**COURSE OUTLINE**

Neural Networks

Term – 5.05

PGDM (BA, AI &ML) 2019-21

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| Faculty Name | Dr. Hemachandran K |
| Email ID |  |

**Brief Description and Relevance of the Course**

An introduction to fundamental methods in neural networks. Single- and multi-layer perceptrons; radial-basis function networks; support vector machines; stochastic machines and deep networks; convolutional and recurrent networks; supervised and unsupervised learning; application to pattern classification and function approximation problems.

\**The course will require the students to develop lab-based projects*

**Intended Learning Outcomes**

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

1. understand the differences between networks for supervised and unsupervised learning;
2. design single and multi-layer feed-forward neural networks;
3. develop and train radial-basis function networks;
4. program linear and nonlinear models for data mining;
5. analyse the performance of neural networks.

**Recommended and Reference Textbooks**

S. Haykin, "Neural networks and learning machines," Pearson, 2009

J. Langr; V. Bok, “GANs in Action”, 2019

**Software Requirements for the Course**

Microsoft Office

MacOS 10.15 / Windows 10/ Linux VM

Python – Jupyter Notebook – Anaconda Navigator

**Session-Wise Topics and Reading/References**

**\*Note\* –**

**Readings**: Each session is preceded by a reading assignment. It is important to keep on top of the reading, which will be assumed during the lecture and discussion in class. You should set aside 2 hours to compete each reading. We do not expect you to fully understand everything before coming to class, but the goal is to prepare for class, familiarize yourself with new terminology and definitions, and to determine which part of the subject you want to hear more about. We encourage you to bring questions to class about material that is confusing. Other students might share your confusion.

In addition, you will be provided with handouts by the designated lecturer on a subject related to the session. You are expected to read the paper before class and collate your queries before arriving the lecture hall. The query should be thought provoking about the assigned paper.

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| **Sn.** | **Topic** | **Intended Learning Outcomes** | **Reading/Reference** |
| 1 | Introduction, McCulloch-Pitts networks | 1. Understand the differences between networks for supervised and unsupervised learning; | Chapter 1  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 2-3 | Perceptrons | 1. Design single and multi-layer feed-forward neural networks | Chapter 1  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 4-5 | Regression and least mean square algorithm | 1. Develop and train radial-basis function networks  2. Program linear and nonlinear models for data mining | Chapter 2 & 3  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 6-7 | Multilayer perceptrons | 1. Develop and train radial-basis function networks  2. Program linear and nonlinear models for data mining | Chapter 4  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 8-9 | Radial-basis function networks | 1. Develop and train radial-basis function networks  2. Program linear and nonlinear models for data mining | Chapter 5  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 10-11 | Support vector machines | 1. Develop and train radial-basis function networks  2. Program linear and nonlinear models for data mining | Chapter 6  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 12 | Unsupervised learning and self-organization | 1. Understand the differences between networks for supervised and unsupervised learning  2. Design single and multi-layer feed-forward neural networks  3. Develop and train radial-basis function networks | Chapter 9  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 13-14 | Boltzmann machines and deep networks | 1. Understand the differences between networks for supervised and unsupervised learning  2. Design single and multi-layer feed-forward neural networks  3. Develop and train radial-basis function networks | Chapter 11  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 15-16 | Convolutional networks | 1. Understand the differences between networks for supervised and unsupervised learning  2. Design single and multi-layer feed-forward neural networks  3. Develop and train radial-basis function networks  4. Analyse the performance of neural networks | Chapter 4  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 17-18 | Recurrent networks | 1. Understand the differences between networks for supervised and unsupervised learning  2. Design single and multi-layer feed-forward neural networks  3. Develop and train radial-basis function networks  4. Analyse the performance of neural networks | Chapter 15  S. Haykin, "Neural networks and learning machines," Pearson, 2009 |
| 19-20 | Generative Adversarial Networks | 1. Understand the differences between networks for supervised and unsupervised learning  2. Design single and multi-layer feed-forward neural networks  3. Develop and train radial-basis function networks  4. Analyse the performance of neural networks | Chapter 1 & 2  J. Langr; V. Bok, “GANs in Action”, 2019 |

**Performance Evaluation Components for the Course**

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| **Session No.** | **Marks** | **Evaluation Form** |
| **Continuous Evaluation** | | |
| **2** | 5 | Quiz |
| **4** | 5 | Quiz |
| **6** | 5 | Quiz |
| **8** | 5 | Quiz |
| **10** | 5 | Quiz |
| **12** | 5 | Quiz |
| **14** | 10 | Assignment |
| **16** | 10 | Assignment |
| **18** | 10 | Assignment |
| **20** | 10 | Class Participation |
| **End Term Examination** | | |
| **After Course Completion** | 30 | Written Test |

**Assignment Schedule**

All assignments are to be presented in class along with the submission of a written report in soft copy format.

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| **Name of Assignment** | **Date of Submission** | **Take-home**  **or in-class** | **Individual-work or Team-work** | **Other Instructions** |
| Build a logistic regression classifier to recognize cats | As per Woxsen standards | Take-home | Individual work | Using Python and other instructions will be shared in the class |
| If a person is affected by corona virus there are many ways to find. CT image is one of the technique to find whether a person is affected by corona or not. This can be done using Convolutional Neural Network (CNN). Justify your answer | As per Woxsen standards | Take-home | Individual work | Using Python and other instructions will be shared in the class |
| In what way lstm is related to text summarization? How lstm is applied in automatic text summarization? | As per Woxsen standards | Take-home | Individual work | Using Python and other instructions will be shared in the class |

Computational assignments will ask you to develop implementations of algorithms for search, game-solving, constraint satisfaction, knowledge representation and reasoning, and planning, to apply them to different real-world problems, and to analyze the performance. We expect that all code will run, be well-written and be commented appropriately; the course staff is always happy to help explain style and conventions. The written components ask you questions about the concepts and methods that you have learned and to reflect on the performance of your implementations.

Attendance & Punctuality

Learning is an interactive process. Woxsen students are admitted partly based on the experience they bring to the school and what they can add to class discussions. Therefore, attendance is an important aspect of studying here. Students are expected to be present in all the classes. Absence is only appropriate in cases of extreme personal illness, injury, or close family bereavement. Voluntary activities are never valid reasons for missing any class. The faculty, with the assistance of the Faculty Associate, shall keep track of students’ attendance and decide on the nature and extent of penalty for any absence from the class. Penalty may include reduction in grade or repetition of the course.

Late arrival is disruptive to the learning environment; students are expected to be in class before the scheduled commencement time. Students arriving for class after the scheduled commencement time should be turned away unless they have a valid reason to be permitted to attend.

Faculty should not consider attendance of sessions as a component of performance evaluation. The grading system at Woxsen accounts for this.

**External Websites Disclaimer**

Neither the instructor nor Woxsen School of Business is responsible for the content of external websites discussed in the classroom and/or linked to via online course materials, e-mail messages, message boards, or other means. Referred websites are for illustrative purposes only, and are neither warranted nor endorsed by the faculty or Woxsen School of Business. Web pages change frequently, as do ownership of domain names. While every effort is made to ensure proper referencing, it is possible that students may, on occasion, find materials to be objectionable for reasons beyond our control.

**Copyright**

The content provided by the faculty in the class is copy-righted. Students are instructed not to distribute or share content used during courses with external entities without the explicit written consent of the author and/or faculty.

**Student Code of Ethics**

Each student enrolled in this course accepts personal responsibility to uphold and defend academic integrity and to promote an atmosphere in which all individuals may flourish. The Students’ Code of Ethics strives to set a standard of honest behavior that reflects well on students and the school. All students enrolled in these courses are expected to follow the Students’ Code of Ethics, which they have been given at the time of enrolling for the program and pledged to adhere to. Unethical and unfair practices adopted by students may lead to penalties such as having to repeat the course or having the student’s enrollment cancelled.