Software and Informatics Engineering Department

College of Engineering

Salahaddin University

Deep learning Course Book – (P.Hd. Level)

Lecturer's name: Dr. Abbas M. Ali

Academic Year 2023/2024

Course Book

1. Course name	**Deep Learning**
2. Lecturer in charge	**Asst. Prof. Dr. Abbas M. Ali**
3. Department/ College	**SIE Engineering/College of Engineering**
4. Contact	**e-mail: abbas.mohamad@su.edu.krd**
5. Time (in hours) per week	**Theory: 3**
6. Office hours	**Sunday 10:30 – 12:30**
7. Course code	**MSc**
8. Teacher's academic profile	**Dr.Abbas M. Ali** **Lecturer in Software Engineering Department** **College of Engineering – Salahaddine University** **Hawler – Kurdistan** **Current Lecture :** **Deep learning (PhD & MSc level)** **A.I. (H.Diploma)** **Education:** **B.Sc. in Computer science** **M.Sc in Computer science** **Ph.D in Computer Vision.**
9. Keywords	**DFS, BFS, Heuristic Search, Predicate Calculus, Semantic Nets, CNN, RNN**

10. Course overview:

This is an introductory course covering Deep Learning (DL) concepts and implementations. The course captures the essence of DL and introduces basic ideas regarding Layers inside each Model. The course will introduce the concepts and techniques for implementing these models that are behind many of the software applications found today.

The goal of DL is to build software systems that behave "intelligently". DL is a branch of ML to makes computer software recognizes objects, classify classes of objects, or analyses the content of images and many other issues about the world.

11. Course objective:

The course has the following objectives:

- **Define the reasons, goals, and trends of DL.**
- **Introduce DL application areas.**
- **Introduce the basic knowledge representation of DL models and their layers**

12. Student's obligation

Homework is normally given, and assignments and quizzes provide an active way to keep the students active and more

in touch with the subject. In addition, students' attendance and their activity in the lectures will all collected together.

to form the assessment of each semester.

13. Forms of teaching

Lectures:

PowerPoint presentations are used in addition to the whiteboard clarification which is usually used to make a frequent

Step-by-step communication with the students

Practices:

In the HW the students will use their computers and the principles taken in the theory will be run by the students to give

them more information.

14. Assessment scheme

The course breaks into compound parts theoretical and Assignment reports. There is a midterm exam to assess each

student and the final exam.

The theoretical Exams only cover the theoretical part of the unit. The total marks will be as follows:

Midterm Exam: 20 %

First Semester daily activities (quizzes and homework): 15%

Seminar: 15 %

Final Exam: 50%

15. Student learning outcome:

At the end of this course, students will be able to:

1- **Describe the purpose and DL.**
2- **Identify the importance of DL. in the computer field.**
3- **Understand the fundamentals of the structure and architecture of DL.**
4- **Install and gain a basic of how DL. Treats data.**
5- **Understand the fundamental concepts of Dataset and Augmentation techniques.**
6- **Write fundamental programs of DL. Models.**

16. Course Reading List and References:

1- **Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning. MIT Press, 2016. online version.**

There will also be additional readings from published papers. The following textbooks are useful as additional references:

- **Aston Zhang, Zack C. Lipton, Mu Li, and Alex J. Smola. Dive into Deep Learning. 2019. online version**
- **Michael Nielsen. Neural Networks and Deep Learning. 2019. online version.**

17. The Topics:	Lecturer's name

Week	Subject	Details
1	Introduction	Introduction, administrivia, ML, DL overview/review
2-3	Lecture 1-2	Neural network basics (tasks, operations, training)
4-5	Lecture 3-4	Convolutional neural networks (architectures, visualization, applications)
5-6	Lecture 4 -5	LeNet -5, .
7-8	Lecture 5 -6	Alex Net.
9 – 10	Lecture 9 – 10	Recurrent neural networks (architectures, training, applications)
11 – 12	Lecture 11 -12	LSTM
13 – 14	Lecture 13 – 14	Project presentations

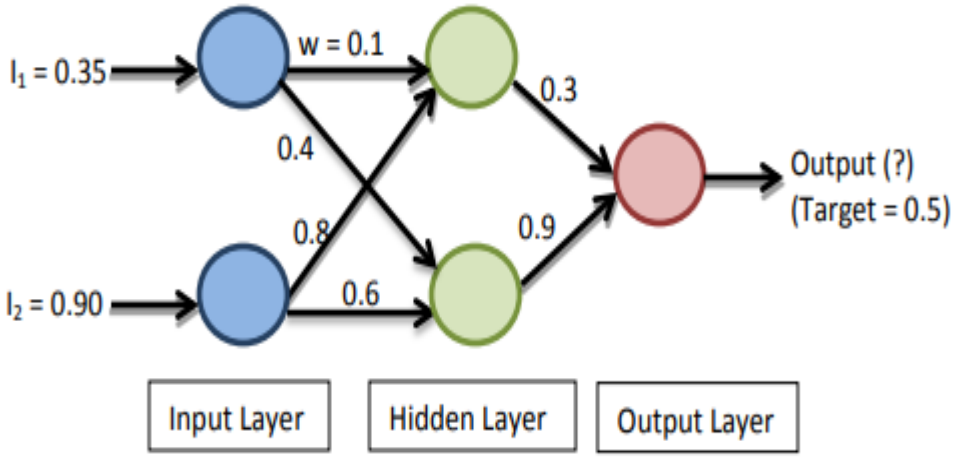
Some questions sample

Problem 1 (50 M) You come up with a CNN classifier. For each layer, calculate the number of weights, the number of biases, and the size of the associated feature maps. The notation follows the convention:

• CONV-K-N denotes a convolutional layer with N filters, each of them of size K×K, Padding and stride parameters are always 0 and 1 respectively.
• POOL-K indicates a K × K pooling layer with stride K and padding 0.
• FC-N stands for a fully connected layer with N neurons.

Layer	Activation map dimensions	Number of weights	Number of biase
INPUT	128 × 128 × 3	0	0
CONV-9-32			
POOL-2			
CONV-5-64			
POOL-2			
CONV-5-64			
POOL-2			
FC-3			

Problem 2 (50 M) - Consider the following ANN, the initial weights are set randomly as in the figure, and consider a training set where inputs I_1 and I_2 are equal to 0.35 and, 0.90 respectively, and the desired output is 0.5



Compute the output for each neuron using the sigmoid activation function, then determine the weight corrections using Backpropagation, without using the learning rate parameter, then show if the error is reduced or not, after weights modification. (**use only one epoch**)