

```
1 "C:\Program Files\Anaconda3\python.exe" C:/Users/anant/OneDrive/Documents/Niveditha/PSU/
  Spring2018/ML/ProgrammingAssignments/mnistPerceptronVectorized_edit1.py
2 Learning Rate : 0.001
3 Epoch Number : 0
4 Accuracy for training set : 11.23
5 Accuracy for testing set : 11.69
6 Epoch Number : 1
7 Accuracy for training set : 82.04
8 Accuracy for testing set : 85.77
9 Epoch Number : 2
10 Accuracy for training set : 85.05
11 Accuracy for testing set : 84.48
12 Epoch Number : 3
13 Accuracy for training set : 85.5
14 Accuracy for testing set : 84.04
15 Epoch Number : 4
16 Accuracy for training set : 85.66
17 Accuracy for testing set : 83.97
18 Epoch Number : 5
19 Accuracy for training set : 85.58
20 Accuracy for testing set : 83.94
21 Epoch Number : 6
22 Accuracy for training set : 85.57
23 Accuracy for testing set : 83.8
24 Epoch Number : 7
25 Accuracy for training set : 85.68
26 Accuracy for testing set : 84.56
27 Epoch Number : 8
28 Accuracy for training set : 85.82
29 Accuracy for testing set : 83.34
30 Epoch Number : 9
31 Accuracy for training set : 85.91
32 Accuracy for testing set : 85.14
33 Epoch Number : 10
34 Accuracy for training set : 85.81
35 Accuracy for testing set : 82.8
36 Epoch Number : 11
37 Accuracy for training set : 85.77
38 Accuracy for testing set : 79.22
39 Epoch Number : 12
40 Accuracy for training set : 85.86
41 Accuracy for testing set : 84.11
42 Epoch Number : 13
43 Accuracy for training set : 85.85
44 Accuracy for testing set : 85.45
45 Epoch Number : 14
46 Accuracy for training set : 85.92
47 Accuracy for testing set : 82.68
48 Epoch Number : 15
49 Accuracy for training set : 85.98
50 Accuracy for testing set : 83.45
51 Epoch Number : 16
52 Accuracy for training set : 85.8
53 Accuracy for testing set : 82.19
54 Epoch Number : 17
55 Accuracy for training set : 85.88
56 Accuracy for testing set : 81.26
57 Epoch Number : 18
58 Accuracy for training set : 85.98
59 Accuracy for testing set : 83.62
60 Epoch Number : 19
61 Accuracy for training set : 86.0
62 Accuracy for testing set : 83.51
```

63 Epoch Number : 20
64 Accuracy for training set : 85.85
65 Accuracy for testing set : 82.89
66 Epoch Number : 21
67 Accuracy for training set : 85.9
68 Accuracy for testing set : 85.2
69 Epoch Number : 22
70 Accuracy for training set : 86.17
71 Accuracy for testing set : 82.61
72 Epoch Number : 23
73 Accuracy for training set : 85.95
74 Accuracy for testing set : 82.62
75 Epoch Number : 24
76 Accuracy for training set : 86.03
77 Accuracy for testing set : 81.08
78 Epoch Number : 25
79 Accuracy for training set : 86.12
80 Accuracy for testing set : 84.26
81 Epoch Number : 26
82 Accuracy for training set : 86.0
83 Accuracy for testing set : 81.52
84 Epoch Number : 27
85 Accuracy for training set : 85.96
86 Accuracy for testing set : 83.44
87 Epoch Number : 28
88 Accuracy for training set : 86.05
89 Accuracy for testing set : 84.11
90 Epoch Number : 29
91 Accuracy for training set : 86.06
92 Accuracy for testing set : 83.05
93 Epoch Number : 30
94 Accuracy for training set : 86.16
95 Accuracy for testing set : 80.17
96 Epoch Number : 31
97 Accuracy for training set : 86.13
98 Accuracy for testing set : 83.18
99 Epoch Number : 32
100 Accuracy for training set : 86.18
101 Accuracy for testing set : 86.78
102 Epoch Number : 33
103 Accuracy for training set : 86.16
104 Accuracy for testing set : 84.17
105 Epoch Number : 34
106 Accuracy for training set : 86.17
107 Accuracy for testing set : 85.48
108 Epoch Number : 35
109 Accuracy for training set : 86.09
110 Accuracy for testing set : 84.56
111 Epoch Number : 36
112 Accuracy for training set : 86.17
113 Accuracy for testing set : 81.59
114 Epoch Number : 37
115 Accuracy for training set : 85.97
116 Accuracy for testing set : 82.22
117 Epoch Number : 38
118 Accuracy for training set : 86.19
119 Accuracy for testing set : 83.29
120 Epoch Number : 39
121 Accuracy for training set : 86.07
122 Accuracy for testing set : 84.99
123 Epoch Number : 40
124 Accuracy for training set : 86.16
125 Accuracy for testing set : 83.19

```
126 Epoch Number : 41
127 Accuracy for training set : 86.17
128 Accuracy for testing set : 84.71
129 Epoch Number : 42
130 Accuracy for training set : 86.12
131 Accuracy for testing set : 82.08
132 Epoch Number : 43
133 Accuracy for training set : 86.0
134 Accuracy for testing set : 80.9
135 Epoch Number : 44
136 Accuracy for training set : 86.23
137 Accuracy for testing set : 81.08
138 Epoch Number : 45
139 Accuracy for training set : 86.1
140 Accuracy for testing set : 84.54
141 Epoch Number : 46
142 Accuracy for training set : 86.2
143 Accuracy for testing set : 82.88
144 Epoch Number : 47
145 Accuracy for training set : 86.17
146 Accuracy for testing set : 81.73
147 Epoch Number : 48
148 Accuracy for training set : 86.23
149 Accuracy for testing set : 82.7
150 Epoch Number : 49
151 Accuracy for training set : 86.36
152 Accuracy for testing set : 82.9
153 Epoch Number : 50
154 Accuracy for training set : 86.1
155 Accuracy for testing set : 84.55
156 Epoch Number : 51
157 Accuracy for training set : 86.37
158 Accuracy for testing set : 83.3
159 Epoch Number : 52
160 Accuracy for training set : 86.37
161 Accuracy for testing set : 82.4
162 Confusion Matrix for Learning Rate : 0.001
163 [[ 974    0    1    1    0    2    1    0    1    0]
164 [   4 1117    2    4    1    1    3    0    3    0]
165 [ 195   47  623   92    9    3   22    4   30    7]
166 [   51    4    9  924    2    3    4    3    2    8]
167 [   40    5    3   18  861    1   16    0   16   22]
168 [  110    3    2  141   36  536   22    4   21   17]
169 [   58    4    2    2    8   59  825    0    0    0]
170 [   61   11   10  128   28    7    1  745    6   31]
171 [  154   27    2  121   41   19   32    1  527   50]
172 [   32    8    0   86   76    4    3   33   46  721]]
173 Learning Rate : 0.01
174 Epoch Number : 0
175 Accuracy for training set : 11.01
176 Accuracy for testing set : 11.15
177 Epoch Number : 1
178 Accuracy for training set : 82.62
179 Accuracy for testing set : 82.28
180 Epoch Number : 2
181 Accuracy for training set : 84.62
182 Accuracy for testing set : 81.48
183 Epoch Number : 3
184 Accuracy for training set : 85.0
185 Accuracy for testing set : 85.09
186 Epoch Number : 4
187 Accuracy for training set : 85.22
188 Accuracy for testing set : 85.02
```

189 Epoch Number : 5
190 Accuracy for training set : 85.26
191 Accuracy for testing set : 84.24
192 Epoch Number : 6
193 Accuracy for training set : 85.48
194 Accuracy for testing set : 85.1
195 Epoch Number : 7
196 Accuracy for training set : 85.43
197 Accuracy for testing set : 81.75
198 Epoch Number : 8
199 Accuracy for training set : 85.6
200 Accuracy for testing set : 82.1
201 Epoch Number : 9
202 Accuracy for training set : 85.56
203 Accuracy for testing set : 83.0
204 Epoch Number : 10
205 Accuracy for training set : 85.6
206 Accuracy for testing set : 81.78
207 Epoch Number : 11
208 Accuracy for training set : 85.63
209 Accuracy for testing set : 84.66
210 Epoch Number : 12
211 Accuracy for training set : 85.71
212 Accuracy for testing set : 85.64
213 Epoch Number : 13
214 Accuracy for training set : 85.9
215 Accuracy for testing set : 82.31
216 Epoch Number : 14
217 Accuracy for training set : 86.02
218 Accuracy for testing set : 82.96
219 Epoch Number : 15
220 Accuracy for training set : 85.7
221 Accuracy for testing set : 83.39
222 Epoch Number : 16
223 Accuracy for training set : 85.88
224 Accuracy for testing set : 83.61
225 Epoch Number : 17
226 Accuracy for training set : 85.81
227 Accuracy for testing set : 82.61
228 Epoch Number : 18
229 Accuracy for training set : 85.95
230 Accuracy for testing set : 80.45
231 Epoch Number : 19
232 Accuracy for training set : 85.81
233 Accuracy for testing set : 85.03
234 Epoch Number : 20
235 Accuracy for training set : 85.91
236 Accuracy for testing set : 83.37
237 Epoch Number : 21
238 Accuracy for training set : 85.95
239 Accuracy for testing set : 83.0
240 Epoch Number : 22
241 Accuracy for training set : 85.75
242 Accuracy for testing set : 80.48
243 Epoch Number : 23
244 Accuracy for training set : 85.9
245 Accuracy for testing set : 84.59
246 Epoch Number : 24
247 Accuracy for training set : 86.01
248 Accuracy for testing set : 84.61
249 Epoch Number : 25
250 Accuracy for training set : 86.02
251 Accuracy for testing set : 83.91

```
252 Confusion Matrix for Learning Rate : 0.01
253 [[ 967    0    0    0    0    5    2    4    2    0]
254 [   30 1067    1   10    5    2    3    1   16    0]
255 [  276   26  543  128    6   14   14    4   17    4]
256 [   53    0    3  937    0   10    1    4    0    2]
257 [  145    0    0    3  728    0   21    2   12   71]
258 [  111    2    1   96    9  641   11    7   11    3]
259 [   56    3    1    1    3  118  775    0    1    0]
260 [   63    2    5   90   11    2    1  841    3   10]
261 [  385    5    0   54    7   31   15    6  460   11]
262 [   95    1    0   32   10    5    2   45   17  802]]
```

```
263 Learning Rate : 0.1
```

```
264 Epoch Number : 0
```

```
265 Accuracy for training set : 8.65
```

```
266 Accuracy for testing set : 8.44
```

```
267 Epoch Number : 1
```

```
268 Accuracy for training set : 82.51
```

```
269 Accuracy for testing set : 77.92
```

```
270 Epoch Number : 2
```

```
271 Accuracy for training set : 84.53
```

```
272 Accuracy for testing set : 82.56
```

```
273 Epoch Number : 3
```

```
274 Accuracy for training set : 84.97
```

```
275 Accuracy for testing set : 84.95
```

```
276 Epoch Number : 4
```

```
277 Accuracy for training set : 85.09
```

```
278 Accuracy for testing set : 84.02
```

```
279 Epoch Number : 5
```

```
280 Accuracy for training set : 85.56
```

```
281 Accuracy for testing set : 82.71
```

```
282 Epoch Number : 6
```

```
283 Accuracy for training set : 85.37
```

```
284 Accuracy for testing set : 84.42
```

```
285 Epoch Number : 7
```

```
286 Accuracy for training set : 85.45
```

```
287 Accuracy for testing set : 84.93
```

```
288 Epoch Number : 8
```

```
289 Accuracy for training set : 85.47
```

```
290 Accuracy for testing set : 85.81
```

```
291 Epoch Number : 9
```

```
292 Accuracy for training set : 85.52
```

```
293 Accuracy for testing set : 81.04
```

```
294 Epoch Number : 10
```

```
295 Accuracy for training set : 85.76
```

```
296 Accuracy for testing set : 84.13
```

```
297 Epoch Number : 11
```

```
298 Accuracy for training set : 85.64
```

```
299 Accuracy for testing set : 83.01
```

```
300 Epoch Number : 12
```

```
301 Accuracy for training set : 85.79
```

```
302 Accuracy for testing set : 82.55
```

```
303 Epoch Number : 13
```

```
304 Accuracy for training set : 85.6
```

```
305 Accuracy for testing set : 83.62
```

```
306 Epoch Number : 14
```

```
307 Accuracy for training set : 85.7
```

```
308 Accuracy for testing set : 84.45
```

```
309 Epoch Number : 15
```

```
310 Accuracy for training set : 85.85
```

```
311 Accuracy for testing set : 84.14
```

```
312 Epoch Number : 16
```

```
313 Accuracy for training set : 85.86
```

```
314 Accuracy for testing set : 84.5
```

315 Epoch Number : 17
316 Accuracy for training set : 85.88
317 Accuracy for testing set : 82.06
318 Epoch Number : 18
319 Accuracy for training set : 86.03
320 Accuracy for testing set : 81.67
321 Epoch Number : 19
322 Accuracy for training set : 85.79
323 Accuracy for testing set : 84.45
324 Epoch Number : 20
325 Accuracy for training set : 85.7
326 Accuracy for testing set : 83.69
327 Epoch Number : 21
328 Accuracy for training set : 85.93
329 Accuracy for testing set : 81.23
330 Epoch Number : 22
331 Accuracy for training set : 85.85
332 Accuracy for testing set : 80.42
333 Epoch Number : 23
334 Accuracy for training set : 85.92
335 Accuracy for testing set : 83.86
336 Epoch Number : 24
337 Accuracy for training set : 85.91
338 Accuracy for testing set : 85.92
339 Epoch Number : 25
340 Accuracy for training set : 86.02
341 Accuracy for testing set : 83.95
342 Epoch Number : 26
343 Accuracy for training set : 85.85
344 Accuracy for testing set : 85.67
345 Epoch Number : 27
346 Accuracy for training set : 86.13
347 Accuracy for testing set : 84.94
348 Epoch Number : 28
349 Accuracy for training set : 85.96
350 Accuracy for testing set : 81.41
351 Epoch Number : 29
352 Accuracy for training set : 86.01
353 Accuracy for testing set : 83.34
354 Epoch Number : 30
355 Accuracy for training set : 86.1
356 Accuracy for testing set : 83.74
357 Epoch Number : 31
358 Accuracy for training set : 86.08
359 Accuracy for testing set : 85.23
360 Epoch Number : 32
361 Accuracy for training set : 86.09
362 Accuracy for testing set : 81.82
363 Epoch Number : 33
364 Accuracy for training set : 86.15
365 Accuracy for testing set : 85.68
366 Epoch Number : 34
367 Accuracy for training set : 86.17
368 Accuracy for testing set : 83.34
369 Epoch Number : 35
370 Accuracy for training set : 86.1
371 Accuracy for testing set : 83.7
372 Epoch Number : 36
373 Accuracy for training set : 86.04
374 Accuracy for testing set : 83.98
375 Epoch Number : 37
376 Accuracy for training set : 86.14
377 Accuracy for testing set : 81.77

```
378 Epoch Number : 38
379 Accuracy for training set : 85.95
380 Accuracy for testing set : 82.67
381 Epoch Number : 39
382 Accuracy for training set : 86.3
383 Accuracy for testing set : 85.59
384 Epoch Number : 40
385 Accuracy for training set : 86.15
386 Accuracy for testing set : 82.82
387 Epoch Number : 41
388 Accuracy for training set : 86.05
389 Accuracy for testing set : 82.02
390 Epoch Number : 42
391 Accuracy for training set : 86.13
392 Accuracy for testing set : 85.9
393 Epoch Number : 43
394 Accuracy for training set : 86.16
395 Accuracy for testing set : 85.88
396 Epoch Number : 44
397 Accuracy for training set : 86.22
398 Accuracy for testing set : 84.93
399 Epoch Number : 45
400 Accuracy for training set : 86.11
401 Accuracy for testing set : 79.89
402 Epoch Number : 46
403 Accuracy for training set : 86.18
404 Accuracy for testing set : 79.79
405 Epoch Number : 47
406 Accuracy for training set : 86.23
407 Accuracy for testing set : 82.52
408 Epoch Number : 48
409 Accuracy for training set : 86.22
410 Accuracy for testing set : 83.76
411 Epoch Number : 49
412 Accuracy for training set : 86.22
413 Accuracy for testing set : 84.53
414 Confusion Matrix for Learning Rate : 0.1
415 [[ 977    0    0    2    0    0    1    0    0    0]
416 [  14 1108    3    1    0    2    2    0    5    0]
417 [ 168   29  696   71    7    9   11    2   35    4]
418 [   68    1   12  907    0    6    2    1    9    4]
419 [   66    2    4    4  825    0    8    1   11   61]
420 [  117    1    3  126   15  595   10    1   19    5]
421 [   97    4   13    0    5   60  779    0    0    0]
422 [  118    6   20   65   12    6    1  726   16   58]
423 [  210   16    3   76    9   38   17    2  597    6]
424 [   58    4    0   29   17    4    2    9   24  862]]
425
426 Process finished with exit code 0
427
```