

week_1_solution_10

March 15, 2018

```
In [1]: import os
import urllib2
# import urllib
import io
import gzip

def download_file(remote, local):
    url = remote

    u = urllib2.urlopen(url)
    f = open(local, 'wb')
    meta = u.info()

    file_size = int(meta.getheaders("Content-Length")[0])
    print "Downloading: %s Bytes: %s" % (local, file_size)

    file_size_dl = 0
    block_sz = 8192
    while True:
        buffer = u.read(block_sz)
        if not buffer:
            break

        file_size_dl += len(buffer)
        f.write(buffer)
        status = r"%10d  [%3.2f%%]" % (file_size_dl, file_size_dl * 100. / file_size)
        status = status + chr(8)*(len(status)+1)
        #     print status,

    f.close()

data_dir = "../data"
data_file_url = "https://github.com/mnielsen/neural-networks-and-deep-learning/raw/master/data/mnist/train-images-idx1-ubyte.gz"
if os.path.exists(data_dir) == False:
    os.makedirs(data_dir)
    print("Directory created: " + data_dir)
```

```

data_filename = "mnist.pkl.gz"
data_filepath = data_dir + "/" + data_filename

download_file(remote = data_file_url, local = data_filepath)

# with urllib2.urlopen(data_file_url) as d:
#     data = d.read()
#     d.close()

# with open(data_filepath, 'wb') as f:
#     f.write(data)

print("# Completed downloading file: " + data_filename)

```

Downloading: ../data/mnist.pkl.gz Bytes: 17051982
 # Completed downloading file: mnist.pkl.gz

```

In [2]: import mnist_loader
import numpy as np
import pandas as pd

training_data, validation_data, test_data = mnist_loader.load_data_wrapper()
print("Training data, validation data and test data loaded.")

```

Training data, validation data and test data loaded.

```

In [10]: message = """
Repeat 8,9 using a regularization parameter lambda=0.1 (note python has a reserved word lambda)
net.SGD(training_data[:1000], 400, 10, 0.5,
... evaluation_data=test_data, lmbda = 0.1,
... monitor_evaluation_cost=True, monitor_evaluation_accuracy=True,
... monitor_training_cost=True, monitor_training_accuracy=True)
"""

import network2

net2 = network2.Network([784, 30, 10], cost=network2.CrossEntropyCost)
net2.large_weight_initializer()

epochs = 400

evaluation_cost, evaluation_accuracy, training_cost, training_accuracy = net2.SGD(
    training_data[:10000],
    epochs,
    10,

```

```
    0.5,  
    evaluation_data=test_data,  
    lambda=0.1,  
    monitor_evaluation_cost=True,  
    monitor_evaluation_accuracy=True,  
    monitor_training_cost=True,  
    monitor_training_accuracy=True  
)
```

Epoch 0 training complete

Cost on training data: 0.948709795623

Accuracy on training data: 8753 / 10000

Cost on evaluation data: 1.034100472

Accuracy on evaluation data: 8557 / 10000

Epoch 1 training complete

Cost on training data: 0.73015594784

Accuracy on training data: 9063 / 10000

Cost on evaluation data: 0.851004715191

Accuracy on evaluation data: 8824 / 10000

Epoch 2 training complete

Cost on training data: 0.610741223297

Accuracy on training data: 9288 / 10000

Cost on evaluation data: 0.761230727829

Accuracy on evaluation data: 9017 / 10000

Epoch 3 training complete

Cost on training data: 0.554676834922

Accuracy on training data: 9369 / 10000

Cost on evaluation data: 0.737468388182

Accuracy on evaluation data: 9079 / 10000

Epoch 4 training complete

Cost on training data: 0.521335070386

Accuracy on training data: 9430 / 10000

Cost on evaluation data: 0.704321042228

Accuracy on evaluation data: 9109 / 10000

Epoch 5 training complete

Cost on training data: 0.475575120133

Accuracy on training data: 9502 / 10000

Cost on evaluation data: 0.696112471111

Accuracy on evaluation data: 9137 / 10000

Epoch 6 training complete

Cost on training data: 0.424719454306

Accuracy on training data: 9586 / 10000

Cost on evaluation data: 0.655336927235
Accuracy on evaluation data: 9180 / 10000

Epoch 7 training complete
Cost on training data: 0.401727100578
Accuracy on training data: 9627 / 10000
Cost on evaluation data: 0.64663071817
Accuracy on evaluation data: 9196 / 10000

Epoch 8 training complete
Cost on training data: 0.38950940889
Accuracy on training data: 9640 / 10000
Cost on evaluation data: 0.650313317043
Accuracy on evaluation data: 9216 / 10000

Epoch 9 training complete
Cost on training data: 0.376586017706
Accuracy on training data: 9662 / 10000
Cost on evaluation data: 0.646723930698
Accuracy on evaluation data: 9212 / 10000

Epoch 10 training complete
Cost on training data: 0.3517742728
Accuracy on training data: 9694 / 10000
Cost on evaluation data: 0.639704702511
Accuracy on evaluation data: 9225 / 10000

Epoch 11 training complete
Cost on training data: 0.351300124157
Accuracy on training data: 9686 / 10000
Cost on evaluation data: 0.643479316679
Accuracy on evaluation data: 9233 / 10000

Epoch 12 training complete
Cost on training data: 0.33658430429
Accuracy on training data: 9728 / 10000
Cost on evaluation data: 0.639264349414
Accuracy on evaluation data: 9235 / 10000

Epoch 13 training complete
Cost on training data: 0.324774506765
Accuracy on training data: 9741 / 10000
Cost on evaluation data: 0.635849343996
Accuracy on evaluation data: 9241 / 10000

Epoch 14 training complete
Cost on training data: 0.315956746808
Accuracy on training data: 9759 / 10000

Cost on evaluation data: 0.637886994599
Accuracy on evaluation data: 9217 / 10000

Epoch 15 training complete
Cost on training data: 0.308643725448
Accuracy on training data: 9779 / 10000
Cost on evaluation data: 0.643363438589
Accuracy on evaluation data: 9225 / 10000

Epoch 16 training complete
Cost on training data: 0.29548134089
Accuracy on training data: 9793 / 10000
Cost on evaluation data: 0.634848300573
Accuracy on evaluation data: 9232 / 10000

Epoch 17 training complete
Cost on training data: 0.284495977859
Accuracy on training data: 9801 / 10000
Cost on evaluation data: 0.653442242369
Accuracy on evaluation data: 9223 / 10000

Epoch 18 training complete
Cost on training data: 0.279706038578
Accuracy on training data: 9795 / 10000
Cost on evaluation data: 0.639108075202
Accuracy on evaluation data: 9249 / 10000

Epoch 19 training complete
Cost on training data: 0.29592450871
Accuracy on training data: 9774 / 10000
Cost on evaluation data: 0.675809577575
Accuracy on evaluation data: 9203 / 10000

Epoch 20 training complete
Cost on training data: 0.267824011523
Accuracy on training data: 9814 / 10000
Cost on evaluation data: 0.662706400769
Accuracy on evaluation data: 9250 / 10000

Epoch 21 training complete
Cost on training data: 0.264186277986
Accuracy on training data: 9824 / 10000
Cost on evaluation data: 0.663676794116
Accuracy on evaluation data: 9233 / 10000

Epoch 22 training complete
Cost on training data: 0.263824974764
Accuracy on training data: 9815 / 10000

Cost on evaluation data: 0.674702291333
Accuracy on evaluation data: 9237 / 10000

Epoch 23 training complete
Cost on training data: 0.245129718695
Accuracy on training data: 9854 / 10000
Cost on evaluation data: 0.649403261587
Accuracy on evaluation data: 9251 / 10000

Epoch 24 training complete
Cost on training data: 0.238471519971
Accuracy on training data: 9863 / 10000
Cost on evaluation data: 0.647176399379
Accuracy on evaluation data: 9264 / 10000

Epoch 25 training complete
Cost on training data: 0.237581054125
Accuracy on training data: 9858 / 10000
Cost on evaluation data: 0.660050926491
Accuracy on evaluation data: 9269 / 10000

Epoch 26 training complete
Cost on training data: 0.2307235062
Accuracy on training data: 9872 / 10000
Cost on evaluation data: 0.664080059692
Accuracy on evaluation data: 9243 / 10000

Epoch 27 training complete
Cost on training data: 0.222983931931
Accuracy on training data: 9875 / 10000
Cost on evaluation data: 0.659621825406
Accuracy on evaluation data: 9251 / 10000

Epoch 28 training complete
Cost on training data: 0.223456769959
Accuracy on training data: 9881 / 10000
Cost on evaluation data: 0.666095809311
Accuracy on evaluation data: 9237 / 10000

Epoch 29 training complete
Cost on training data: 0.231634966414
Accuracy on training data: 9868 / 10000
Cost on evaluation data: 0.669979185789
Accuracy on evaluation data: 9245 / 10000

Epoch 30 training complete
Cost on training data: 0.211957287396
Accuracy on training data: 9889 / 10000

Cost on evaluation data: 0.655303143821
Accuracy on evaluation data: 9274 / 10000

Epoch 31 training complete
Cost on training data: 0.208677978354
Accuracy on training data: 9893 / 10000
Cost on evaluation data: 0.661381648788
Accuracy on evaluation data: 9282 / 10000

Epoch 32 training complete
Cost on training data: 0.215318221882
Accuracy on training data: 9879 / 10000
Cost on evaluation data: 0.680329094788
Accuracy on evaluation data: 9272 / 10000

Epoch 33 training complete
Cost on training data: 0.205226655359
Accuracy on training data: 9902 / 10000
Cost on evaluation data: 0.667492679015
Accuracy on evaluation data: 9259 / 10000

Epoch 34 training complete
Cost on training data: 0.206361598826
Accuracy on training data: 9898 / 10000
Cost on evaluation data: 0.672587944598
Accuracy on evaluation data: 9255 / 10000

Epoch 35 training complete
Cost on training data: 0.206041124549
Accuracy on training data: 9904 / 10000
Cost on evaluation data: 0.684756290021
Accuracy on evaluation data: 9260 / 10000

Epoch 36 training complete
Cost on training data: 0.196482104922
Accuracy on training data: 9903 / 10000
Cost on evaluation data: 0.670160390071
Accuracy on evaluation data: 9275 / 10000

Epoch 37 training complete
Cost on training data: 0.189955384375
Accuracy on training data: 9917 / 10000
Cost on evaluation data: 0.674301624158
Accuracy on evaluation data: 9278 / 10000

Epoch 38 training complete
Cost on training data: 0.186878719528
Accuracy on training data: 9914 / 10000

Cost on evaluation data: 0.670084344138
Accuracy on evaluation data: 9267 / 10000

Epoch 39 training complete
Cost on training data: 0.186993011721
Accuracy on training data: 9917 / 10000
Cost on evaluation data: 0.680090713196
Accuracy on evaluation data: 9264 / 10000

Epoch 40 training complete
Cost on training data: 0.181422913399
Accuracy on training data: 9926 / 10000
Cost on evaluation data: 0.670495544539
Accuracy on evaluation data: 9294 / 10000

Epoch 41 training complete
Cost on training data: 0.182853859768
Accuracy on training data: 9922 / 10000
Cost on evaluation data: 0.678942060991
Accuracy on evaluation data: 9274 / 10000

Epoch 42 training complete
Cost on training data: 0.174739792802
Accuracy on training data: 9927 / 10000
Cost on evaluation data: 0.669726512123
Accuracy on evaluation data: 9291 / 10000

Epoch 43 training complete
Cost on training data: 0.176415215079
Accuracy on training data: 9927 / 10000
Cost on evaluation data: 0.678215494812
Accuracy on evaluation data: 9284 / 10000

Epoch 44 training complete
Cost on training data: 0.173888293385
Accuracy on training data: 9929 / 10000
Cost on evaluation data: 0.672966003731
Accuracy on evaluation data: 9291 / 10000

Epoch 45 training complete
Cost on training data: 0.170104333817
Accuracy on training data: 9934 / 10000
Cost on evaluation data: 0.680808445752
Accuracy on evaluation data: 9271 / 10000

Epoch 46 training complete
Cost on training data: 0.168834821507
Accuracy on training data: 9929 / 10000

Cost on evaluation data: 0.674444485343
Accuracy on evaluation data: 9286 / 10000

Epoch 47 training complete
Cost on training data: 0.17278694774
Accuracy on training data: 9931 / 10000
Cost on evaluation data: 0.682278653721
Accuracy on evaluation data: 9265 / 10000

Epoch 48 training complete
Cost on training data: 0.165965719774
Accuracy on training data: 9933 / 10000
Cost on evaluation data: 0.674619265599
Accuracy on evaluation data: 9274 / 10000

Epoch 49 training complete
Cost on training data: 0.162063661452
Accuracy on training data: 9933 / 10000
Cost on evaluation data: 0.679467401277
Accuracy on evaluation data: 9287 / 10000

Epoch 50 training complete
Cost on training data: 0.159779983682
Accuracy on training data: 9942 / 10000
Cost on evaluation data: 0.681281954066
Accuracy on evaluation data: 9273 / 10000

Epoch 51 training complete
Cost on training data: 0.159919260044
Accuracy on training data: 9939 / 10000
Cost on evaluation data: 0.694239257561
Accuracy on evaluation data: 9271 / 10000

Epoch 52 training complete
Cost on training data: 0.157990393365
Accuracy on training data: 9945 / 10000
Cost on evaluation data: 0.688127778661
Accuracy on evaluation data: 9269 / 10000

Epoch 53 training complete
Cost on training data: 0.155222008852
Accuracy on training data: 9946 / 10000
Cost on evaluation data: 0.676978186111
Accuracy on evaluation data: 9295 / 10000

Epoch 54 training complete
Cost on training data: 0.156689730926
Accuracy on training data: 9943 / 10000

Cost on evaluation data: 0.689055428778
Accuracy on evaluation data: 9287 / 10000

Epoch 55 training complete
Cost on training data: 0.153147446649
Accuracy on training data: 9943 / 10000
Cost on evaluation data: 0.696867165349
Accuracy on evaluation data: 9266 / 10000

Epoch 56 training complete
Cost on training data: 0.150051235067
Accuracy on training data: 9950 / 10000
Cost on evaluation data: 0.696506272421
Accuracy on evaluation data: 9277 / 10000

Epoch 57 training complete
Cost on training data: 0.148657183054
Accuracy on training data: 9954 / 10000
Cost on evaluation data: 0.681149008559
Accuracy on evaluation data: 9292 / 10000

Epoch 58 training complete
Cost on training data: 0.149527871323
Accuracy on training data: 9949 / 10000
Cost on evaluation data: 0.684194549854
Accuracy on evaluation data: 9280 / 10000

Epoch 59 training complete
Cost on training data: 0.146166832692
Accuracy on training data: 9955 / 10000
Cost on evaluation data: 0.685794712593
Accuracy on evaluation data: 9270 / 10000

Epoch 60 training complete
Cost on training data: 0.144279633282
Accuracy on training data: 9955 / 10000
Cost on evaluation data: 0.68552083775
Accuracy on evaluation data: 9290 / 10000

Epoch 61 training complete
Cost on training data: 0.14467066031
Accuracy on training data: 9955 / 10000
Cost on evaluation data: 0.686616977973
Accuracy on evaluation data: 9279 / 10000

Epoch 62 training complete
Cost on training data: 0.143419747759
Accuracy on training data: 9957 / 10000

Cost on evaluation data: 0.687552082165
Accuracy on evaluation data: 9285 / 10000

Epoch 63 training complete
Cost on training data: 0.142473449927
Accuracy on training data: 9954 / 10000
Cost on evaluation data: 0.69723095407
Accuracy on evaluation data: 9290 / 10000

Epoch 64 training complete
Cost on training data: 0.140370061558
Accuracy on training data: 9957 / 10000
Cost on evaluation data: 0.690952974989
Accuracy on evaluation data: 9281 / 10000

Epoch 65 training complete
Cost on training data: 0.138503229923
Accuracy on training data: 9958 / 10000
Cost on evaluation data: 0.688736762351
Accuracy on evaluation data: 9279 / 10000

Epoch 66 training complete
Cost on training data: 0.140043783491
Accuracy on training data: 9957 / 10000
Cost on evaluation data: 0.692415574602
Accuracy on evaluation data: 9282 / 10000

Epoch 67 training complete
Cost on training data: 0.136993387232
Accuracy on training data: 9958 / 10000
Cost on evaluation data: 0.690343261579
Accuracy on evaluation data: 9273 / 10000

Epoch 68 training complete
Cost on training data: 0.135760163934
Accuracy on training data: 9960 / 10000
Cost on evaluation data: 0.687201905931
Accuracy on evaluation data: 9275 / 10000

Epoch 69 training complete
Cost on training data: 0.136339221631
Accuracy on training data: 9958 / 10000
Cost on evaluation data: 0.688556882094
Accuracy on evaluation data: 9283 / 10000

Epoch 70 training complete
Cost on training data: 0.133968501961
Accuracy on training data: 9960 / 10000

Cost on evaluation data: 0.69293031236
Accuracy on evaluation data: 9294 / 10000

Epoch 71 training complete
Cost on training data: 0.132906980756
Accuracy on training data: 9964 / 10000
Cost on evaluation data: 0.693616423555
Accuracy on evaluation data: 9286 / 10000

Epoch 72 training complete
Cost on training data: 0.131876616619
Accuracy on training data: 9964 / 10000
Cost on evaluation data: 0.69030686266
Accuracy on evaluation data: 9284 / 10000

Epoch 73 training complete
Cost on training data: 0.130440484615
Accuracy on training data: 9962 / 10000
Cost on evaluation data: 0.691947226337
Accuracy on evaluation data: 9288 / 10000

Epoch 74 training complete
Cost on training data: 0.129616999339
Accuracy on training data: 9962 / 10000
Cost on evaluation data: 0.694151938071
Accuracy on evaluation data: 9276 / 10000

Epoch 75 training complete
Cost on training data: 0.128509879717
Accuracy on training data: 9967 / 10000
Cost on evaluation data: 0.693414921807
Accuracy on evaluation data: 9282 / 10000

Epoch 76 training complete
Cost on training data: 0.127360905958
Accuracy on training data: 9964 / 10000
Cost on evaluation data: 0.692850745954
Accuracy on evaluation data: 9296 / 10000

Epoch 77 training complete
Cost on training data: 0.126748093427
Accuracy on training data: 9967 / 10000
Cost on evaluation data: 0.694302723451
Accuracy on evaluation data: 9296 / 10000

Epoch 78 training complete
Cost on training data: 0.126238491599
Accuracy on training data: 9962 / 10000

Cost on evaluation data: 0.69139343052
Accuracy on evaluation data: 9285 / 10000

Epoch 79 training complete
Cost on training data: 0.127248388202
Accuracy on training data: 9965 / 10000
Cost on evaluation data: 0.698555765534
Accuracy on evaluation data: 9273 / 10000

Epoch 80 training complete
Cost on training data: 0.124647853792
Accuracy on training data: 9969 / 10000
Cost on evaluation data: 0.693295175054
Accuracy on evaluation data: 9292 / 10000

Epoch 81 training complete
Cost on training data: 0.124776166638
Accuracy on training data: 9970 / 10000
Cost on evaluation data: 0.694043522338
Accuracy on evaluation data: 9288 / 10000

Epoch 82 training complete
Cost on training data: 0.122269484174
Accuracy on training data: 9970 / 10000
Cost on evaluation data: 0.69276346225
Accuracy on evaluation data: 9288 / 10000

Epoch 83 training complete
Cost on training data: 0.121647931269
Accuracy on training data: 9968 / 10000
Cost on evaluation data: 0.698990783466
Accuracy on evaluation data: 9288 / 10000

Epoch 84 training complete
Cost on training data: 0.119702769233
Accuracy on training data: 9972 / 10000
Cost on evaluation data: 0.692334197772
Accuracy on evaluation data: 9294 / 10000

Epoch 85 training complete
Cost on training data: 0.119733439677
Accuracy on training data: 9972 / 10000
Cost on evaluation data: 0.6936574686
Accuracy on evaluation data: 9286 / 10000

Epoch 86 training complete
Cost on training data: 0.118717512959
Accuracy on training data: 9973 / 10000

Cost on evaluation data: 0.691644198407
Accuracy on evaluation data: 9292 / 10000

Epoch 87 training complete
Cost on training data: 0.117726537404
Accuracy on training data: 9975 / 10000
Cost on evaluation data: 0.688281993184
Accuracy on evaluation data: 9301 / 10000

Epoch 88 training complete
Cost on training data: 0.116771830016
Accuracy on training data: 9974 / 10000
Cost on evaluation data: 0.693190594002
Accuracy on evaluation data: 9293 / 10000

Epoch 89 training complete
Cost on training data: 0.116426767965
Accuracy on training data: 9975 / 10000
Cost on evaluation data: 0.705205733705
Accuracy on evaluation data: 9294 / 10000

Epoch 90 training complete
Cost on training data: 0.119625707353
Accuracy on training data: 9972 / 10000
Cost on evaluation data: 0.691806200279
Accuracy on evaluation data: 9286 / 10000

Epoch 91 training complete
Cost on training data: 0.115052133891
Accuracy on training data: 9978 / 10000
Cost on evaluation data: 0.69638719423
Accuracy on evaluation data: 9297 / 10000

Epoch 92 training complete
Cost on training data: 0.112528728645
Accuracy on training data: 9973 / 10000
Cost on evaluation data: 0.689971011982
Accuracy on evaluation data: 9299 / 10000

Epoch 93 training complete
Cost on training data: 0.113136661543
Accuracy on training data: 9978 / 10000
Cost on evaluation data: 0.69947194093
Accuracy on evaluation data: 9295 / 10000

Epoch 94 training complete
Cost on training data: 0.112133285252
Accuracy on training data: 9980 / 10000

Cost on evaluation data: 0.693292190073
Accuracy on evaluation data: 9305 / 10000

Epoch 95 training complete
Cost on training data: 0.111476086412
Accuracy on training data: 9979 / 10000
Cost on evaluation data: 0.695004368671
Accuracy on evaluation data: 9293 / 10000

Epoch 96 training complete
Cost on training data: 0.110148298349
Accuracy on training data: 9979 / 10000
Cost on evaluation data: 0.69908002184
Accuracy on evaluation data: 9288 / 10000

Epoch 97 training complete
Cost on training data: 0.110544625462
Accuracy on training data: 9977 / 10000
Cost on evaluation data: 0.696317788908
Accuracy on evaluation data: 9294 / 10000

Epoch 98 training complete
Cost on training data: 0.109166087867
Accuracy on training data: 9982 / 10000
Cost on evaluation data: 0.690914121592
Accuracy on evaluation data: 9310 / 10000

Epoch 99 training complete
Cost on training data: 0.109102810881
Accuracy on training data: 9979 / 10000
Cost on evaluation data: 0.694414496065
Accuracy on evaluation data: 9289 / 10000

Epoch 100 training complete
Cost on training data: 0.112874553664
Accuracy on training data: 9973 / 10000
Cost on evaluation data: 0.686503795536
Accuracy on evaluation data: 9317 / 10000

Epoch 101 training complete
Cost on training data: 0.107501618325
Accuracy on training data: 9979 / 10000
Cost on evaluation data: 0.699010383044
Accuracy on evaluation data: 9304 / 10000

Epoch 102 training complete
Cost on training data: 0.106521618276
Accuracy on training data: 9983 / 10000

Cost on evaluation data: 0.69014354836
Accuracy on evaluation data: 9300 / 10000

Epoch 103 training complete
Cost on training data: 0.105267145673
Accuracy on training data: 9980 / 10000
Cost on evaluation data: 0.686411399772
Accuracy on evaluation data: 9305 / 10000

Epoch 104 training complete
Cost on training data: 0.104759599153
Accuracy on training data: 9981 / 10000
Cost on evaluation data: 0.700953279642
Accuracy on evaluation data: 9296 / 10000

Epoch 105 training complete
Cost on training data: 0.105375861396
Accuracy on training data: 9981 / 10000
Cost on evaluation data: 0.693401045683
Accuracy on evaluation data: 9282 / 10000

Epoch 106 training complete
Cost on training data: 0.103862378119
Accuracy on training data: 9980 / 10000
Cost on evaluation data: 0.685984353242
Accuracy on evaluation data: 9298 / 10000

Epoch 107 training complete
Cost on training data: 0.102889143369
Accuracy on training data: 9985 / 10000
Cost on evaluation data: 0.686790640348
Accuracy on evaluation data: 9305 / 10000

Epoch 108 training complete
Cost on training data: 0.102340347041
Accuracy on training data: 9982 / 10000
Cost on evaluation data: 0.689199860087
Accuracy on evaluation data: 9299 / 10000

Epoch 109 training complete
Cost on training data: 0.101238095804
Accuracy on training data: 9982 / 10000
Cost on evaluation data: 0.692197905498
Accuracy on evaluation data: 9299 / 10000

Epoch 110 training complete
Cost on training data: 0.100683344425
Accuracy on training data: 9983 / 10000

Cost on evaluation data: 0.690580963264
Accuracy on evaluation data: 9291 / 10000

Epoch 111 training complete
Cost on training data: 0.101119399774
Accuracy on training data: 9983 / 10000
Cost on evaluation data: 0.692517276251
Accuracy on evaluation data: 9304 / 10000

Epoch 112 training complete
Cost on training data: 0.0995870194509
Accuracy on training data: 9984 / 10000
Cost on evaluation data: 0.685800216057
Accuracy on evaluation data: 9305 / 10000

Epoch 113 training complete
Cost on training data: 0.0988203414388
Accuracy on training data: 9984 / 10000
Cost on evaluation data: 0.687767169837
Accuracy on evaluation data: 9314 / 10000

Epoch 114 training complete
Cost on training data: 0.0992456904425
Accuracy on training data: 9983 / 10000
Cost on evaluation data: 0.684973141025
Accuracy on evaluation data: 9310 / 10000

Epoch 115 training complete
Cost on training data: 0.0977769356038
Accuracy on training data: 9984 / 10000
Cost on evaluation data: 0.691736063409
Accuracy on evaluation data: 9302 / 10000

Epoch 116 training complete
Cost on training data: 0.0971422795968
Accuracy on training data: 9983 / 10000
Cost on evaluation data: 0.686034292848
Accuracy on evaluation data: 9297 / 10000

Epoch 117 training complete
Cost on training data: 0.098708721754
Accuracy on training data: 9981 / 10000
Cost on evaluation data: 0.702370206786
Accuracy on evaluation data: 9296 / 10000

Epoch 118 training complete
Cost on training data: 0.0959360111607
Accuracy on training data: 9984 / 10000

Cost on evaluation data: 0.687334263738
Accuracy on evaluation data: 9306 / 10000

Epoch 119 training complete
Cost on training data: 0.0947368448461
Accuracy on training data: 9983 / 10000
Cost on evaluation data: 0.688505567307
Accuracy on evaluation data: 9299 / 10000

Epoch 120 training complete
Cost on training data: 0.0951924259681
Accuracy on training data: 9985 / 10000
Cost on evaluation data: 0.688622574953
Accuracy on evaluation data: 9298 / 10000

Epoch 121 training complete
Cost on training data: 0.0953351096496
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.692977649748
Accuracy on evaluation data: 9294 / 10000

Epoch 122 training complete
Cost on training data: 0.0948892171307
Accuracy on training data: 9983 / 10000
Cost on evaluation data: 0.685417711
Accuracy on evaluation data: 9307 / 10000

Epoch 123 training complete
Cost on training data: 0.0924234008097
Accuracy on training data: 9985 / 10000
Cost on evaluation data: 0.685073130073
Accuracy on evaluation data: 9308 / 10000

Epoch 124 training complete
Cost on training data: 0.0938835263503
Accuracy on training data: 9986 / 10000
Cost on evaluation data: 0.690005386802
Accuracy on evaluation data: 9300 / 10000

Epoch 125 training complete
Cost on training data: 0.0918947141239
Accuracy on training data: 9986 / 10000
Cost on evaluation data: 0.685289532466
Accuracy on evaluation data: 9316 / 10000

Epoch 126 training complete
Cost on training data: 0.0907435921839
Accuracy on training data: 9987 / 10000

Cost on evaluation data: 0.690078293463
Accuracy on evaluation data: 9300 / 10000

Epoch 127 training complete
Cost on training data: 0.0905045105574
Accuracy on training data: 9985 / 10000
Cost on evaluation data: 0.689506531408
Accuracy on evaluation data: 9304 / 10000

Epoch 128 training complete
Cost on training data: 0.0904523181743
Accuracy on training data: 9986 / 10000
Cost on evaluation data: 0.685248458523
Accuracy on evaluation data: 9310 / 10000

Epoch 129 training complete
Cost on training data: 0.0891681459967
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.688975525291
Accuracy on evaluation data: 9305 / 10000

Epoch 130 training complete
Cost on training data: 0.0881300914444
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.688249750904
Accuracy on evaluation data: 9312 / 10000

Epoch 131 training complete
Cost on training data: 0.0879039354836
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.686927269841
Accuracy on evaluation data: 9307 / 10000

Epoch 132 training complete
Cost on training data: 0.0901291684919
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.689488024501
Accuracy on evaluation data: 9300 / 10000

Epoch 133 training complete
Cost on training data: 0.0892604461213
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.691909732311
Accuracy on evaluation data: 9303 / 10000

Epoch 134 training complete
Cost on training data: 0.0865598170227
Accuracy on training data: 9988 / 10000

Cost on evaluation data: 0.6878611441
Accuracy on evaluation data: 9306 / 10000

Epoch 135 training complete
Cost on training data: 0.0866399592137
Accuracy on training data: 9988 / 10000
Cost on evaluation data: 0.682154163205
Accuracy on evaluation data: 9317 / 10000

Epoch 136 training complete
Cost on training data: 0.0850849227827
Accuracy on training data: 9988 / 10000
Cost on evaluation data: 0.686403620279
Accuracy on evaluation data: 9316 / 10000

Epoch 137 training complete
Cost on training data: 0.08657470273
Accuracy on training data: 9989 / 10000
Cost on evaluation data: 0.705031532847
Accuracy on evaluation data: 9276 / 10000

Epoch 138 training complete
Cost on training data: 0.0849701861285
Accuracy on training data: 9989 / 10000
Cost on evaluation data: 0.68664435131
Accuracy on evaluation data: 9312 / 10000

Epoch 139 training complete
Cost on training data: 0.0848954323471
Accuracy on training data: 9989 / 10000
Cost on evaluation data: 0.682786846494
Accuracy on evaluation data: 9317 / 10000

Epoch 140 training complete
Cost on training data: 0.0842417111201
Accuracy on training data: 9988 / 10000
Cost on evaluation data: 0.686553092257
Accuracy on evaluation data: 9297 / 10000

Epoch 141 training complete
Cost on training data: 0.084012170065
Accuracy on training data: 9988 / 10000
Cost on evaluation data: 0.69343699595
Accuracy on evaluation data: 9301 / 10000

Epoch 142 training complete
Cost on training data: 0.0825944457131
Accuracy on training data: 9989 / 10000

Cost on evaluation data: 0.689820039477
Accuracy on evaluation data: 9304 / 10000

Epoch 143 training complete
Cost on training data: 0.0818244255963
Accuracy on training data: 9989 / 10000
Cost on evaluation data: 0.681205232169
Accuracy on evaluation data: 9305 / 10000

Epoch 144 training complete
Cost on training data: 0.0830152058321
Accuracy on training data: 9987 / 10000
Cost on evaluation data: 0.676522170498
Accuracy on evaluation data: 9319 / 10000

Epoch 145 training complete
Cost on training data: 0.081180755907
Accuracy on training data: 9989 / 10000
Cost on evaluation data: 0.67826884494
Accuracy on evaluation data: 9315 / 10000

Epoch 146 training complete
Cost on training data: 0.0811411446097
Accuracy on training data: 9989 / 10000
Cost on evaluation data: 0.682009003411
Accuracy on evaluation data: 9321 / 10000

Epoch 147 training complete
Cost on training data: 0.0813766477471
Accuracy on training data: 9990 / 10000
Cost on evaluation data: 0.679970176103
Accuracy on evaluation data: 9303 / 10000

Epoch 148 training complete
Cost on training data: 0.08125335918
Accuracy on training data: 9990 / 10000
Cost on evaluation data: 0.684488153515
Accuracy on evaluation data: 9296 / 10000

Epoch 149 training complete
Cost on training data: 0.0797600619146
Accuracy on training data: 9990 / 10000
Cost on evaluation data: 0.682165446587
Accuracy on evaluation data: 9311 / 10000

Epoch 150 training complete
Cost on training data: 0.0792337653301
Accuracy on training data: 9991 / 10000

Cost on evaluation data: 0.680130373407
Accuracy on evaluation data: 9314 / 10000

Epoch 151 training complete
Cost on training data: 0.0790688640605
Accuracy on training data: 9991 / 10000
Cost on evaluation data: 0.680693173299
Accuracy on evaluation data: 9315 / 10000

Epoch 152 training complete
Cost on training data: 0.0785312336334
Accuracy on training data: 9991 / 10000
Cost on evaluation data: 0.671668865852
Accuracy on evaluation data: 9322 / 10000

Epoch 153 training complete
Cost on training data: 0.0802673223025
Accuracy on training data: 9990 / 10000
Cost on evaluation data: 0.67772254589
Accuracy on evaluation data: 9313 / 10000

Epoch 154 training complete
Cost on training data: 0.0786882444554
Accuracy on training data: 9991 / 10000
Cost on evaluation data: 0.681917760555
Accuracy on evaluation data: 9326 / 10000

Epoch 155 training complete
Cost on training data: 0.0785967658758
Accuracy on training data: 9991 / 10000
Cost on evaluation data: 0.680181499679
Accuracy on evaluation data: 9325 / 10000

Epoch 156 training complete
Cost on training data: 0.0769677070327
Accuracy on training data: 9990 / 10000
Cost on evaluation data: 0.6746249825
Accuracy on evaluation data: 9320 / 10000

Epoch 157 training complete
Cost on training data: 0.0764727421747
Accuracy on training data: 9992 / 10000
Cost on evaluation data: 0.680713593231
Accuracy on evaluation data: 9314 / 10000

Epoch 158 training complete
Cost on training data: 0.0765994132747
Accuracy on training data: 9991 / 10000

Cost on evaluation data: 0.679726429514
Accuracy on evaluation data: 9319 / 10000

Epoch 159 training complete
Cost on training data: 0.0758254587803
Accuracy on training data: 9991 / 10000
Cost on evaluation data: 0.670413134341
Accuracy on evaluation data: 9324 / 10000

Epoch 160 training complete
Cost on training data: 0.0758470655948
Accuracy on training data: 9992 / 10000
Cost on evaluation data: 0.680638342003
Accuracy on evaluation data: 9305 / 10000

Epoch 161 training complete
Cost on training data: 0.0757546575342
Accuracy on training data: 9992 / 10000
Cost on evaluation data: 0.682492128572
Accuracy on evaluation data: 9310 / 10000

Epoch 162 training complete
Cost on training data: 0.0746830907046
Accuracy on training data: 9992 / 10000
Cost on evaluation data: 0.678752073847
Accuracy on evaluation data: 9322 / 10000

Epoch 163 training complete
Cost on training data: 0.0739877810111
Accuracy on training data: 9993 / 10000
Cost on evaluation data: 0.673706802922
Accuracy on evaluation data: 9332 / 10000

Epoch 164 training complete
Cost on training data: 0.0739760065691
Accuracy on training data: 9993 / 10000
Cost on evaluation data: 0.67523456787
Accuracy on evaluation data: 9319 / 10000

Epoch 165 training complete
Cost on training data: 0.0744299354503
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.676022121197
Accuracy on evaluation data: 9314 / 10000

Epoch 166 training complete
Cost on training data: 0.0728298275962
Accuracy on training data: 9993 / 10000

Cost on evaluation data: 0.679716297183
Accuracy on evaluation data: 9318 / 10000

Epoch 167 training complete
Cost on training data: 0.0725569118654
Accuracy on training data: 9994 / 10000
Cost on evaluation data: 0.673497031046
Accuracy on evaluation data: 9320 / 10000

Epoch 168 training complete
Cost on training data: 0.0723919745099
Accuracy on training data: 9993 / 10000
Cost on evaluation data: 0.674329326664
Accuracy on evaluation data: 9322 / 10000

Epoch 169 training complete
Cost on training data: 0.0726965021934
Accuracy on training data: 9994 / 10000
Cost on evaluation data: 0.68053369127
Accuracy on evaluation data: 9317 / 10000

Epoch 170 training complete
Cost on training data: 0.0720194451227
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.670996912837
Accuracy on evaluation data: 9318 / 10000

Epoch 171 training complete
Cost on training data: 0.0713957621188
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.677782956497
Accuracy on evaluation data: 9320 / 10000

Epoch 172 training complete
Cost on training data: 0.0713855744093
Accuracy on training data: 9994 / 10000
Cost on evaluation data: 0.674655874856
Accuracy on evaluation data: 9317 / 10000

Epoch 173 training complete
Cost on training data: 0.0711430681229
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.675581827361
Accuracy on evaluation data: 9329 / 10000

Epoch 174 training complete
Cost on training data: 0.0707411669977
Accuracy on training data: 9996 / 10000

Cost on evaluation data: 0.670259181616
Accuracy on evaluation data: 9330 / 10000

Epoch 175 training complete
Cost on training data: 0.0704498985711
Accuracy on training data: 9996 / 10000
Cost on evaluation data: 0.669162687428
Accuracy on evaluation data: 9320 / 10000

Epoch 176 training complete
Cost on training data: 0.0700831194216
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.674244159322
Accuracy on evaluation data: 9324 / 10000

Epoch 177 training complete
Cost on training data: 0.0730965429863
Accuracy on training data: 9991 / 10000
Cost on evaluation data: 0.673436754442
Accuracy on evaluation data: 9316 / 10000

Epoch 178 training complete
Cost on training data: 0.0698043790409
Accuracy on training data: 9996 / 10000
Cost on evaluation data: 0.668857899748
Accuracy on evaluation data: 9336 / 10000

Epoch 179 training complete
Cost on training data: 0.0683634022742
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.672678917359
Accuracy on evaluation data: 9322 / 10000

Epoch 180 training complete
Cost on training data: 0.0690697732096
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.672898306717
Accuracy on evaluation data: 9343 / 10000

Epoch 181 training complete
Cost on training data: 0.0684022859808
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.669472229398
Accuracy on evaluation data: 9327 / 10000

Epoch 182 training complete
Cost on training data: 0.0678832254275
Accuracy on training data: 9996 / 10000

Cost on evaluation data: 0.669868611373
Accuracy on evaluation data: 9330 / 10000

Epoch 183 training complete
Cost on training data: 0.0675516650193
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.668983545275
Accuracy on evaluation data: 9340 / 10000

Epoch 184 training complete
Cost on training data: 0.0671011921687
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.671551517666
Accuracy on evaluation data: 9323 / 10000

Epoch 185 training complete
Cost on training data: 0.0701565666136
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.682646060797
Accuracy on evaluation data: 9314 / 10000

Epoch 186 training complete
Cost on training data: 0.199776310262
Accuracy on training data: 9821 / 10000
Cost on evaluation data: 0.845524775458
Accuracy on evaluation data: 9137 / 10000

Epoch 187 training complete
Cost on training data: 0.101525830146
Accuracy on training data: 9960 / 10000
Cost on evaluation data: 0.706544065228
Accuracy on evaluation data: 9292 / 10000

Epoch 188 training complete
Cost on training data: 0.0830817755515
Accuracy on training data: 9990 / 10000
Cost on evaluation data: 0.687883707867
Accuracy on evaluation data: 9310 / 10000

Epoch 189 training complete
Cost on training data: 0.138959724612
Accuracy on training data: 9926 / 10000
Cost on evaluation data: 0.732542315763
Accuracy on evaluation data: 9252 / 10000

Epoch 190 training complete
Cost on training data: 0.079096749378
Accuracy on training data: 9995 / 10000

Cost on evaluation data: 0.671977367162
Accuracy on evaluation data: 9334 / 10000

Epoch 191 training complete
Cost on training data: 0.070050185845
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.66800813494
Accuracy on evaluation data: 9322 / 10000

Epoch 192 training complete
Cost on training data: 0.0683026496346
Accuracy on training data: 9996 / 10000
Cost on evaluation data: 0.666102841909
Accuracy on evaluation data: 9316 / 10000

Epoch 193 training complete
Cost on training data: 0.06695993351
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.672725360969
Accuracy on evaluation data: 9331 / 10000

Epoch 194 training complete
Cost on training data: 0.065847938853
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.662236004512
Accuracy on evaluation data: 9339 / 10000

Epoch 195 training complete
Cost on training data: 0.0662302829553
Accuracy on training data: 9996 / 10000
Cost on evaluation data: 0.659046906743
Accuracy on evaluation data: 9336 / 10000

Epoch 196 training complete
Cost on training data: 0.0661201080907
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.663055963734
Accuracy on evaluation data: 9336 / 10000

Epoch 197 training complete
Cost on training data: 0.0649735454429
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.671549033589
Accuracy on evaluation data: 9339 / 10000

Epoch 198 training complete
Cost on training data: 0.0645385254979
Accuracy on training data: 9997 / 10000

Cost on evaluation data: 0.658792055731
Accuracy on evaluation data: 9345 / 10000

Epoch 199 training complete
Cost on training data: 0.0645483882405
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.660645778144
Accuracy on evaluation data: 9331 / 10000

Epoch 200 training complete
Cost on training data: 0.0642385016916
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.657621085173
Accuracy on evaluation data: 9346 / 10000

Epoch 201 training complete
Cost on training data: 0.0636733039217
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.659859536933
Accuracy on evaluation data: 9337 / 10000

Epoch 202 training complete
Cost on training data: 0.0633646251723
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.655032722323
Accuracy on evaluation data: 9346 / 10000

Epoch 203 training complete
Cost on training data: 0.0634738459505
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.663755437702
Accuracy on evaluation data: 9344 / 10000

Epoch 204 training complete
Cost on training data: 0.0641025126796
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.661695388689
Accuracy on evaluation data: 9344 / 10000

Epoch 205 training complete
Cost on training data: 0.0630910150726
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.664975057118
Accuracy on evaluation data: 9336 / 10000

Epoch 206 training complete
Cost on training data: 0.062535256056
Accuracy on training data: 9998 / 10000

Cost on evaluation data: 0.657557110075
Accuracy on evaluation data: 9337 / 10000

Epoch 207 training complete
Cost on training data: 0.0622746549826
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.65789702535
Accuracy on evaluation data: 9342 / 10000

Epoch 208 training complete
Cost on training data: 0.0620040394863
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.656363597833
Accuracy on evaluation data: 9339 / 10000

Epoch 209 training complete
Cost on training data: 0.0616737036914
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.657573852185
Accuracy on evaluation data: 9331 / 10000

Epoch 210 training complete
Cost on training data: 0.0615276734577
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.652319500855
Accuracy on evaluation data: 9342 / 10000

Epoch 211 training complete
Cost on training data: 0.0621059282163
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.660436122169
Accuracy on evaluation data: 9339 / 10000

Epoch 212 training complete
Cost on training data: 0.0612456919955
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.656417357708
Accuracy on evaluation data: 9345 / 10000

Epoch 213 training complete
Cost on training data: 0.0612269313056
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.647161570113
Accuracy on evaluation data: 9349 / 10000

Epoch 214 training complete
Cost on training data: 0.0606766111004
Accuracy on training data: 9998 / 10000

Cost on evaluation data: 0.6545714673
Accuracy on evaluation data: 9349 / 10000

Epoch 215 training complete
Cost on training data: 0.0609713132575
Accuracy on training data: 9997 / 10000
Cost on evaluation data: 0.656613290322
Accuracy on evaluation data: 9339 / 10000

Epoch 216 training complete
Cost on training data: 0.0601214816279
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.651326975522
Accuracy on evaluation data: 9348 / 10000

Epoch 217 training complete
Cost on training data: 0.0601918748268
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.652071489793
Accuracy on evaluation data: 9341 / 10000

Epoch 218 training complete
Cost on training data: 0.0599261509177
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.648761825528
Accuracy on evaluation data: 9340 / 10000

Epoch 219 training complete
Cost on training data: 0.059738490076
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.646961632677
Accuracy on evaluation data: 9342 / 10000

Epoch 220 training complete
Cost on training data: 0.0654012483529
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.651219893956
Accuracy on evaluation data: 9342 / 10000

Epoch 221 training complete
Cost on training data: 0.0595287676249
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.648635710988
Accuracy on evaluation data: 9340 / 10000

Epoch 222 training complete
Cost on training data: 0.0591655494188
Accuracy on training data: 9999 / 10000

Cost on evaluation data: 0.646204876814
Accuracy on evaluation data: 9342 / 10000

Epoch 223 training complete
Cost on training data: 0.0586355825234
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.647961297891
Accuracy on evaluation data: 9343 / 10000

Epoch 224 training complete
Cost on training data: 0.0585658179187
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.646664509148
Accuracy on evaluation data: 9356 / 10000

Epoch 225 training complete
Cost on training data: 0.058508938061
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.646714328649
Accuracy on evaluation data: 9343 / 10000

Epoch 226 training complete
Cost on training data: 0.0586487432941
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.646442001659
Accuracy on evaluation data: 9340 / 10000

Epoch 227 training complete
Cost on training data: 0.059614998853
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.656954970463
Accuracy on evaluation data: 9329 / 10000

Epoch 228 training complete
Cost on training data: 0.0576839147443
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.643066012114
Accuracy on evaluation data: 9356 / 10000

Epoch 229 training complete
Cost on training data: 0.0577917421604
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.647562907505
Accuracy on evaluation data: 9348 / 10000

Epoch 230 training complete
Cost on training data: 0.0572011051845
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.637097585427
Accuracy on evaluation data: 9350 / 10000

Epoch 231 training complete
Cost on training data: 0.0580672493307
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.638992871996
Accuracy on evaluation data: 9354 / 10000

Epoch 232 training complete
Cost on training data: 0.0573308001341
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.63953324073
Accuracy on evaluation data: 9354 / 10000

Epoch 233 training complete
Cost on training data: 0.0568228443792
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.644563418465
Accuracy on evaluation data: 9363 / 10000

Epoch 234 training complete
Cost on training data: 0.0619370049344
Accuracy on training data: 9998 / 10000
Cost on evaluation data: 0.654400807684
Accuracy on evaluation data: 9334 / 10000

Epoch 235 training complete
Cost on training data: 0.0573058111021
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.645494916762
Accuracy on evaluation data: 9345 / 10000

Epoch 236 training complete
Cost on training data: 0.0566956914772
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.646790618405
Accuracy on evaluation data: 9348 / 10000

Epoch 237 training complete
Cost on training data: 0.0563267209846
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.638686617844
Accuracy on evaluation data: 9358 / 10000

Epoch 238 training complete
Cost on training data: 0.0558033069811
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.637246433866
Accuracy on evaluation data: 9355 / 10000

Epoch 239 training complete
Cost on training data: 0.0561797217411
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.639343168295
Accuracy on evaluation data: 9343 / 10000

Epoch 240 training complete
Cost on training data: 0.0559792784836
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.637395727114
Accuracy on evaluation data: 9345 / 10000

Epoch 241 training complete
Cost on training data: 0.0555896167778
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.636888596621
Accuracy on evaluation data: 9351 / 10000

Epoch 242 training complete
Cost on training data: 0.0554846456507
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.63762513183
Accuracy on evaluation data: 9347 / 10000

Epoch 243 training complete
Cost on training data: 0.0554224434574
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.633330490149
Accuracy on evaluation data: 9360 / 10000

Epoch 244 training complete
Cost on training data: 0.0558125131407
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.643414211117
Accuracy on evaluation data: 9336 / 10000

Epoch 245 training complete
Cost on training data: 0.0552757801412
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.634270892153
Accuracy on evaluation data: 9357 / 10000

Epoch 246 training complete
Cost on training data: 0.0549570857907
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.631276479821
Accuracy on evaluation data: 9364 / 10000

Epoch 247 training complete
Cost on training data: 0.0550727412383
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.634998904774
Accuracy on evaluation data: 9341 / 10000

Epoch 248 training complete
Cost on training data: 0.0549573529767
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.638033959665
Accuracy on evaluation data: 9348 / 10000

Epoch 249 training complete
Cost on training data: 0.0549877051147
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.639352088609
Accuracy on evaluation data: 9342 / 10000

Epoch 250 training complete
Cost on training data: 0.0548281397956
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.635950514505
Accuracy on evaluation data: 9350 / 10000

Epoch 251 training complete
Cost on training data: 0.0545597133909
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.630157609761
Accuracy on evaluation data: 9351 / 10000

Epoch 252 training complete
Cost on training data: 0.0539287806179
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.627978106508
Accuracy on evaluation data: 9345 / 10000

Epoch 253 training complete
Cost on training data: 0.0537820476061
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.629891389183
Accuracy on evaluation data: 9352 / 10000

Epoch 254 training complete
Cost on training data: 0.0539150749149
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.636313587234
Accuracy on evaluation data: 9341 / 10000

Epoch 255 training complete
Cost on training data: 0.0541591636383
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.6348263953
Accuracy on evaluation data: 9358 / 10000

Epoch 256 training complete
Cost on training data: 0.0537610242713
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.630222328223
Accuracy on evaluation data: 9345 / 10000

Epoch 257 training complete
Cost on training data: 0.0535169488164
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.631699533134
Accuracy on evaluation data: 9344 / 10000

Epoch 258 training complete
Cost on training data: 0.0531685669474
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.625392816321
Accuracy on evaluation data: 9355 / 10000

Epoch 259 training complete
Cost on training data: 0.0530519877024
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.624733802402
Accuracy on evaluation data: 9345 / 10000

Epoch 260 training complete
Cost on training data: 0.0527099158468
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.627816397633
Accuracy on evaluation data: 9352 / 10000

Epoch 261 training complete
Cost on training data: 0.0526971269523
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.62232425237
Accuracy on evaluation data: 9355 / 10000

Epoch 262 training complete
Cost on training data: 0.0531383317316
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.635676115048
Accuracy on evaluation data: 9354 / 10000

Epoch 263 training complete
Cost on training data: 0.0545793861537
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.636854561237
Accuracy on evaluation data: 9348 / 10000

Epoch 264 training complete
Cost on training data: 0.052874005029
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.62943957757
Accuracy on evaluation data: 9337 / 10000

Epoch 265 training complete
Cost on training data: 0.0524299165603
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.627563804301
Accuracy on evaluation data: 9351 / 10000

Epoch 266 training complete
Cost on training data: 0.0523559417251
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.621907164958
Accuracy on evaluation data: 9360 / 10000

Epoch 267 training complete
Cost on training data: 0.0530733415675
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.628788989129
Accuracy on evaluation data: 9351 / 10000

Epoch 268 training complete
Cost on training data: 0.0522939166164
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.625540732271
Accuracy on evaluation data: 9340 / 10000

Epoch 269 training complete
Cost on training data: 0.0518993966415
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.627715027908
Accuracy on evaluation data: 9351 / 10000

Epoch 270 training complete
Cost on training data: 0.0518577037518
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.629416352136
Accuracy on evaluation data: 9350 / 10000

Epoch 271 training complete
Cost on training data: 0.0519989484442
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.617552405933
Accuracy on evaluation data: 9348 / 10000

Epoch 272 training complete
Cost on training data: 0.0517950715145
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.623429938323
Accuracy on evaluation data: 9359 / 10000

Epoch 273 training complete
Cost on training data: 0.0518962019463
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.629347299554
Accuracy on evaluation data: 9349 / 10000

Epoch 274 training complete
Cost on training data: 0.0513852846362
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.616598146328
Accuracy on evaluation data: 9355 / 10000

Epoch 275 training complete
Cost on training data: 0.0510689990975
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.619437203491
Accuracy on evaluation data: 9363 / 10000

Epoch 276 training complete
Cost on training data: 0.0511845623614
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.62058465971
Accuracy on evaluation data: 9362 / 10000

Epoch 277 training complete
Cost on training data: 0.0516869260258
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.626045037571
Accuracy on evaluation data: 9344 / 10000

Epoch 278 training complete
Cost on training data: 0.0508328466923
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.62101768003
Accuracy on evaluation data: 9348 / 10000

Epoch 279 training complete
Cost on training data: 0.051582618956
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.618272020664
Accuracy on evaluation data: 9364 / 10000

Epoch 280 training complete
Cost on training data: 0.0510650476346
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.621295208311
Accuracy on evaluation data: 9361 / 10000

Epoch 281 training complete
Cost on training data: 0.0510809832544
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.617933494421
Accuracy on evaluation data: 9353 / 10000

Epoch 282 training complete
Cost on training data: 0.0509939101779
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.617464855359
Accuracy on evaluation data: 9352 / 10000

Epoch 283 training complete
Cost on training data: 0.0508971165721
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.615106540702
Accuracy on evaluation data: 9360 / 10000

Epoch 284 training complete
Cost on training data: 0.0505596477629
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.619908065811
Accuracy on evaluation data: 9353 / 10000

Epoch 285 training complete
Cost on training data: 0.0504631617134
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.616094775497
Accuracy on evaluation data: 9356 / 10000

Epoch 286 training complete
Cost on training data: 0.050317528562
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.615323249438
Accuracy on evaluation data: 9353 / 10000

Epoch 287 training complete
Cost on training data: 0.0503041263956
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.618260111172
Accuracy on evaluation data: 9352 / 10000

Epoch 288 training complete
Cost on training data: 0.0501104229682
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.617787655013
Accuracy on evaluation data: 9341 / 10000

Epoch 289 training complete
Cost on training data: 0.0496373912155
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.615821835336
Accuracy on evaluation data: 9361 / 10000

Epoch 290 training complete
Cost on training data: 0.0498720188254
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.61249783901
Accuracy on evaluation data: 9357 / 10000

Epoch 291 training complete
Cost on training data: 0.0502241531081
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.618282936603
Accuracy on evaluation data: 9350 / 10000

Epoch 292 training complete
Cost on training data: 0.0499301754989
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.61494970705
Accuracy on evaluation data: 9354 / 10000

Epoch 293 training complete
Cost on training data: 0.0497127236196
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.620279419838
Accuracy on evaluation data: 9357 / 10000

Epoch 294 training complete
Cost on training data: 0.0496713880196
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.610421391309
Accuracy on evaluation data: 9361 / 10000

Epoch 295 training complete
Cost on training data: 0.04975822177
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.614482917175
Accuracy on evaluation data: 9371 / 10000

Epoch 296 training complete
Cost on training data: 0.0492332109239
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.611719131975
Accuracy on evaluation data: 9361 / 10000

Epoch 297 training complete
Cost on training data: 0.0492976448381
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.610857074985
Accuracy on evaluation data: 9368 / 10000

Epoch 298 training complete
Cost on training data: 0.0491511290865
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.614241865303
Accuracy on evaluation data: 9365 / 10000

Epoch 299 training complete
Cost on training data: 0.0492957023596
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.615245992907
Accuracy on evaluation data: 9369 / 10000

Epoch 300 training complete
Cost on training data: 0.0491738947505
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.618576073636
Accuracy on evaluation data: 9342 / 10000

Epoch 301 training complete
Cost on training data: 0.0495193889174
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.615138353601
Accuracy on evaluation data: 9364 / 10000

Epoch 302 training complete
Cost on training data: 0.0498946663676
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.61777343938
Accuracy on evaluation data: 9351 / 10000

Epoch 303 training complete
Cost on training data: 0.0485649360727
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.613273958636
Accuracy on evaluation data: 9366 / 10000

Epoch 304 training complete
Cost on training data: 0.0486575417232
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.610688121733
Accuracy on evaluation data: 9351 / 10000

Epoch 305 training complete
Cost on training data: 0.103896909128
Accuracy on training data: 9951 / 10000
Cost on evaluation data: 0.689792049356
Accuracy on evaluation data: 9260 / 10000

Epoch 306 training complete
Cost on training data: 0.189236983114
Accuracy on training data: 9822 / 10000
Cost on evaluation data: 0.733559004734
Accuracy on evaluation data: 9210 / 10000

Epoch 307 training complete
Cost on training data: 0.176003451416
Accuracy on training data: 9842 / 10000
Cost on evaluation data: 0.684298597124
Accuracy on evaluation data: 9257 / 10000

Epoch 308 training complete
Cost on training data: 0.242133666064
Accuracy on training data: 9751 / 10000
Cost on evaluation data: 0.753241567095
Accuracy on evaluation data: 9197 / 10000

Epoch 309 training complete
Cost on training data: 0.15556942856
Accuracy on training data: 9883 / 10000
Cost on evaluation data: 0.67705769794
Accuracy on evaluation data: 9285 / 10000

Epoch 310 training complete
Cost on training data: 0.083219462035
Accuracy on training data: 9974 / 10000

Cost on evaluation data: 0.662112710604
Accuracy on evaluation data: 9318 / 10000

Epoch 311 training complete
Cost on training data: 0.0646261668217
Accuracy on training data: 9995 / 10000
Cost on evaluation data: 0.628140485262
Accuracy on evaluation data: 9344 / 10000

Epoch 312 training complete
Cost on training data: 0.0676193945944
Accuracy on training data: 9992 / 10000
Cost on evaluation data: 0.650710108265
Accuracy on evaluation data: 9330 / 10000

Epoch 313 training complete
Cost on training data: 0.0566843604312
Accuracy on training data: 9999 / 10000
Cost on evaluation data: 0.615916527393
Accuracy on evaluation data: 9353 / 10000

Epoch 314 training complete
Cost on training data: 0.0552431841851
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.62351890745
Accuracy on evaluation data: 9362 / 10000

Epoch 315 training complete
Cost on training data: 0.0536599714753
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.6159543968
Accuracy on evaluation data: 9375 / 10000

Epoch 316 training complete
Cost on training data: 0.053281740322
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.621726673609
Accuracy on evaluation data: 9375 / 10000

Epoch 317 training complete
Cost on training data: 0.0529596495138
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.625736907855
Accuracy on evaluation data: 9371 / 10000

Epoch 318 training complete
Cost on training data: 0.0522751866262
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.61899841324
Accuracy on evaluation data: 9367 / 10000

Epoch 319 training complete
Cost on training data: 0.0519666206346
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.621039145158
Accuracy on evaluation data: 9367 / 10000

Epoch 320 training complete
Cost on training data: 0.0519990243375
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.614360972111
Accuracy on evaluation data: 9370 / 10000

Epoch 321 training complete
Cost on training data: 0.0513215030903
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.618943211104
Accuracy on evaluation data: 9375 / 10000

Epoch 322 training complete
Cost on training data: 0.0510965619521
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.617597854426
Accuracy on evaluation data: 9364 / 10000

Epoch 323 training complete
Cost on training data: 0.0508594493202
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.621954257029
Accuracy on evaluation data: 9372 / 10000

Epoch 324 training complete
Cost on training data: 0.0505892516774
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.617264414572
Accuracy on evaluation data: 9367 / 10000

Epoch 325 training complete
Cost on training data: 0.0503365289872
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.615246392266
Accuracy on evaluation data: 9369 / 10000

Epoch 326 training complete
Cost on training data: 0.0502173612546
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.615812227891
Accuracy on evaluation data: 9363 / 10000

Epoch 327 training complete
Cost on training data: 0.0499005282244
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.616906857779
Accuracy on evaluation data: 9371 / 10000

Epoch 328 training complete
Cost on training data: 0.0497197865651
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.616347994868
Accuracy on evaluation data: 9369 / 10000

Epoch 329 training complete
Cost on training data: 0.0495942470946
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.611175102965
Accuracy on evaluation data: 9368 / 10000

Epoch 330 training complete
Cost on training data: 0.0494998452121
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.618878857524
Accuracy on evaluation data: 9377 / 10000

Epoch 331 training complete
Cost on training data: 0.0492822748266
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.612558484536
Accuracy on evaluation data: 9379 / 10000

Epoch 332 training complete
Cost on training data: 0.0492663593773
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.6164345836
Accuracy on evaluation data: 9369 / 10000

Epoch 333 training complete
Cost on training data: 0.049042046337
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.612722303489
Accuracy on evaluation data: 9365 / 10000

Epoch 334 training complete
Cost on training data: 0.0488225597555
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.615751536687
Accuracy on evaluation data: 9370 / 10000

Epoch 335 training complete
Cost on training data: 0.0485620688239
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.610204637045
Accuracy on evaluation data: 9366 / 10000

Epoch 336 training complete
Cost on training data: 0.048752328361
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.605900299035
Accuracy on evaluation data: 9375 / 10000

Epoch 337 training complete
Cost on training data: 0.0488182742629
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.610144738554
Accuracy on evaluation data: 9357 / 10000

Epoch 338 training complete
Cost on training data: 0.0483720517391
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.60916798968
Accuracy on evaluation data: 9364 / 10000

Epoch 339 training complete
Cost on training data: 0.0482189686254
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.60859802498
Accuracy on evaluation data: 9380 / 10000

Epoch 340 training complete
Cost on training data: 0.0482149754724
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.604508978899
Accuracy on evaluation data: 9374 / 10000

Epoch 341 training complete
Cost on training data: 0.0478575099253
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.609781867231
Accuracy on evaluation data: 9376 / 10000

Epoch 342 training complete
Cost on training data: 0.0477695919408
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.605955612157
Accuracy on evaluation data: 9384 / 10000

Epoch 343 training complete
Cost on training data: 0.0478303006773
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.606462399233
Accuracy on evaluation data: 9373 / 10000

Epoch 344 training complete
Cost on training data: 0.0474456782117
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.605621836411
Accuracy on evaluation data: 9370 / 10000

Epoch 345 training complete
Cost on training data: 0.0474661730048
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.604787944722
Accuracy on evaluation data: 9376 / 10000

Epoch 346 training complete
Cost on training data: 0.0475565150044
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.605571154714
Accuracy on evaluation data: 9377 / 10000

Epoch 347 training complete
Cost on training data: 0.0473245929024
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.607143360587
Accuracy on evaluation data: 9371 / 10000

Epoch 348 training complete
Cost on training data: 0.0470835937568
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.602241969214
Accuracy on evaluation data: 9367 / 10000

Epoch 349 training complete
Cost on training data: 0.0470238702706
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.600517326318
Accuracy on evaluation data: 9375 / 10000

Epoch 350 training complete
Cost on training data: 0.0468351715679
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.604465490752
Accuracy on evaluation data: 9374 / 10000

Epoch 351 training complete
Cost on training data: 0.0468849073061
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.603098152572
Accuracy on evaluation data: 9371 / 10000

Epoch 352 training complete
Cost on training data: 0.0466971447293
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.603623301922
Accuracy on evaluation data: 9368 / 10000

Epoch 353 training complete
Cost on training data: 0.0465469121108
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.598427234915
Accuracy on evaluation data: 9378 / 10000

Epoch 354 training complete
Cost on training data: 0.0465438104835
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.603293992015
Accuracy on evaluation data: 9378 / 10000

Epoch 355 training complete
Cost on training data: 0.0466771302385
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.599740708862
Accuracy on evaluation data: 9373 / 10000

Epoch 356 training complete
Cost on training data: 0.046414374733
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.59897597825
Accuracy on evaluation data: 9374 / 10000

Epoch 357 training complete
Cost on training data: 0.0462406040808
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.59856287903
Accuracy on evaluation data: 9364 / 10000

Epoch 358 training complete
Cost on training data: 0.0462247715094
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.601607409692
Accuracy on evaluation data: 9355 / 10000

Epoch 359 training complete
Cost on training data: 0.0460892516891
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.598983280752
Accuracy on evaluation data: 9368 / 10000

Epoch 360 training complete
Cost on training data: 0.0460240467315
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.597855545261
Accuracy on evaluation data: 9372 / 10000

Epoch 361 training complete
Cost on training data: 0.0462259484521
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.599092210441
Accuracy on evaluation data: 9379 / 10000

Epoch 362 training complete
Cost on training data: 0.0458814429361
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.598391774582
Accuracy on evaluation data: 9366 / 10000

Epoch 363 training complete
Cost on training data: 0.0458175307485
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.599210274869
Accuracy on evaluation data: 9363 / 10000

Epoch 364 training complete
Cost on training data: 0.0459021039475
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.598124112481
Accuracy on evaluation data: 9364 / 10000

Epoch 365 training complete
Cost on training data: 0.0457450459807
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.593446378539
Accuracy on evaluation data: 9379 / 10000

Epoch 366 training complete
Cost on training data: 0.0458704204609
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.59767133345
Accuracy on evaluation data: 9362 / 10000

Epoch 367 training complete
Cost on training data: 0.0456344730013
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.597225141906
Accuracy on evaluation data: 9370 / 10000

Epoch 368 training complete
Cost on training data: 0.0454112773098
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.596479213778
Accuracy on evaluation data: 9379 / 10000

Epoch 369 training complete
Cost on training data: 0.0454573276232
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.59083874942
Accuracy on evaluation data: 9377 / 10000

Epoch 370 training complete
Cost on training data: 0.0459937810817
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.599140394921
Accuracy on evaluation data: 9374 / 10000

Epoch 371 training complete
Cost on training data: 0.0454102503804
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.599538310723
Accuracy on evaluation data: 9365 / 10000

Epoch 372 training complete
Cost on training data: 0.0454393694212
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.591624428897
Accuracy on evaluation data: 9376 / 10000

Epoch 373 training complete
Cost on training data: 0.0452308847858
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.594854351217
Accuracy on evaluation data: 9371 / 10000

Epoch 374 training complete
Cost on training data: 0.0452347480076
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.595037480808
Accuracy on evaluation data: 9382 / 10000

Epoch 375 training complete
Cost on training data: 0.0450369069949
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.593689632396
Accuracy on evaluation data: 9387 / 10000

Epoch 376 training complete
Cost on training data: 0.0449474943217
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.595673913062
Accuracy on evaluation data: 9385 / 10000

Epoch 377 training complete
Cost on training data: 0.0449963348023
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.595262280088
Accuracy on evaluation data: 9375 / 10000

Epoch 378 training complete
Cost on training data: 0.0454076678712
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.592198361262
Accuracy on evaluation data: 9379 / 10000

Epoch 379 training complete
Cost on training data: 0.0446794258485
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.595827889317
Accuracy on evaluation data: 9380 / 10000

Epoch 380 training complete
Cost on training data: 0.0447971560074
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.59206359166
Accuracy on evaluation data: 9375 / 10000

Epoch 381 training complete
Cost on training data: 0.0451190789082
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.589457146474
Accuracy on evaluation data: 9365 / 10000

Epoch 382 training complete
Cost on training data: 0.0446402647453
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.589513522734
Accuracy on evaluation data: 9378 / 10000

Epoch 383 training complete
Cost on training data: 0.0446066827241
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.589257503156
Accuracy on evaluation data: 9373 / 10000

Epoch 384 training complete
Cost on training data: 0.0445583493798
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.591264483568
Accuracy on evaluation data: 9378 / 10000

Epoch 385 training complete
Cost on training data: 0.0445491543536
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.589482578527
Accuracy on evaluation data: 9378 / 10000

Epoch 386 training complete
Cost on training data: 0.0442739760434
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.591340698335
Accuracy on evaluation data: 9378 / 10000

Epoch 387 training complete
Cost on training data: 0.0445176386417
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.59066793811
Accuracy on evaluation data: 9374 / 10000

Epoch 388 training complete
Cost on training data: 0.0442299658551
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.591751415658
Accuracy on evaluation data: 9367 / 10000

Epoch 389 training complete
Cost on training data: 0.0442017798288
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.587729054469
Accuracy on evaluation data: 9379 / 10000

Epoch 390 training complete
Cost on training data: 0.0443077085102
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.589694086745
Accuracy on evaluation data: 9366 / 10000

Epoch 391 training complete
Cost on training data: 0.0442524839059
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.588783126849
Accuracy on evaluation data: 9380 / 10000

Epoch 392 training complete
Cost on training data: 0.0441950635241
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.590155600736
Accuracy on evaluation data: 9364 / 10000

Epoch 393 training complete
Cost on training data: 0.0445421909257
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.589830159012
Accuracy on evaluation data: 9372 / 10000

Epoch 394 training complete
Cost on training data: 0.0440813762138
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.591864368058
Accuracy on evaluation data: 9384 / 10000

Epoch 395 training complete
Cost on training data: 0.0439118868523
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.592822679388
Accuracy on evaluation data: 9378 / 10000

Epoch 396 training complete
Cost on training data: 0.0441793175861
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.586225627977
Accuracy on evaluation data: 9386 / 10000

Epoch 397 training complete
Cost on training data: 0.0440006841744
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.586619053155
Accuracy on evaluation data: 9378 / 10000

Epoch 398 training complete
Cost on training data: 0.0439196533815
Accuracy on training data: 10000 / 10000

Cost on evaluation data: 0.590926350879
Accuracy on evaluation data: 9375 / 10000

Epoch 399 training complete
Cost on training data: 0.0533728321953
Accuracy on training data: 10000 / 10000
Cost on evaluation data: 0.6173416156
Accuracy on evaluation data: 9342 / 10000

```
In [9]: print evaluation_cost, evaluation_accuracy, training_cost, training_accuracy
```

```
[1.0601689632680433, 0.91288121853150872, 0.84015182500425278] [8352, 8731, 8887] [0.9594571660, 0.9594571660, 0.9594571660]
```

```
In [11]: import plot_helper
```

```
In [12]: plot_helper.plot_training_cost(num_epochs=epochs, training_cost=training_cost, training_accuracy=training_accuracy)
plot_helper.plot_training_accuracy(num_epochs=epochs, training_accuracy=training_accuracy)
plot_helper.plot_test_cost(num_epochs=epochs, test_cost=evaluation_cost, test_cost_xm=evaluation_cost * 1000)
plot_helper.plot_test_accuracy(num_epochs=epochs, test_accuracy=evaluation_accuracy, test_accuracy_xm=evaluation_accuracy * 100)
```





