

CSE 474

Pattern Recognition Sessional

Lab# 3: Implementation of a Neural
Network Classifier

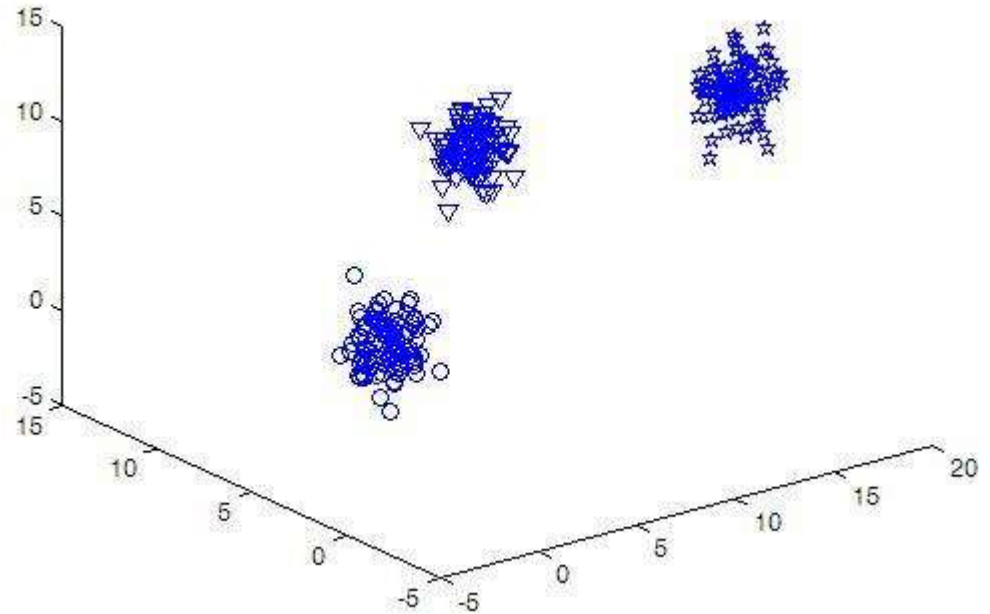
Lab Objective

- Implement a multiclass classifier using Neural Network
 - Number classes: **variable**
 - Feature dimension: **variable**
 - Network structure: **arbitrary**

Training Data

- Assume the following training set

- Multiple classes
- Multiple features



What to do

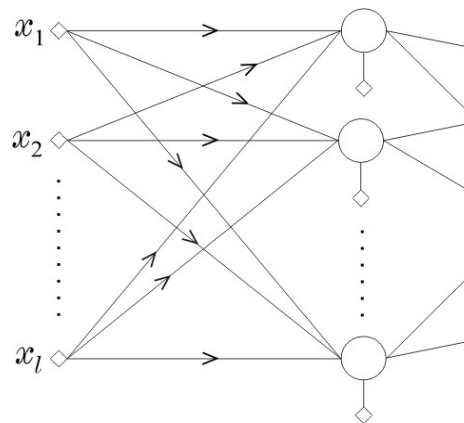
- Assume the following training set
 - All numerical data
 - Features are real numbers
 - Classes are integers

F1	F2	F3	Class
9.4512	7.3199	6.4664	1
10.7276	9.6067	5.9398	2
10.1960	9.3145	8.3873	1
15.7777	1.5879	11.4440	3
15.8685	2.7902	11.2532	3
14.9448	0.7798	12.7481	2

Training Set

What to do

- Use the **training set** to learn a **neural network** of *arbitrary structure* using *backpropagation* algorithm

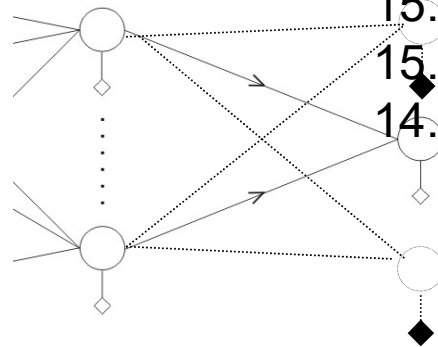


input
layer

1st hidden
layer

$(L-1)^{\text{th}}$ hidden
layer

L^{th} or output
layer



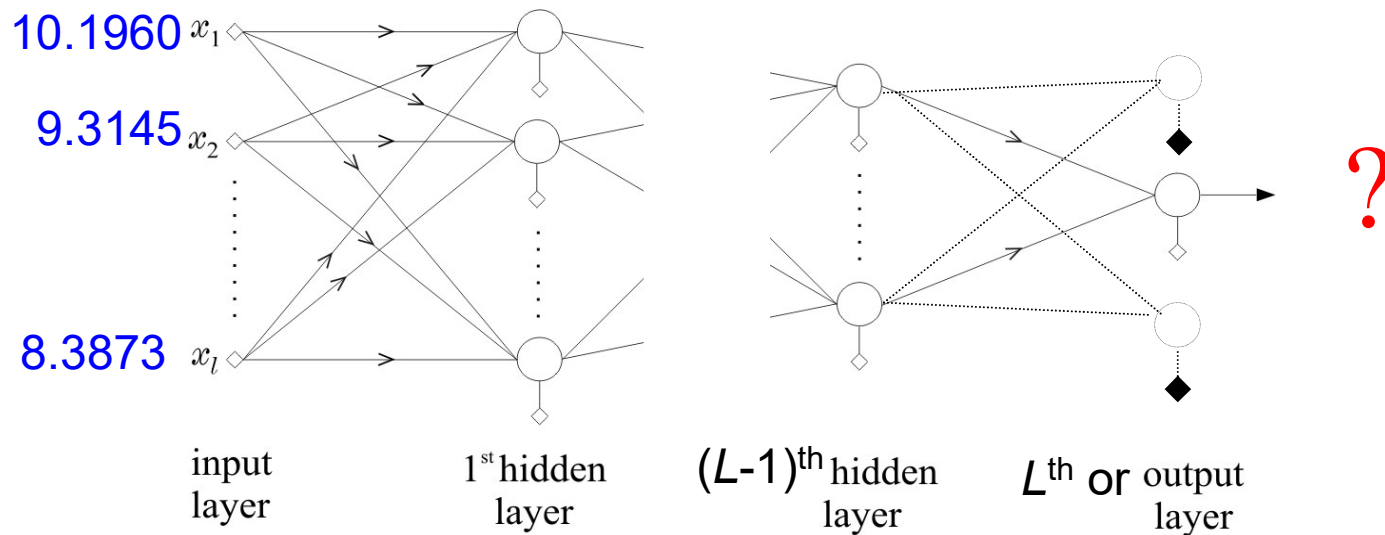
F1	F2	F3	Class
9.4512	7.3199	6.4664	1
10.7276	9.6067	5.9398	2
10.1960	9.3145	8.3873	1
15.7777	1.5879	11.4440	3
15.8685	2.7902	11.2532	3
14.9448	0.7798	12.7481	2

Training Set

What to do

- Given an unknown sample,
 $[x_1, x_2, x_3] = [10.1960 \quad 9.3145 \quad 8.3873]$

Predict its class!



Training and Testing Files

- Each file contains multiple lines
- Each line describes a sample
 - Except the last one, all are **real** valued features
 - Last number is the class of the sample in **integer**
- Analyze the **training file** to know the feature dimension and total number of classes
- You can assume necessary hyper parameters

Output Submission to Moodle (1)

- Change network structure, e.g., no. of layers and nodes in layers.
- For each network
 - Learn *different network parameters (e.g., weights, etc)* from the *supplied training file* using *backpropagation* algorithm
 - Store the network structure and learned parameters in a file.
 - Use the corresponding testing file to identify all misclassified samples and report as follows

no. of layers no. of nodes/layer accuracy

Output Submission to Moodle (2)

- Write a separate s/w module to use a learned network
- For each stored file
 - Load the network **structure** and **learned parameters** in memory.
 - Use the corresponding testing file to **identify all misclassified samples** and **report as follows**

no. of layers no. of nodes/layer accuracy

- **Compare** this result with that found in the previous slide
- **Compile** all the reports in a separate word file
- **Make a single zip file** containing all source codes and the word file and **submit at moodle**.

Output during Evaluation

- The instructor may ask you to **change network structure** and to run the experiment using **new training/testing files**
 - Learn the network using the new training file
 - Use the corresponding testing file to **identify all misclassified samples** and **report as follows**

sample no. feature values actual class predicted class

- % of accuracy

Other information

- Your program must be able to handle variable no. of features, classes, layers and nodes per layer. **Hard coded assumption will NOT be accepted.**
- **Submission deadline is Tuesday 11/01/2022 at 11:55 pm**
- Sample training and testing files will be available in the moodle
- **Follow the algorithms and notations of your text book (e.g., *Pattern Recognition* by S. Theodoridis)**
- You can use your own data to judge your code
- Different files will be used during evaluation
- You can use feature normalization as necessary.