aasignment4

March 13, 2021

```python
[2]: import numpy as np
     import pandas as pd
     import seaborn as sb
     from matplotlib import pyplot as plt
     from sklearn.metrics import accuracy_score
     from sklearn.model_selection import cross_val_score
     from sklearn.model_selection import train_test_split
     from sklearn.decomposition import PCA
     from sklearn.preprocessing import StandardScaler
     from sklearn.metrics import confusion_matrix
     from sklearn import svm
```

1 Loading the data

```python
[4]: df = pd.read_csv('/home/hiraditya/Desktop/HomeWork/SJSU/cs156/jupiter/
     ↪JupyterBooks/homework4_input_data.csv')

     df.head()
```

```
[4]:              id       ASS1       SPX  C6orf141       SP5       SP6  \
     0  TCGA-AB-2828-03  3.935027  0.523329      0.0  0.000000  0.102277
     1  TCGA-AB-2846-03  3.372801  0.000000      0.0  0.000000  0.116270
     2  TCGA-AB-2870-03  4.198301  0.000000      0.0  0.000000  0.249176
     3  TCGA-AB-2872-03  4.115014  0.000000      0.0  0.222018  0.632254
     4  TCGA-AB-2881-03  3.662169  0.467823      0.0  0.000000  0.000000

           ITGA8     ATP2A1    ATP2A3     ITGA2  …     IKZF1   SLC14A1    TCEAL2  \
     0  2.686908  2.837357  7.444575  2.246715  …  8.972232  1.560704  0.000000
     1  2.083429  5.567935  8.361999  3.626850  …  8.662337  2.509522  0.000000
     2  1.546059  6.605116  9.138359  2.858430  …  8.848274  3.137405  0.185980
     3  2.158989  6.858708  9.201254  2.295229  …  7.730065  3.087055  0.380857
     4  1.183388  5.567935  9.040883  1.815837  …  8.414421  2.683150  0.176611

          TCEAL7  TCEAL5       VCAN      CDR1    KRBOX1      SELL     Class
     0  0.00000     0.0  11.189255  5.866117  0.000000  7.560923  Leukemia
```

```
1   0.00000      0.0    9.472547   6.514825   0.289298   8.023838   Leukemia
2   0.00000      0.0    9.710047   0.000000   0.000000   8.031553   Leukemia
3   0.23682      0.0    6.085074   6.012453   0.411678   5.186830   Leukemia
4   0.00000      0.0    8.203471   5.718898   0.000000   8.031553   Leukemia

[5 rows x 3002 columns]
```

[ ]:

[5]: `df.Class.value_counts()`

[5]:
```
Breast          875
Uterine         431
LungAdeno       424
Kidney          420
Head&Neck       415
LungSquamous    390
Colon           370
Ovarian         337
Bladder         327
Rectal          128
Glioblastoma    117
Leukemia        102
Name: Class, dtype: int64
```

[6]: `df.info(verbose = True)`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4336 entries, 0 to 4335
Data columns (total 3002 columns):
 #    Column       Dtype
---   ------       -----
 0    id           object
 1    ASS1         float64
 2    SPX          float64
 3    C6orf141     float64
 4    SP5          float64
 5    SP6          float64
 6    ITGA8        float64
 7    ATP2A1       float64
 8    ATP2A3       float64
 9    ITGA2        float64
 10   ITGA3        float64
 11   GAP43        float64
 12   FBXL16       float64
 13   SDK1         float64
 14   SDK2         float64
```

```
15    THSD4         float64
16    CHST9         float64
17    CHST8         float64
18    BCL2A1        float64
19    ART4          float64
20    ATP1A3        float64
21    ATP1A2        float64
22    SPHK1         float64
23    ABAT          float64
24    UPK2          float64
25    CFH           float64
26    CFB           float64
27    SIDT1         float64
28    NRXN2         float64
29    NRXN1         float64
30    DPYSL3        float64
31    SEZ6L         float64
32    TMC4          float64
33    TMC5          float64
34    PRKAR2B       float64
35    PHACTR3       float64
36    ASGR1         float64
37    ASGR2         float64
38    SYNDIG1       float64
39    CPLX2         float64
40    CPLX3         float64
41    CPLX1         float64
42    PBX1          float64
43    B3GAT1        float64
44    UPK1A         float64
45    UPK1B         float64
46    DLGAP1        float64
47    DLGAP5        float64
48    C2orf82       float64
49    NPTX2         float64
50    NPTX1         float64
51    MZB1          float64
52    HLA-DQB1      float64
53    HLA-DQB2      float64
54    MRC1          float64
55    NPTXR         float64
56    MYO1G         float64
57    MYO1A         float64
58    LY6G6C        float64
59    HOXA13        float64
60    HOXA11        float64
61    HOXA10        float64
62    LGALS3        float64
```

```
63   LGALS7          float64
64   LGALS4          float64
65   NMU             float64
66   NMB             float64
67   ELN             float64
68   LRRC26          float64
69   KIAA1522        float64
70   GCNT1           float64
71   GCNT3           float64
72   ENTPD8          float64
73   TAGLN           float64
74   PDK4            float64
75   ALPL            float64
76   PTGS2           float64
77   EIF1AY          float64
78   BMP5            float64
79   BMP4            float64
80   BMP2            float64
81   CT45A7          float64
82   TTC6            float64
83   BHLHA15         float64
84   C3orf52         float64
85   CHDH            float64
86   CAPG            float64
87   SPC25           float64
88   HIST1H3H        float64
89   SRGAP2C         float64
90   SOSTDC1         float64
91   C10orf99        float64
92   FHOD3           float64
93   ADH7            float64
94   ADH6            float64
95   ADH4            float64
96   BEX5            float64
97   BEX4            float64
98   BEX2            float64
99   BEX1            float64
100  TMEM163         float64
101  TAS2R19         float64
102  BCAT1           float64
103  TAS2R13         float64
104  NOVA1           float64
105  F12             float64
106  DIO1            float64
107  DIO2            float64
108  C8orf46         float64
109  MB              float64
110  CAMSAP3         float64
```

```
111  SLC18A1        float64
112  TRIM9          float64
113  IL2RB          float64
114  SLC17A9        float64
115  IL2RG          float64
116  CHMP4C         float64
117  CTSK           float64
118  TMEM255A       float64
119  MMP28          float64
120  HOXB13         float64
121  LIF            float64
122  MMP23B         float64
123  B3GNT6         float64
124  B3GNT7         float64
125  B3GNT3         float64
126  ADRA2A         float64
127  ADRA2C         float64
128  HLA-DRB3       float64
129  DAAM2          float64
130  HLA-DRB1       float64
131  HLA-DRB4       float64
132  HLA-DRB5       float64
133  SYT8           float64
134  SYT1           float64
135  SYT4           float64
136  SYT5           float64
137  SYT7           float64
138  SCHIP1         float64
139  FAM189A2       float64
140  NBL1           float64
141  1-Mar          float64
142  KRT75          float64
143  KRT78          float64
144  HFE2           float64
145  TTC22          float64
146  ENO2           float64
147  ENO3           float64
148  CFI            float64
149  CFD            float64
150  OBSCN          float64
151  PTK6           float64
152  SORBS1         float64
153  SORBS2         float64
154  SFTA3          float64
155  SFTA2          float64
156  HIST3H2BB      float64
157  SPEG           float64
158  NKAIN4         float64
```

```
159   NKAIN3          float64
160   NKAIN1          float64
161   MAP1A           float64
162   MAP1B           float64
163   TMEM200C        float64
164   IGSF9B          float64
165   UNC5C           float64
166   VGF             float64
167   UNC5A           float64
168   FST             float64
169   SDR42E1         float64
170   NMNAT2          float64
171   FOXG1           float64
172   ACSS3           float64
173   NCCRP1          float64
174   FAM72C          float64
175   WNT2            float64
176   LRRN4           float64
177   AGXT            float64
178   LRRN1           float64
179   GPRIN2          float64
180   HIST2H2BF       float64
181   SLC44A5         float64
182   ZBTB7C          float64
183   MSI1            float64
184   UTY             float64
185   ZFHX4           float64
186   SHOX2           float64
187   C1S             float64
188   C1R             float64
189   HBB             float64
190   MUC20           float64
191   MUC21           float64
192   BOC             float64
193   TPX2            float64
194   DENND2A         float64
195   GAGE4           float64
196   TRNP1           float64
197   MISP            float64
198   KCP             float64
199   CNR1            float64
200   RAPGEFL1        float64
201   ANKS1B          float64
202   ABI3BP          float64
203   ADAM12          float64
204   GLYAT           float64
205   SHANK2          float64
206   SHANK1          float64
```

```
207  NPIPA8          float64
208  NPIPA7          float64
209  PCSK9           float64
210  PCSK2           float64
211  PCSK1           float64
212  PCSK6           float64
213  LEMD1           float64
214  OSR2            float64
215  COL15A1         float64
216  TC2N            float64
217  LGR5            float64
218  LGR6            float64
219  DPYSL4          float64
220  TMEM125         float64
221  FOXJ1           float64
222  IGFBP6          float64
223  PLGLB1          float64
224  S100A9          float64
225  S100A8          float64
226  S100A4          float64
227  S100A6          float64
228  S100A1          float64
229  S100A2          float64
230  LONRF2          float64
231  BIRC3           float64
232  APLNR           float64
233  DYNC1I1         float64
234  TAS2R50         float64
235  PPP1R13L        float64
236  TUSC3           float64
237  WNT10A          float64
238  LAMB1           float64
239  LAMB3           float64
240  SHH             float64
241  FAM157A         float64
242  LOC729159       float64
243  MGP             float64
244  LUM             float64
245  NUDT10          float64
246  NUDT11          float64
247  CPN2            float64
248  CPN1            float64
249  CFHR2           float64
250  LGI4            float64
251  CLIC5           float64
252  LGI3            float64
253  NLGN3           float64
254  CASQ1           float64
```

```
255  ARHGAP40        float64
256  TNNT1           float64
257  CDC42EP5        float64
258  TESC            float64
259  FOXL2           float64
260  C4B             float64
261  ADCY5           float64
262  ADCY2           float64
263  SLC22A1         float64
264  MEIS2           float64
265  MEIS1           float64
266  SLC22A3         float64
267  TFR2            float64
268  DNAJC25-GNG10   float64
269  KCNA3           float64
270  BHMT            float64
271  PLA2G2A         float64
272  PLA2G2D         float64
273  KYNU            float64
274  PDZK1           float64
275  REG1A           float64
276  REG1B           float64
277  MRGPRF          float64
278  PLK1            float64
279  CLMP            float64
280  GPR75-ASB3      float64
281  IP6K3           float64
282  PLEKHB1         float64
283  SERPINB3        float64
284  SERPINB2        float64
285  SERPINB5        float64
286  SERPINB4        float64
287  SERPINB7        float64
288  CX3CR1          float64
289  MAGED4          float64
290  STC1            float64
291  STC2            float64
292  RAC2            float64
293  IVL             float64
294  NEB             float64
295  NES             float64
296  GPR143          float64
297  CITED1          float64
298  CITED4          float64
299  DTNA            float64
300  GAGE12C         float64
301  GAGE12E         float64
302  GAGE12G         float64
```

```
303  SRCIN1        float64
304  CRABP1        float64
305  CRABP2        float64
306  PHYHIPL       float64
307  ABLIM3        float64
308  ABLIM2        float64
309  F7            float64
310  BIVM-ERCC5    float64
311  RAB6B         float64
312  CHL1          float64
313  PIM2          float64
314  CRIP1         float64
315  PLP1          float64
316  NAT8          float64
317  ADGRL3        float64
318  FAIM2         float64
319  PPFIA4        float64
320  TSPAN10       float64
321  TSPAN12       float64
322  TSPAN13       float64
323  MAB21L2       float64
324  FOXF1         float64
325  FOXF2         float64
326  TYR           float64
327  WIF1          float64
328  TP63          float64
329  CYTL1         float64
330  PDX1          float64
331  ADAP1         float64
332  KLHL13        float64
333  KLHL14        float64
334  SOWAHB        float64
335  NDRG1         float64
336  NDRG4         float64
337  ERCC6-PGBD3   float64
338  SLN           float64
339  CRHBP         float64
340  PHGR1         float64
341  TCTEX1D4      float64
342  VIL1          float64
343  MSMB          float64
344  CPB2          float64
345  CPB1          float64
346  SYNGR3        float64
347  CRP           float64
348  GLDC          float64
349  QPCT          float64
350  TPD52L1       float64
```

```
351  AOX1           float64
352  USP9Y          float64
353  PAEP           float64
354  PLN            float64
355  PLOD2          float64
356  IL36RN         float64
357  NKX6-1         float64
358  BCHE           float64
359  TUBA1A         float64
360  IGSF10         float64
361  IGSF11         float64
362  PGBD5          float64
363  G6PC           float64
364  LY6G6D         float64
365  SMIM1          float64
366  SERPINF1       float64
367  SERPINF2       float64
368  GPC2           float64
369  GPC3           float64
370  GPC4           float64
371  C2orf40        float64
372  SLC28A3        float64
373  ORM1           float64
374  ORM2           float64
375  KCNIP3         float64
376  KCNIP1         float64
377  MOGAT2         float64
378  MOGAT3         float64
379  FTCD           float64
380  SPP1           float64
381  EEF1A2         float64
382  CA14           float64
383  CA12           float64
384  CA11           float64
385  CA10           float64
386  TPSAB1         float64
387  RAB25          float64
388  C5orf46        float64
389  LEFTY2         float64
390  LEFTY1         float64
391  RAB27B         float64
392  LSAMP          float64
393  CYP2D6         float64
394  CBX2           float64
395  LCN12          float64
396  TNS4           float64
397  SPRR3          float64
398  NLRP2          float64
```

```
399  ARPP21         float64
400  TPM2           float64
401  JCHAIN         float64
402  SH3RF2         float64
403  TJP3           float64
404  TUB            float64
405  GCGR           float64
406  PTGS1          float64
407  PAH            float64
408  DCN            float64
409  PERP           float64
410  DCX            float64
411  FLRT3          float64
412  GDF10          float64
413  PRLR           float64
414  PRAC1          float64
415  SLC3A1         float64
416  CSDC2          float64
417  CRNDE          float64
418  TCAP           float64
419  LYPD2          float64
420  LYPD3          float64
421  LYPD1          float64
422  RGS5           float64
423  RGS6           float64
424  RGS1           float64
425  RGS2           float64
426  RDH16          float64
427  MGARP          float64
428  NALCN          float64
429  CD24           float64
430  FAT3           float64
431  FAT2           float64
432  LOC100129307   float64
433  COL27A1        float64
434  TMEM246        float64
435  AKR7A3         float64
436  PRODH          float64
437  HPGD           float64
438  HIST1H1D       float64
439  HIST1H1E       float64
440  RASSF6         float64
441  HIST1H1B       float64
442  MKI67          float64
443  GNMT           float64
444  CKMT1A         float64
445  CKMT1B         float64
446  ZNF556         float64
```

```
447  PCDH9         float64
448  ATF3          float64
449  CTTNBP2       float64
450  LHX2          float64
451  PTGER3        float64
452  SLC38A5       float64
453  B3GALT5       float64
454  SLC38A3       float64
455  YBX2          float64
456  NKG7          float64
457  GUCY2C        float64
458  NOTUM         float64
459  GFPT2         float64
460  B4GALNT4      float64
461  VSNL1         float64
462  UGT2B7        float64
463  HAND2         float64
464  PARM1         float64
465  MTRNR2L9      float64
466  MTRNR2L8      float64
467  MTRNR2L2      float64
468  MTRNR2L1      float64
469  MTRNR2L6      float64
470  NLGN4Y        float64
471  NLGN4X        float64
472  FBN2          float64
473  FBN1          float64
474  INHBC         float64
475  BAAT          float64
476  TPSD1         float64
477  SFTPD         float64
478  SFTPB         float64
479  IBSP          float64
480  FOXA3         float64
481  BST2          float64
482  SARDH         float64
483  CYP1B1        float64
484  HAS2          float64
485  HAS3          float64
486  CA9           float64
487  ADGRD1        float64
488  IRS2          float64
489  HOXA7         float64
490  HOXA5         float64
491  HOXA4         float64
492  HOXA3         float64
493  CA2           float64
494  IGLL5         float64
```

```
495  HOXA9          float64
496  CA4            float64
497  RGL3           float64
498  OGN            float64
499  ATP10B         float64
500  TRABD2A        float64
501  TRABD2B        float64
502  TYMP           float64
503  DAPL1          float64
504  CYP4F12        float64
505  CYP4F11        float64
506  TRPV6          float64
507  CTSE           float64
508  POSTN          float64
509  FGFR4          float64
510  FGFR3          float64
511  CXCL1          float64
512  CXCL3          float64
513  CXCL2          float64
514  CXCL5          float64
515  CXCL6          float64
516  CXCL9          float64
517  CXCL8          float64
518  EMB            float64
519  AFF3           float64
520  PDPN           float64
521  THRSP          float64
522  GCKR           float64
523  CPXM1          float64
524  CPXM2          float64
525  LFNG           float64
526  PENK           float64
527  BIRC7          float64
528  BIRC5          float64
529  INSM1          float64
530  TMEM35         float64
531  TMEM37         float64
532  SDS            float64
533  PRUNE2         float64
534  NRCAM          float64
535  KCNK1          float64
536  FAM155A        float64
537  SUSD4          float64
538  SUSD2          float64
539  BRINP3         float64
540  BRINP1         float64
541  DPCR1          float64
542  NFKBIZ         float64
```

```
543  SPRR1A          float64
544  SPRR1B          float64
545  DLX5            float64
546  DLX1            float64
547  DLX3            float64
548  HIST1H2BE       float64
549  HIST1H2BF       float64
550  HIST1H2BG       float64
551  HIST1H2BB       float64
552  HIST1H2BL       float64
553  HIST1H2BM       float64
554  HIST1H2BN       float64
555  HIST1H2BO       float64
556  HIST1H2BH       float64
557  HIST1H2BI       float64
558  HIST1H2BJ       float64
559  VAV3            float64
560  TNFAIP6         float64
561  TNFAIP2         float64
562  COL26A1         float64
563  ARL17B          float64
564  FERMT1          float64
565  COL14A1         float64
566  KLHDC8A         float64
567  ESPN            float64
568  LOC100130370    float64
569  MT1H            float64
570  ARHGEF16        float64
571  ARHGEF19        float64
572  AGXT2           float64
573  CYP4X1          float64
574  SNAP91          float64
575  SERF1A          float64
576  TSPYL5          float64
577  HIST2H3D        float64
578  HIST2H3C        float64
579  HIST2H3A        float64
580  SLC39A5         float64
581  XIRP2           float64
582  RET             float64
583  TRIM73          float64
584  TMEM63C         float64
585  NTN1            float64
586  NTN4            float64
587  B4GALNT1        float64
588  B4GALNT3        float64
589  DEFA5           float64
590  ARSE            float64
```

```
591  CA8          float64
592  CA3          float64
593  MAGED4B      float64
594  GSTA1        float64
595  GSTA2        float64
596  FBLN2        float64
597  FBLN1        float64
598  FBLN5        float64
599  STRA6        float64
600  KIFC1        float64
601  NLGN1        float64
602  SYNPO2       float64
603  IQCA1        float64
604  SEMA5B       float64
605  LYNX1        float64
606  HS6ST2       float64
607  HS6ST3       float64
608  LOC391322    float64
609  CCL4L1       float64
610  CCL4L2       float64
611  TGFB2        float64
612  PEG10        float64
613  TGFBI        float64
614  PNMA6A       float64
615  WNK4         float64
616  GRIA2        float64
617  GRIA4        float64
618  TNFRSF12A    float64
619  BASP1        float64
620  SCNN1G       float64
621  SCNN1B       float64
622  SCNN1A       float64
623  SCUBE2       float64
624  SCUBE1       float64
625  ZNF750       float64
626  MYOM3        float64
627  FBXO2        float64
628  FGF1         float64
629  GLYATL1      float64
630  WASF3        float64
631  PTHLH        float64
632  TSPAN7       float64
633  TPPP3        float64
634  PIP          float64
635  PI3          float64
636  GPR27        float64
637  KCNMB1       float64
638  PNCK         float64
```

```
639  FCRL5          float64
640  PLXNB3         float64
641  AMN            float64
642  FSD1           float64
643  RBM24          float64
644  EPHA7          float64
645  EPHA6          float64
646  EPHA3          float64
647  EPHA2          float64
648  EPHA1          float64
649  COL9A2         float64
650  CHST13         float64
651  COL9A1         float64
652  GLB1L2         float64
653  ARHGAP11B      float64
654  CRCT1          float64
655  ZC3H12A        float64
656  TH             float64
657  TF             float64
658  MLXIPL         float64
659  CYP4A11        float64
660  CYP3A5         float64
661  CARTPT         float64
662  OTX1           float64
663  MFAP4          float64
664  PVRL1          float64
665  SULT1E1        float64
666  SNAP25         float64
667  TNFSF10        float64
668  DIRAS1         float64
669  SLC4A4         float64
670  SLC4A3         float64
671  RPS4Y1         float64
672  ASPM           float64
673  ASPN           float64
674  MXRA5          float64
675  ZNF883         float64
676  IGSF9          float64
677  IGSF1          float64
678  IGSF3          float64
679  ITGB3          float64
680  ITGB4          float64
681  ITGB6          float64
682  ITGB8          float64
683  MAT1A          float64
684  LBP            float64
685  FGG            float64
686  FGA            float64
```

```
687  FGB            float64
688  ATP1B2         float64
689  ATP1B1         float64
690  NRTN           float64
691  MAOB           float64
692  MAOA           float64
693  BAIAP2L1       float64
694  FABP6          float64
695  FABP7          float64
696  FABP4          float64
697  FABP1          float64
698  AKR1C4         float64
699  AKR1C1         float64
700  SNCAIP         float64
701  DOCK3          float64
702  FASN           float64
703  GRIA1          float64
704  GPX2           float64
705  NEU4           float64
706  ABCB1          float64
707  SLC9A2         float64
708  SLC9A3         float64
709  ADH1C          float64
710  ADH1B          float64
711  ADH1A          float64
712  SLC30A2        float64
713  ASPDH          float64
714  GADD45G        float64
715  RSPO1          float64
716  CNN1           float64
717  RSPO4          float64
718  ITGA11         float64
719  CTXN1          float64
720  TUBB3          float64
721  SH3BGRL2       float64
722  PRR36          float64
723  OLFM2          float64
724  OLFM1          float64
725  OLFM4          float64
726  EFNA5          float64
727  EFNA3          float64
728  EFNA2          float64
729  EFNA1          float64
730  LRP2           float64
731  LRP4           float64
732  MAP2           float64
733  C8A            float64
734  C8B            float64
```

```
735  MAP6              float64
736  MAP7              float64
737  C8G               float64
738  C1orf186          float64
739  CHIT1             float64
740  SPOCD1            float64
741  ZNF711            float64
742  MAPT              float64
743  HLA-DQA1          float64
744  HLA-DQA2          float64
745  TBX2              float64
746  FN1               float64
747  TFPI2             float64
748  TBX1              float64
749  BATF              float64
750  TNC               float64
751  LRRC15            float64
752  LRG1              float64
753  CHRNA1            float64
754  CHRNA3            float64
755  CHGA              float64
756  CHGB              float64
757  MSC               float64
758  XBP1              float64
759  COL8A2            float64
760  COL8A1            float64
761  MARCO             float64
762  AARD              float64
763  CWH43             float64
764  WNT11             float64
765  FOLR1             float64
766  HIST1H4K          float64
767  PRPH              float64
768  FOXM1             float64
769  ILDR2             float64
770  ILDR1             float64
771  NOL4              float64
772  OLIG2             float64
773  OLIG1             float64
774  DPYS              float64
775  CDCA7             float64
776  CDCA5             float64
777  NDUFA4L2          float64
778  GFAP              float64
779  TNFAIP8L2-SCNM1   float64
780  CRB3              float64
781  CRB2              float64
782  FAP               float64
```

```
783  RELN         float64
784  TYRP1        float64
785  CRISPLD1     float64
786  FAM69C       float64
787  KLK2         float64
788  KLK3         float64
789  KLK4         float64
790  KLK5         float64
791  KLK6         float64
792  KLK7         float64
793  KLK8         float64
794  PLCH2        float64
795  PLCH1        float64
796  IGF2         float64
797  COL16A1      float64
798  SST          float64
799  ZNF334       float64
800  TRIL         float64
801  NTF4         float64
802  CYP24A1      float64
803  SLC16A9      float64
804  SLC16A3      float64
805  SLC16A5      float64
806  ARHGAP36     float64
807  LYVE1        float64
808  CACNA1H      float64
809  CACNA1B      float64
810  CACNA1D      float64
811  CACNA1G      float64
812  NPY1R        float64
813  EGR2         float64
814  EGR3         float64
815  EGR1         float64
816  PAX3         float64
817  PAX2         float64
818  PCDHA10      float64
819  PCDHA11      float64
820  PCDHA12      float64
821  PAX9         float64
822  PAX8         float64
823  EPHA4        float64
824  MLIP         float64
825  DSG3         float64
826  SFRP2        float64
827  SFRP1        float64
828  COL1A2       float64
829  COL1A1       float64
830  KIAA1217     float64
```

```
831  KIAA1211        float64
832  CEMIP           float64
833  CMYA5           float64
834  AADAC           float64
835  C19orf33        float64
836  EPCAM           float64
837  FOXC2           float64
838  COL6A1          float64
839  COL6A2          float64
840  KLK12           float64
841  KLK13           float64
842  KLK10           float64
843  KLK11           float64
844  ANOS1           float64
845  LRRK2           float64
846  CRMP1           float64
847  RNF43           float64
848  PLA1A           float64
849  SNCG            float64
850  MTTP            float64
851  SNCB            float64
852  RNF128          float64
853  MUC5B           float64
854  PDZRN4          float64
855  PDZRN3          float64
856  EMILIN3         float64
857  EMILIN1         float64
858  CTGF            float64
859  OVOL2           float64
860  OVOL1           float64
861  P2RX1           float64
862  ERRFI1          float64
863  AP1M2           float64
864  CDRT4           float64
865  PRR15           float64
866  L1CAM           float64
867  SLC45A3         float64
868  SLC45A2         float64
869  ALS2CL          float64
870  TUBB4A          float64
871  FZD10           float64
872  RASL11B         float64
873  DSP             float64
874  DCDC2           float64
875  SLC38A4         float64
876  LMO1            float64
877  LMO3            float64
878  LMO7            float64
```

```
879  ERBB2          float64
880  ERBB4          float64
881  GJB1           float64
882  GJB3           float64
883  GJB2           float64
884  GJB5           float64
885  GJB6           float64
886  C9orf152       float64
887  TMEM179        float64
888  CLSTN2         float64
889  TMEM171        float64
890  TMEM100        float64
891  WT1            float64
892  CDKN2A         float64
893  CCL2           float64
894  CYP26B1        float64
895  PPP1R14A       float64
896  SSC5D          float64
897  PCDH10         float64
898  UBE2Q2L        float64
899  NIPAL1         float64
900  COL17A1        float64
901  COL9A3         float64
902  FAM131B        float64
903  FAM131C        float64
904  FREM2          float64
905  FREM1          float64
906  CHI3L1         float64
907  FOS            float64
908  VSTM2L         float64
909  IL1B           float64
910  KRT6B          float64
911  KRT6C          float64
912  KRT6A          float64
913  COMP           float64
914  SLC47A1        float64
915  AIF1L          float64
916  EFHD1          float64
917  AEBP1          float64
918  CPT1C          float64
919  ZDHHC22        float64
920  ISL1           float64
921  PKMYT1         float64
922  MS4A8          float64
923  MROH6          float64
924  MS4A1          float64
925  DSC2           float64
926  DSC3           float64
```

```
927  VWA2         float64
928  KCNN4        float64
929  ISLR         float64
930  PKIA         float64
931  CCDC64       float64
932  VDR          float64
933  OSR1         float64
934  APLN         float64
935  SLC25A47     float64
936  PDZD4        float64
937  SORCS1       float64
938  SORCS2       float64
939  SGPP2        float64
940  CCL11        float64
941  CCL13        float64
942  CCL14        float64
943  CCL15        float64
944  CCL18        float64
945  CCL19        float64
946  C1orf106     float64
947  PLEKHN1      float64
948  SERPINA3     float64
949  SERPINA4     float64
950  SERPINA5     float64
951  SERPINA6     float64
952  SERPINA7     float64
953  NRAP         float64
954  MLC1         float64
955  RNF165       float64
956  ALOX15B      float64
957  TAT          float64
958  PPP1R9A      float64
959  MUC17        float64
960  MUC16        float64
961  MUC15        float64
962  MUC13        float64
963  MUC12        float64
964  MFAP2        float64
965  AFM          float64
966  PPP1R1A      float64
967  PPP1R1B      float64
968  LIPG         float64
969  IFI44L       float64
970  LMOD1        float64
971  SPTBN2       float64
972  CRISP3       float64
973  WNT7A        float64
974  RRAD         float64
```

```
975  SLC44A4      float64
976  CSRNP3       float64
977  NUPR2        float64
978  NUPR1        float64
979  MYBPC2       float64
980  MYBPC1       float64
981  TMEM139      float64
982  FOXE1        float64
983  SPRY4        float64
984  BBOX1        float64
985  TBX15        float64
986  MUCL1        float64
987  SCGB1D2      float64
988  SFRP4        float64
989  SFRP5        float64
990  C16orf89     float64
991  LIMCH1       float64
992  GEM          float64
993  DDC          float64
994  PCDHGA3      float64
995  LOC389602    float64
996  C2CD4A       float64
997  C2CD4B       float64
998  ERN2         float64
999  CCL3         float64
1000 ECEL1        float64
1001 DRD2         float64
1002 UPB1         float64
1003 ENTPD2       float64
1004 KRT23        float64
1005 KRT20        float64
1006 PNMA3        float64
1007 ASPG         float64
1008 TMEFF1       float64
1009 TMEFF2       float64
1010 UNC13A       float64
1011 KCNB1        float64
1012 DEGS2        float64
1013 EMP1         float64
1014 RUNDC3A      float64
1015 CNTNAP2      float64
1016 FIBIN        float64
1017 DPEP1        float64
1018 MAP7D2       float64
1019 RANBP3L      float64
1020 FAM101A      float64
1021 ZFY          float64
1022 BRINP2       float64
```

```
1023 COX6A2          float64
1024 GABBR2          float64
1025 SERPINE1        float64
1026 SERPINE2        float64
1027 TNNT3           float64
1028 TNNT2           float64
1029 SOX10           float64
1030 SOX11           float64
1031 SOX15           float64
1032 SOX17           float64
1033 C4A             float64
1034 PDLIM4          float64
1035 PDLIM3          float64
1036 PLAC4           float64
1037 HES5            float64
1038 HES6            float64
1039 CAPNS2          float64
1040 TRIM55          float64
1041 TRIM54          float64
1042 GPR157          float64
1043 GPR158          float64
1044 KRTCAP3         float64
1045 TMEM151A        float64
1046 MITF            float64
1047 TM4SF1          float64
1048 MAB21L1         float64
1049 TM4SF4          float64
1050 TM4SF5          float64
1051 HOXD4           float64
1052 HSD17B2         float64
1053 HSD17B6         float64
1054 ALDH3B2         float64
1055 RTN1            float64
1056 HGD             float64
1057 HOXD3           float64
1058 IER3            float64
1059 CILP            float64
1060 IL1RL1          float64
1061 PKP3            float64
1062 PKP2            float64
1063 PKP1            float64
1064 ROS1            float64
1065 PEBP4           float64
1066 METTL7B         float64
1067 ELMO3           float64
1068 SLC29A4         float64
1069 SLC29A2         float64
1070 HYDIN           float64
```

```
1071 CCDC64B        float64
1072 RAB19          float64
1073 RAB17          float64
1074 KDF1           float64
1075 CD248          float64
1076 LOC100131107   float64
1077 TNNI2          float64
1078 TPBG           float64
1079 APOC4          float64
1080 APOC2          float64
1081 APOC3          float64
1082 APOC1          float64
1083 PRODH2         float64
1084 MYRF           float64
1085 FOXA1          float64
1086 FOXA2          float64
1087 RASAL1         float64
1088 PAGE4          float64
1089 PCDHB8         float64
1090 PCDHB3         float64
1091 PCDHB2         float64
1092 PCDHB5         float64
1093 TINAGL1        float64
1094 CDH11          float64
1095 CDH17          float64
1096 CDH16          float64
1097 GAL            float64
1098 MBP            float64
1099 HRASLS         float64
1100 PON3           float64
1101 GFRA1          float64
1102 GFRA2          float64
1103 ADAMTS16       float64
1104 PRSS48         float64
1105 SLAIN1         float64
1106 CPA3           float64
1107 OSM            float64
1108 PVRL4          float64
1109 ATG9B          float64
1110 PKDCC          float64
1111 ARG1           float64
1112 BAIAP2L2       float64
1113 CD52           float64
1114 CD55           float64
1115 UGT1A9         float64
1116 UGT1A4         float64
1117 UGT1A6         float64
1118 UGT1A1         float64
```

```
1119 UGT1A3          float64
1120 MGAM2           float64
1121 DACH1           float64
1122 CD163           float64
1123 HIST1H4C        float64
1124 HIST1H4B        float64
1125 HIST1H4A        float64
1126 CEL             float64
1127 HIST1H4F        float64
1128 HIST1H4E        float64
1129 HIST1H4D        float64
1130 HIST1H4J        float64
1131 HIST1H4I        float64
1132 HIST1H4H        float64
1133 HBA2            float64
1134 HIST1H4L        float64
1135 ADIPOQ          float64
1136 HKDC1           float64
1137 MUC2            float64
1138 MUC1            float64
1139 MUC6            float64
1140 KCNF1           float64
1141 MUC4            float64
1142 DNASE1L3        float64
1143 TUBB2B          float64
1144 CALB2           float64
1145 FGL1            float64
1146 CXXC4           float64
1147 CTHRC1          float64
1148 MAGEA9          float64
1149 MAGEA3          float64
1150 MAGEA2          float64
1151 MAGEA6          float64
1152 MAGEA4          float64
1153 HOMER2          float64
1154 SYBU            float64
1155 TRIM15          float64
1156 CHI3L2          float64
1157 C2orf54         float64
1158 FABP5           float64
1159 EDIL3           float64
1160 SERINC2         float64
1161 MESP1           float64
1162 AKR1C2          float64
1163 EPS8L1          float64
1164 EPS8L2          float64
1165 EPS8L3          float64
1166 NXPH1           float64
```

```
1167 NXPH4          float64
1168 PRELP          float64
1169 HPD            float64
1170 F2RL1          float64
1171 ST6GAL2        float64
1172 SULT2A1        float64
1173 IFI30          float64
1174 COL5A3         float64
1175 SCGB3A1        float64
1176 SCGB3A2        float64
1177 HAVCR1         float64
1178 CBS            float64
1179 FAM46B         float64
1180 FAM46C         float64
1181 HOXD8          float64
1182 HOXD9          float64
1183 TMEM176A       float64
1184 TMEM176B       float64
1185 LYPD6B         float64
1186 DMGDH          float64
1187 PLIN4          float64
1188 PPARGC1A       float64
1189 XDH            float64
1190 CX3CL1         float64
1191 PLIN1          float64
1192 CYP2E1         float64
1193 SLC52A3        float64
1194 SLC6A13        float64
1195 SLC6A12        float64
1196 SLC6A11        float64
1197 SLC6A17        float64
1198 SLC6A15        float64
1199 SLC6A14        float64
1200 HMGCS2         float64
1201 DDIT4L         float64
1202 DEFB4A         float64
1203 TAC4           float64
1204 SPINK5         float64
1205 SPINK4         float64
1206 SPINK1         float64
1207 HPX            float64
1208 HPR            float64
1209 HPN            float64
1210 FBP1           float64
1211 PLIN5          float64
1212 PALM2-AKAP2    float64
1213 ABCB4          float64
1214 ADAM8          float64
```

```
1215 EGFL6          float64
1216 CYTIP          float64
1217 IL20RA         float64
1218 IL20RB         float64
1219 KREMEN2        float64
1220 WISP2          float64
1221 SCD            float64
1222 WISP1          float64
1223 IL22RA1        float64
1224 SPSB4          float64
1225 TROAP          float64
1226 MN1            float64
1227 WFDC8          float64
1228 WFDC1          float64
1229 INHA           float64
1230 ITM2C          float64
1231 KLHL41         float64
1232 HR             float64
1233 UGT2B17        float64
1234 UGT2B10        float64
1235 UGT2B11        float64
1236 HP             float64
1237 OLFML3         float64
1238 ADM            float64
1239 S100A7         float64
1240 AKR1C3         float64
1241 SLC22A31       float64
1242 HIST1H2AM      float64
1243 HIST1H2AL      float64
1244 HIST1H2AI      float64
1245 HIST1H2AH      float64
1246 HIST1H2AK      float64
1247 HIST1H2AJ      float64
1248 HIST1H2AE      float64
1249 HIST1H2AD      float64
1250 HIST1H2AG      float64
1251 HIST1H2AB      float64
1252 BPIFB2         float64
1253 SCX            float64
1254 CAMK2A         float64
1255 CAMK2B         float64
1256 PPARG          float64
1257 MKRN3          float64
1258 OTUD6A         float64
1259 EML5           float64
1260 PTGES          float64
1261 LHFPL3         float64
1262 WFDC2          float64
```

```
1263 PTX3            float64
1264 SLC7A8          float64
1265 RIMS1           float64
1266 RIMS2           float64
1267 EMX2            float64
1268 HIST2H4B        float64
1269 HIST2H4A        float64
1270 ITM2A           float64
1271 KLF5            float64
1272 SLC7A2          float64
1273 FAM163B         float64
1274 GNLY            float64
1275 IMPA2           float64
1276 PHGDH           float64
1277 IGFL1           float64
1278 LRRTM4          float64
1279 LRRTM1          float64
1280 F10             float64
1281 SERPINA10       float64
1282 SERPINA11       float64
1283 RCOR2           float64
1284 UGT2B15         float64
1285 CLU             float64
1286 KNG1            float64
1287 COBL            float64
1288 LCN2            float64
1289 SEMA6D          float64
1290 DNAJC12         float64
1291 NRK             float64
1292 ACTG2           float64
1293 TPSG1           float64
1294 DUOX1           float64
1295 DUX4            float64
1296 DUOX2           float64
1297 SULT1C4         float64
1298 FRZB            float64
1299 DNER            float64
1300 CDHR1           float64
1301 CDHR5           float64
1302 TFF1            float64
1303 SALL4           float64
1304 SALL1           float64
1305 SALL3           float64
1306 SALL2           float64
1307 CYP1A2          float64
1308 C5orf38         float64
1309 IFITM1          float64
1310 IFITM5          float64
```

```
1311 LIPH         float64
1312 OGDHL        float64
1313 PI16         float64
1314 PI15         float64
1315 PCP4         float64
1316 FCGR3B       float64
1317 LDOC1        float64
1318 DGCR6        float64
1319 SMIM22       float64
1320 PMEL         float64
1321 ROBO2        float64
1322 PRRX1        float64
1323 DCLK1        float64
1324 DCLK2        float64
1325 NOX1         float64
1326 TRO          float64
1327 SLC26A3      float64
1328 MIA2         float64
1329 CNKSR1       float64
1330 GPR52        float64
1331 FAM83H       float64
1332 FAM83B       float64
1333 FAM83A       float64
1334 FAM83G       float64
1335 FAM83F       float64
1336 FAM83E       float64
1337 PTGIS        float64
1338 FAM222A      float64
1339 SCG5         float64
1340 SCG3         float64
1341 CRTAC1       float64
1342 GPR160       float64
1343 BPIFB1       float64
1344 COLEC12      float64
1345 COLEC10      float64
1346 COLEC11      float64
1347 VWA5B2       float64
1348 ASTN1        float64
1349 PCLO         float64
1350 EGFR         float64
1351 UCN2         float64
1352 WDR86        float64
1353 CLRN3        float64
1354 EVA1A        float64
1355 ADAMTS1      float64
1356 ADAMTS2      float64
1357 ARHGEF4      float64
1358 CCSER1       float64
```

```
1359 CDH1            float64
1360 CDH3            float64
1361 CDH4            float64
1362 CDH6            float64
1363 VNN1            float64
1364 HHATL           float64
1365 CILP2           float64
1366 TREM1           float64
1367 TREM2           float64
1368 FAM167A         float64
1369 CELF3           float64
1370 VTN             float64
1371 GDF15           float64
1372 NDNF            float64
1373 PRSS1           float64
1374 SLC5A1          float64
1375 MEGF6           float64
1376 CARD11          float64
1377 DLL3            float64
1378 CYP2C19         float64
1379 CYP2C18         float64
1380 SLC6A1          float64
1381 SLC6A8          float64
1382 AQP7            float64
1383 AQP4            float64
1384 AQP5            float64
1385 AQP3            float64
1386 AQP1            float64
1387 AQP9            float64
1388 NR1H4           float64
1389 ETNPPL          float64
1390 IFI6            float64
1391 RNF212          float64
1392 ADORA1          float64
1393 CACNA2D1        float64
1394 BTNL9           float64
1395 ALDH4A1         float64
1396 ACTC1           float64
1397 FHL2            float64
1398 FHL1            float64
1399 MYLPF           float64
1400 SLCO2A1         float64
1401 C6orf132        float64
1402 CASQ2           float64
1403 S100A10         float64
1404 S100A12         float64
1405 S100A14         float64
1406 PHYHIP          float64
```

```
1407 S100A16      float64
1408 MAMDC2       float64
1409 ST14         float64
1410 TNXB         float64
1411 SERPINB13    float64
1412 NELL1        float64
1413 NELL2        float64
1414 GSTT2B       float64
1415 SPOCK1       float64
1416 SPOCK2       float64
1417 SPOCK3       float64
1418 GSTM1        float64
1419 SEZ6         float64
1420 TNFRSF13C    float64
1421 TRPS1        float64
1422 OTC          float64
1423 GRHL1        float64
1424 GRHL2        float64
1425 GRHL3        float64
1426 TNR          float64
1427 MYO7B        float64
1428 JSRP1        float64
1429 NAPSA        float64
1430 SV2A         float64
1431 EHF          float64
1432 GRB14        float64
1433 NYAP1        float64
1434 AMH          float64
1435 HOXA6        float64
1436 KCNMA1       float64
1437 ARNT2        float64
1438 PLCG2        float64
1439 ALB          float64
1440 DKK3         float64
1441 DKK1         float64
1442 P3H2         float64
1443 PLBD1        float64
1444 EFR3B        float64
1445 C11orf52     float64
1446 PNMT         float64
1447 MLLT11       float64
1448 DEFB103B     float64
1449 DEFB103A     float64
1450 KIAA1549L    float64
1451 CST2         float64
1452 CST1         float64
1453 CST6         float64
1454 SEMA3C       float64
```

```
1455 CSTA          float64
1456 AMIGO2        float64
1457 SOX8          float64
1458 SOX9          float64
1459 SOX2          float64
1460 SOX6          float64
1461 SOX5          float64
1462 CTNNA2        float64
1463 GP1BB         float64
1464 EPB41L4B      float64
1465 ATP2C2        float64
1466 CERS1         float64
1467 INHBA         float64
1468 INHBB         float64
1469 PCDHAC1       float64
1470 INHBE         float64
1471 GP2           float64
1472 EXTL1         float64
1473 GPT           float64
1474 SYNM          float64
1475 PNMAL1        float64
1476 TSHR          float64
1477 MALL          float64
1478 C14orf178     float64
1479 MAL2          float64
1480 AGTR1         float64
1481 SYN2          float64
1482 SYN1          float64
1483 CD7           float64
1484 CD2           float64
1485 CD9           float64
1486 CDA           float64
1487 ADCYAP1R1     float64
1488 DYDC1         float64
1489 RAP1GAP       float64
1490 ABCC6         float64
1491 COL20A1       float64
1492 ABCC2         float64
1493 ABCC3         float64
1494 RYR1          float64
1495 EDN1          float64
1496 EDN3          float64
1497 EDN2          float64
1498 ENPP2         float64
1499 ENPP3         float64
1500 ENPP1         float64
1501 DDX3Y         float64
1502 FA2H          float64
```

```
1503 DNM1          float64
1504 TGFA          float64
1505 PREX2         float64
1506 PLPPR1        float64
1507 PLPPR3        float64
1508 TCEB3CL2      float64
1509 IL4I1         float64
1510 SLC13A5       float64
1511 RGS11         float64
1512 ADAMTS15      float64
1513 CRYAB         float64
1514 IGFL2         float64
1515 ELF5          float64
1516 VANGL2        float64
1517 UPK3B         float64
1518 UPK3A         float64
1519 PLAU          float64
1520 PLAT          float64
1521 FOXD1         float64
1522 C1orf195      float64
1523 PLEKHG6       float64
1524 PLEKHG4       float64
1525 HIF3A         float64
1526 GRIN1         float64
1527 COL7A1        float64
1528 PHLDA2        float64
1529 PAMR1         float64
1530 COL4A6        float64
1531 COL4A5        float64
1532 COL4A4        float64
1533 COL4A3        float64
1534 COL4A2        float64
1535 COL4A1        float64
1536 HLF           float64
1537 TMPRSS11D     float64
1538 TMPRSS11E     float64
1539 ERICH5        float64
1540 TCEA3         float64
1541 CBLC          float64
1542 DPT           float64
1543 IGFBPL1       float64
1544 ATP6V0E2      float64
1545 HAMP          float64
1546 SIX1          float64
1547 SIX2          float64
1548 SIX3          float64
1549 KNDC1         float64
1550 RFX4          float64
```

```
1551 KHDRBS3        float64
1552 IGFBP2         float64
1553 IGFBP3         float64
1554 IGFBP1         float64
1555 IGFBP4         float64
1556 IGFBP5         float64
1557 GJA1           float64
1558 CYP8B1         float64
1559 FAM157B        float64
1560 MECOM          float64
1561 CLIC6          float64
1562 CFHR3          float64
1563 CFHR1          float64
1564 CLIC3          float64
1565 LRFN5          float64
1566 TMEM145        float64
1567 FER1L6         float64
1568 SMOC2          float64
1569 SMOC1          float64
1570 MYBL2          float64
1571 CADPS          float64
1572 TARP           float64
1573 SRPX2          float64
1574 A1BG           float64
1575 CH25H          float64
1576 C16orf74       float64
1577 PPP1R14C       float64
1578 HABP2          float64
1579 NDRG2          float64
1580 PSD            float64
1581 SRL            float64
1582 PLAUR          float64
1583 SLCO1B3        float64
1584 LOX            float64
1585 C14orf132      float64
1586 PIGR           float64
1587 RHPN1          float64
1588 OLR1           float64
1589 RHPN2          float64
1590 SRRM3          float64
1591 NTRK2          float64
1592 NTRK3          float64
1593 HNF4G          float64
1594 HNF4A          float64
1595 AKR1B10        float64
1596 C15orf48       float64
1597 ZNF135         float64
1598 TCEB3C         float64
```

```
1599 KCNK5          float64
1600 KCNK3          float64
1601 FCGBP          float64
1602 CRYM           float64
1603 GNA15          float64
1604 FRRS1L         float64
1605 AKAP6          float64
1606 TMEM98         float64
1607 TMEM132E       float64
1608 TMEM132A       float64
1609 TMEM132C       float64
1610 H3F3A          float64
1611 CCL21          float64
1612 CCL20          float64
1613 CCL24          float64
1614 ALPK2          float64
1615 CUX2           float64
1616 DNAJC6         float64
1617 NRN1           float64
1618 RNF150         float64
1619 FMOD           float64
1620 TAS2R4         float64
1621 TAS2R3         float64
1622 FMO2           float64
1623 CCDC144A       float64
1624 PRKCDBP        float64
1625 FMO5           float64
1626 SULF1          float64
1627 ATP6V1B1       float64
1628 RND1           float64
1629 FNDC4          float64
1630 FNDC1          float64
1631 LRRC4C         float64
1632 LRRC4B         float64
1633 MEP1A          float64
1634 PALM3          float64
1635 CEP295NL       float64
1636 FDCSP          float64
1637 ADAM33         float64
1638 ITGBL1         float64
1639 PODXL2         float64
1640 SYCP2          float64
1641 LLGL2          float64
1642 ACOX2          float64
1643 GAL3ST1        float64
1644 GAL3ST2        float64
1645 SCARA3         float64
1646 SCARA5         float64
```

```
1647 ARHGDIG          float64
1648 USH1C            float64
1649 MATN3            float64
1650 MATN2            float64
1651 CES1             float64
1652 EBF3             float64
1653 KBTBD11          float64
1654 HBA1             float64
1655 GULP1            float64
1656 TBX20            float64
1657 FAM3B            float64
1658 FAM3D            float64
1659 ERBB3            float64
1660 SHC2             float64
1661 FPR1             float64
1662 TMEM108          float64
1663 NACAD            float64
1664 SMPDL3B          float64
1665 RAMP1            float64
1666 AIM1L            float64
1667 MET              float64
1668 CORO6            float64
1669 PKNOX2           float64
1670 KRT1             float64
1671 KRT7             float64
1672 KRT5             float64
1673 KRT4             float64
1674 KRT8             float64
1675 DACT3            float64
1676 DACT2            float64
1677 TAS2R30          float64
1678 TAS2R31          float64
1679 CLPS             float64
1680 RIPK4            float64
1681 CRISPLD2         float64
1682 SPTBN4           float64
1683 KLF15            float64
1684 TFAP2A           float64
1685 TFAP2C           float64
1686 TFAP2B           float64
1687 TNFSF12-TNFSF13  float64
1688 KRTDAP           float64
1689 KLK1             float64
1690 REC8             float64
1691 FAM198A          float64
1692 FAM132B          float64
1693 PCDHGB3          float64
1694 PCDHGB1          float64
```

```
1695 PCDHGB5        float64
1696 PCDHGB4        float64
1697 MICAL2         float64
1698 PIANP          float64
1699 TMEM59L        float64
1700 FLG            float64
1701 PCOLCE         float64
1702 PRSS3          float64
1703 SGCA           float64
1704 BAIAP3         float64
1705 VAX2           float64
1706 ACTN2          float64
1707 SAA2           float64
1708 NKX3-1         float64
1709 CPNE7          float64
1710 CPNE4          float64
1711 PTPRH          float64
1712 DUSP26         float64
1713 DUSP27         float64
1714 NCAN           float64
1715 ISM1           float64
1716 TMEM45B        float64
1717 ELAVL4         float64
1718 ELAVL3         float64
1719 EDNRB          float64
1720 APOD           float64
1721 APOE           float64
1722 APOB           float64
1723 APOM           float64
1724 APOH           float64
1725 REG3A          float64
1726 SULT4A1        float64
1727 FBXO32         float64
1728 SDPR           float64
1729 APBA2          float64
1730 COL10A1        float64
1731 PTPRZ1         float64
1732 ATP13A4        float64
1733 RAI2           float64
1734 C1orf111       float64
1735 C1orf116       float64
1736 C1orf115       float64
1737 SOX21          float64
1738 IL36A          float64
1739 IL36G          float64
1740 LIPC           float64
1741 HPCAL4         float64
1742 LIPF           float64
```

```
1743 HGFAC          float64
1744 GOS2           float64
1745 CCDC8          float64
1746 CYP2A6         float64
1747 SLC4A11        float64
1748 AURKB          float64
1749 FEZ1           float64
1750 CAV1           float64
1751 SECTM1         float64
1752 LRRC31         float64
1753 SKAP1          float64
1754 IL13RA2        float64
1755 PMP2           float64
1756 SCRG1          float64
1757 CAPN13         float64
1758 CAPN12         float64
1759 HS3ST2         float64
1760 C11orf96       float64
1761 KRT17          float64
1762 KRT14          float64
1763 PCDHA6         float64
1764 PCDHA4         float64
1765 CDX1           float64
1766 CDX2           float64
1767 NKX2-2         float64
1768 NKX2-1         float64
1769 OAS1           float64
1770 OAS2           float64
1771 TTYH1          float64
1772 ASPHD1         float64
1773 DES            float64
1774 TMEM92         float64
1775 REG4           float64
1776 MPZL2          float64
1777 TFPI           float64
1778 ACHE           float64
1779 PRB3           float64
1780 WSCD1          float64
1781 GDA            float64
1782 SLC9A3R1       float64
1783 SVEP1          float64
1784 GGT1           float64
1785 PTPRU          float64
1786 PTPRT          float64
1787 PTPRF          float64
1788 PTPRD          float64
1789 PTPRC          float64
1790 PTPRN          float64
```

```
1791 CPE            float64
1792 CPZ            float64
1793 SAA2-SAA4      float64
1794 BANK1          float64
1795 DOC2B          float64
1796 LMTK3          float64
1797 HHIP           float64
1798 ISG15          float64
1799 GABRP          float64
1800 KRT15          float64
1801 KRT13          float64
1802 KRT10          float64
1803 GABRE          float64
1804 KRT19          float64
1805 KRT18          float64
1806 TLE2           float64
1807 PKLR           float64
1808 PCDHB10        float64
1809 PCDHB16        float64
1810 TMEM178B       float64
1811 NGFR           float64
1812 MUM1L1         float64
1813 GRIA3          float64
1814 APCS           float64
1815 LTBP2          float64
1816 APC2           float64
1817 PLA2G4F        float64
1818 CMTM5          float64
1819 COL11A1        float64
1820 COL11A2        float64
1821 SLC25A18       float64
1822 CDHR2          float64
1823 ALDH1L1        float64
1824 TMEM88B        float64
1825 CLDN1          float64
1826 CLDN2          float64
1827 CLDN3          float64
1828 CLDN4          float64
1829 CLDN7          float64
1830 LGALS7B        float64
1831 PLEKHS1        float64
1832 SERPIND1       float64
1833 IRF6           float64
1834 IRF4           float64
1835 ONECUT2        float64
1836 ONECUT1        float64
1837 ZBTB16         float64
1838 TRIM63         float64
```

```
1839 OMG              float64
1840 OMD              float64
1841 OMP              float64
1842 SERTAD4          float64
1843 BIK              float64
1844 DHCR24           float64
1845 C4BPA            float64
1846 MLPH             float64
1847 C4BPB            float64
1848 CRLF2            float64
1849 CRLF1            float64
1850 RORC             float64
1851 RORB             float64
1852 ROR2             float64
1853 KIT              float64
1854 GOLT1A           float64
1855 TNFRSF18         float64
1856 TNFRSF19         float64
1857 ARHGEF5          float64
1858 FCN3             float64
1859 FCN1             float64
1860 FAM174B          float64
1861 SULT2B1          float64
1862 SOGA3            float64
1863 FOSL1            float64
1864 LAD1             float64
1865 SERPINA1         float64
1866 CHRD             float64
1867 CLEC3B           float64
1868 CLEC3A           float64
1869 AMBP             float64
1870 FAM83D           float64
1871 HSPB6            float64
1872 HSPB7            float64
1873 HSPB2            float64
1874 HSPB8            float64
1875 NAV3             float64
1876 CSPG5            float64
1877 SCGB2A1          float64
1878 SCGB2A2          float64
1879 AJAP1            float64
1880 HCAR3            float64
1881 SCGB1A1          float64
1882 FOSB             float64
1883 TCF21            float64
1884 ARFGEF3          float64
1885 DSG1             float64
1886 PDE9A            float64
```

```
1887 LRP1B          float64
1888 ESM1           float64
1889 CLDN8          float64
1890 TMEM54         float64
1891 KCNJ3          float64
1892 SCG2           float64
1893 ZNF676         float64
1894 MAG            float64
1895 MAL            float64
1896 MGST1          float64
1897 LSR            float64
1898 HMCN2          float64
1899 HMCN1          float64
1900 KRT16          float64
1901 MEDAG          float64
1902 BPIFA1         float64
1903 ARL14          float64
1904 CLIP3          float64
1905 CD48           float64
1906 CDO1           float64
1907 CD177          float64
1908 PAK6           float64
1909 PAK3           float64
1910 KCNG1          float64
1911 CPS1           float64
1912 RPRM           float64
1913 MFSD2A         float64
1914 DMBT1          float64
1915 PMEPA1         float64
1916 CALML3         float64
1917 CALML5         float64
1918 GAS1           float64
1919 UGT2A3         float64
1920 PDGFRL         float64
1921 MCTP2          float64
1922 PLPP2          float64
1923 PLPP4          float64
1924 CLGN           float64
1925 XAGE1B         float64
1926 XAGE1E         float64
1927 FCGR2B         float64
1928 FCGR2C         float64
1929 COL6A3         float64
1930 AGR2           float64
1931 AGR3           float64
1932 CALCA          float64
1933 CKB            float64
1934 CKM            float64
```

```
1935 MUC5AC        float64
1936 ACSM1         float64
1937 ACSM3         float64
1938 ACSM5         float64
1939 TRIM29        float64
1940 ARHGAP8       float64
1941 ARHGAP6       float64
1942 ANXA10        float64
1943 ANXA13        float64
1944 ALDH8A1       float64
1945 CD79B         float64
1946 MEOX1         float64
1947 MEOX2         float64
1948 CD79A         float64
1949 ZNF385B       float64
1950 SLPI          float64
1951 PLLP          float64
1952 ECM1          float64
1953 NAP1L2        float64
1954 FAM178B       float64
1955 ADGRG2        float64
1956 NR1I2         float64
1957 GRB7          float64
1958 AKAP12        float64
1959 HOXC9         float64
1960 HOXC8         float64
1961 HOXC5         float64
1962 HOXC4         float64
1963 HOXC6         float64
1964 MAPK15        float64
1965 MAPK10        float64
1966 FZD7          float64
1967 CYP2B6        float64
1968 ACMSD         float64
1969 TMEM238       float64
1970 SMIM24        float64
1971 IL1R1         float64
1972 MSX1          float64
1973 MSX2          float64
1974 CSF3R         float64
1975 CXCL11        float64
1976 CXCL13        float64
1977 CXCL12        float64
1978 CXCL17        float64
1979 HCN2          float64
1980 PTGDS         float64
1981 ZIC2          float64
1982 ZIC1          float64
```

```
1983 TMPRSS13      float64
1984 ACP5          float64
1985 PRAME         float64
1986 AMPH          float64
1987 SLC27A5       float64
1988 SLC27A6       float64
1989 SLC27A2       float64
1990 ACPP          float64
1991 NPNT          float64
1992 ALOX5AP       float64
1993 MME           float64
1994 SH2D3A        float64
1995 PRR15L        float64
1996 PRSS12        float64
1997 SLC24A2       float64
1998 SLC24A3       float64
1999 MEX3A         float64
2000 ITLN1         float64
2001 STYK1         float64
2002 TACSTD2       float64
2003 STXBP6        float64
2004 TMEM200A      float64
2005 S1PR4         float64
2006 CDK1          float64
2007 LPAR3         float64
2008 RERG          float64
2009 FAM231A       float64
2010 HIST1H3B      float64
2011 HIST1H3C      float64
2012 HIST1H3A      float64
2013 HIST1H3G      float64
2014 HIST1H3D      float64
2015 HIST1H3E      float64
2016 ACKR1         float64
2017 LAMC2         float64
2018 FAM25A        float64
2019 SYP           float64
2020 PRRX2         float64
2021 PDZK1IP1      float64
2022 RGN           float64
2023 ERP27         float64
2024 HMP19         float64
2025 ABCA12        float64
2026 ABCA13        float64
2027 ADIRF         float64
2028 RHBG          float64
2029 FAM171A2      float64
2030 CDH2          float64
```

```
2031 IL6           float64
2032 DPP10         float64
2033 MT2A          float64
2034 POU3F3        float64
2035 POU3F2        float64
2036 AOC1          float64
2037 TIMP4         float64
2038 TIMP3         float64
2039 TIMP1         float64
2040 CGREF1        float64
2041 PSORS1C2      float64
2042 BRSK2         float64
2043 BRSK1         float64
2044 SCN3A         float64
2045 SCN3B         float64
2046 SLC7A5        float64
2047 PHF21B        float64
2048 AMER2         float64
2049 PLEKHA6       float64
2050 MGAT5B        float64
2051 DRAXIN        float64
2052 PAQR6         float64
2053 FADS2         float64
2054 ADGRF1        float64
2055 ANLN          float64
2056 ADGRF4        float64
2057 ZCCHC12       float64
2058 JPH2          float64
2059 JPH4          float64
2060 SLITRK6       float64
2061 SLITRK5       float64
2062 SLITRK2       float64
2063 PIK3C2G       float64
2064 COL23A1       float64
2065 TDO2          float64
2066 MYBPH         float64
2067 PSCA          float64
2068 GZMA          float64
2069 GZMB          float64
2070 GZMK          float64
2071 EPDR1         float64
2072 MYH11         float64
2073 MYH14         float64
2074 SLC30A10      float64
2075 KLRG2         float64
2076 SLCO4A1       float64
2077 GREB1L        float64
2078 PGC           float64
```

```
2079 PDE1A          float64
2080 POTEM          float64
2081 PGR            float64
2082 POTEJ          float64
2083 POTEI          float64
2084 POTEG          float64
2085 POTEF          float64
2086 POTEE          float64
2087 ARMCX2         float64
2088 FUT3           float64
2089 MIA            float64
2090 VTCN1          float64
2091 APCDD1L        float64
2092 SFN            float64
2093 STARD10        float64
2094 MT1X           float64
2095 MT1M           float64
2096 MT1E           float64
2097 MT1F           float64
2098 MT1G           float64
2099 MT1A           float64
2100 RNF113B        float64
2101 SNCA           float64
2102 GXYLT2         float64
2103 CADM3          float64
2104 SLAMF7         float64
2105 F13A1          float64
2106 CHRM1          float64
2107 MGAT3          float64
2108 MMP9           float64
2109 MMP7           float64
2110 MMP2           float64
2111 MMP3           float64
2112 MMP1           float64
2113 RPL39L         float64
2114 RUNX3          float64
2115 RUNX1          float64
2116 EPHX3          float64
2117 KIF26B         float64
2118 JUP            float64
2119 PLCB4          float64
2120 CYP4Z1         float64
2121 ARHGEF38       float64
2122 ESR1           float64
2123 ANKS4B         float64
2124 TBX3           float64
2125 CTNND2         float64
2126 TBX5           float64
```

```
2127 A2M           float64
2128 ZNF536        float64
2129 PRRT2         float64
2130 PRSS8         float64
2131 MOXD1         float64
2132 NPAS3         float64
2133 PURG          float64
2134 FSTL1         float64
2135 ANXA8L1       float64
2136 KCTD14        float64
2137 UBD           float64
2138 CFTR          float64
2139 PCBP3         float64
2140 RNF223        float64
2141 C1QL1         float64
2142 C1QL4         float64
2143 SEZ6L2        float64
2144 FAM57B        float64
2145 HOPX          float64
2146 HIST3H2A      float64
2147 SCN7A         float64
2148 FGF13         float64
2149 FGF11         float64
2150 FGF10         float64
2151 FGF14         float64
2152 VCAM1         float64
2153 SEMA3A        float64
2154 TPSB2         float64
2155 SEMA3B        float64
2156 KCNJ13        float64
2157 KCNJ10        float64
2158 KCNJ16        float64
2159 KCNJ15        float64
2160 AR            float64
2161 CREB3L3       float64
2162 CREB3L1       float64
2163 HCAR2         float64
2164 COL22A1       float64
2165 CYP2J2        float64
2166 CLCA2         float64
2167 CLCA1         float64
2168 CLCA4         float64
2169 ADGRB1        float64
2170 ADGRB2        float64
2171 ADGRB3        float64
2172 A2ML1         float64
2173 SPARCL1       float64
2174 MYOC          float64
```

```
2175 CYS1            float64
2176 LOC100129940    float64
2177 LCP1            float64
2178 MRVI1           float64
2179 ITPKA           float64
2180 LOC79999        float64
2181 CHAD            float64
2182 GKN1            float64
2183 GKN2            float64
2184 COL5A2          float64
2185 LAMP5           float64
2186 COL5A1          float64
2187 PRR4            float64
2188 3-Sep           float64
2189 CRACR2B         float64
2190 MIR205HG        float64
2191 CYP2W1          float64
2192 TAGLN3          float64
2193 GMPR            float64
2194 EXOC3L4         float64
2195 TRPM8           float64
2196 TRPM4           float64
2197 TRPM3           float64
2198 SULT1C2         float64
2199 METRN           float64
2200 EPN3            float64
2201 CDSN            float64
2202 CCR7            float64
2203 BCAS1           float64
2204 ZBED2           float64
2205 GALNT16         float64
2206 GALNT14         float64
2207 GALNT12         float64
2208 CDS1            float64
2209 CCDC74B         float64
2210 S100P           float64
2211 S100B           float64
2212 PPL             float64
2213 CLDN23          float64
2214 CLDN20          float64
2215 FAM160A1        float64
2216 CASP14          float64
2217 FAM19A5         float64
2218 CACNA2D2        float64
2219 PRAP1           float64
2220 CACNG4          float64
2221 RBBP8NL         float64
2222 PTPRN2          float64
```

```
2223 C14orf105      float64
2224 RTN4RL1        float64
2225 POF1B          float64
2226 HEPH           float64
2227 NCAM1          float64
2228 NCAM2          float64
2229 CCL4           float64
2230 CGN            float64
2231 REEP1          float64
2232 REEP2          float64
2233 REEP6          float64
2234 MAPK8IP1       float64
2235 MAPK8IP2       float64
2236 ID4            float64
2237 ID1            float64
2238 CPAMD8         float64
2239 OPLAH          float64
2240 ANKRD1         float64
2241 GLI3           float64
2242 DMKN           float64
2243 DUOXA1         float64
2244 DUOXA2         float64
2245 NR0B2          float64
2246 PPP1R14D       float64
2247 SBSN           float64
2248 AGT            float64
2249 DGAT2          float64
2250 SOBP           float64
2251 CNTFR          float64
2252 KCNH2          float64
2253 SLC28A1        float64
2254 BARX2          float64
2255 BARX1          float64
2256 PGLYRP2        float64
2257 RGS20          float64
2258 FAM84A         float64
2259 PCDH19         float64
2260 IGDCC4         float64
2261 SYTL5          float64
2262 PCK1           float64
2263 SYTL1          float64
2264 ESRP2          float64
2265 ESRP1          float64
2266 PRRG2          float64
2267 SAA4           float64
2268 SAA1           float64
2269 NPIPB15        float64
2270 MYCN           float64
```

```
2271 TMEM45A        float64
2272 TK1            float64
2273 MSLN           float64
2274 PRIMA1         float64
2275 ALDH3A1        float64
2276 CELSR3         float64
2277 CELSR2         float64
2278 CELSR1         float64
2279 MAGEA12        float64
2280 TMEM178A       float64
2281 RASEF          float64
2282 RBM47          float64
2283 ABCA8          float64
2284 NNMT           float64
2285 CYP2S1         float64
2286 GPNMB          float64
2287 C9             float64
2288 C2             float64
2289 C7             float64
2290 C6             float64
2291 C5             float64
2292 CP             float64
2293 C9orf131       float64
2294 CAPN8          float64
2295 FOXO6          float64
2296 TMEM158        float64
2297 AP3B2          float64
2298 PGA3           float64
2299 PGA4           float64
2300 PGA5           float64
2301 KLHL4          float64
2302 SLC34A2        float64
2303 SOCS1          float64
2304 SOCS3          float64
2305 SRPX           float64
2306 CCNO           float64
2307 CCL3L3         float64
2308 CCL3L1         float64
2309 IL1R2          float64
2310 PTN            float64
2311 ITPR3          float64
2312 IL1RN          float64
2313 LRIG3          float64
2314 LRIG1          float64
2315 CASKIN1        float64
2316 A1CF           float64
2317 ACAN           float64
2318 PPBP           float64
```

```
2319 TMEM30B          float64
2320 PIFO             float64
2321 TCEB3CL          float64
2322 SAMD12           float64
2323 SAMD11           float64
2324 HIST1H3F         float64
2325 IL7R             float64
2326 HIST1H3J         float64
2327 HID1             float64
2328 GSTO2            float64
2329 TTC36            float64
2330 HIST1H3I         float64
2331 TIMD4            float64
2332 ENHO             float64
2333 TGM1             float64
2334 TGM2             float64
2335 TGM3             float64
2336 FGFBP1           float64
2337 PLEK2            float64
2338 DNAJB3           float64
2339 AMDHD1           float64
2340 CALY             float64
2341 FRK              float64
2342 GRIK2            float64
2343 GRIK3            float64
2344 GRIK5            float64
2345 MYOCD            float64
2346 MUC3A            float64
2347 PCDH18           float64
2348 GREM2            float64
2349 GREM1            float64
2350 PADI1            float64
2351 PADI3            float64
2352 PADI2            float64
2353 HIST2H2AB        float64
2354 HIST2H2AC        float64
2355 PPP1R3C          float64
2356 SYNE4            float64
2357 NSG1             float64
2358 HAL              float64
2359 HEPN1            float64
2360 MOCOS            float64
2361 INPP5J           float64
2362 PON1             float64
2363 GUCA2A           float64
2364 COL12A1          float64
2365 ADAM23           float64
2366 PCOLCE2          float64
```

```
2367 TMSB15A        float64
2368 GDF1           float64
2369 MTRNR2L10      float64
2370 ANXA1          float64
2371 ANXA3          float64
2372 ANXA8          float64
2373 MEST           float64
2374 POU5F1         float64
2375 POU5F2         float64
2376 WNT9A          float64
2377 HEPACAM        float64
2378 BAMBI          float64
2379 TMEM119        float64
2380 SBK1           float64
2381 HOXD13         float64
2382 HOXD10         float64
2383 HOXD11         float64
2384 TOX3           float64
2385 TAS2R43        float64
2386 TAS2R46        float64
2387 GPR87          float64
2388 PCSK1N         float64
2389 NTNG2          float64
2390 THY1           float64
2391 PCDHGC4        float64
2392 ANGPTL7        float64
2393 ANGPTL4        float64
2394 ANGPTL3        float64
2395 ANGPTL8        float64
2396 MMP14          float64
2397 MMP16          float64
2398 MMP17          float64
2399 MMP10          float64
2400 MMP11          float64
2401 MMP12          float64
2402 MMP13          float64
2403 HLA-DRA        float64
2404 PRG4           float64
2405 TCN1           float64
2406 COLGALT2       float64
2407 GAGE2D         float64
2408 DLK1           float64
2409 GPRC5A         float64
2410 GPRC5C         float64
2411 GPRC5B         float64
2412 LTB            float64
2413 LTF            float64
2414 AHSG           float64
```

```
2415 C1orf61        float64
2416 PYGM           float64
2417 C1orf64        float64
2418 GYG2           float64
2419 TWIST1         float64
2420 TWIST2         float64
2421 PFN2           float64
2422 HNF1B          float64
2423 SHISA2         float64
2424 IL32           float64
2425 IL33           float64
2426 CAMK2N2        float64
2427 CAMK2N1        float64
2428 PDGFRA         float64
2429 AMACR          float64
2430 PROM1          float64
2431 NMRK2          float64
2432 CNTN2          float64
2433 CNTN1          float64
2434 CTSG           float64
2435 GATM           float64
2436 CDC42BPG       float64
2437 EGLN3          float64
2438 PLA2G16        float64
2439 DNAH5          float64
2440 GPR17          float64
2441 DUSP15         float64
2442 AIM1           float64
2443 AIM2           float64
2444 UNC80          float64
2445 FAM107A        float64
2446 FRAS1          float64
2447 IQGAP3         float64
2448 SPTSSB         float64
2449 TUBA4A         float64
2450 ADGRV1         float64
2451 SERPINC1       float64
2452 ACSM2A         float64
2453 ACSM2B         float64
2454 RNF186         float64
2455 RNF183         float64
2456 RNF182         float64
2457 ADAMDEC1       float64
2458 SYT12          float64
2459 SYT13          float64
2460 SYT11          float64
2461 SYT17          float64
2462 SYT14          float64
```

```
2463 GSTT1          float64
2464 ATP6V1G2       float64
2465 GPR173         float64
2466 GPR174         float64
2467 SDR16C5        float64
2468 NDN            float64
2469 NDP            float64
2470 UCHL1          float64
2471 RARRES2        float64
2472 RARRES3        float64
2473 RARRES1        float64
2474 COL13A1        float64
2475 CSAG3          float64
2476 CSAG1          float64
2477 HSH2D          float64
2478 SOD3           float64
2479 FAM171B        float64
2480 GPX3           float64
2481 GYLTL1B        float64
2482 FLNC           float64
2483 GOLGA6L6       float64
2484 SIAE           float64
2485 MYC            float64
2486 MYB            float64
2487 ALOX5          float64
2488 MST1R          float64
2489 LOC728392      float64
2490 EFEMP1         float64
2491 MRAP2          float64
2492 WNT5A          float64
2493 TBC1D3         float64
2494 NRSN1          float64
2495 CD22           float64
2496 RXRG           float64
2497 MYOZ1          float64
2498 GPM6A          float64
2499 GPM6B          float64
2500 TTC39A         float64
2501 GATA6          float64
2502 GATA4          float64
2503 GATA2          float64
2504 GATA3          float64
2505 CCND1          float64
2506 CCND2          float64
2507 EPPK1          float64
2508 PGM5           float64
2509 LIX1           float64
2510 ANPEP          float64
```

```
2511 MDK          float64
2512 LOC389199    float64
2513 GGH          float64
2514 LAMA1        float64
2515 LAMA2        float64
2516 LAMA3        float64
2517 CHRDL1       float64
2518 CHRDL2       float64
2519 DCT          float64
2520 F2           float64
2521 F3           float64
2522 F5           float64
2523 RBPMS        float64
2524 BAALC        float64
2525 CDC20        float64
2526 AOC3         float64
2527 CYR61        float64
2528 ABO          float64
2529 FLRT2        float64
2530 LPL          float64
2531 C1QB         float64
2532 PKHD1        float64
2533 VSIG4        float64
2534 VSIG2        float64
2535 IHH          float64
2536 GALNT5       float64
2537 GALNT6       float64
2538 GALNT3       float64
2539 CD70         float64
2540 KIF12        float64
2541 GNAO1        float64
2542 MAPK4        float64
2543 ASCL2        float64
2544 ASCL1        float64
2545 IGF2BP1      float64
2546 IGF2BP3      float64
2547 IGF2BP2      float64
2548 KIF1A        float64
2549 ZFP36        float64
2550 ATHL1        float64
2551 LOXL1        float64
2552 LOXL4        float64
2553 VIPR1        float64
2554 KCND3        float64
2555 KCND2        float64
2556 CACNG7       float64
2557 SELENBP1     float64
2558 BHLHE41      float64
```

```
2559 UGT2B4         float64
2560 NGEF           float64
2561 COLCA1         float64
2562 SMTNL2         float64
2563 PRAC2          float64
2564 TNIK           float64
2565 MAGEC2         float64
2566 SNX10          float64
2567 ICAM5          float64
2568 ICAM1          float64
2569 LY6D           float64
2570 LY6K           float64
2571 LY6H           float64
2572 SGK2           float64
2573 GPD1           float64
2574 NEFM           float64
2575 NEFL           float64
2576 NEFH           float64
2577 C2orf72        float64
2578 PCP4L1         float64
2579 NRG1           float64
2580 NRG3           float64
2581 NRGN           float64
2582 TFCP2L1        float64
2583 PSAT1          float64
2584 SPINT2         float64
2585 SPINT1         float64
2586 RTL1           float64
2587 TSPAN1         float64
2588 TSPAN8         float64
2589 RASD2          float64
2590 RASD1          float64
2591 THBS4          float64
2592 THBS2          float64
2593 THBS1          float64
2594 XKRX           float64
2595 IYD            float64
2596 NNAT           float64
2597 AMTN           float64
2598 RAB38          float64
2599 DOK5           float64
2600 C6orf223       float64
2601 PLS1           float64
2602 RAB3C          float64
2603 HSPA6          float64
2604 LIFR           float64
2605 SRMS           float64
2606 IRX5           float64
```

```
2607 IRX4          float64
2608 IRX6          float64
2609 IRX1          float64
2610 IRX3          float64
2611 IRX2          float64
2612 PPP2R2C       float64
2613 PPP2R2B       float64
2614 GC            float64
2615 APOA5         float64
2616 GPRASP2       float64
2617 APOA1         float64
2618 APOA2         float64
2619 TTR           float64
2620 TTN           float64
2621 SHROOM3       float64
2622 ATRNL1        float64
2623 MYEOV         float64
2624 BDKRB2        float64
2625 NPC1L1        float64
2626 SLIT3         float64
2627 SLIT2         float64
2628 SLIT1         float64
2629 HIST4H4       float64
2630 NAP1L3        float64
2631 CYP4F8        float64
2632 WNK2          float64
2633 CYP4F2        float64
2634 CYP4F3        float64
2635 ANKRD30A      float64
2636 ANKRD30B      float64
2637 PDE8B         float64
2638 DBH           float64
2639 MNX1          float64
2640 SLC22A17      float64
2641 STK32A        float64
2642 AZGP1         float64
2643 PROC          float64
2644 AREG          float64
2645 C4B_2         float64
2646 ACTA1         float64
2647 PITX2         float64
2648 PITX1         float64
2649 AXIN2         float64
2650 SDCBP2        float64
2651 IFI27         float64
2652 CD36          float64
2653 APCDD1        float64
2654 PSD2          float64
```

```
2655 ASRGL1          float64
2656 KIF5A           float64
2657 KIF5C           float64
2658 MASP1           float64
2659 MASP2           float64
2660 CD3D            float64
2661 CD3E            float64
2662 ACADL           float64
2663 KCNK15          float64
2664 VAT1L           float64
2665 ADAMTS12        float64
2666 ADAMTS14        float64
2667 SORD            float64
2668 IGSF21          float64
2669 ADRB1           float64
2670 FCGR3A          float64
2671 ALDH1A1         float64
2672 ALDH1A2         float64
2673 ALDH1A3         float64
2674 RPL21           float64
2675 EYA4            float64
2676 EYA1            float64
2677 EYA2            float64
2678 CD27            float64
2679 TTK             float64
2680 UGT1A10         float64
2681 FXYD6           float64
2682 FXYD7           float64
2683 FXYD2           float64
2684 FXYD3           float64
2685 FXYD1           float64
2686 IGFN1           float64
2687 RBP1            float64
2688 RBP4            float64
2689 RBP5            float64
2690 ACSL5           float64
2691 SMPX            float64
2692 TRIM31          float64
2693 TRIM36          float64
2694 CYGB            float64
2695 NEBL            float64
2696 RHOV            float64
2697 RHOH            float64
2698 RHOD            float64
2699 CRNN            float64
2700 NEURL1          float64
2701 PROX1           float64
2702 TFF2            float64
```

```
2703 TFF3          float64
2704 WBSCR17       float64
2705 TMPRSS2       float64
2706 TMPRSS3       float64
2707 TMPRSS4       float64
2708 TMPRSS6       float64
2709 ABCC11        float64
2710 NPR1          float64
2711 NPR3          float64
2712 TMEM184A      float64
2713 ANO9          float64
2714 ANO7          float64
2715 ANO1          float64
2716 COL3A1        float64
2717 HOXB8         float64
2718 HOXB9         float64
2719 HOXB2         float64
2720 HOXB3         float64
2721 HOXB6         float64
2722 HOXB7         float64
2723 HOXB4         float64
2724 HOXB5         float64
2725 RIMBP2        float64
2726 SPDEF         float64
2727 MYZAP         float64
2728 CTAG2         float64
2729 RGMA          float64
2730 NR2F1         float64
2731 CYP2C9        float64
2732 CYP2C8        float64
2733 APOBEC3B      float64
2734 KLHDC7B       float64
2735 KLHDC7A       float64
2736 SLC1A2        float64
2737 SLC1A3        float64
2738 GAMT          float64
2739 DHRS9         float64
2740 DHRS2         float64
2741 HNF1A         float64
2742 MYT1          float64
2743 TPO           float64
2744 LEAP2         float64
2745 SNAI2         float64
2746 HRG           float64
2747 SLC2A5        float64
2748 SLC2A2        float64
2749 SLC2A1        float64
2750 TBC1D3C       float64
```

```
2751 TBC1D3E        float64
2752 CEACAM1        float64
2753 EN1            float64
2754 CEACAM5        float64
2755 CEACAM7        float64
2756 CEACAM6        float64
2757 C20orf144      float64
2758 CYP4B1         float64
2759 SLC24A5        float64
2760 PODN           float64
2761 PVALB          float64
2762 COL25A1        float64
2763 CYP17A1        float64
2764 CNIH2          float64
2765 NAT8L          float64
2766 SCIN           float64
2767 ADD2           float64
2768 HIST1H1A       float64
2769 MARVELD2       float64
2770 FMO3           float64
2771 FMO1           float64
2772 CASZ1          float64
2773 PRSS21         float64
2774 PRSS22         float64
2775 ARHGEF35       float64
2776 ATP2B2         float64
2777 SPRR2E         float64
2778 SPRR2D         float64
2779 SPRR2G         float64
2780 SPRR2F         float64
2781 SPRR2A         float64
2782 RASSF7         float64
2783 SPRR2B         float64
2784 BTBD11         float64
2785 KRT80          float64
2786 KRT81          float64
2787 CCDC136        float64
2788 MAST1          float64
2789 SLURP1         float64
2790 STK33          float64
2791 DPP4           float64
2792 DPP6           float64
2793 LCK            float64
2794 PROM2          float64
2795 RNASE1         float64
2796 CCDC80         float64
2797 STMN4          float64
2798 STMN2          float64
```

```
2799 TOP2A          float64
2800 FGF7           float64
2801 BCAN           float64
2802 OLFML2B        float64
2803 BCAM           float64
2804 SDC1           float64
2805 SDC2           float64
2806 SDC4           float64
2807 ELOVL2         float64
2808 AMY1A          float64
2809 AMY1B          float64
2810 DEFB1          float64
2811 HSPA2          float64
2812 SGCD           float64
2813 DUSP4          float64
2814 DUSP1          float64
2815 NKD1           float64
2816 NKD2           float64
2817 HEY1           float64
2818 PCDH7          float64
2819 C8orf4         float64
2820 TCERG1L        float64
2821 RHCG           float64
2822 C1orf95        float64
2823 AHNAK2         float64
2824 RIC3           float64
2825 GABRB3         float64
2826 NPY            float64
2827 ENC1           float64
2828 NPW            float64
2829 ACTA2          float64
2830 TSTD1          float64
2831 KCNQ5          float64
2832 KCNQ2          float64
2833 HOXC11         float64
2834 HOXC10         float64
2835 HOXC13         float64
2836 VEGFA          float64
2837 COL2A1         float64
2838 HTRA1          float64
2839 HTRA3          float64
2840 UNC5CL         float64
2841 CYP21A2        float64
2842 EMID1          float64
2843 SIM2           float64
2844 SIM1           float64
2845 FOLH1          float64
2846 BNC1           float64
```

```
2847 BNC2           float64
2848 ANK2           float64
2849 ANK3           float64
2850 MGAT4C         float64
2851 TNNC1          float64
2852 TNNC2          float64
2853 CXCL10         float64
2854 CYP3A4         float64
2855 CXCL14         float64
2856 CENPF          float64
2857 CENPA          float64
2858 LDB3           float64
2859 CENPV          float64
2860 ADGRG6         float64
2861 ADGRG1         float64
2862 HRNR           float64
2863 RASSF10        float64
2864 MYH2           float64
2865 MYH7           float64
2866 VGLL3          float64
2867 CADM4          float64
2868 VGLL1          float64
2869 CADM2          float64
2870 CADM1          float64
2871 KRTAP5-1       float64
2872 SATB2          float64
2873 PIP5K1B        float64
2874 FOXQ1          float64
2875 NR4A2          float64
2876 NR4A3          float64
2877 NR4A1          float64
2878 GPR39          float64
2879 GPR35          float64
2880 GPR37          float64
2881 SCEL           float64
2882 CDK5R2         float64
2883 EPHB3          float64
2884 EPHB6          float64
2885 ANG            float64
2886 RIMS4          float64
2887 MDFI           float64
2888 SH3GL2         float64
2889 SLC10A1        float64
2890 BSPRY          float64
2891 GPA33          float64
2892 ENPP5          float64
2893 INA            float64
2894 CYBRD1         float64
```

```
2895 CAPN6          float64
2896 CAPN5          float64
2897 CAPN9          float64
2898 ELFN2          float64
2899 RBPMS2         float64
2900 HBG2           float64
2901 DCHS2          float64
2902 CLDN10         float64
2903 CLDN11         float64
2904 CLDN18         float64
2905 TENM3          float64
2906 TENM2          float64
2907 TENM1          float64
2908 TENM4          float64
2909 GAD1           float64
2910 LCE3D          float64
2911 LCE3E          float64
2912 ZNF521         float64
2913 STEAP1         float64
2914 STEAP3         float64
2915 STEAP4         float64
2916 BCL11A         float64
2917 DSCAM          float64
2918 ZG16B          float64
2919 SLC26A7        float64
2920 NFASC          float64
2921 SLC26A9        float64
2922 PRDM1          float64
2923 EVPL           float64
2924 HSD11B2        float64
2925 NTS            float64
2926 NTM            float64
2927 ABCA3          float64
2928 HSD11B1        float64
2929 SPON2          float64
2930 SPON1          float64
2931 ST6GALNAC5     float64
2932 ST6GALNAC2     float64
2933 ST6GALNAC1     float64
2934 CDCP1          float64
2935 DERL3          float64
2936 SAPCD2         float64
2937 C3             float64
2938 FBN3           float64
2939 S100A7A        float64
2940 EFNB3          float64
2941 ITIH1          float64
2942 ITIH3          float64
```

```
2943 ITIH2          float64
2944 ITIH4          float64
2945 OIT3           float64
2946 KL             float64
2947 ZNF727         float64
2948 RGS4           float64
2949 TNFRSF11B      float64
2950 FAM181B        float64
2951 BGN            float64
2952 MYL4           float64
2953 MYL2           float64
2954 MYL3           float64
2955 MYL1           float64
2956 BICC1          float64
2957 MYL9           float64
2958 LINGO1         float64
2959 SFTPC          float64
2960 FAM110C        float64
2961 MFI2           float64
2962 MYLK           float64
2963 EFS            float64
2964 CORO2B         float64
2965 SPACA4         float64
2966 LAMC3          float64
2967 GSTM5          float64
2968 SLC11A1        float64
2969 PLXNA4         float64
2970 PLG            float64
2971 PEG3           float64
2972 BMPR1B         float64
2973 ELF3           float64
2974 MT3            float64
2975 ACY3           float64
2976 ALDOC          float64
2977 ALDOB          float64
2978 ARX            float64
2979 ARC            float64
2980 HAO1           float64
2981 TMOD1          float64
2982 APLP1          float64
2983 SFTPA2         float64
2984 SFTPA1         float64
2985 FMN2           float64
2986 MEGF10         float64
2987 KDM5D          float64
2988 CNFN           float64
2989 ETV1           float64
2990 ETV4           float64
```

```
2991 SULT1B1          float64
2992 IKZF1            float64
2993 SLC14A1          float64
2994 TCEAL2           float64
2995 TCEAL7           float64
2996 TCEAL5           float64
2997 VCAN             float64
2998 CDR1             float64
2999 KRBOX1           float64
3000 SELL             float64
3001 Class            object
dtypes: float64(3000), object(2)
memory usage: 99.3+ MB
```

2 Producing a PCA plot of the input data, using the colors specified above.

```python
[23]: pca = PCA(n_components = 2)
      pc = pca.fit_transform(df.iloc[:, 1:-1].values)

      pDF = pd.DataFrame(data = pc, columns = ['principal_component_1',
       →'principal_component_2'])
      newDF = pd.concat([pDF, df.iloc[:, -1]], axis = 1)

      newDF.head()
```

```
[23]:    principal_component_1  principal_component_2      Class
      0             82.045986             46.713047  Leukemia
      1             76.722514             37.919090  Leukemia
      2             76.643205             39.867652  Leukemia
      3             74.817223             36.351098  Leukemia
      4             79.694764             43.781020  Leukemia
```

```python
[8]: colors = {
              "Breast": '#4287f5',
              "Bladder": '#19c5e3',
              "Colon": '#80d941',
              "Glioblastoma": '#179933',
              "Head&Neck": '#f07e78',
              "Kidney": '#f01e13',
              "Leukemia": '#f0841f',
              "LungAdeno": '#db5209',
              "LungSquamous": '#ce8ced',
              "Ovarian": '#551075',
              "Rectal": '#e3d329',
```
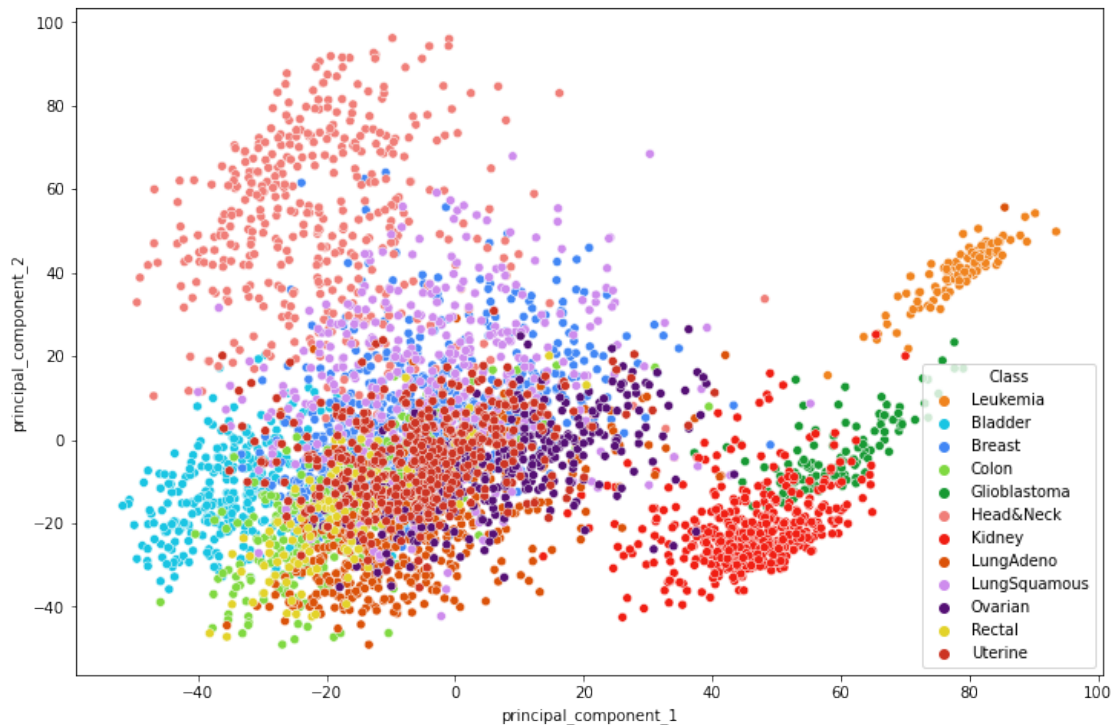
```
            "Uterine": '#cc3423'
        }

plt.figure(figsize = (12, 8))
sb.scatterplot(x = "principal_component_1", y = "principal_component_2", data =␣
 ↪newDF, hue='Class', palette=colors)
plt.show()
```


3   Normalizing the data using StandardScaler.

```
[24]: scaler = StandardScaler()

      X = scaler.fit_transform(df.iloc[:, 1:-1])
      target = df.iloc[:, -1]
```

```
[25]: # Using LabelEncoder to transform the target columns to integers

      from sklearn.preprocessing import LabelEncoder
      le = LabelEncoder()
      y = le.fit_transform(target)
      y
```

```
[25]: array([ 6,  6,  6, …, 11, 11, 11])
```

```
[11]: le.inverse_transform(y)
```

```
[11]: array(['Leukemia', 'Leukemia', 'Leukemia', …, 'Uterine', 'Uterine',
             'Uterine'], dtype=object)
```

4 Breaking the data into the training and test datasets

```
[26]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2,␣
      ↪stratify = y)
```

5 Defining SVM model

```
[27]: clf = svm.SVC(
                    C=5,
                    kernel='rbf',
                    gamma='auto',
                    tol=0.001,
                    class_weight='balanced'
                )
```

6 5-fold cross-validation

```
[29]: scores = cross_val_score(clf, X_train, y_train, cv=5)
```

```
[15]: print(" Individual cross-validation accuracies:", scores,"\n Mean␣
      ↪Cross-Validation Accuracies:", np.mean(scores))
```

```
 Individual cross-validation accuracies: [0.9740634  0.9610951  0.9740634
0.96103896 0.97113997]
 Mean Cross-Validation Accuracies: 0.9682801668392447
```

7 Training the final model on all the training data and assessing model performance on the test set

```
[16]: clf.fit(X_train, y_train)

      preds = clf.predict(X_test)
```
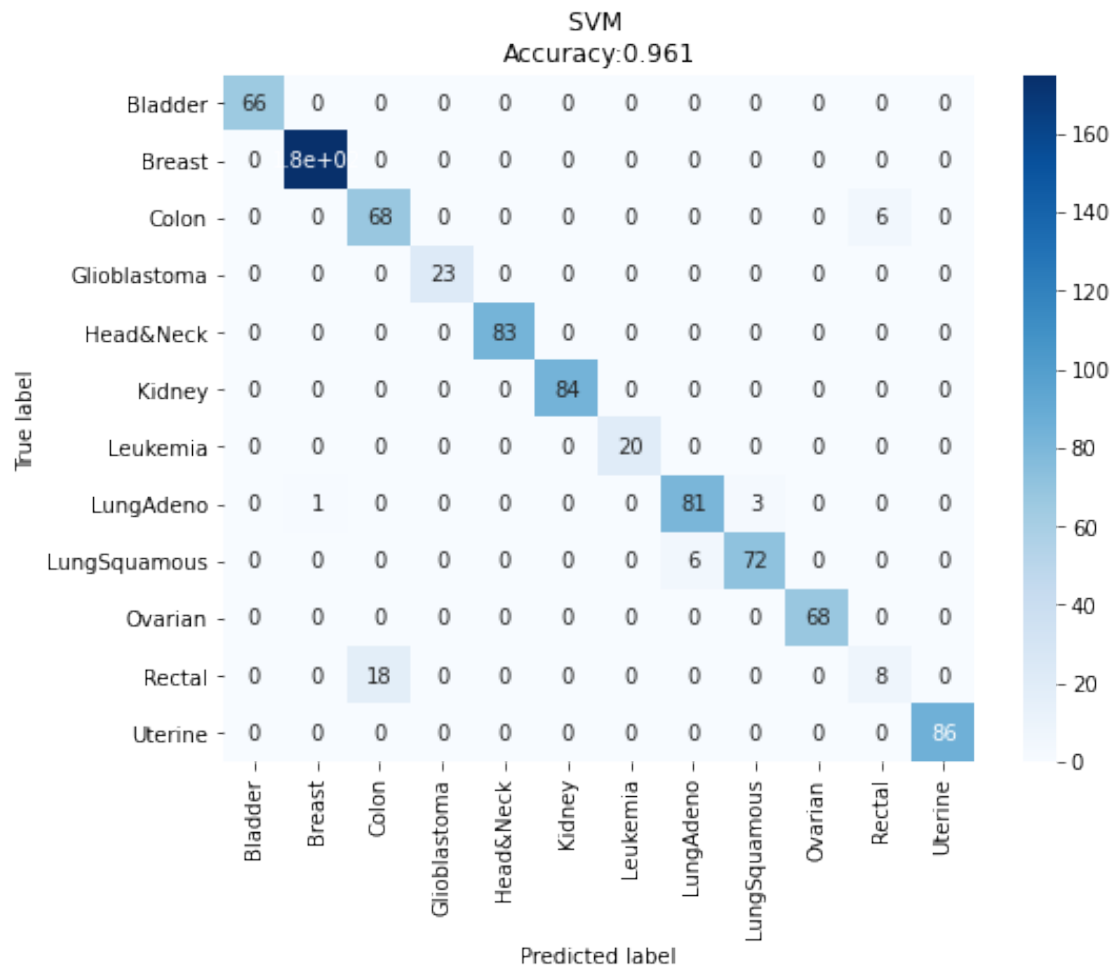
```
[17]: # accuracy
      accuracy_score(preds, y_test)
```

```
[17]: 0.9608294930875576
```

8 With Normalization

```
[18]: cm = confusion_matrix(y_test, preds)
      cm_df = pd.DataFrame(cm, index = le.classes_, columns = le.classes_)
```

```
[19]: plt.figure(figsize=(8, 6))
      sb.heatmap(cm_df, annot=True, cmap=plt.cm.Blues)
      plt.title('SVM \nAccuracy:{0:.3f}'.format(accuracy_score(y_test, preds)))
      plt.ylabel('True label')
      plt.xlabel('Predicted label')
      plt.show()
```

SVM
Accuracy:0.961

	Bladder	Breast	Colon	Glioblastoma	Head&Neck	Kidney	Leukemia	LungAdeno	LungSquamous	Ovarian	Rectal	Uterine
Bladder	66	0	0	0	0	0	0	0	0	0	0	0
Breast	0	1.8e+0	0	0	0	0	0	0	0	0	0	0
Colon	0	0	68	0	0	0	0	0	0	0	6	0
Glioblastoma	0	0	0	23	0	0	0	0	0	0	0	0
Head&Neck	0	0	0	0	83	0	0	0	0	0	0	0
Kidney	0	0	0	0	0	84	0	0	0	0	0	0
Leukemia	0	0	0	0	0	0	20	0	0	0	0	0
LungAdeno	0	1	0	0	0	0	0	81	3	0	0	0
LungSquamous	0	0	0	0	0	0	0	6	72	0	0	0
Ovarian	0	0	0	0	0	0	0	0	0	68	0	0
Rectal	0	0	18	0	0	0	0	0	0	0	8	0
Uterine	0	0	0	0	0	0	0	0	0	0	0	86

True label / Predicted label

9 Without normalization
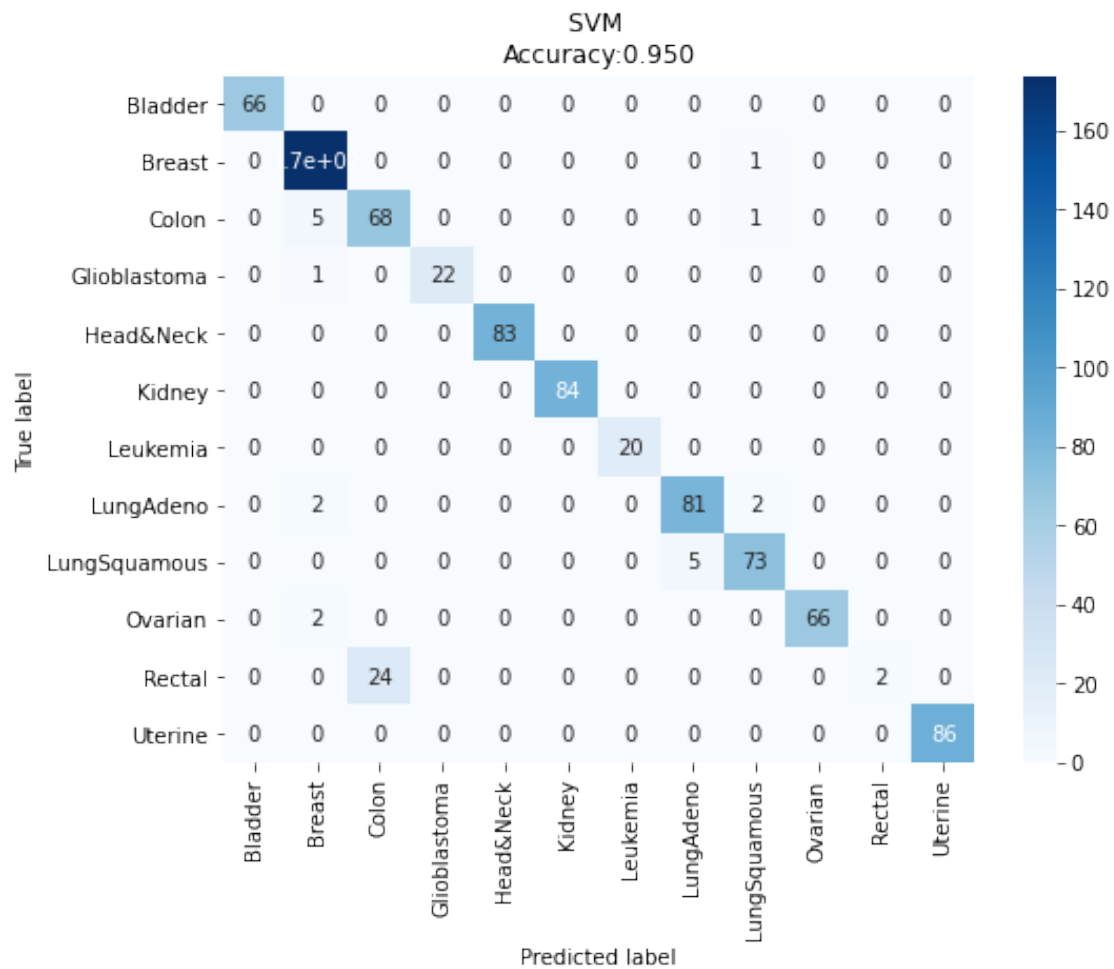
```
[20]: X_train, X_test, y_train, y_test = train_test_split(df.iloc[:, 1:-1], y,␣
      ↪test_size = 0.2, stratify = y)


      clf.fit(X_train, y_train)


      preds = clf.predict(X_test)
```

```
[21]: cm = confusion_matrix(y_test, preds)
      cm_df = pd.DataFrame(cm, index = le.classes_, columns = le.classes_)
```

```
[22]: plt.figure(figsize=(8, 6))
      sb.heatmap(cm_df, annot=True, cmap=plt.cm.Blues)
      plt.title('SVM \nAccuracy:{0:.3f}'.format(accuracy_score(y_test, preds)))
      plt.ylabel('True label')
      plt.xlabel('Predicted label')
      plt.show()
```


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