

week_1_solution_11_12

March 15, 2018

```
In [1]: 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 [2]: message = """
11. Repeat 8,9 for a lambda=5.0
"""

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,
    lmbda=5.0,
    monitor_evaluation_cost=True,
    monitor_evaluation_accuracy=True,
    monitor_training_cost=True,
    monitor_training_accuracy=True
)
```

Epoch 0 training complete
Cost on training data: 4.50533142513
Accuracy on training data: 8786 / 10000
Cost on evaluation data: 4.5685993302

Accuracy on evaluation data: 8666 / 10000

Epoch 1 training complete

Cost on training data: 2.90126955131

Accuracy on training data: 9148 / 10000

Cost on evaluation data: 3.00780579926

Accuracy on evaluation data: 8949 / 10000

Epoch 2 training complete

Cost on training data: 1.93626355674

Accuracy on training data: 9385 / 10000

Cost on evaluation data: 2.05764989022

Accuracy on evaluation data: 9145 / 10000

Epoch 3 training complete

Cost on training data: 1.4138855738

Accuracy on training data: 9415 / 10000

Cost on evaluation data: 1.53211872842

Accuracy on evaluation data: 9173 / 10000

Epoch 4 training complete

Cost on training data: 1.06819567929

Accuracy on training data: 9486 / 10000

Cost on evaluation data: 1.19945578121

Accuracy on evaluation data: 9236 / 10000

Epoch 5 training complete

Cost on training data: 0.929695255527

Accuracy on training data: 9413 / 10000

Cost on evaluation data: 1.0524042615

Accuracy on evaluation data: 9190 / 10000

Epoch 6 training complete

Cost on training data: 0.742287090302

Accuracy on training data: 9586 / 10000

Cost on evaluation data: 0.88077803407

Accuracy on evaluation data: 9279 / 10000

Epoch 7 training complete

Cost on training data: 0.687121398447

Accuracy on training data: 9578 / 10000

Cost on evaluation data: 0.819990238083

Accuracy on evaluation data: 9316 / 10000

Epoch 8 training complete

Cost on training data: 0.629509689846

Accuracy on training data: 9581 / 10000

Cost on evaluation data: 0.767284314723

Accuracy on evaluation data: 9305 / 10000

Epoch 9 training complete

Cost on training data: 0.636271308991

Accuracy on training data: 9540 / 10000

Cost on evaluation data: 0.779310614033

Accuracy on evaluation data: 9251 / 10000

Epoch 10 training complete

Cost on training data: 0.58163391002

Accuracy on training data: 9647 / 10000

Cost on evaluation data: 0.721907869935

Accuracy on evaluation data: 9326 / 10000

Epoch 11 training complete

Cost on training data: 0.579968254929

Accuracy on training data: 9608 / 10000

Cost on evaluation data: 0.722471058639

Accuracy on evaluation data: 9324 / 10000

Epoch 12 training complete

Cost on training data: 0.585001827127

Accuracy on training data: 9609 / 10000

Cost on evaluation data: 0.730027041536

Accuracy on evaluation data: 9291 / 10000

Epoch 13 training complete

Cost on training data: 0.570873925251

Accuracy on training data: 9602 / 10000

Cost on evaluation data: 0.706075873334

Accuracy on evaluation data: 9323 / 10000

Epoch 14 training complete

Cost on training data: 0.57608144219

Accuracy on training data: 9609 / 10000

Cost on evaluation data: 0.726133284985

Accuracy on evaluation data: 9292 / 10000

Epoch 15 training complete

Cost on training data: 0.625570453469

Accuracy on training data: 9517 / 10000

Cost on evaluation data: 0.781869894307

Accuracy on evaluation data: 9180 / 10000

Epoch 16 training complete

Cost on training data: 0.539193645556

Accuracy on training data: 9672 / 10000

Cost on evaluation data: 0.692422746153

Accuracy on evaluation data: 9350 / 10000

Epoch 17 training complete

Cost on training data: 0.555420322284

Accuracy on training data: 9667 / 10000

Cost on evaluation data: 0.698315686709

Accuracy on evaluation data: 9357 / 10000

Epoch 18 training complete

Cost on training data: 0.577759817188

Accuracy on training data: 9648 / 10000

Cost on evaluation data: 0.715212621802

Accuracy on evaluation data: 9329 / 10000

Epoch 19 training complete

Cost on training data: 0.569483728696

Accuracy on training data: 9625 / 10000

Cost on evaluation data: 0.720398834262

Accuracy on evaluation data: 9311 / 10000

Epoch 20 training complete

Cost on training data: 0.538293202476

Accuracy on training data: 9679 / 10000

Cost on evaluation data: 0.683781719091

Accuracy on evaluation data: 9365 / 10000

Epoch 21 training complete

Cost on training data: 0.549614940782

Accuracy on training data: 9665 / 10000

Cost on evaluation data: 0.69600864972

Accuracy on evaluation data: 9371 / 10000

Epoch 22 training complete

Cost on training data: 0.563301162385

Accuracy on training data: 9620 / 10000

Cost on evaluation data: 0.701707491279

Accuracy on evaluation data: 9336 / 10000

Epoch 23 training complete

Cost on training data: 0.573344971577

Accuracy on training data: 9640 / 10000

Cost on evaluation data: 0.715586308488

Accuracy on evaluation data: 9350 / 10000

Epoch 24 training complete

Cost on training data: 0.527317984275

Accuracy on training data: 9700 / 10000

Cost on evaluation data: 0.677499428522

Accuracy on evaluation data: 9374 / 10000

Epoch 25 training complete

Cost on training data: 0.573101710292

Accuracy on training data: 9630 / 10000

Cost on evaluation data: 0.718784058188

Accuracy on evaluation data: 9352 / 10000

Epoch 26 training complete

Cost on training data: 0.539558297994

Accuracy on training data: 9713 / 10000

Cost on evaluation data: 0.690778487039

Accuracy on evaluation data: 9388 / 10000

Epoch 27 training complete

Cost on training data: 0.552963318372

Accuracy on training data: 9659 / 10000

Cost on evaluation data: 0.694078821111

Accuracy on evaluation data: 9331 / 10000

Epoch 28 training complete

Cost on training data: 0.533481832613

Accuracy on training data: 9677 / 10000

Cost on evaluation data: 0.675399250141

Accuracy on evaluation data: 9411 / 10000

Epoch 29 training complete

Cost on training data: 0.581220832668

Accuracy on training data: 9590 / 10000

Cost on evaluation data: 0.725629530736

Accuracy on evaluation data: 9318 / 10000

Epoch 30 training complete

Cost on training data: 0.538930874072

Accuracy on training data: 9659 / 10000

Cost on evaluation data: 0.686612634016

Accuracy on evaluation data: 9359 / 10000

Epoch 31 training complete

Cost on training data: 0.533817311826

Accuracy on training data: 9678 / 10000

Cost on evaluation data: 0.677327201588

Accuracy on evaluation data: 9392 / 10000

Epoch 32 training complete

Cost on training data: 0.560128250549

Accuracy on training data: 9636 / 10000

Cost on evaluation data: 0.71588966995

Accuracy on evaluation data: 9303 / 10000

Epoch 33 training complete

Cost on training data: 0.547847796566

Accuracy on training data: 9691 / 10000

Cost on evaluation data: 0.687959580557

Accuracy on evaluation data: 9370 / 10000

Epoch 34 training complete

Cost on training data: 0.566197131835

Accuracy on training data: 9623 / 10000

Cost on evaluation data: 0.716226586415

Accuracy on evaluation data: 9321 / 10000

Epoch 35 training complete

Cost on training data: 0.579056849862

Accuracy on training data: 9617 / 10000

Cost on evaluation data: 0.721735400907

Accuracy on evaluation data: 9304 / 10000

Epoch 36 training complete

Cost on training data: 0.539971080108

Accuracy on training data: 9681 / 10000

Cost on evaluation data: 0.67631234217

Accuracy on evaluation data: 9411 / 10000

Epoch 37 training complete

Cost on training data: 0.524441376596

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.672174175219

Accuracy on evaluation data: 9380 / 10000

Epoch 38 training complete

Cost on training data: 0.549346012223

Accuracy on training data: 9664 / 10000

Cost on evaluation data: 0.702069681743

Accuracy on evaluation data: 9344 / 10000

Epoch 39 training complete

Cost on training data: 0.531072134676

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.674658042574

Accuracy on evaluation data: 9390 / 10000

Epoch 40 training complete

Cost on training data: 0.538841456216

Accuracy on training data: 9680 / 10000

Cost on evaluation data: 0.68877298465

Accuracy on evaluation data: 9367 / 10000

Epoch 41 training complete

Cost on training data: 0.564750714056

Accuracy on training data: 9662 / 10000

Cost on evaluation data: 0.707336144416

Accuracy on evaluation data: 9352 / 10000

Epoch 42 training complete

Cost on training data: 0.592567145421

Accuracy on training data: 9587 / 10000

Cost on evaluation data: 0.745357070166

Accuracy on evaluation data: 9287 / 10000

Epoch 43 training complete

Cost on training data: 0.540897179589

Accuracy on training data: 9694 / 10000

Cost on evaluation data: 0.67790188774

Accuracy on evaluation data: 9387 / 10000

Epoch 44 training complete

Cost on training data: 0.52404028392

Accuracy on training data: 9720 / 10000

Cost on evaluation data: 0.6697728755

Accuracy on evaluation data: 9401 / 10000

Epoch 45 training complete

Cost on training data: 0.579478836748

Accuracy on training data: 9636 / 10000

Cost on evaluation data: 0.715406262876

Accuracy on evaluation data: 9343 / 10000

Epoch 46 training complete

Cost on training data: 0.534824228056

Accuracy on training data: 9709 / 10000

Cost on evaluation data: 0.683230971463

Accuracy on evaluation data: 9401 / 10000

Epoch 47 training complete

Cost on training data: 0.581877847719

Accuracy on training data: 9615 / 10000

Cost on evaluation data: 0.729904389549

Accuracy on evaluation data: 9289 / 10000

Epoch 48 training complete

Cost on training data: 0.53880739459

Accuracy on training data: 9707 / 10000

Cost on evaluation data: 0.676602516024

Accuracy on evaluation data: 9392 / 10000

Epoch 49 training complete

Cost on training data: 0.540635562295

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.685119639862

Accuracy on evaluation data: 9367 / 10000

Epoch 50 training complete

Cost on training data: 0.547076417121

Accuracy on training data: 9681 / 10000

Cost on evaluation data: 0.689050200465

Accuracy on evaluation data: 9364 / 10000

Epoch 51 training complete

Cost on training data: 0.540016300309

Accuracy on training data: 9686 / 10000

Cost on evaluation data: 0.684758496183

Accuracy on evaluation data: 9375 / 10000

Epoch 52 training complete

Cost on training data: 0.521183682757

Accuracy on training data: 9737 / 10000

Cost on evaluation data: 0.664244457777

Accuracy on evaluation data: 9394 / 10000

Epoch 53 training complete

Cost on training data: 0.574080521435

Accuracy on training data: 9615 / 10000

Cost on evaluation data: 0.72353242828

Accuracy on evaluation data: 9282 / 10000

Epoch 54 training complete

Cost on training data: 0.543765998565

Accuracy on training data: 9688 / 10000

Cost on evaluation data: 0.693186041467

Accuracy on evaluation data: 9373 / 10000

Epoch 55 training complete

Cost on training data: 0.513633702619

Accuracy on training data: 9724 / 10000

Cost on evaluation data: 0.660565975092

Accuracy on evaluation data: 9411 / 10000

Epoch 56 training complete

Cost on training data: 0.521465958031

Accuracy on training data: 9720 / 10000

Cost on evaluation data: 0.665055500138

Accuracy on evaluation data: 9396 / 10000

Epoch 57 training complete

Cost on training data: 0.533711425398

Accuracy on training data: 9703 / 10000

Cost on evaluation data: 0.678551995146

Accuracy on evaluation data: 9404 / 10000

Epoch 58 training complete

Cost on training data: 0.527682517779

Accuracy on training data: 9693 / 10000

Cost on evaluation data: 0.67088561635

Accuracy on evaluation data: 9414 / 10000

Epoch 59 training complete

Cost on training data: 0.547712749083

Accuracy on training data: 9670 / 10000

Cost on evaluation data: 0.695866513562

Accuracy on evaluation data: 9338 / 10000

Epoch 60 training complete

Cost on training data: 0.551239467587

Accuracy on training data: 9655 / 10000

Cost on evaluation data: 0.702199189253

Accuracy on evaluation data: 9352 / 10000

Epoch 61 training complete

Cost on training data: 0.527140776122

Accuracy on training data: 9710 / 10000

Cost on evaluation data: 0.668699614606

Accuracy on evaluation data: 9411 / 10000

Epoch 62 training complete

Cost on training data: 0.52878749913

Accuracy on training data: 9730 / 10000

Cost on evaluation data: 0.670351278068

Accuracy on evaluation data: 9391 / 10000

Epoch 63 training complete

Cost on training data: 0.577828003716

Accuracy on training data: 9592 / 10000

Cost on evaluation data: 0.71699587618

Accuracy on evaluation data: 9345 / 10000

Epoch 64 training complete

Cost on training data: 0.562033995541

Accuracy on training data: 9675 / 10000

Cost on evaluation data: 0.706603809323

Accuracy on evaluation data: 9358 / 10000

Epoch 65 training complete

Cost on training data: 0.513157558204

Accuracy on training data: 9721 / 10000

Cost on evaluation data: 0.657009149025

Accuracy on evaluation data: 9415 / 10000

Epoch 66 training complete

Cost on training data: 0.55412372229

Accuracy on training data: 9687 / 10000

Cost on evaluation data: 0.696103896126

Accuracy on evaluation data: 9369 / 10000

Epoch 67 training complete

Cost on training data: 0.554995619482

Accuracy on training data: 9666 / 10000

Cost on evaluation data: 0.701794258179

Accuracy on evaluation data: 9349 / 10000

Epoch 68 training complete

Cost on training data: 0.543136544182

Accuracy on training data: 9679 / 10000

Cost on evaluation data: 0.684181150475

Accuracy on evaluation data: 9370 / 10000

Epoch 69 training complete

Cost on training data: 0.526649370914

Accuracy on training data: 9703 / 10000

Cost on evaluation data: 0.659759618999

Accuracy on evaluation data: 9413 / 10000

Epoch 70 training complete

Cost on training data: 0.521218019378

Accuracy on training data: 9710 / 10000

Cost on evaluation data: 0.665934377191

Accuracy on evaluation data: 9391 / 10000

Epoch 71 training complete

Cost on training data: 0.536731613687

Accuracy on training data: 9698 / 10000

Cost on evaluation data: 0.67798406473

Accuracy on evaluation data: 9400 / 10000

Epoch 72 training complete

Cost on training data: 0.519956560717

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.66136078514

Accuracy on evaluation data: 9428 / 10000

Epoch 73 training complete

Cost on training data: 0.531233691337

Accuracy on training data: 9703 / 10000

Cost on evaluation data: 0.669586678188

Accuracy on evaluation data: 9394 / 10000

Epoch 74 training complete

Cost on training data: 0.558395607245

Accuracy on training data: 9662 / 10000

Cost on evaluation data: 0.699326719366

Accuracy on evaluation data: 9351 / 10000

Epoch 75 training complete

Cost on training data: 0.532188092699

Accuracy on training data: 9707 / 10000

Cost on evaluation data: 0.669566998106

Accuracy on evaluation data: 9402 / 10000

Epoch 76 training complete

Cost on training data: 0.540276915178

Accuracy on training data: 9682 / 10000

Cost on evaluation data: 0.682335319818

Accuracy on evaluation data: 9357 / 10000

Epoch 77 training complete

Cost on training data: 0.518687760792

Accuracy on training data: 9727 / 10000

Cost on evaluation data: 0.661380693791

Accuracy on evaluation data: 9412 / 10000

Epoch 78 training complete

Cost on training data: 0.554640540471

Accuracy on training data: 9674 / 10000

Cost on evaluation data: 0.688204585235

Accuracy on evaluation data: 9373 / 10000

Epoch 79 training complete

Cost on training data: 0.546005477488

Accuracy on training data: 9671 / 10000

Cost on evaluation data: 0.695274588254

Accuracy on evaluation data: 9337 / 10000

Epoch 80 training complete

Cost on training data: 0.529769714626

Accuracy on training data: 9698 / 10000

Cost on evaluation data: 0.678349791942

Accuracy on evaluation data: 9369 / 10000

Epoch 81 training complete

Cost on training data: 0.577075603268

Accuracy on training data: 9607 / 10000

Cost on evaluation data: 0.724524255115

Accuracy on evaluation data: 9304 / 10000

Epoch 82 training complete

Cost on training data: 0.540536556968

Accuracy on training data: 9693 / 10000

Cost on evaluation data: 0.691788169416

Accuracy on evaluation data: 9363 / 10000

Epoch 83 training complete

Cost on training data: 0.568029741308

Accuracy on training data: 9628 / 10000

Cost on evaluation data: 0.717916971777

Accuracy on evaluation data: 9282 / 10000

Epoch 84 training complete

Cost on training data: 0.576104493497

Accuracy on training data: 9606 / 10000

Cost on evaluation data: 0.716506970933

Accuracy on evaluation data: 9308 / 10000

Epoch 85 training complete

Cost on training data: 0.565694034395

Accuracy on training data: 9642 / 10000

Cost on evaluation data: 0.713177751862

Accuracy on evaluation data: 9328 / 10000

Epoch 86 training complete

Cost on training data: 0.538156360269

Accuracy on training data: 9691 / 10000

Cost on evaluation data: 0.671137879746

Accuracy on evaluation data: 9415 / 10000

Epoch 87 training complete

Cost on training data: 0.529927444736

Accuracy on training data: 9700 / 10000

Cost on evaluation data: 0.66028408237

Accuracy on evaluation data: 9433 / 10000

Epoch 88 training complete

Cost on training data: 0.524839068826

Accuracy on training data: 9719 / 10000

Cost on evaluation data: 0.671638252121

Accuracy on evaluation data: 9403 / 10000

Epoch 89 training complete

Cost on training data: 0.559277104715

Accuracy on training data: 9646 / 10000

Cost on evaluation data: 0.699252601704

Accuracy on evaluation data: 9335 / 10000

Epoch 90 training complete

Cost on training data: 0.527455710856

Accuracy on training data: 9715 / 10000

Cost on evaluation data: 0.664875655526

Accuracy on evaluation data: 9403 / 10000

Epoch 91 training complete

Cost on training data: 0.561481499462

Accuracy on training data: 9647 / 10000

Cost on evaluation data: 0.706340037297

Accuracy on evaluation data: 9316 / 10000

Epoch 92 training complete

Cost on training data: 0.559194748219

Accuracy on training data: 9634 / 10000

Cost on evaluation data: 0.692741053582

Accuracy on evaluation data: 9347 / 10000

Epoch 93 training complete

Cost on training data: 0.569299340751

Accuracy on training data: 9630 / 10000

Cost on evaluation data: 0.71643674487

Accuracy on evaluation data: 9316 / 10000

Epoch 94 training complete

Cost on training data: 0.517082876511

Accuracy on training data: 9716 / 10000

Cost on evaluation data: 0.659805864426

Accuracy on evaluation data: 9416 / 10000

Epoch 95 training complete

Cost on training data: 0.510761265172

Accuracy on training data: 9731 / 10000

Cost on evaluation data: 0.647149378654

Accuracy on evaluation data: 9420 / 10000

Epoch 96 training complete

Cost on training data: 0.522391161855

Accuracy on training data: 9713 / 10000

Cost on evaluation data: 0.657076898273

Accuracy on evaluation data: 9439 / 10000

Epoch 97 training complete

Cost on training data: 0.590839586717

Accuracy on training data: 9572 / 10000

Cost on evaluation data: 0.734076835239

Accuracy on evaluation data: 9280 / 10000

Epoch 98 training complete

Cost on training data: 0.536773666954

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.677310271045

Accuracy on evaluation data: 9400 / 10000

Epoch 99 training complete

Cost on training data: 0.62416584191

Accuracy on training data: 9485 / 10000

Cost on evaluation data: 0.766226597268

Accuracy on evaluation data: 9193 / 10000

Epoch 100 training complete

Cost on training data: 0.513183539364

Accuracy on training data: 9735 / 10000

Cost on evaluation data: 0.652714807195

Accuracy on evaluation data: 9461 / 10000

Epoch 101 training complete

Cost on training data: 0.541487871225

Accuracy on training data: 9681 / 10000

Cost on evaluation data: 0.686691939564

Accuracy on evaluation data: 9376 / 10000

Epoch 102 training complete

Cost on training data: 0.530403630321

Accuracy on training data: 9697 / 10000

Cost on evaluation data: 0.677380231499

Accuracy on evaluation data: 9403 / 10000

Epoch 103 training complete

Cost on training data: 0.54867131973

Accuracy on training data: 9659 / 10000

Cost on evaluation data: 0.688429881979

Accuracy on evaluation data: 9347 / 10000

Epoch 104 training complete

Cost on training data: 0.526111627884

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.668641023389

Accuracy on evaluation data: 9407 / 10000

Epoch 105 training complete

Cost on training data: 0.549241888031

Accuracy on training data: 9675 / 10000

Cost on evaluation data: 0.689279997413

Accuracy on evaluation data: 9351 / 10000

Epoch 106 training complete

Cost on training data: 0.54980457533

Accuracy on training data: 9662 / 10000

Cost on evaluation data: 0.6938739713

Accuracy on evaluation data: 9368 / 10000

Epoch 107 training complete

Cost on training data: 0.51073817537

Accuracy on training data: 9732 / 10000

Cost on evaluation data: 0.64918343692

Accuracy on evaluation data: 9456 / 10000

Epoch 108 training complete

Cost on training data: 0.55241496471

Accuracy on training data: 9680 / 10000

Cost on evaluation data: 0.695468447505

Accuracy on evaluation data: 9340 / 10000

Epoch 109 training complete

Cost on training data: 0.561357882843

Accuracy on training data: 9641 / 10000

Cost on evaluation data: 0.721452244581

Accuracy on evaluation data: 9298 / 10000

Epoch 110 training complete

Cost on training data: 0.558867454401

Accuracy on training data: 9656 / 10000

Cost on evaluation data: 0.698268418103

Accuracy on evaluation data: 9361 / 10000

Epoch 111 training complete

Cost on training data: 0.543920512287

Accuracy on training data: 9688 / 10000

Cost on evaluation data: 0.683864303254

Accuracy on evaluation data: 9379 / 10000

Epoch 112 training complete

Cost on training data: 0.516170085742

Accuracy on training data: 9738 / 10000

Cost on evaluation data: 0.650288226402

Accuracy on evaluation data: 9429 / 10000

Epoch 113 training complete

Cost on training data: 0.568978663819

Accuracy on training data: 9675 / 10000

Cost on evaluation data: 0.715718789906

Accuracy on evaluation data: 9336 / 10000

Epoch 114 training complete

Cost on training data: 0.530901894867

Accuracy on training data: 9717 / 10000

Cost on evaluation data: 0.674517344994

Accuracy on evaluation data: 9381 / 10000

Epoch 115 training complete

Cost on training data: 0.532264768792

Accuracy on training data: 9698 / 10000

Cost on evaluation data: 0.674269768827

Accuracy on evaluation data: 9373 / 10000

Epoch 116 training complete

Cost on training data: 0.5193568128

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.660977191878

Accuracy on evaluation data: 9410 / 10000

Epoch 117 training complete

Cost on training data: 0.554854751468

Accuracy on training data: 9670 / 10000

Cost on evaluation data: 0.697154054053

Accuracy on evaluation data: 9364 / 10000

Epoch 118 training complete

Cost on training data: 0.589474080605

Accuracy on training data: 9606 / 10000

Cost on evaluation data: 0.743074977455

Accuracy on evaluation data: 9281 / 10000

Epoch 119 training complete

Cost on training data: 0.54179061588

Accuracy on training data: 9673 / 10000

Cost on evaluation data: 0.683470996746

Accuracy on evaluation data: 9405 / 10000

Epoch 120 training complete

Cost on training data: 0.52912865959

Accuracy on training data: 9721 / 10000

Cost on evaluation data: 0.674615551176

Accuracy on evaluation data: 9397 / 10000

Epoch 121 training complete

Cost on training data: 0.523176750562

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.664307395408

Accuracy on evaluation data: 9419 / 10000

Epoch 122 training complete

Cost on training data: 0.529321009529

Accuracy on training data: 9692 / 10000

Cost on evaluation data: 0.67361110569

Accuracy on evaluation data: 9386 / 10000

Epoch 123 training complete

Cost on training data: 0.664075446483

Accuracy on training data: 9461 / 10000

Cost on evaluation data: 0.817424450836

Accuracy on evaluation data: 9128 / 10000

Epoch 124 training complete

Cost on training data: 0.565501671745

Accuracy on training data: 9642 / 10000

Cost on evaluation data: 0.713431143897

Accuracy on evaluation data: 9302 / 10000

Epoch 125 training complete

Cost on training data: 0.56444261798

Accuracy on training data: 9649 / 10000

Cost on evaluation data: 0.704936275024

Accuracy on evaluation data: 9343 / 10000

Epoch 126 training complete

Cost on training data: 0.549538111023

Accuracy on training data: 9682 / 10000

Cost on evaluation data: 0.69064385038

Accuracy on evaluation data: 9349 / 10000

Epoch 127 training complete

Cost on training data: 0.513905658096

Accuracy on training data: 9742 / 10000

Cost on evaluation data: 0.653308824721

Accuracy on evaluation data: 9444 / 10000

Epoch 128 training complete

Cost on training data: 0.52270379916

Accuracy on training data: 9704 / 10000

Cost on evaluation data: 0.66103008074

Accuracy on evaluation data: 9413 / 10000

Epoch 129 training complete

Cost on training data: 0.524519324668

Accuracy on training data: 9690 / 10000

Cost on evaluation data: 0.6773170728

Accuracy on evaluation data: 9411 / 10000

Epoch 130 training complete

Cost on training data: 0.549742451691

Accuracy on training data: 9682 / 10000

Cost on evaluation data: 0.687901953967

Accuracy on evaluation data: 9365 / 10000

Epoch 131 training complete

Cost on training data: 0.623365615753

Accuracy on training data: 9491 / 10000

Cost on evaluation data: 0.753389098264

Accuracy on evaluation data: 9224 / 10000

Epoch 132 training complete

Cost on training data: 0.603212956811

Accuracy on training data: 9574 / 10000

Cost on evaluation data: 0.736712551803

Accuracy on evaluation data: 9284 / 10000

Epoch 133 training complete

Cost on training data: 0.553089009343

Accuracy on training data: 9664 / 10000

Cost on evaluation data: 0.698334691264

Accuracy on evaluation data: 9371 / 10000

Epoch 134 training complete

Cost on training data: 0.516631813493

Accuracy on training data: 9748 / 10000

Cost on evaluation data: 0.658670923499

Accuracy on evaluation data: 9416 / 10000

Epoch 135 training complete

Cost on training data: 0.545518496494

Accuracy on training data: 9666 / 10000

Cost on evaluation data: 0.692277873675

Accuracy on evaluation data: 9351 / 10000

Epoch 136 training complete

Cost on training data: 0.560504984522

Accuracy on training data: 9658 / 10000

Cost on evaluation data: 0.707261717708

Accuracy on evaluation data: 9343 / 10000

Epoch 137 training complete

Cost on training data: 0.53289845052

Accuracy on training data: 9726 / 10000

Cost on evaluation data: 0.665784704081

Accuracy on evaluation data: 9428 / 10000

Epoch 138 training complete

Cost on training data: 0.548877703603

Accuracy on training data: 9666 / 10000

Cost on evaluation data: 0.6903331545

Accuracy on evaluation data: 9361 / 10000

Epoch 139 training complete

Cost on training data: 0.536311454612

Accuracy on training data: 9701 / 10000

Cost on evaluation data: 0.672192793208

Accuracy on evaluation data: 9408 / 10000

Epoch 140 training complete

Cost on training data: 0.531998800938

Accuracy on training data: 9696 / 10000

Cost on evaluation data: 0.67353853192

Accuracy on evaluation data: 9385 / 10000

Epoch 141 training complete

Cost on training data: 0.51566404471

Accuracy on training data: 9724 / 10000

Cost on evaluation data: 0.666792905613

Accuracy on evaluation data: 9404 / 10000

Epoch 142 training complete

Cost on training data: 0.514682717651

Accuracy on training data: 9724 / 10000

Cost on evaluation data: 0.650383825484

Accuracy on evaluation data: 9424 / 10000

Epoch 143 training complete

Cost on training data: 0.529402780392

Accuracy on training data: 9705 / 10000

Cost on evaluation data: 0.670317644038

Accuracy on evaluation data: 9420 / 10000

Epoch 144 training complete

Cost on training data: 0.552583583224

Accuracy on training data: 9675 / 10000

Cost on evaluation data: 0.702375436722

Accuracy on evaluation data: 9359 / 10000

Epoch 145 training complete

Cost on training data: 0.521491369583

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.658926414015

Accuracy on evaluation data: 9404 / 10000

Epoch 146 training complete

Cost on training data: 0.526728322742

Accuracy on training data: 9696 / 10000

Cost on evaluation data: 0.663065158616

Accuracy on evaluation data: 9384 / 10000

Epoch 147 training complete

Cost on training data: 0.520613871645

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.654950184453

Accuracy on evaluation data: 9417 / 10000

Epoch 148 training complete

Cost on training data: 0.528298872844

Accuracy on training data: 9705 / 10000

Cost on evaluation data: 0.669163613096

Accuracy on evaluation data: 9396 / 10000

Epoch 149 training complete

Cost on training data: 0.556921468112

Accuracy on training data: 9636 / 10000

Cost on evaluation data: 0.686906393295

Accuracy on evaluation data: 9359 / 10000

Epoch 150 training complete

Cost on training data: 0.562117095555

Accuracy on training data: 9615 / 10000

Cost on evaluation data: 0.709252383788

Accuracy on evaluation data: 9314 / 10000

Epoch 151 training complete

Cost on training data: 0.518223742488

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.657086623677

Accuracy on evaluation data: 9408 / 10000

Epoch 152 training complete

Cost on training data: 0.610610609813

Accuracy on training data: 9513 / 10000

Cost on evaluation data: 0.741064432595

Accuracy on evaluation data: 9261 / 10000

Epoch 153 training complete

Cost on training data: 0.546156437373

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.681889581014

Accuracy on evaluation data: 9404 / 10000

Epoch 154 training complete

Cost on training data: 0.531402358672

Accuracy on training data: 9688 / 10000

Cost on evaluation data: 0.673880579678

Accuracy on evaluation data: 9384 / 10000

Epoch 155 training complete

Cost on training data: 0.53860232778

Accuracy on training data: 9697 / 10000

Cost on evaluation data: 0.66968963796

Accuracy on evaluation data: 9401 / 10000

Epoch 156 training complete

Cost on training data: 0.540391012172

Accuracy on training data: 9681 / 10000

Cost on evaluation data: 0.674225698193

Accuracy on evaluation data: 9360 / 10000

Epoch 157 training complete

Cost on training data: 0.525982349779

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.657490588463

Accuracy on evaluation data: 9440 / 10000

Epoch 158 training complete

Cost on training data: 0.526320984648

Accuracy on training data: 9712 / 10000

Cost on evaluation data: 0.659722194035

Accuracy on evaluation data: 9440 / 10000

Epoch 159 training complete

Cost on training data: 0.548425014584

Accuracy on training data: 9648 / 10000

Cost on evaluation data: 0.677713323095

Accuracy on evaluation data: 9391 / 10000

Epoch 160 training complete

Cost on training data: 0.56027599772

Accuracy on training data: 9634 / 10000

Cost on evaluation data: 0.704110256987

Accuracy on evaluation data: 9318 / 10000

Epoch 161 training complete

Cost on training data: 0.545526137363

Accuracy on training data: 9674 / 10000

Cost on evaluation data: 0.677129241876

Accuracy on evaluation data: 9380 / 10000

Epoch 162 training complete

Cost on training data: 0.610668864789

Accuracy on training data: 9500 / 10000

Cost on evaluation data: 0.767686468225

Accuracy on evaluation data: 9222 / 10000

Epoch 163 training complete

Cost on training data: 0.540969433712

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.680248067212

Accuracy on evaluation data: 9422 / 10000

Epoch 164 training complete

Cost on training data: 0.544213875091

Accuracy on training data: 9682 / 10000

Cost on evaluation data: 0.669446213761

Accuracy on evaluation data: 9396 / 10000

Epoch 165 training complete

Cost on training data: 0.565603534515

Accuracy on training data: 9668 / 10000

Cost on evaluation data: 0.695269742396

Accuracy on evaluation data: 9361 / 10000

Epoch 166 training complete

Cost on training data: 0.528766602402

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.66593272015

Accuracy on evaluation data: 9389 / 10000

Epoch 167 training complete

Cost on training data: 0.55225050129

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.697481205791

Accuracy on evaluation data: 9386 / 10000

Epoch 168 training complete

Cost on training data: 0.548208942945

Accuracy on training data: 9680 / 10000

Cost on evaluation data: 0.68773693865

Accuracy on evaluation data: 9391 / 10000

Epoch 169 training complete

Cost on training data: 0.537234113232

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.670050936597

Accuracy on evaluation data: 9398 / 10000

Epoch 170 training complete

Cost on training data: 0.558462068057

Accuracy on training data: 9641 / 10000

Cost on evaluation data: 0.697493692335

Accuracy on evaluation data: 9359 / 10000

Epoch 171 training complete

Cost on training data: 0.517286183235

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.646422538996

Accuracy on evaluation data: 9433 / 10000

Epoch 172 training complete

Cost on training data: 0.517207276404

Accuracy on training data: 9732 / 10000

Cost on evaluation data: 0.653284921384

Accuracy on evaluation data: 9436 / 10000

Epoch 173 training complete

Cost on training data: 0.529512484905

Accuracy on training data: 9701 / 10000

Cost on evaluation data: 0.671739018441

Accuracy on evaluation data: 9383 / 10000

Epoch 174 training complete

Cost on training data: 0.541201496638

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.686280045853

Accuracy on evaluation data: 9395 / 10000

Epoch 175 training complete

Cost on training data: 0.53098763759

Accuracy on training data: 9724 / 10000

Cost on evaluation data: 0.655681519099

Accuracy on evaluation data: 9447 / 10000

Epoch 176 training complete

Cost on training data: 0.509916504315

Accuracy on training data: 9741 / 10000

Cost on evaluation data: 0.647579928043

Accuracy on evaluation data: 9433 / 10000

Epoch 177 training complete

Cost on training data: 0.542800321512

Accuracy on training data: 9681 / 10000

Cost on evaluation data: 0.681324037562

Accuracy on evaluation data: 9403 / 10000

Epoch 178 training complete

Cost on training data: 0.540620411391

Accuracy on training data: 9694 / 10000

Cost on evaluation data: 0.676718001107

Accuracy on evaluation data: 9386 / 10000

Epoch 179 training complete

Cost on training data: 0.53043155123

Accuracy on training data: 9721 / 10000

Cost on evaluation data: 0.663461560732

Accuracy on evaluation data: 9422 / 10000

Epoch 180 training complete

Cost on training data: 0.541670734347

Accuracy on training data: 9677 / 10000

Cost on evaluation data: 0.689442218837

Accuracy on evaluation data: 9360 / 10000

Epoch 181 training complete

Cost on training data: 0.552219535544

Accuracy on training data: 9662 / 10000

Cost on evaluation data: 0.695572630564

Accuracy on evaluation data: 9383 / 10000

Epoch 182 training complete

Cost on training data: 0.538603740522

Accuracy on training data: 9697 / 10000

Cost on evaluation data: 0.683832868675

Accuracy on evaluation data: 9377 / 10000

Epoch 183 training complete

Cost on training data: 0.529000718634

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.664258277102

Accuracy on evaluation data: 9419 / 10000

Epoch 184 training complete

Cost on training data: 0.522498843995

Accuracy on training data: 9721 / 10000

Cost on evaluation data: 0.662932899141

Accuracy on evaluation data: 9420 / 10000

Epoch 185 training complete

Cost on training data: 0.538470897115

Accuracy on training data: 9694 / 10000

Cost on evaluation data: 0.667393615775

Accuracy on evaluation data: 9395 / 10000

Epoch 186 training complete

Cost on training data: 0.550643302223

Accuracy on training data: 9658 / 10000

Cost on evaluation data: 0.692758840779

Accuracy on evaluation data: 9338 / 10000

Epoch 187 training complete

Cost on training data: 0.559816766338

Accuracy on training data: 9681 / 10000

Cost on evaluation data: 0.686381311605

Accuracy on evaluation data: 9391 / 10000

Epoch 188 training complete

Cost on training data: 0.574246499569

Accuracy on training data: 9596 / 10000

Cost on evaluation data: 0.729237452512

Accuracy on evaluation data: 9284 / 10000

Epoch 189 training complete

Cost on training data: 0.53555960559

Accuracy on training data: 9695 / 10000

Cost on evaluation data: 0.668319451083

Accuracy on evaluation data: 9391 / 10000

Epoch 190 training complete

Cost on training data: 0.539039606295

Accuracy on training data: 9697 / 10000

Cost on evaluation data: 0.677822364595

Accuracy on evaluation data: 9368 / 10000

Epoch 191 training complete

Cost on training data: 0.592323930099

Accuracy on training data: 9593 / 10000

Cost on evaluation data: 0.731647515882

Accuracy on evaluation data: 9254 / 10000

Epoch 192 training complete

Cost on training data: 0.552801203741

Accuracy on training data: 9682 / 10000

Cost on evaluation data: 0.689546938075

Accuracy on evaluation data: 9403 / 10000

Epoch 193 training complete

Cost on training data: 0.551305376833

Accuracy on training data: 9673 / 10000

Cost on evaluation data: 0.688796258101

Accuracy on evaluation data: 9371 / 10000

Epoch 194 training complete

Cost on training data: 0.511144972144

Accuracy on training data: 9735 / 10000

Cost on evaluation data: 0.650754320055

Accuracy on evaluation data: 9449 / 10000

Epoch 195 training complete

Cost on training data: 0.509170766163

Accuracy on training data: 9745 / 10000

Cost on evaluation data: 0.641426897808

Accuracy on evaluation data: 9460 / 10000

Epoch 196 training complete

Cost on training data: 0.529435156139

Accuracy on training data: 9738 / 10000

Cost on evaluation data: 0.671216805554

Accuracy on evaluation data: 9397 / 10000

Epoch 197 training complete

Cost on training data: 0.551743428567

Accuracy on training data: 9655 / 10000

Cost on evaluation data: 0.695342799702

Accuracy on evaluation data: 9360 / 10000

Epoch 198 training complete

Cost on training data: 0.545207851729

Accuracy on training data: 9658 / 10000

Cost on evaluation data: 0.681273127787

Accuracy on evaluation data: 9377 / 10000

Epoch 199 training complete

Cost on training data: 0.515514592987

Accuracy on training data: 9739 / 10000

Cost on evaluation data: 0.654232577513

Accuracy on evaluation data: 9435 / 10000

Epoch 200 training complete

Cost on training data: 0.533105709961

Accuracy on training data: 9678 / 10000

Cost on evaluation data: 0.669438122505

Accuracy on evaluation data: 9392 / 10000

Epoch 201 training complete

Cost on training data: 0.536122581348

Accuracy on training data: 9685 / 10000

Cost on evaluation data: 0.665572494149

Accuracy on evaluation data: 9413 / 10000

Epoch 202 training complete

Cost on training data: 0.544668074692

Accuracy on training data: 9664 / 10000

Cost on evaluation data: 0.690248307509

Accuracy on evaluation data: 9365 / 10000

Epoch 203 training complete

Cost on training data: 0.529397626605

Accuracy on training data: 9719 / 10000

Cost on evaluation data: 0.666573643402

Accuracy on evaluation data: 9397 / 10000

Epoch 204 training complete

Cost on training data: 0.562767471

Accuracy on training data: 9666 / 10000

Cost on evaluation data: 0.697676774955

Accuracy on evaluation data: 9384 / 10000

Epoch 205 training complete

Cost on training data: 0.531921708777

Accuracy on training data: 9702 / 10000

Cost on evaluation data: 0.665961494193

Accuracy on evaluation data: 9401 / 10000

Epoch 206 training complete

Cost on training data: 0.519163115328

Accuracy on training data: 9720 / 10000

Cost on evaluation data: 0.651317494067

Accuracy on evaluation data: 9451 / 10000

Epoch 207 training complete

Cost on training data: 0.553881529206

Accuracy on training data: 9665 / 10000

Cost on evaluation data: 0.694774135907

Accuracy on evaluation data: 9387 / 10000

Epoch 208 training complete

Cost on training data: 0.52279406458

Accuracy on training data: 9736 / 10000

Cost on evaluation data: 0.663390058715

Accuracy on evaluation data: 9427 / 10000

Epoch 209 training complete

Cost on training data: 0.508375018638

Accuracy on training data: 9745 / 10000

Cost on evaluation data: 0.648618267845

Accuracy on evaluation data: 9423 / 10000

Epoch 210 training complete

Cost on training data: 0.516190412918

Accuracy on training data: 9729 / 10000

Cost on evaluation data: 0.657548730199

Accuracy on evaluation data: 9423 / 10000

Epoch 211 training complete

Cost on training data: 0.553142887996

Accuracy on training data: 9639 / 10000

Cost on evaluation data: 0.688041569771

Accuracy on evaluation data: 9365 / 10000

Epoch 212 training complete

Cost on training data: 0.518313146572

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.654503709011

Accuracy on evaluation data: 9425 / 10000

Epoch 213 training complete

Cost on training data: 0.547021152509

Accuracy on training data: 9676 / 10000

Cost on evaluation data: 0.689131668842

Accuracy on evaluation data: 9362 / 10000

Epoch 214 training complete

Cost on training data: 0.524619489821

Accuracy on training data: 9733 / 10000

Cost on evaluation data: 0.656757824548

Accuracy on evaluation data: 9414 / 10000

Epoch 215 training complete

Cost on training data: 0.513570243435

Accuracy on training data: 9740 / 10000

Cost on evaluation data: 0.654503002089

Accuracy on evaluation data: 9444 / 10000

Epoch 216 training complete

Cost on training data: 0.524314448606

Accuracy on training data: 9725 / 10000

Cost on evaluation data: 0.65692664215

Accuracy on evaluation data: 9396 / 10000

Epoch 217 training complete

Cost on training data: 0.552477054885

Accuracy on training data: 9676 / 10000

Cost on evaluation data: 0.686038006069

Accuracy on evaluation data: 9396 / 10000

Epoch 218 training complete

Cost on training data: 0.515193220578

Accuracy on training data: 9739 / 10000

Cost on evaluation data: 0.653280943828

Accuracy on evaluation data: 9416 / 10000

Epoch 219 training complete

Cost on training data: 0.530049404527

Accuracy on training data: 9712 / 10000

Cost on evaluation data: 0.662667990282

Accuracy on evaluation data: 9397 / 10000

Epoch 220 training complete

Cost on training data: 0.523798237187

Accuracy on training data: 9712 / 10000

Cost on evaluation data: 0.660923777671

Accuracy on evaluation data: 9405 / 10000

Epoch 221 training complete

Cost on training data: 0.559997721754

Accuracy on training data: 9647 / 10000

Cost on evaluation data: 0.694785441044

Accuracy on evaluation data: 9379 / 10000

Epoch 222 training complete

Cost on training data: 0.563991049434

Accuracy on training data: 9647 / 10000

Cost on evaluation data: 0.706848212335

Accuracy on evaluation data: 9345 / 10000

Epoch 223 training complete

Cost on training data: 0.524695945253

Accuracy on training data: 9709 / 10000

Cost on evaluation data: 0.657638288764

Accuracy on evaluation data: 9407 / 10000

Epoch 224 training complete

Cost on training data: 0.576414051412

Accuracy on training data: 9589 / 10000

Cost on evaluation data: 0.712990074641

Accuracy on evaluation data: 9322 / 10000

Epoch 225 training complete

Cost on training data: 0.518787340113

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.661899369379

Accuracy on evaluation data: 9408 / 10000

Epoch 226 training complete

Cost on training data: 0.515851289006

Accuracy on training data: 9714 / 10000

Cost on evaluation data: 0.655403935063

Accuracy on evaluation data: 9410 / 10000

Epoch 227 training complete

Cost on training data: 0.520691040996

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.655348836325

Accuracy on evaluation data: 9412 / 10000

Epoch 228 training complete

Cost on training data: 0.58609768132

Accuracy on training data: 9620 / 10000

Cost on evaluation data: 0.746345335807

Accuracy on evaluation data: 9279 / 10000

Epoch 229 training complete

Cost on training data: 0.511580998613

Accuracy on training data: 9728 / 10000

Cost on evaluation data: 0.653114122064

Accuracy on evaluation data: 9422 / 10000

Epoch 230 training complete

Cost on training data: 0.531045167706

Accuracy on training data: 9693 / 10000

Cost on evaluation data: 0.669935960643

Accuracy on evaluation data: 9397 / 10000

Epoch 231 training complete

Cost on training data: 0.517953317897

Accuracy on training data: 9710 / 10000

Cost on evaluation data: 0.653880810804

Accuracy on evaluation data: 9436 / 10000

Epoch 232 training complete

Cost on training data: 0.571686029536

Accuracy on training data: 9662 / 10000

Cost on evaluation data: 0.710274304869

Accuracy on evaluation data: 9364 / 10000

Epoch 233 training complete

Cost on training data: 0.594008953184

Accuracy on training data: 9555 / 10000

Cost on evaluation data: 0.730984379692

Accuracy on evaluation data: 9260 / 10000

Epoch 234 training complete

Cost on training data: 0.53930075776

Accuracy on training data: 9713 / 10000

Cost on evaluation data: 0.678498883798

Accuracy on evaluation data: 9387 / 10000

Epoch 235 training complete

Cost on training data: 0.51869500939

Accuracy on training data: 9723 / 10000

Cost on evaluation data: 0.658436194645

Accuracy on evaluation data: 9401 / 10000

Epoch 236 training complete

Cost on training data: 0.51808960549

Accuracy on training data: 9736 / 10000

Cost on evaluation data: 0.648191292781

Accuracy on evaluation data: 9440 / 10000

Epoch 237 training complete

Cost on training data: 0.530906252325

Accuracy on training data: 9716 / 10000

Cost on evaluation data: 0.671015162458

Accuracy on evaluation data: 9401 / 10000

Epoch 238 training complete

Cost on training data: 0.514124202623

Accuracy on training data: 9728 / 10000

Cost on evaluation data: 0.642402411058

Accuracy on evaluation data: 9460 / 10000

Epoch 239 training complete

Cost on training data: 0.520077925117

Accuracy on training data: 9726 / 10000

Cost on evaluation data: 0.654643347371

Accuracy on evaluation data: 9417 / 10000

Epoch 240 training complete

Cost on training data: 0.518471848168

Accuracy on training data: 9721 / 10000

Cost on evaluation data: 0.655776326907

Accuracy on evaluation data: 9418 / 10000

Epoch 241 training complete

Cost on training data: 0.548690819238

Accuracy on training data: 9660 / 10000

Cost on evaluation data: 0.692494956836

Accuracy on evaluation data: 9376 / 10000

Epoch 242 training complete

Cost on training data: 0.547308950977

Accuracy on training data: 9702 / 10000

Cost on evaluation data: 0.702071273922

Accuracy on evaluation data: 9345 / 10000

Epoch 243 training complete

Cost on training data: 0.538097706472

Accuracy on training data: 9678 / 10000

Cost on evaluation data: 0.678856802675

Accuracy on evaluation data: 9384 / 10000

Epoch 244 training complete

Cost on training data: 0.528325869166

Accuracy on training data: 9692 / 10000

Cost on evaluation data: 0.677354246389

Accuracy on evaluation data: 9367 / 10000

Epoch 245 training complete

Cost on training data: 0.535429740273

Accuracy on training data: 9714 / 10000

Cost on evaluation data: 0.670670473879

Accuracy on evaluation data: 9409 / 10000

Epoch 246 training complete

Cost on training data: 0.52664089121

Accuracy on training data: 9709 / 10000

Cost on evaluation data: 0.665515769574

Accuracy on evaluation data: 9417 / 10000

Epoch 247 training complete

Cost on training data: 0.522187323437

Accuracy on training data: 9729 / 10000

Cost on evaluation data: 0.656291178697

Accuracy on evaluation data: 9431 / 10000

Epoch 248 training complete

Cost on training data: 0.543670295267

Accuracy on training data: 9693 / 10000

Cost on evaluation data: 0.691546519135

Accuracy on evaluation data: 9363 / 10000

Epoch 249 training complete

Cost on training data: 0.539809768477

Accuracy on training data: 9698 / 10000

Cost on evaluation data: 0.679089295852

Accuracy on evaluation data: 9381 / 10000

Epoch 250 training complete

Cost on training data: 0.551260837283

Accuracy on training data: 9685 / 10000

Cost on evaluation data: 0.690036516105

Accuracy on evaluation data: 9392 / 10000

Epoch 251 training complete

Cost on training data: 0.542729676199

Accuracy on training data: 9675 / 10000

Cost on evaluation data: 0.691472055445

Accuracy on evaluation data: 9366 / 10000

Epoch 252 training complete

Cost on training data: 0.545139283268

Accuracy on training data: 9665 / 10000

Cost on evaluation data: 0.686627456457

Accuracy on evaluation data: 9360 / 10000

Epoch 253 training complete

Cost on training data: 0.5150008738

Accuracy on training data: 9735 / 10000

Cost on evaluation data: 0.648252873528

Accuracy on evaluation data: 9453 / 10000

Epoch 254 training complete

Cost on training data: 0.56264754523

Accuracy on training data: 9635 / 10000

Cost on evaluation data: 0.703635093966

Accuracy on evaluation data: 9332 / 10000

Epoch 255 training complete

Cost on training data: 0.531317433603

Accuracy on training data: 9671 / 10000

Cost on evaluation data: 0.676539503761

Accuracy on evaluation data: 9366 / 10000

Epoch 256 training complete

Cost on training data: 0.54016181965

Accuracy on training data: 9715 / 10000

Cost on evaluation data: 0.681314793656

Accuracy on evaluation data: 9403 / 10000

Epoch 257 training complete

Cost on training data: 0.53784031324

Accuracy on training data: 9696 / 10000

Cost on evaluation data: 0.676152768161

Accuracy on evaluation data: 9389 / 10000

Epoch 258 training complete

Cost on training data: 0.570808810326

Accuracy on training data: 9625 / 10000

Cost on evaluation data: 0.714988498694

Accuracy on evaluation data: 9321 / 10000

Epoch 259 training complete

Cost on training data: 0.527363607049

Accuracy on training data: 9693 / 10000

Cost on evaluation data: 0.668603372171

Accuracy on evaluation data: 9392 / 10000

Epoch 260 training complete

Cost on training data: 0.512603612113

Accuracy on training data: 9746 / 10000

Cost on evaluation data: 0.65426507897

Accuracy on evaluation data: 9444 / 10000

Epoch 261 training complete

Cost on training data: 0.539989421827

Accuracy on training data: 9695 / 10000

Cost on evaluation data: 0.681997479732

Accuracy on evaluation data: 9403 / 10000

Epoch 262 training complete

Cost on training data: 0.550705256924

Accuracy on training data: 9690 / 10000

Cost on evaluation data: 0.694666961757

Accuracy on evaluation data: 9374 / 10000

Epoch 263 training complete

Cost on training data: 0.550902526081

Accuracy on training data: 9691 / 10000

Cost on evaluation data: 0.688645488669

Accuracy on evaluation data: 9364 / 10000

Epoch 264 training complete

Cost on training data: 0.539365840545

Accuracy on training data: 9710 / 10000

Cost on evaluation data: 0.67438707931

Accuracy on evaluation data: 9388 / 10000

Epoch 265 training complete

Cost on training data: 0.543841148289

Accuracy on training data: 9690 / 10000

Cost on evaluation data: 0.687112194949

Accuracy on evaluation data: 9359 / 10000

Epoch 266 training complete

Cost on training data: 0.508330194504

Accuracy on training data: 9733 / 10000

Cost on evaluation data: 0.646489168036

Accuracy on evaluation data: 9418 / 10000

Epoch 267 training complete

Cost on training data: 0.527516304239

Accuracy on training data: 9704 / 10000

Cost on evaluation data: 0.662028201591

Accuracy on evaluation data: 9409 / 10000

Epoch 268 training complete

Cost on training data: 0.517419030923

Accuracy on training data: 9735 / 10000

Cost on evaluation data: 0.664584189247

Accuracy on evaluation data: 9408 / 10000

Epoch 269 training complete

Cost on training data: 0.546320728388

Accuracy on training data: 9691 / 10000

Cost on evaluation data: 0.687149542889

Accuracy on evaluation data: 9374 / 10000

Epoch 270 training complete

Cost on training data: 0.509173044564

Accuracy on training data: 9731 / 10000

Cost on evaluation data: 0.646730016658

Accuracy on evaluation data: 9423 / 10000

Epoch 271 training complete

Cost on training data: 0.551083129343

Accuracy on training data: 9665 / 10000

Cost on evaluation data: 0.697098602782

Accuracy on evaluation data: 9374 / 10000

Epoch 272 training complete

Cost on training data: 0.516142390538

Accuracy on training data: 9740 / 10000

Cost on evaluation data: 0.658186717417

Accuracy on evaluation data: 9418 / 10000

Epoch 273 training complete

Cost on training data: 0.527571261959

Accuracy on training data: 9688 / 10000

Cost on evaluation data: 0.674005494266

Accuracy on evaluation data: 9374 / 10000

Epoch 274 training complete

Cost on training data: 0.559012973362

Accuracy on training data: 9646 / 10000

Cost on evaluation data: 0.70599619441

Accuracy on evaluation data: 9338 / 10000

Epoch 275 training complete

Cost on training data: 0.560692967133

Accuracy on training data: 9671 / 10000

Cost on evaluation data: 0.706163006949

Accuracy on evaluation data: 9364 / 10000

Epoch 276 training complete

Cost on training data: 0.540876027505

Accuracy on training data: 9685 / 10000

Cost on evaluation data: 0.679192577396

Accuracy on evaluation data: 9364 / 10000

Epoch 277 training complete

Cost on training data: 0.507121648921

Accuracy on training data: 9759 / 10000

Cost on evaluation data: 0.639385468092

Accuracy on evaluation data: 9458 / 10000

Epoch 278 training complete

Cost on training data: 0.525448383224

Accuracy on training data: 9714 / 10000

Cost on evaluation data: 0.670958800275

Accuracy on evaluation data: 9402 / 10000

Epoch 279 training complete

Cost on training data: 0.524470265952

Accuracy on training data: 9713 / 10000

Cost on evaluation data: 0.65083752897

Accuracy on evaluation data: 9434 / 10000

Epoch 280 training complete

Cost on training data: 0.520566912246

Accuracy on training data: 9723 / 10000

Cost on evaluation data: 0.666937106923

Accuracy on evaluation data: 9424 / 10000

Epoch 281 training complete

Cost on training data: 0.577048467324

Accuracy on training data: 9619 / 10000

Cost on evaluation data: 0.726866152399

Accuracy on evaluation data: 9278 / 10000

Epoch 282 training complete

Cost on training data: 0.557217607082

Accuracy on training data: 9676 / 10000

Cost on evaluation data: 0.700466750717

Accuracy on evaluation data: 9356 / 10000

Epoch 283 training complete

Cost on training data: 0.544129371459

Accuracy on training data: 9685 / 10000

Cost on evaluation data: 0.683769925706

Accuracy on evaluation data: 9386 / 10000

Epoch 284 training complete

Cost on training data: 0.530340676237

Accuracy on training data: 9696 / 10000

Cost on evaluation data: 0.668439058457

Accuracy on evaluation data: 9406 / 10000

Epoch 285 training complete

Cost on training data: 0.54482004902

Accuracy on training data: 9690 / 10000

Cost on evaluation data: 0.688080311584

Accuracy on evaluation data: 9369 / 10000

Epoch 286 training complete

Cost on training data: 0.519372837039

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.663175343582

Accuracy on evaluation data: 9423 / 10000

Epoch 287 training complete

Cost on training data: 0.522993650229

Accuracy on training data: 9733 / 10000

Cost on evaluation data: 0.660880689241

Accuracy on evaluation data: 9409 / 10000

Epoch 288 training complete

Cost on training data: 0.520607379686

Accuracy on training data: 9702 / 10000

Cost on evaluation data: 0.66484653419

Accuracy on evaluation data: 9402 / 10000

Epoch 289 training complete

Cost on training data: 0.538840559719

Accuracy on training data: 9702 / 10000

Cost on evaluation data: 0.693846529094

Accuracy on evaluation data: 9371 / 10000

Epoch 290 training complete

Cost on training data: 0.533502419761

Accuracy on training data: 9700 / 10000

Cost on evaluation data: 0.677287223208

Accuracy on evaluation data: 9372 / 10000

Epoch 291 training complete

Cost on training data: 0.533681535822

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.672500354378

Accuracy on evaluation data: 9406 / 10000

Epoch 292 training complete

Cost on training data: 0.517529811064

Accuracy on training data: 9727 / 10000

Cost on evaluation data: 0.658205749314

Accuracy on evaluation data: 9432 / 10000

Epoch 293 training complete

Cost on training data: 0.544181507796

Accuracy on training data: 9673 / 10000

Cost on evaluation data: 0.691547730449

Accuracy on evaluation data: 9347 / 10000

Epoch 294 training complete

Cost on training data: 0.535471230785

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.682284996948

Accuracy on evaluation data: 9405 / 10000

Epoch 295 training complete

Cost on training data: 0.510963463947

Accuracy on training data: 9743 / 10000

Cost on evaluation data: 0.652875195882

Accuracy on evaluation data: 9438 / 10000

Epoch 296 training complete

Cost on training data: 0.610292451978

Accuracy on training data: 9549 / 10000

Cost on evaluation data: 0.760652148584

Accuracy on evaluation data: 9249 / 10000

Epoch 297 training complete

Cost on training data: 0.583744884028

Accuracy on training data: 9618 / 10000

Cost on evaluation data: 0.741741052294

Accuracy on evaluation data: 9256 / 10000

Epoch 298 training complete

Cost on training data: 0.527883805023

Accuracy on training data: 9733 / 10000

Cost on evaluation data: 0.659642770389

Accuracy on evaluation data: 9404 / 10000

Epoch 299 training complete

Cost on training data: 0.544869952265

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.687173955752

Accuracy on evaluation data: 9386 / 10000

Epoch 300 training complete

Cost on training data: 0.522217907328

Accuracy on training data: 9701 / 10000

Cost on evaluation data: 0.659927214393

Accuracy on evaluation data: 9399 / 10000

Epoch 301 training complete

Cost on training data: 0.525980207776

Accuracy on training data: 9742 / 10000

Cost on evaluation data: 0.667934029465

Accuracy on evaluation data: 9416 / 10000

Epoch 302 training complete

Cost on training data: 0.532947506905

Accuracy on training data: 9693 / 10000

Cost on evaluation data: 0.671475465704

Accuracy on evaluation data: 9393 / 10000

Epoch 303 training complete

Cost on training data: 0.54305264381

Accuracy on training data: 9705 / 10000

Cost on evaluation data: 0.67999179167

Accuracy on evaluation data: 9376 / 10000

Epoch 304 training complete

Cost on training data: 0.537107645058

Accuracy on training data: 9690 / 10000

Cost on evaluation data: 0.67947981279

Accuracy on evaluation data: 9353 / 10000

Epoch 305 training complete

Cost on training data: 0.615593291678

Accuracy on training data: 9489 / 10000

Cost on evaluation data: 0.761547353471

Accuracy on evaluation data: 9206 / 10000

Epoch 306 training complete

Cost on training data: 0.507261466042

Accuracy on training data: 9738 / 10000

Cost on evaluation data: 0.639987486802

Accuracy on evaluation data: 9456 / 10000

Epoch 307 training complete

Cost on training data: 0.529894401448

Accuracy on training data: 9712 / 10000

Cost on evaluation data: 0.670625464385

Accuracy on evaluation data: 9396 / 10000

Epoch 308 training complete

Cost on training data: 0.534010927002

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.673849067704

Accuracy on evaluation data: 9414 / 10000

Epoch 309 training complete

Cost on training data: 0.526892616345

Accuracy on training data: 9705 / 10000

Cost on evaluation data: 0.672413643989

Accuracy on evaluation data: 9403 / 10000

Epoch 310 training complete

Cost on training data: 0.555983362104

Accuracy on training data: 9645 / 10000

Cost on evaluation data: 0.691518614034

Accuracy on evaluation data: 9369 / 10000

Epoch 311 training complete

Cost on training data: 0.546886236309

Accuracy on training data: 9688 / 10000

Cost on evaluation data: 0.693151853469

Accuracy on evaluation data: 9384 / 10000

Epoch 312 training complete

Cost on training data: 0.503694906396

Accuracy on training data: 9733 / 10000

Cost on evaluation data: 0.641487176609

Accuracy on evaluation data: 9440 / 10000

Epoch 313 training complete

Cost on training data: 0.51976478907

Accuracy on training data: 9760 / 10000

Cost on evaluation data: 0.654495947618

Accuracy on evaluation data: 9436 / 10000

Epoch 314 training complete

Cost on training data: 0.522780413734

Accuracy on training data: 9726 / 10000

Cost on evaluation data: 0.657445206764

Accuracy on evaluation data: 9431 / 10000

Epoch 315 training complete

Cost on training data: 0.50504925434

Accuracy on training data: 9749 / 10000

Cost on evaluation data: 0.642542655447

Accuracy on evaluation data: 9436 / 10000

Epoch 316 training complete

Cost on training data: 0.514615353118

Accuracy on training data: 9709 / 10000

Cost on evaluation data: 0.649713774625

Accuracy on evaluation data: 9426 / 10000

Epoch 317 training complete

Cost on training data: 0.524268454626

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.664827343743

Accuracy on evaluation data: 9398 / 10000

Epoch 318 training complete

Cost on training data: 0.613737100002

Accuracy on training data: 9515 / 10000

Cost on evaluation data: 0.770399930622

Accuracy on evaluation data: 9207 / 10000

Epoch 319 training complete

Cost on training data: 0.545431571197

Accuracy on training data: 9720 / 10000

Cost on evaluation data: 0.675125302251

Accuracy on evaluation data: 9408 / 10000

Epoch 320 training complete

Cost on training data: 0.535956442694

Accuracy on training data: 9694 / 10000

Cost on evaluation data: 0.68326138114

Accuracy on evaluation data: 9381 / 10000

Epoch 321 training complete

Cost on training data: 0.518913587964

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.673610237324

Accuracy on evaluation data: 9406 / 10000

Epoch 322 training complete

Cost on training data: 0.524699935655

Accuracy on training data: 9744 / 10000

Cost on evaluation data: 0.677260574768

Accuracy on evaluation data: 9396 / 10000

Epoch 323 training complete

Cost on training data: 0.51196438843

Accuracy on training data: 9755 / 10000

Cost on evaluation data: 0.65002443948

Accuracy on evaluation data: 9439 / 10000

Epoch 324 training complete

Cost on training data: 0.564237621721

Accuracy on training data: 9653 / 10000

Cost on evaluation data: 0.699917645894

Accuracy on evaluation data: 9362 / 10000

Epoch 325 training complete

Cost on training data: 0.547845054476

Accuracy on training data: 9649 / 10000

Cost on evaluation data: 0.700202765143

Accuracy on evaluation data: 9338 / 10000

Epoch 326 training complete

Cost on training data: 0.519974109351

Accuracy on training data: 9709 / 10000

Cost on evaluation data: 0.660751162967

Accuracy on evaluation data: 9410 / 10000

Epoch 327 training complete

Cost on training data: 0.530256944315

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.672017569762

Accuracy on evaluation data: 9413 / 10000

Epoch 328 training complete

Cost on training data: 0.531283489941

Accuracy on training data: 9688 / 10000

Cost on evaluation data: 0.681535478481

Accuracy on evaluation data: 9369 / 10000

Epoch 329 training complete

Cost on training data: 0.537079008674

Accuracy on training data: 9675 / 10000

Cost on evaluation data: 0.670828339067

Accuracy on evaluation data: 9388 / 10000

Epoch 330 training complete

Cost on training data: 0.536267598516

Accuracy on training data: 9708 / 10000

Cost on evaluation data: 0.684606356461

Accuracy on evaluation data: 9388 / 10000

Epoch 331 training complete

Cost on training data: 0.533772261091

Accuracy on training data: 9701 / 10000

Cost on evaluation data: 0.677488928862

Accuracy on evaluation data: 9365 / 10000

Epoch 332 training complete

Cost on training data: 0.519619480215

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.662740213743

Accuracy on evaluation data: 9416 / 10000

Epoch 333 training complete

Cost on training data: 0.520821020987

Accuracy on training data: 9705 / 10000

Cost on evaluation data: 0.666279864357

Accuracy on evaluation data: 9418 / 10000

Epoch 334 training complete

Cost on training data: 0.524361617568

Accuracy on training data: 9747 / 10000

Cost on evaluation data: 0.66926690049

Accuracy on evaluation data: 9398 / 10000

Epoch 335 training complete

Cost on training data: 0.534615691822

Accuracy on training data: 9700 / 10000

Cost on evaluation data: 0.680820412345

Accuracy on evaluation data: 9381 / 10000

Epoch 336 training complete

Cost on training data: 0.52718334008

Accuracy on training data: 9716 / 10000

Cost on evaluation data: 0.664659640084

Accuracy on evaluation data: 9415 / 10000

Epoch 337 training complete

Cost on training data: 0.560630667933

Accuracy on training data: 9632 / 10000

Cost on evaluation data: 0.707984920743

Accuracy on evaluation data: 9321 / 10000

Epoch 338 training complete

Cost on training data: 0.547989682506

Accuracy on training data: 9674 / 10000

Cost on evaluation data: 0.683275321518

Accuracy on evaluation data: 9375 / 10000

Epoch 339 training complete

Cost on training data: 0.559032402937

Accuracy on training data: 9643 / 10000

Cost on evaluation data: 0.699236107838

Accuracy on evaluation data: 9352 / 10000

Epoch 340 training complete

Cost on training data: 0.49888102221

Accuracy on training data: 9771 / 10000

Cost on evaluation data: 0.637189432027

Accuracy on evaluation data: 9455 / 10000

Epoch 341 training complete

Cost on training data: 0.549678782909

Accuracy on training data: 9670 / 10000

Cost on evaluation data: 0.691323828968

Accuracy on evaluation data: 9372 / 10000

Epoch 342 training complete

Cost on training data: 0.553705960432

Accuracy on training data: 9642 / 10000

Cost on evaluation data: 0.706677094921

Accuracy on evaluation data: 9333 / 10000

Epoch 343 training complete

Cost on training data: 0.509576224879

Accuracy on training data: 9738 / 10000

Cost on evaluation data: 0.656323074918

Accuracy on evaluation data: 9436 / 10000

Epoch 344 training complete

Cost on training data: 0.516656568764

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.658969907985

Accuracy on evaluation data: 9407 / 10000

Epoch 345 training complete

Cost on training data: 0.537938695197

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.667705414401

Accuracy on evaluation data: 9412 / 10000

Epoch 346 training complete

Cost on training data: 0.512773617661

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.654394689672

Accuracy on evaluation data: 9418 / 10000

Epoch 347 training complete

Cost on training data: 0.605999922625

Accuracy on training data: 9494 / 10000

Cost on evaluation data: 0.760480405497

Accuracy on evaluation data: 9198 / 10000

Epoch 348 training complete

Cost on training data: 0.528236803079

Accuracy on training data: 9704 / 10000

Cost on evaluation data: 0.665268694499

Accuracy on evaluation data: 9399 / 10000

Epoch 349 training complete

Cost on training data: 0.506143482739

Accuracy on training data: 9750 / 10000

Cost on evaluation data: 0.648486010295

Accuracy on evaluation data: 9429 / 10000

Epoch 350 training complete

Cost on training data: 0.512702610271

Accuracy on training data: 9749 / 10000

Cost on evaluation data: 0.657608750044

Accuracy on evaluation data: 9421 / 10000

Epoch 351 training complete

Cost on training data: 0.525089906643

Accuracy on training data: 9717 / 10000

Cost on evaluation data: 0.674358602085

Accuracy on evaluation data: 9385 / 10000

Epoch 352 training complete

Cost on training data: 0.513390572431

Accuracy on training data: 9729 / 10000

Cost on evaluation data: 0.649047058503

Accuracy on evaluation data: 9419 / 10000

Epoch 353 training complete

Cost on training data: 0.519765031303

Accuracy on training data: 9724 / 10000

Cost on evaluation data: 0.66470216395

Accuracy on evaluation data: 9410 / 10000

Epoch 354 training complete

Cost on training data: 0.540436274848

Accuracy on training data: 9669 / 10000

Cost on evaluation data: 0.683656313623

Accuracy on evaluation data: 9380 / 10000

Epoch 355 training complete

Cost on training data: 0.531164227365

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.67125664762

Accuracy on evaluation data: 9401 / 10000

Epoch 356 training complete

Cost on training data: 0.523187064696

Accuracy on training data: 9717 / 10000

Cost on evaluation data: 0.662039071309

Accuracy on evaluation data: 9422 / 10000

Epoch 357 training complete

Cost on training data: 0.534935267957

Accuracy on training data: 9689 / 10000

Cost on evaluation data: 0.680600787445

Accuracy on evaluation data: 9382 / 10000

Epoch 358 training complete

Cost on training data: 0.52468925814

Accuracy on training data: 9727 / 10000

Cost on evaluation data: 0.663027874193

Accuracy on evaluation data: 9429 / 10000

Epoch 359 training complete

Cost on training data: 0.564618556691

Accuracy on training data: 9611 / 10000

Cost on evaluation data: 0.707680952079

Accuracy on evaluation data: 9320 / 10000

Epoch 360 training complete

Cost on training data: 0.511366128652

Accuracy on training data: 9729 / 10000

Cost on evaluation data: 0.646481933932

Accuracy on evaluation data: 9434 / 10000

Epoch 361 training complete

Cost on training data: 0.524577523298

Accuracy on training data: 9717 / 10000

Cost on evaluation data: 0.654437722704

Accuracy on evaluation data: 9427 / 10000

Epoch 362 training complete

Cost on training data: 0.511869510638

Accuracy on training data: 9732 / 10000

Cost on evaluation data: 0.642318067737

Accuracy on evaluation data: 9433 / 10000

Epoch 363 training complete

Cost on training data: 0.528871333278

Accuracy on training data: 9724 / 10000

Cost on evaluation data: 0.664900488329

Accuracy on evaluation data: 9443 / 10000

Epoch 364 training complete

Cost on training data: 0.539910165611

Accuracy on training data: 9685 / 10000

Cost on evaluation data: 0.688304271815

Accuracy on evaluation data: 9367 / 10000

Epoch 365 training complete

Cost on training data: 0.524053431449

Accuracy on training data: 9687 / 10000

Cost on evaluation data: 0.666717737668

Accuracy on evaluation data: 9364 / 10000

Epoch 366 training complete

Cost on training data: 0.523860938919

Accuracy on training data: 9699 / 10000

Cost on evaluation data: 0.67267879301

Accuracy on evaluation data: 9372 / 10000

Epoch 367 training complete

Cost on training data: 0.504958416397

Accuracy on training data: 9752 / 10000

Cost on evaluation data: 0.644542756753

Accuracy on evaluation data: 9434 / 10000

Epoch 368 training complete

Cost on training data: 0.52202508117

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.660675204638

Accuracy on evaluation data: 9403 / 10000

Epoch 369 training complete

Cost on training data: 0.537056058483

Accuracy on training data: 9711 / 10000

Cost on evaluation data: 0.671892541347

Accuracy on evaluation data: 9399 / 10000

Epoch 370 training complete

Cost on training data: 0.559798538158

Accuracy on training data: 9657 / 10000

Cost on evaluation data: 0.704096699785

Accuracy on evaluation data: 9342 / 10000

Epoch 371 training complete

Cost on training data: 0.545649600742

Accuracy on training data: 9691 / 10000

Cost on evaluation data: 0.694556406326

Accuracy on evaluation data: 9354 / 10000

Epoch 372 training complete

Cost on training data: 0.540593989036

Accuracy on training data: 9676 / 10000

Cost on evaluation data: 0.689242034655

Accuracy on evaluation data: 9348 / 10000

Epoch 373 training complete

Cost on training data: 0.542145249451

Accuracy on training data: 9707 / 10000

Cost on evaluation data: 0.688359817946

Accuracy on evaluation data: 9401 / 10000

Epoch 374 training complete

Cost on training data: 0.6144671284

Accuracy on training data: 9521 / 10000

Cost on evaluation data: 0.753385216347

Accuracy on evaluation data: 9237 / 10000

Epoch 375 training complete

Cost on training data: 0.526059502523

Accuracy on training data: 9728 / 10000

Cost on evaluation data: 0.664409595906

Accuracy on evaluation data: 9445 / 10000

Epoch 376 training complete

Cost on training data: 0.528182958362

Accuracy on training data: 9706 / 10000

Cost on evaluation data: 0.68311486266

Accuracy on evaluation data: 9353 / 10000

Epoch 377 training complete

Cost on training data: 0.520091587363

Accuracy on training data: 9710 / 10000

Cost on evaluation data: 0.661884585285

Accuracy on evaluation data: 9414 / 10000

Epoch 378 training complete

Cost on training data: 0.524152307096

Accuracy on training data: 9722 / 10000

Cost on evaluation data: 0.665744837987

Accuracy on evaluation data: 9400 / 10000

Epoch 379 training complete

Cost on training data: 0.525630828879

Accuracy on training data: 9729 / 10000

Cost on evaluation data: 0.66670209474

Accuracy on evaluation data: 9416 / 10000

Epoch 380 training complete

Cost on training data: 0.549678239321

Accuracy on training data: 9689 / 10000

Cost on evaluation data: 0.695966873208

Accuracy on evaluation data: 9371 / 10000

Epoch 381 training complete

Cost on training data: 0.52666868922

Accuracy on training data: 9718 / 10000

Cost on evaluation data: 0.667298808231

Accuracy on evaluation data: 9396 / 10000

Epoch 382 training complete

Cost on training data: 0.529151664082

Accuracy on training data: 9704 / 10000

Cost on evaluation data: 0.666179091723

Accuracy on evaluation data: 9416 / 10000

Epoch 383 training complete

Cost on training data: 0.521333736225

Accuracy on training data: 9732 / 10000

Cost on evaluation data: 0.661117940713

Accuracy on evaluation data: 9406 / 10000

Epoch 384 training complete

Cost on training data: 0.541517995965

Accuracy on training data: 9665 / 10000

Cost on evaluation data: 0.684298341678

Accuracy on evaluation data: 9353 / 10000

Epoch 385 training complete

Cost on training data: 0.530555011457

Accuracy on training data: 9695 / 10000

Cost on evaluation data: 0.681473331455

Accuracy on evaluation data: 9380 / 10000

Epoch 386 training complete

Cost on training data: 0.553137626613

Accuracy on training data: 9682 / 10000

Cost on evaluation data: 0.688934624098

Accuracy on evaluation data: 9390 / 10000

Epoch 387 training complete

Cost on training data: 0.56045094688

Accuracy on training data: 9656 / 10000

Cost on evaluation data: 0.70662332104

Accuracy on evaluation data: 9336 / 10000

Epoch 388 training complete

Cost on training data: 0.595556784249

Accuracy on training data: 9629 / 10000

Cost on evaluation data: 0.744136615804

Accuracy on evaluation data: 9314 / 10000

Epoch 389 training complete

Cost on training data: 0.566123226847

Accuracy on training data: 9631 / 10000

Cost on evaluation data: 0.720176963045

Accuracy on evaluation data: 9332 / 10000

Epoch 390 training complete

Cost on training data: 0.521311874562

Accuracy on training data: 9749 / 10000

Cost on evaluation data: 0.672939679983

Accuracy on evaluation data: 9394 / 10000

Epoch 391 training complete

Cost on training data: 0.568309850812

Accuracy on training data: 9630 / 10000

Cost on evaluation data: 0.707758241752

Accuracy on evaluation data: 9330 / 10000

Epoch 392 training complete

Cost on training data: 0.532054314948

Accuracy on training data: 9695 / 10000

Cost on evaluation data: 0.675565983353

Accuracy on evaluation data: 9371 / 10000

Epoch 393 training complete

Cost on training data: 0.535527287977

Accuracy on training data: 9710 / 10000

Cost on evaluation data: 0.680372158497

Accuracy on evaluation data: 9386 / 10000

Epoch 394 training complete

Cost on training data: 0.530359108192

Accuracy on training data: 9700 / 10000

Cost on evaluation data: 0.675971313968

Accuracy on evaluation data: 9385 / 10000

Epoch 395 training complete

Cost on training data: 0.553715496307

Accuracy on training data: 9652 / 10000

Cost on evaluation data: 0.710823523643

Accuracy on evaluation data: 9316 / 10000

Epoch 396 training complete

Cost on training data: 0.539900767368

Accuracy on training data: 9657 / 10000

Cost on evaluation data: 0.6854107159

Accuracy on evaluation data: 9374 / 10000

Epoch 397 training complete

Cost on training data: 0.569822549901

Accuracy on training data: 9633 / 10000

Cost on evaluation data: 0.705971913703

Accuracy on evaluation data: 9334 / 10000

Epoch 398 training complete

Cost on training data: 0.563681215698

Accuracy on training data: 9655 / 10000

Cost on evaluation data: 0.707730090582

Accuracy on evaluation data: 9353 / 10000

Epoch 399 training complete

Cost on training data: 0.531255832331

Accuracy on training data: 9723 / 10000

Cost on evaluation data: 0.66876006733

Accuracy on evaluation data: 9421 / 10000

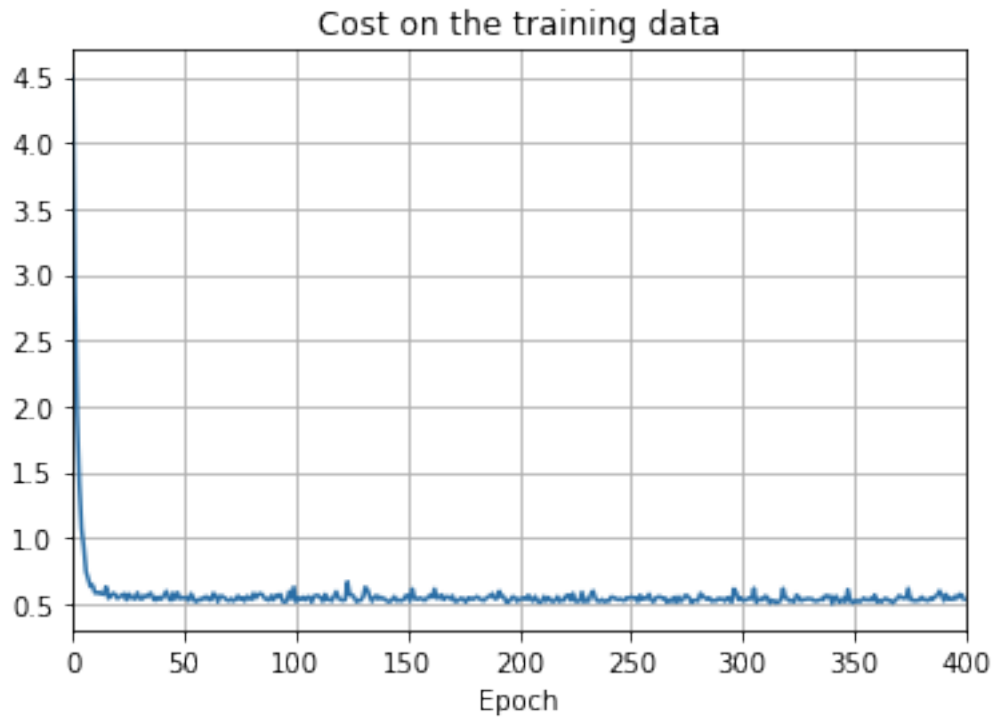
```
In [18]: import plot_helper
```

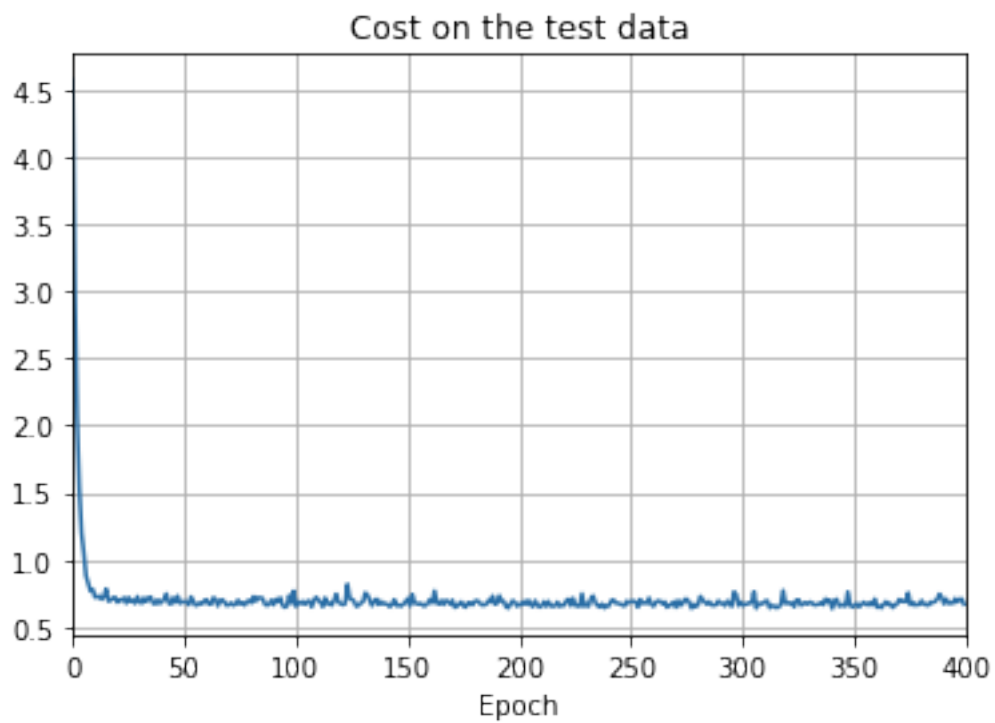
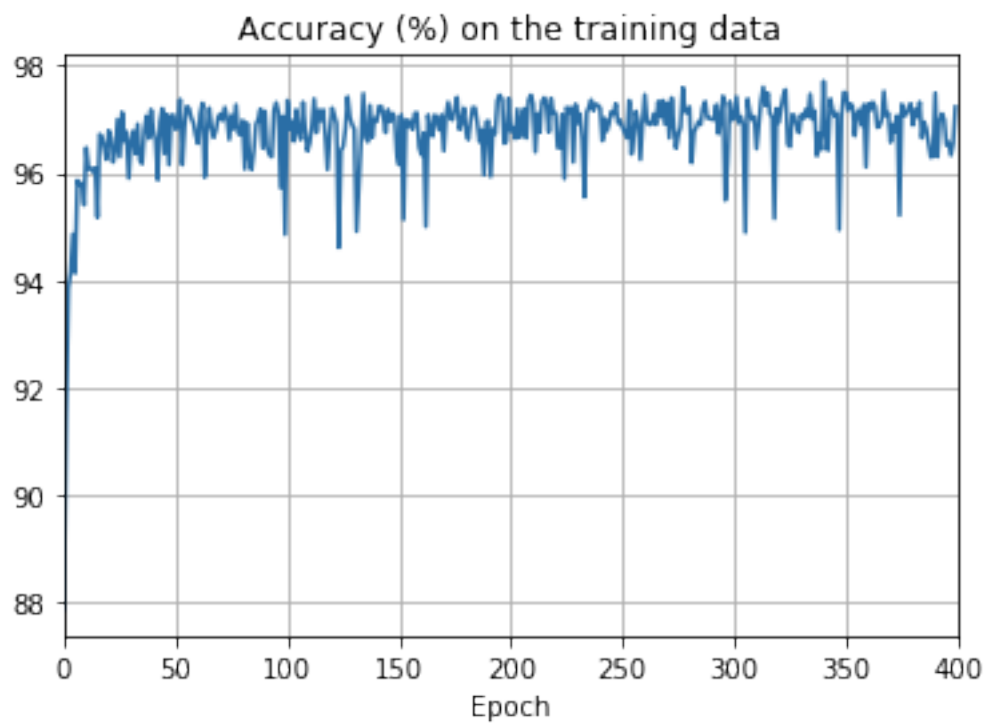
```
In [21]: plot_helper.plot_training_cost(num_epochs=epochs, training_cost=training_cost, trainin
```

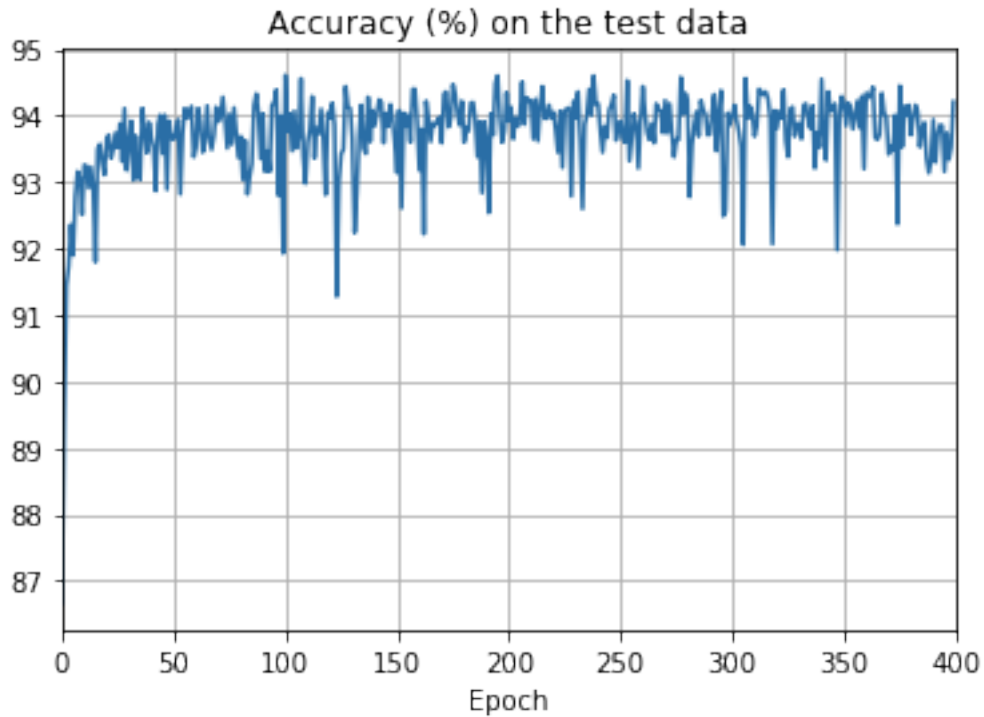
```
plot_helper.plot_training_accuracy(num_epochs=epochs, training_accuracy=training_accu
```

```
plot_helper.plot_test_cost(num_epochs=epochs, test_cost=evaluation_cost, test_cost_xm
```

```
plot_helper.plot_test_accuracy(num_epochs=epochs, test_accuracy=evaluation_accuracy, t
```







```
In [3]: import network2
net2_all_train = network2.Network([784, 100, 10], cost=network2.CrossEntropyCost)
net2_all_train.large_weight_initializer()

epochs = 30

evaluation_cost_all_train, evaluation_accuracy_all_train, training_cost_all_train, tra
    training_data,
    epochs,
    10,
    0.5,
    evaluation_data=test_data,
    lambda=5.0,
    monitor_evaluation_cost=True,
    monitor_evaluation_accuracy=True,
    monitor_training_cost=True,
    monitor_training_accuracy=True
)
```

```
Epoch 0 training complete
Cost on training data: 2.82672129051
Accuracy on training data: 47233 / 50000
Cost on evaluation data: 12.5757665523
Accuracy on evaluation data: 9410 / 10000
```

Epoch 1 training complete
Cost on training data: 1.87238494386
Accuracy on training data: 47430 / 50000
Cost on evaluation data: 7.97602784226
Accuracy on evaluation data: 9395 / 10000

Epoch 2 training complete
Cost on training data: 1.21885165955
Accuracy on training data: 48335 / 50000
Cost on evaluation data: 5.11661906748
Accuracy on evaluation data: 9595 / 10000

Epoch 3 training complete
Cost on training data: 0.850523075602
Accuracy on training data: 48570 / 50000
Cost on evaluation data: 3.42957618148
Accuracy on evaluation data: 9629 / 10000

Epoch 4 training complete
Cost on training data: 0.646245604174
Accuracy on training data: 48692 / 50000
Cost on evaluation data: 2.42618074499
Accuracy on evaluation data: 9641 / 10000

Epoch 5 training complete
Cost on training data: 0.50850051722
Accuracy on training data: 48771 / 50000
Cost on evaluation data: 1.84275332874
Accuracy on evaluation data: 9627 / 10000

Epoch 6 training complete
Cost on training data: 0.404384098785
Accuracy on training data: 49079 / 50000
Cost on evaluation data: 1.45600748916
Accuracy on evaluation data: 9684 / 10000

Epoch 7 training complete
Cost on training data: 0.349831634146
Accuracy on training data: 49148 / 50000
Cost on evaluation data: 1.23725840284
Accuracy on evaluation data: 9708 / 10000

Epoch 8 training complete
Cost on training data: 0.348229479236
Accuracy on training data: 48983 / 50000
Cost on evaluation data: 1.13204983354
Accuracy on evaluation data: 9693 / 10000

Epoch 9 training complete
Cost on training data: 0.303323674088
Accuracy on training data: 49213 / 50000
Cost on evaluation data: 1.03314922901
Accuracy on evaluation data: 9724 / 10000

Epoch 10 training complete
Cost on training data: 0.30521272809
Accuracy on training data: 49171 / 50000
Cost on evaluation data: 0.99572275402
Accuracy on evaluation data: 9716 / 10000

Epoch 11 training complete
Cost on training data: 0.298147093506
Accuracy on training data: 49202 / 50000
Cost on evaluation data: 0.960908371339
Accuracy on evaluation data: 9734 / 10000

Epoch 12 training complete
Cost on training data: 0.290034898436
Accuracy on training data: 49194 / 50000
Cost on evaluation data: 0.950825276325
Accuracy on evaluation data: 9722 / 10000

Epoch 13 training complete
Cost on training data: 0.288153004097
Accuracy on training data: 49255 / 50000
Cost on evaluation data: 0.942688877001
Accuracy on evaluation data: 9728 / 10000

Epoch 14 training complete
Cost on training data: 0.263899680115
Accuracy on training data: 49368 / 50000
Cost on evaluation data: 0.912578749945
Accuracy on evaluation data: 9750 / 10000

Epoch 15 training complete
Cost on training data: 0.281154092188
Accuracy on training data: 49211 / 50000
Cost on evaluation data: 0.924217681396
Accuracy on evaluation data: 9721 / 10000

Epoch 16 training complete
Cost on training data: 0.275855477853
Accuracy on training data: 49322 / 50000
Cost on evaluation data: 0.920732894021
Accuracy on evaluation data: 9740 / 10000

Epoch 17 training complete
Cost on training data: 0.287786533881
Accuracy on training data: 49150 / 50000
Cost on evaluation data: 0.932325385164
Accuracy on evaluation data: 9709 / 10000

Epoch 18 training complete
Cost on training data: 0.276388763384
Accuracy on training data: 49253 / 50000
Cost on evaluation data: 0.926396607099
Accuracy on evaluation data: 9734 / 10000

Epoch 19 training complete
Cost on training data: 0.299068504239
Accuracy on training data: 49165 / 50000
Cost on evaluation data: 0.938525470175
Accuracy on evaluation data: 9716 / 10000

Epoch 20 training complete
Cost on training data: 0.286049474544
Accuracy on training data: 49233 / 50000
Cost on evaluation data: 0.935580191048
Accuracy on evaluation data: 9702 / 10000

Epoch 21 training complete
Cost on training data: 0.264621532118
Accuracy on training data: 49345 / 50000
Cost on evaluation data: 0.898980814099
Accuracy on evaluation data: 9756 / 10000

Epoch 22 training complete
Cost on training data: 0.260207055025
Accuracy on training data: 49390 / 50000
Cost on evaluation data: 0.904141303966
Accuracy on evaluation data: 9747 / 10000

Epoch 23 training complete
Cost on training data: 0.270795417376
Accuracy on training data: 49322 / 50000
Cost on evaluation data: 0.910342341653
Accuracy on evaluation data: 9764 / 10000

Epoch 24 training complete
Cost on training data: 0.287209547787
Accuracy on training data: 49221 / 50000
Cost on evaluation data: 0.929717261715
Accuracy on evaluation data: 9724 / 10000

Epoch 25 training complete
Cost on training data: 0.265568143307
Accuracy on training data: 49358 / 50000
Cost on evaluation data: 0.904527462136
Accuracy on evaluation data: 9765 / 10000

Epoch 26 training complete
Cost on training data: 0.283897528859
Accuracy on training data: 49294 / 50000
Cost on evaluation data: 0.923053442592
Accuracy on evaluation data: 9736 / 10000

Epoch 27 training complete
Cost on training data: 0.278051644006
Accuracy on training data: 49298 / 50000
Cost on evaluation data: 0.91562689152
Accuracy on evaluation data: 9737 / 10000

Epoch 28 training complete
Cost on training data: 0.259888585859
Accuracy on training data: 49375 / 50000
Cost on evaluation data: 0.894448477245
Accuracy on evaluation data: 9756 / 10000

Epoch 29 training complete
Cost on training data: 0.252169973489
Accuracy on training data: 49439 / 50000
Cost on evaluation data: 0.893286445876
Accuracy on evaluation data: 9761 / 10000

```
In [5]: import plot_helper
        plot_helper.plot_training_cost(num_epochs=epochs, training_cost=training_cost_all_train, test_cost=evaluation_cost_all_train)
        plot_helper.plot_training_accuracy(num_epochs=epochs, training_accuracy=training_accuracy_all_train, test_accuracy=evaluation_accuracy_all_train)

        plot_helper.plot_test_cost(num_epochs=epochs, test_cost=evaluation_cost_all_train, test_accuracy=evaluation_accuracy_all_train)
        plot_helper.plot_test_accuracy(num_epochs=epochs, test_accuracy=evaluation_accuracy_all_train, test_cost=evaluation_cost_all_train)
```

