14.180931	13.997363	13.510558	13.199411	13.164774
## Proportion of Variance	0.000078	0.000076	0.000071	0.000068	0.000067

## Cumulative Proportion	0.998218	0.998294	0.998365	0.998432	0.998500
##	pc87	pc88	pc89	pc90	pc91
## Standard deviation	12.706910	12.471315	12.294626	11.920947	11.405376
## Proportion of Variance	0.000063	0.000060	0.000059	0.000055	0.000050
## Cumulative Proportion	0.998562	0.998622	0.998681	0.998736	0.998787
##	pc92	pc93	pc94	pc95	pc96
## Standard deviation	10.868350	10.755065	10.615904	10.447391	10.240022
## Proportion of Variance	0.000046	0.000045	0.000044	0.000042	0.000041
## Cumulative Proportion	0.998832	0.998877	0.998921	0.998963	0.999004
##	pc97	pc98	pc99	pc100	pc101
## Standard deviation	10.039655	9.639609	9.619014	9.371075	9.049477
## Proportion of Variance	0.000039	0.000036	0.000036	0.000034	0.000032
## Cumulative Proportion	0.999043	0.999079	0.999115	0.999149	0.999181
##	pc102	pc103	pc104	pc105	pc106
## Standard deviation	8.847642	8.520904	8.393524	8.275680	8.151704
## Proportion of Variance	0.000030	0.000028	0.000027	0.000027	0.000026
## Cumulative Proportion	0.999211	0.999239	0.999267	0.999293	0.999319
##	pc107	pc108	pc109	pc110	pc111
## Standard deviation	7.932270	7.806701	7.544461	7.462464	7.317688
## Proportion of Variance	0.000024	0.000024	0.000022	0.000022	0.000021
## Cumulative Proportion	0.999343	0.999367	0.999389	0.999411	0.999431
##	pc112	pc113	pc114	pc115	pc116
## Standard deviation	7.231821	7.056751	7.036919	6.809337	6.749605
## Proportion of Variance	0.000020	0.000019	0.000019	0.000018	0.000018
## Cumulative Proportion	0.999452	0.999471	0.999490	0.999508	0.999526
##	pc117	pc118	pc119	pc120	pc121
## Standard deviation	6.717518	6.654124	6.454950	6.134173	6.045494
## Proportion of Variance	0.000017	0.000017	0.000016	0.000015	0.000014
## Cumulative Proportion	0.999543	0.999561	0.999577	0.999591	0.999605
##	pc122	pc123	pc124	pc125	pc126
## Standard deviation	5.938174	5.866071	5.708103	5.527348	5.437435
## Proportion of Variance	0.000014	0.000013	0.000013	0.000012	0.000011
## Cumulative Proportion	0.999619	0.999632	0.999645	0.999657	0.999668
##	pc127	pc128	pc129	pc130	pc131
## Standard deviation	5.401527	5.345411	5.304517	5.192840	5.111759
## Proportion of Variance	0.000011	0.000011	0.000011	0.000010	0.000010
## Cumulative Proportion	0.999680	0.999691	0.999702	0.999712	0.999722
##	pc132	pc133	pc134	pc135	pc136
## Standard deviation	4.882674	4.840304	4.809149	4.694346	4.531503
## Proportion of Variance	0.000009	0.000009	0.000009	0.000009	0.000008
## Cumulative Proportion	0.999732	0.999741	0.999750	0.999758	0.999766
##	pc137	pc138	pc139	pc140	pc141
## Standard deviation	4.460919	4.415453	4.356742	4.329604	4.198763
## Proportion of Variance	0.000008	0.000008	0.000007	0.000007	0.000007
## Cumulative Proportion	0.999774	0.999781	0.999789	0.999796	0.999803
##	pc142	pc143	pc144	pc145	pc146
## Standard deviation	4.098713	4.075505	4.035855	4.000611	3.950898
## Proportion of Variance	0.000007	0.000006	0.000006	0.000006	0.000006
## Cumulative Proportion	0.999809	0.999816	0.999822	0.999828	0.999834
##	pc147	pc148	pc149	pc150	pc151
## Standard deviation	3.891251	3.804353	3.739364	3.701704	3.593626
## Proportion of Variance	0.000006	0.000006	0.000005	0.000005	0.000005
## Cumulative Proportion	0.999840	0.999846	0.999851	0.999857	0.999862
##	pc152	pc153	pc154	pc155	pc156

## Standard deviation	3.511938	3.476335	3.405915	3.314068	3.296975
## Proportion of Variance	0.000005	0.000005	0.000004	0.000004	0.000004
## Cumulative Proportion	0.999866	0.999871	0.999876	0.999880	0.999884
##	pc157	pc158	pc159	pc160	pc161
## Standard deviation	3.265922	3.182625	3.139144	3.129682	3.080028
## Proportion of Variance	0.000004	0.000004	0.000004	0.000004	0.000004
## Cumulative Proportion	0.999888	0.999892	0.999896	0.999900	0.999903
##	pc162	pc163	pc164	pc165	pc166
## Standard deviation	3.047589	2.993577	2.982730	2.936685	2.903852
## Proportion of Variance	0.000004	0.000003	0.000003	0.000003	0.000003
## Cumulative Proportion	0.999907	0.999910	0.999914	0.999917	0.999921
##	pc167	pc168	pc169	pc170	pc171
## Standard deviation	2.821971	2.768194	2.692140	2.641267	2.600669
## Proportion of Variance	0.000003	0.000003	0.000003	0.000003	0.000003
## Cumulative Proportion	0.999924	0.999927	0.999929	0.999932	0.999935
##	pc172	pc173	pc174	pc175	pc176
## Standard deviation	2.548103	2.515712	2.512119	2.441507	2.432208
## Proportion of Variance	0.000003	0.000002	0.000002	0.000002	0.000002
## Cumulative Proportion	0.999937	0.999940	0.999942	0.999944	0.999947
##	pc177	pc178	pc179	pc180	pc181
## Standard deviation	2.371046	2.340110	2.316440	2.297229	2.266848
## Proportion of Variance	0.000002	0.000002	0.000002	0.000002	0.000002
## Cumulative Proportion	0.999949	0.999951	0.999953	0.999955	0.999957
##	pc182	pc183	pc184	pc185	pc186
## Standard deviation	2.189303	2.165049	2.127722	2.114389	2.019621
## Proportion of Variance	0.000002	0.000002	0.000002	0.000002	0.000002
## Cumulative Proportion	0.999959	0.999961	0.999963	0.999964	0.999966
##	pc187	pc188	pc189	pc190	pc191
## Standard deviation	2.017006	1.917275	1.904669	1.857218	1.846740
## Proportion of Variance	0.000002	0.000001	0.000001	0.000001	0.000001
## Cumulative Proportion	0.999968	0.999969	0.999970	0.999972	0.999973
##	pc192	pc193	pc194	pc195	pc196
## Standard deviation	1.826634	1.785150	1.743534	1.718968	1.713053
## Proportion of Variance	0.000001	0.000001	0.000001	0.000001	0.000001
## Cumulative Proportion	0.999974	0.999976	0.999977	0.999978	0.999979
##	pc197	pc198	pc199	pc200	pc201
## Standard deviation	1.658477	1.616345	1.567824	1.514959	1.499081
## Proportion of Variance	0.000001	0.000001	0.000001	0.000001	0.000001
## Cumulative Proportion	0.999980	0.999981	0.999982	0.999983	0.999984
##	pc202	pc203	pc204	pc205	pc206
## Standard deviation	1.478476	1.448103	1.417590	1.381124	1.368978
## Proportion of Variance	0.000001	0.000001	0.000001	0.000001	0.000001
## Cumulative Proportion	0.999985	0.999985	0.999986	0.999987	0.999988
##	pc207	pc208	pc209	pc210	pc211
## Standard deviation	1.322920	1.280988	1.246856	1.238697	1.219711
## Proportion of Variance	0.000001	0.000001	0.000001	0.000001	0.000001
## Cumulative Proportion	0.999988	0.999989	0.999990	0.999990	0.999991
##	pc212	pc213	pc214	pc215	pc216
## Standard deviation	1.174494	1.159001	1.111435	1.086112	1.053414
## Proportion of Variance	0.000001	0.000001	0.000000	0.000000	0.000000
## Cumulative Proportion	0.999991	0.999992	0.999992	0.999993	0.999993
##	pc217	pc218	pc219	pc220	pc221
## Standard deviation	1.017867	1.011305	1.000389	0.973905	0.959337
## Proportion of Variance	0.000000	0.000000	0.000000	0.000000	0.000000

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## Cumulative Proportion 0.999994 0.999994 0.999994 0.999995 0.999995
## pc222 pc223 pc224 pc225 pc226
## Standard deviation 0.925202 0.867259 0.848138 0.831245 0.821670
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 0.999995 0.999996 0.999996 0.999996 0.999997
## pc227 pc228 pc229 pc230 pc231
## Standard deviation 0.806934 0.790703 0.775839 0.724028 0.688933
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 0.999997 0.999997 0.999997 0.999997 0.999998
## pc232 pc233 pc234 pc235 pc236
## Standard deviation 0.682407 0.670796 0.654977 0.633642 0.619227
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 0.999998 0.999998 0.999998 0.999998 0.999998
## pc237 pc238 pc239 pc240 pc241
## Standard deviation 0.589804 0.572931 0.564169 0.539657 0.517071
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 0.999999 0.999999 0.999999 0.999999 0.999999
## pc242 pc243 pc244 pc245 pc246
## Standard deviation 0.501699 0.492296 0.478275 0.464773 0.439308
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 0.999999 0.999999 0.999999 0.999999 1.000000
## pc247 pc248 pc249 pc250 pc251
## Standard deviation 0.423885 0.412680 0.397621 0.371710 0.343730
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 1.000000 1.000000 1.000000 1.000000 1.000000
## pc252 pc253 pc254 pc255 pc256
## Standard deviation 0.323664 0.312185 0.306788 0.285587 0.281602
## Proportion of Variance 0.000000 0.000000 0.000000 0.000000 0.000000
## Cumulative Proportion 1.000000 1.000000 1.000000 1.000000 1.000000
##
## H20DimReductionMetrics: pca
##
## No model metrics available for PCA
##
##
##
## NULL

```

Eigenvectors

```
pcares@model$eigenvectors$pc1
```

```

## [1] 0.0008363244 0.0012199324 0.0025408667 0.0067295063 0.0173580382
## [6] 0.0378760085 0.0665214690 0.0936777642 0.1083741453 0.1051947078
## [11] 0.0845449820 0.0533780952 0.0258287398 0.0102671874 0.0038201193
## [16] 0.0014429170 0.0010409198 0.0024136647 0.0074521897 0.0214277157
## [21] 0.0492034233 0.0863433108 0.1165770335 0.1281098177 0.1275823895
## [26] 0.1265657060 0.1200730457 0.0937001693 0.0544977851 0.0238773684
## [31] 0.0086129379 0.0026413521 0.0016363696 0.0053941139 0.0174000417
## [36] 0.0452799003 0.0859847118 0.1157568058 0.1141747327 0.0930511332
## [41] 0.0798807537 0.0899813416 0.1104995676 0.1081771437 0.0745680637
## [46] 0.0361541459 0.0131495169 0.0037830518 0.0027306562 0.0099916733
## [51] 0.0305060383 0.0695844132 0.1082461640 0.1111217151 0.0793943540

```



```
## [56] 0.0496946705 0.0459326859 0.0706807595 0.1051271819 0.1135508275
## [61] 0.0831304381 0.0416717139 0.0150633328 0.0042076080 0.0039101527
## [66] 0.0143271886 0.0411909494 0.0844187500 0.1129516649 0.0965028981
## [71] 0.0593383004 0.0408231558 0.0520225330 0.0856023597 0.1187486430
## [76] 0.1195653883 0.0827375693 0.0396214038 0.0137811019 0.0038175477
## [81] 0.0045363339 0.0159875586 0.0439730798 0.0856170291 0.1095324112
## [86] 0.0937933689 0.0679843100 0.0624614988 0.0808650955 0.1126592912
## [91] 0.1334288003 0.1180423443 0.0730539279 0.0318557945 0.0102998283
## [96] 0.0028437200 0.0043048238 0.0142705649 0.0379488305 0.0735890947
## [101] 0.0987329078 0.0964662466 0.0860439131 0.0875681577 0.1054043708
## [106] 0.1311465271 0.1378611592 0.1066824826 0.0574736257 0.0220435977
## [111] 0.0065518422 0.0018910975 0.0033107660 0.0104399254 0.0272651290
## [116] 0.0538725687 0.0774370453 0.0861640589 0.0865438566 0.0915747559
## [121] 0.1113690055 0.1364931497 0.1318808342 0.0889001709 0.0409997158
## [126] 0.0136225368 0.0038040160 0.0012786407 0.0020552093 0.0061100205
## [131] 0.0161119861 0.0329782473 0.0504322838 0.0609822154 0.0660829673
## [136] 0.0773257273 0.1073274320 0.1347987059 0.1185420030 0.0685444354
## [141] 0.0269759258 0.0079878526 0.0022686755 0.0009703959 0.0012096021
## [146] 0.0029903764 0.0077151000 0.0161609821 0.0259953166 0.0335533894
## [151] 0.0409650201 0.0626817507 0.1059237350 0.1304152405 0.1006682608
## [156] 0.0493989542 0.0167970466 0.0046890415 0.0015156872 0.0008472907
## [161] 0.0008660043 0.0014592842 0.0031930732 0.0064879423 0.0106973470
## [166] 0.0153756988 0.0267800694 0.0612867735 0.1114118517 0.1230438189
## [171] 0.0808754822 0.0340240113 0.0103940431 0.0028877355 0.0011262337
## [176] 0.0007876997 0.0007632866 0.0009185233 0.0014179456 0.0024238171
## [181] 0.0042405142 0.0088165440 0.0270439827 0.0725486439 0.1186518790
## [186] 0.1110037761 0.0618448916 0.0230733345 0.0067749216 0.0020361153
## [191] 0.0009774757 0.0007721714 0.0007426416 0.0007786673 0.0008949398
## [196] 0.0012653740 0.0029097411 0.0103755759 0.0371777109 0.0887791217
## [201] 0.1220721381 0.0960667591 0.0466980657 0.0163455303 0.0049892784
## [206] 0.0017798281 0.0010078087 0.0007931962 0.0007398061 0.0007521223
## [211] 0.0008269256 0.0012600123 0.0038630836 0.0157356339 0.0503206134
## [216] 0.1017640637 0.1192092513 0.0818239741 0.0367010215 0.0127448165
## [221] 0.0042083328 0.0017259855 0.0010541800 0.0008104370 0.0007404102
## [226] 0.0007512953 0.0008273627 0.0013433951 0.0045917008 0.0189771902
## [231] 0.0558475805 0.1006901524 0.1056699057 0.0666753946 0.0286173474
## [236] 0.0097858411 0.0033437278 0.0015246576 0.0009870718 0.0007908836
## [241] 0.0007398061 0.0007434308 0.0007763100 0.0010567679 0.0032001524
## [246] 0.0134643342 0.0395939556 0.0688578867 0.0686896865 0.0413450331
## [251] 0.0169061851 0.0056658259 0.0020693788 0.0011158213 0.0008532136
## [256] 0.0007601924
```

2D and 3D projection (2,3 eigendirections)

```
lb2 <- lapply(lab,as.character) #to have labels
proj <- data.matrix(data[,]) %%% cbind(wholeres@model$eigenvectors$pc1,wholeres@model$eigenvectors$pc2,
proj <- data.frame(x=proj[,1],y=proj[,2],z=proj[,3],label=lb2$lab)
```

2D

```
plot_ly(proj,x=~x,y=~y,color=~label,type='scatter',text=~label) #3d
```

3D

```
plot_ly(proj,x=~x,y=~y,z=~z,color=~label,type='scatter3d',text=~label) #3d
```