







Coversheet - Proposal for New and Revised Course

(Use for non-Pathways courses)

For CLE/Pathways course, form can be found here: https://www.pathways.prov.vt.edu/proposal-forms.html

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Proposal Date:	3/11/2019			15-Day Review End Date:				
Department:		Computer Science						
	rse Designator and Number: CS 5814						, and	
Title of Course: Introduction to Deep Learning Credit Hours: 3 Please refer to Office of University Registrar for guidelines and policy requirements https://www.registrar.vt.edu/faculty/teaching/instru								
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Course Transcript (ADP) Title: (30 Character Maximum)			Introduction to Deep Learning					
Instructor and/or Departmental Contact:			Chandan Reddy, Cliff Shaffer					
Contact Phone:	571-858-330	571-858-3307		Contact E-mail: reddy@cs.vt.edu, shaffer@vt.edu				
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Proposal Date:	3/11/2019		15-Day Review End Date:						
Department:	J. I.								
Course Designator and Number: CS5814									
Title of Course: Deep Learning Credit Hours: 3									
Please refer to Office of University Registrar for guidelines and policy requirements https://www.registrar.vt.edu/faculty/teaching/instructional-									
minutes.html									
	Course Transcript (ADP) Title:		Deep Learning						
	(30 Character Maximum) Instructor and/or Departmental Contact:		Chandan Reddy, Cliff Shaffer						
Contact Phone:	313-577-9005	Contact E-mail:							
Please count this course toward the following Scorecard Metrics areas:									
Study Abroad Service Learning Experiential Undergraduate Research Scorecard Metrics Definitions can be found here: http://www.registrar.vt.edu/faculty/forms/scorecard-metrics.html Please insert an X if this course should count toward First Year Experience: First Year Experience (FYE) For more information see: http://www.fye.vt.edu									
		Select ONE of	the following boxes						
X New Course		*Revised	Course (<i>Revision</i> > 20%	Revision < 20%)					
For CLE/Pathways	course, form can be found	here: https://www.pathv	ways.prov.vt.edu/proposal-forms.htm	1					
*Please include a si	ımmary of course revision.	s to the Justification sec	ction of proposal						
Attach statement from Dean or Departmental Representative as to whether teaching this course will require or generate the need for additional departmental resources.									
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H: Course Number(s) and Title(s) to be deleted from the Catalog with APPROVAL:									
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General Information

CS 5814 Introduction to Deep Learning

I -- Catalogue Description

History and basic concepts of artificial neural networks. Activation functions, optimization methods and regularization strategies used in deep multi-layered networks. Network architectures such as convolutional networks and recurrent neural networks. Deep reinforcement learning algorithms including deep Q-learning and policy gradient methods. Deep unsupervised models such as auto-encoders, and deep generative models including variational auto-encoders and generative adversarial networks. Encoder-decoder architectures and their applications in real-world problems such as machine translation, image captioning, visual question answering, and text summarization. Pre: 5525 or 5824. Duplicates ECE 6524 (CS 6524). (3H, 3C)

Course Number: CS5814

ADP TITLE: Introduction to Deep Learning

II - Learning Objectives

Having successfully completed this course, the student will be able to:

1. Implement artificial neural network models.

2. Present the pros and cons of various deep learning architectures.

3. Train deep learning models.

- 4. Apply optimization techniques to training deep learning models
- 5. Design computational graphs for neural network training

6. Investigate deep reinforcement learning models

- 7. Design and implement deep learning solutions to problems in text analytics and computer vision
- 8. Train deep unsupervised learning models
- 9. Apply deep learning algorithms to problems involving real-world (big) data.

III - Justification

Deep Learning has seen breakthrough results in many real-world applications such as speech recognition, machine translation, image understanding, computer gaming, and robotics. Deep learning is an important area within the field of artificial intelligence. Hence, it is important to train students with practical skillsets and fundamental knowledge in deep learning. This course introduces the basic principles, algorithms and applications of deep learning. It will provide an in-depth understanding of various concepts and popular techniques in deep learning. Students will also be provided with an extensive set of practical implementations of various deep learning methods. Ability to handle large-scale data and apply intelligent tool has already become a requirement for any CS graduate and this course will be helpful in preparing students to handle challenging tasks that arise in practical real-world problems. This course is more "instructor-led" whereas ECE 6524 is research based, making them distinctive experiences.

Course is taught at the 5000-level because graduate-level experience in programming and mathematical maturity in undergraduate coursework such as algorithms, linear algebra, calculus, and probability is assumed. It is also necessary that the students have sufficient background in machine learning (CS5824) and/or data analytics (CS5525).

IV - Prerequisites and Corequisites

Pre: 5525 Data Analytics or 5824 Advanced Machine Learning

V - Texts and Special Teaching Aids

Required Textbooks

Aggarwal, C. (2018) Neural Networks and Deep Learning: A Textbook, New York, NY: Springer. pp. 497

Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. Cambridge, MA: MIT Press. pp. 800

VI - Syllabus

Course Topic 1. History of Deep Learning	Percent of Course 10%
2. Neural Network Basics	10%
a. Loss Functions	
b. Computational Graphs	
c. Back Propagation	
3. Training Deep Models	10%
a. Activation Functions	
b. Optimization Methods	
c. Regularization Strategies	
4. Recurrent Neural Networks	10%
5. Convolutional Networks	10%
6. Encoder-Decoder Architectures	5%
7. Deep Reinforcement Learning	15%
a. Q-Learning	
b. Policy Gradient Methods	
8. Auto-encoders	5%

9. Deep Generative Models
 10. Deep Learning Applications:
 Text Analytics, Computer Vision, Visual Question Answering
 TOTAL:
 10%



Department of Computer Science College of Engineering

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WWW: http://people.cs.vt.edu/~shaffer

March 12, 2019

TO:

Course Approval Committees

FROM:

Cliff Shaffer

Associate Department Head for Graduate Studies

RE:

CS 5814

No additional resources will be required in order to offer this course.