

Homework 3

Neural Network

Deadline: 2017.4.25 Tuesday (p.m.23:59)

Data

Database of Faces (AT&T Laboratories Cambridge)

Reference : <http://www.cl.cam.ac.uk/research/dtg/attarchive/facedatabase.html>

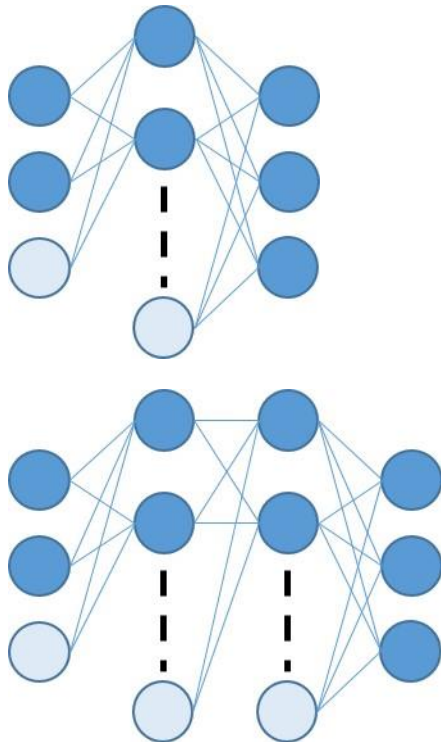


Each class has 1000 30x30 images.

You need to use them to build the classification models.

Model

neural network model (1-hidden layer, 2-hidden layer)



(You can find the details in the textbook.)

Tasks

1. Use Principal **component analysis (PCA)** to map data down to **2 dimensions**.
You can use the tool box about PCA.
2. Use **stochastic gradient descent in back propagation**.
3. Implement the neural network model with **1-hidden layer**.
Choose the **sigmoid function** as the activation function.
Don't use ready-made function in forward-propagation, back-propagation.
You need to make details to build the neural network model.
You can find the details in the textbook.
4. Implement the neural network model with **2-hidden layer**.
Choose the **rectified function** as the activation function.
Don't use ready-made function in forward-propagation, back-propagation.
You need to make details to build the neural network model.
You can find the details in the textbook.
5. Plot **decision regions**.
6. Compare and discuss **their performances** with **homework 2**.
7. Explain and compare the following nouns **with words**
 - batch gradient descent
 - mini-batch gradient descent
 - stochastic gradient descent
 - online gradient descent.
8. **Bonus:**
Use **mini-batch** method to retry the task 3 and add discussion into task 6.

Note:

Choosing how many data for testing and training is up to you.

Choosing how many nodes for hidden layer is up to you.

Reminders

1. Report within 12 pages
2. Using Python is encouraged for you.
3. Don't use high level functions and tool boxes.
Use functions and tool boxes for reading and writing files are allowed.
4. **Do not copy!**
(When using some reference materials, please give credit to them.)

Machine Learning 2017

Grading Policy & Homework Rules

- Homework will be graded by
 - Completeness
 - Correctness
 - Algorithm description
 - Discussion
- You should upload homework files to E3
- Homework Rules
 - File Name: hw3_StudentID.zip/rar (e.g. hw2_1234567.zip)
 - Code with comments
 - You can use any programming language to finish your homework
 - Report (.pdf format)
 - ReadMe.txt (describes how to run your code)
 - Hand in a hardcopy report on the due day.
- Deadline
 - Late Submission (1-7 days): 70% score
 - Don't accept after 7 days.