Department of Computer Science & Information Systems
First Semester: 2020-2021
Course Handout: Part-II

In addition to part-I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course:

Course No. : CS F441
Course Title : Selected Topics from Computer Science *(NLP & Computer Vision with Deep Learning)*
Instructor-in-Charge: Prof. Poonam Goyal (poonam@pilani.bits-pilani.ac.in)

Objective and Scope of the Course

Natural language processing (NLP) is an important technology and is a vital part of AI. NLP applications are widespread: news, articles, web search, emails, customer service, language translation, advertising, medical reports, etc. Computer vision is another important area in our society because of its applications in search, self-driving cars, medicine, surveillance, etc. Image classification, localization, detection etc. are visual recognition tasks which are core to many applications. This course aims at learning deep learning techniques for NLP and vision. It gives an overview of the various deep learning models and techniques, and surveys recent advances in the related fields. Due to the enhancement in computation power (using GPU's) this new paradigm of deep learning based architectures got extensively explored to solve almost all types of NLP and computer vision problems. At the end of this course, students are expected to have significant familiarity with the subject, and will be able to apply Deep Learning to a variety of tasks related to NLP & vision and confident enough to build and tune Deep Learning models for other applications.

1. Course Material

Text Book: *<Being a senior-level course, no single book shall be exact fit the bill.>*

Reference Books:

1. **Daniel Jurafsky and James H. Martin**: Speech and Language Processing, 2018, available at the URL: https://web.stanford.edu/~jurafsky/slp3/
2. **Richard Szeliski** , Computer Vision: Algorithms and Applications, Springer 2010, Available at the URL: http://szeliski.org/Book/drafts/SzeliskiBook 20100903 draft.pdf
3. **Ian Goodfellow and Yoshua Bengio and Aaron Courville**: Deep Learning, 2016, Available at the URL: http://www.deeplearningbook.org, MIT Press
4. **Michael Nielsen**: Neural Networks and Deep Learning 2016, Available at the URL: http://neuralnetworksanddeeplearning.com/

2. Course Plan

Lecture	Topic(s) to be discussed	Learning Objective
1-2	Overview of the course, Introduction to NLP	To be able to understand the NLP, its applications
3-5	Simple Word Vector, TFIDF, Word2Vec representations	To be able to understand the representation of the language
6	Advanced word representations, GloVe	To learn advances in word representation
7-9	Review of basic ML methods, Language Model, Text classification,	To develop models for NLP problems.
10-12	Perceptron, ANN, Neural Networks and back-propagation, Introduction to Deep Learning	Learning basic blocks of DL Architecture
13-14	Gradient descent, overfitting, regularization, activation functions	Lear how to train model efficiently and accurately
15-17	RNN for language modeling and case study - Opinion mining etc.	Learn sequence handling in DL framework
18-19	GRU, LSTM for Machine translation	Learning to handle long term dependencies in data
20	Overview of Computer Vision	Identify computer vision problems and progress in its domain
21-23	Image Classification: High level representations, Image Features	Able to understand the representation of images and its classification models
24-27	Convolutional Neural Networks (CNNs), Pooling, Stride, dynamic vs static computation, ensembles	Able to effectively apply parameter sharing approaches of DL in image representations
28-29	Popular Deep Architectures: VGG, Yolo, U-Net, SefNet, Inception-Net, Res-Net	Get familiarity and advantage of different DL architectures. Ability to device a custom one
30-33	Generative models, autoencoders, VAE, RBM, Deep Beleif Networks, variational inference, GAN	Study generative models to understand the ways distributions help create new objects. Able to apply generative models
34-36	Image analytics: Visual Recognition, Object detection & tracking, Action recognition	To understand various applications of vision and their recent developments
37-40	Grounded Compositional Semantics for Finding and Describing Images with Sentences, Deep Visual-Semantic Alignments for Generating Image Descriptions	Ability to draw semantics from the visual data

3. Evaluation Scheme: *<All evaluation components are MANDATORY. Any failure to participate in one or more evaluation component may lead to an 'NC' report.>*

Evaluation Component	Duration	Weightage(%)	Date	Comment
Test 1	30 min	10-15	7/9	Closed Book
Test 2	30 min	10-15	12/10	Closed Book
Test 3	30 min	10-15	9/11	Closed Book
Assignments	2-3 weeks	20-35	Oct first and last week	Group / Individual
Comprehensive Examination	3 Hrs.	35	8/12	Partially Open book

4. Honor Code

No form of plagiarism shall be tolerated (we would be using appropriate software tools). Student shall be awarded ZERO marks and case may be reported to the appropriate committee of the Institute for appropriate action.

5. Notices

All notices would be put on NALANDA

8. Make-up Policy

To be granted only in case of serious illness or emergency on case by case basis for Mid-sem Test and Comprehensive Exam.

9. Chamber Consultation Hours

To be announced in the class

Instructor-in-Charge