



# National University

of Computer & Emerging Sciences

<b>Department</b>	Department of Computer Science	<b>Dept. Code</b>	CS
<b>Course Title</b>	Deep Learning for Perception	<b>Course Code</b>	CS4045
<b>Pre-requisite(s)</b>		<b>Credit Hrs.</b>	3

<b>Course Objective:</b>	Deep neural networks have achieved state of the art performance on several computer vision and speech recognition benchmarks. Deep learning algorithms extract layered high and low-level features from raw data. With increasing non-linear hidden layers, the discriminative power of the network improves. This course builds on the fundamentals of Neural networks and artificial intelligence and covers advanced topics in neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning. It also embeds applications of these algorithms to several real-world problem in computer vision, speech recognition, natural language processing, game theory, etc.
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PLO	Program Learning Outcome (PLO) Statement
1	<b>Computing Knowledge:</b> Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
4	<b>Investigation &amp; Experimentation:</b> Conduct investigation of complex computing problems using research based knowledge and research based methods.
5	<b>Modern Tool Usage:</b> Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
9	<b>Individual &amp; Team Work</b> Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
1	Student should be able to describe what Deep Learning is and the skill sets needed for Deep Learning	Cognitive	2	1	A, L, M1, F
2	Students should be able to understand supervised and unsupervised methods of Deep Learning,	Cognitive	2	4	A, L, M1, M2, F
3	Students should be able to apply most important deep learning methods, using open-source tools	Cognitive	4	5	A, P, L, M2, F
4	Students should be able to work as a team while integrating important components in deep learning	Cognitive	6	9	P, A

Tool: A = Assignment, L = Labs, M = Midterm, F=Final

<b>Text Book(s)</b>	<b>Title</b>	Research Papers
	<b>Author</b>	
	<b>Title</b>	1. Deep Learning Tutorial, LISA lab, University of Montreal



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<b>Ref. Book(s)</b>		2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, <a href="http://www.deeplearningbook.org/">http://www.deeplearningbook.org/</a>
<b>Author</b>		Ian Goodfellow, Yoshua Bengio, and Aaron Courville

No. of Weeks	Course Contents/Topics	Contact Hours	CLO
2	Introduction, Logistic Regression	6	2,3
1	Neural Networks	3	2,3
1	Introduction to Deep Neural Network	3	1
1	Regularization, Dropout, Drop Connect	3	1,2,3
-	Midterm 1	1	1,2
2	CNN / CNN Architectures	6	2/4
2	RNN, LSTM, GRP	6	2,3
1	Midterm 2 including 1 hour from Midterm1	2	3
1	Ensemble of Deep Learning	3	2,4
1	AutoEncoders	3	2,3
2	Recent Advances in Deep Learning	6	4
1	Project Demo	3	4
15	Total	45	

## Assessment Plan:

Assessment	Weightage
Assignments	10
Labs / DataCamp	10
Midterm Exams	25 (10 + 15)
Project	10
Final	45