DSCI353-353m-453: Class 11b-f-CNN-ConvNets-wTensorFlow2

Profs: R. H. French, L. S. Bruckman, P. Leu, K. Davis, S. Cirlos

TAs: W. Oltjen, K. Hernandez, M. Li, M. Li, D. Colvin

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Contents

11.2.2.1 Class Readings, Assignments, Syllabus Topics

11.2.2.1.1 Reading, Lab Exercises, SemProjects

- Readings:
  - For today: LeClun Deep Learning 2015 Reviewr
  - For next class: DLwR2 Ch 6
- Laboratory Exercises:
  - LE6: Due Thursday April 13th
  - LE7 :
- Office Hours: (Class Canvas Calendar for Zoom Link)
  - Wednesdays @ 4:00 PM to 5:00 PM
  - Saturdays @ 3:00 PM to 4:00 PM
  - **Office Hours are on Zoom, and recorded**
- Semester Projects
  - Office Hours for SemProjs: Mondays at 4pm on Zoom
  - DSCI 453 Students Biweekly Updates Due
    - Update # is Due ** **
  - DSCI 453 Students
    - Next Report Out # is Due ** **
  - All DSCI 353/353M/453, E1453/2453 Students:
    - **Peer Grading of Report Out # is Due**
  - Exams
    - Final: **Thursday May 4th**, 2023, 12:00PM - 3:00PM, Nord 356 or remote

11.2.2.2 Syllabus

Day:Date	Foundation	Practicum	Readings(optional)	Due(optional)
w01a:Tu:1/17/23 w01b:Th:1/19/23	Markov Cluster Stat. Learning, Approach	R, Rstudio IDE, Git Bash, Git, Class Repo	 ISLR1,2 (R4DS-1-3)	(LE0)
w02a:Tu:1/24/23 w02b:Th:1/26/23	Lin. Regr. Bias-Var. Train/Test, Bias vs. Vari.	SemProjs; Regr. Ovrvw Tidyverse Review	ISLR3,(R4DS-4-6) DL01 DL02 (R4DS-7,8)	**(LE0:Due)** LE1
w02Pr:Fr:1/27/23	**ADD DROP**	**DEADLINE**		**453 Update 1**
w03a:Tu:1/31/23	Logistic Regr. Classif	Pred. Analytics, Regr.	DL03,ISLR4	
w03b:Th:2/2/23 w03:Sa:2/4/23	LDA/QDA	ggPlot2, Code Expect.	DL04, DL05	**LE1:Duc**, LE2 **LE1:Due**
w04a:Tu:2/7/23 w04b:Th:2/9/23	Resample Cross-Valid. DL, ML Overview	ggplot Multilevel Mod.	ISLR5 ISLR6 (R4DS9-16)	
w04Pr:Fr:2/10/23				**453 Update 2**
w05a:Tu:2/14/23	Resampling: Bootstrap	Bootstrap Mixed Effects	DL2R1, DL06,07	**LE2:Due**, LE3
w05b:Th:2/16/23 w05Pr:Fr:2/17/23	Subset Selec., Shrink.	Dim. Red. PCA	DLwR2	 **453 Rep. Out 1**
w06a:Tu:2/21/23 w06b:Th:2/23/23	ML with NNs Beyond Linear Modls	ggplot, clustering Feature Select., Caret	DLwR3 ISLR7 (R4DS22-25)	 **LE3:Due**, LE4
w06Pr:Fr:2/24/23				**453 Update 3**
w07a:Tu:2/28/23	Dec. Trees, Rand. Forest	Tidy Modeling	ISLR8, DL08,09	
w07b:Th:3/2/23	MidTerm Review, SVM	SVM, SVR, ROC	ISLR9 (R4DS26-30)	**Peer Review 1**
w08a:Tu:3/7/23	ML Overview	, Keras/TF2, Torch	ISLR10.1,10.2	
w08b:Th:3/9/23 w08Pr:Fr:3/10/23	**MIDTERM EXAM**		DL10,11	**LE4:Duc** LE5 **453 Update 4**
Tu:3/14/23 Th:3/16/23	**SPRING** **SPRING**	**BREAK** **BREAK**	ISLR10.3,10.4 ISLR10.5,10.6,	
w09a:Tu:3/21/23 w09b:Th:3/23/23	Deep Learning Computer Vision, CNN	TF2 Keras Intro CNN w/TF2, Overfit	 DLwR4, DL12,13	ISLR10.7,10.8, DLwR3
w09Pr:Fr:3/24/23				**453 Rep. Out 2**
w10a:Tu:3/28/23	Deep Learn Intro	NN Types	DLwR5 Hinton ImageNet	
w10b:Th:3/30/23 w10Pr:Fr:3/31/23	DL CNN,RNN ImageNet	NN Types, CNN wTF2		 **453 Upd.5 & PrRev 2**
Sa:4/1/23				**LE5:Duc** LE6
w11a:Tu:4/4/23	Fitting NNs	AUC,Prec,Recall Fruit		
w11b:Th:4/6/23	NLP, Graphs & ML		LeCun DL Rev. 2015	
w12a:Tu:4/11/23	Graphs & ML	NLP with sequences	DLwR6	
w12b:Th:4/13/23	NLP w attention	Graph Repr Proc Wrk-flw		**LE6:Duc** LE7
w13a:Tu:4/18/23	DL Frameworks	Explaining DL w Lime		
w13b:Th:4/20/23 w13Pr:Fr:4/21/23	Linux Distros XGBoost	Explain Preds	Deep Dream	 **453 Rep. Out 3 Due**
w14a:Tu:4/25/23 w14b:Th:4/27/23	Tranformers Final Exam Review	 Torch NN & DeepLearn		 **LE7:Due**
w14Pr:Fr:4/28/23				**Peer Rev 3 Duc**
	FINAL EXAM	**Th. 5/4/23, 12-3pm**	Nord 356 & Zoom	
	453 Final PDF Report	**Fr. 4/29, 11:59pm**		

Table 1: DSCI353-353M-453 Weekly Syllabus. R4DS-x.y, OISx.y, ISLRx.y, DLwRx.y, DLGBx.y refers to chapters and sections assigned as reading in our textbooks. DLx are deep learning articles.

Figure 1: IT Fundamentals: Applied Data Science with R, Syllabus

11.2.2.3 Introduction to Convolutional Neural Networks (CNN) with TensorFlow

- Learn
  - The foundations of convolutional neural networks for computer vision
  - And build a CNN with Google's TensorFlow

Convolutional Neural Networks are

- Also referred to as CNN
- Or ConvNets

Recent advances in deep learning

- have made computer vision applications leap forward:
  - from unlocking our mobile phone with our face,
  - to safer self-driving cars.

Convolutional neural networks (CNN)

- are the architecture behind computer vision applications.

Lets look at the foundations of CNNs and computer vision such as

- the convolution operation,
- padding,
- strided convolutions
- and pooling layers.

Then, we will use TensorFlow

- to build a CNN for image recognition.

11.2.2.3.1 Understanding Convolution

- The convolution operation is the building block
  - of a convolutional neural network as the name suggests it.

Now, in the field of computer vision,

- an image can be expressed as a matrix of RGB values.

To complete the convolution operation,

- we need an image
- and a filter.

Therefore, let's consider the 6x6 matrix below

- as a part of an image:

Figure 1. A 6 x 6 matrix.

And the filter

- will be the following matrix:

10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0

Figure 2: A 6 x 6 matrix