REQUEST FOR ADDITION OF NEW COURSE

Department: Computer Science & Engineering  College: Engineering
Date: 9/28/2016

PROPOSED COURSE DESCRIPTION

Rubric & No. | Title
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CSC 7343 | Deep Learning Systems

Short Title (≤ 19 characters) | D E E P L E A R N I N G

Semester Hours of Credit

If combination course type, # hrs. of credit for:

- Lecture: 2
- Lab/Sem/Rec:

Repeat Credit Max. (if repeatable): credit hours Graduate Credit? Yes

Credit will not be given for this course:

Course Type (Indicate hours in the appropriate course type.)

Lecture | Lab | Seminar | Recitation | Lec/Rec | Lec/Sem | Lec/Lab | Res/Ind | Clin/Pract | Intern
--- | --- | --- | --- | --- | --- | --- | --- | --- | ---
2 |  |  |  |  |  |  |  |  |  

Maximum enrollment per section: (use integer, e.g. 25 not 20-30) 40

Grading System: Letter Grade X Pass/Fail Final Exam: Yes

**(Attach justification if the proposed course will not hold a final exam during examination week.**)***

Course Description:

Concise catalog statement exactly as you wish it to appear in the General Catalog.

CSC 7343 Deep Learning Systems (3)

Deep neural networks, including convolutional and recurrent/recursive neural networks, deep belief networks and autoencoders; related hardware and software support; applications such as image and natural language understanding.

BUDGET IMPACT (IF ANSWER TO ANY QUESTION IS "YES", ATTACH EXPLANATION.)

If this course is approved, will additional staff be needed? Yes No

Will additional space, equipment, special library materials or other major expense be involved? Yes No

Academic Affairs Approval: (Date)

ATTACHMENTS (ATTACH THE FOLLOWING TO YOUR PROPOSAL)

JUSTIFICATION: Justification must explain why this course is needed and how it fits into the curricula. Will the course duplicate other courses?
SYLLABUS: Including 14 week outline of the subject matter; titles of text, lab manual, and/or required readings; grading scale and criteria
(For 4000-level, specify graduate student grading criteria if requirements differ for graduate and undergraduate students).

APPROVALS

Department Faculty Approval Date 9/23/2016  College Faculty Approval Date 3/12/2017

Department Chair Signature (date)  Graduate Dean Signature (date)

College Contact: Coretta Douglas douglas@csc.lsu.edu

Chair, FS & C Committee (date)  Academic Affairs Approval (date)
CSC 7343 Deep Learning Systems (3)
Deep neural networks, including convolutional and recurrent/recursive neural networks, deep belief networks and autoencoders; related hardware and software support; applications such as image and natural language understanding.

JUSTIFICATION:
A recent breakthrough in intelligent computer systems is the deep neural-network based machine learning (deep learning). There are many recent successes that have demonstrated the power and the potential of a deep learning system. For example, Google’s AlphaGo is the first computer program that defeated human champion in the game of “Go”, an ancient board game that is several order of magnitudes more complex than Chess. At the center of AlphaGo’s success lies deep learning. Deep learning system is also the current best performer in computer vision and speech processing, matching human performance in several tasks. A lot of active researches are being conducted to leverage the capability of deep learning for achieving automation in areas such as self-driving cars, robotics and automated medical diagnosis.

Deep learning is a branch of machine learning that involves neural networks. However, as a new technology area, it is very different from traditional machine learning and traditional neural networks:
1) Deep learning employs new operators and structures such as convolution and gated memory unit that are not part of traditional neural networks.
2) Unsupervised and semi-supervised training are widely used in deep learning to learn a better data representation. This is a practice not seen with traditional neural networks.
3) Deep learning involves extremely large neural networks. Traditional neural networks deal with tens of neurons and use models with thousands of parameters. Deep learning often involves tens of thousands neurons and hundreds of millions of parameters. The increase in model size by several order of magnitude demands hardware and software that can handle large scale training, which is not a main consideration in traditional neural networks.
4) Finally, deep learning has led to breakthrough in computer vision, image processing, speech recognition and language understanding, where traditional neural networks do not give state of art performance.

Because of the new exciting technology development in deep learning, we believe it's important for our graduate students to have exposure to the technology and research frontier in this area. Hence, we propose a new graduate level class in deep learning systems.

OVERLAP:
The proposed course includes a background section in which an overview of machine learning and neural network basics will be given. The background content coverage may overlap with existing courses:

CSC 7333 Machine Learning (3)
Prereq.: CSC 4444. Fundamental principles of machine learning; inductive learning; explanation-based learning; computational approach to Boolean function learning; learning formal languages and recursive theories; neural network learning and genetic algorithms; applications of machine learning.

EE 4745 Neural Computing (3)
Prereq.: EE 2810. Neural networks and automata; network architecture; learning models; applications to signal processing, vision, speech, and robotics; VLSI implementations.

ISDS 4114 Introduction to Data Mining (3)
Prereq.: ISDS 3100. Fundamental methodology and techniques used in data mining, with particular emphasis on business applications; topics include market basket analysis, memory-based reasoning, cluster detection, link analysis, decision trees and rule induction, neural networks and genetic algorithms.

However, the background content is a small percentage (approximately 2 weeks) of the overall course content; week 2-3 in the 14-week course outline. The great majority part of the course deals with topics that are very different from traditional machine learning and neural networks, as elaborated in the justification section above.
Deep Learning Systems

Course Info

Time and Location
TTH 1:30-2:50  0119  J C MILLER HALL

Instructor
Jian Zhang
358 Hatcher Hall
zhang@csc.lsu.edu

Topics

- Machine learning basics
- Review of traditional supervised neural networks
- Convolutional neural network
- Representation learning, deep autoencoders
- Deep Belief Networks
- Recurrent/recursive neural network for sequential data
- Hardware and software support for deep learning (theano/tensorflow, GPU computing)
- Applications in image classification
- Application in natural language understanding
- Game and deep reinforcement learning

Textbook

Lecture notes, no textbook is required.

Workload and Grading

- 3 (programming) homework assignments
- 1 paper report and presentation
  - Write a report on a selected recent research paper pertinent to the topics discussed in the class
  - Present the paper in the class
- Final project
  - Collaboration (group up to 2 persons)
  - Submit a one page description of the project a month before the project due time
  - Project presentation in class
  - Submit project report (5 pages, describe the project goal, methods and your results, one report each group)
- Final exam
Grading
- Homeworks 30%
- Paper report and presentation 20%
- Final project 20%
- Final exam 30%

Scale
| 98-100 A+ | 67-69.9 D+ |
| 92-97.9 A  | 62-66.9 D  |
| 90-91.9 A- | 60-61.9 D- |
| 87-89.9 B+ | <60 F      |
| 82-86.9 B  |            |
| 80-81.9 B- |            |
| 77-79.9 C+ |            |
| 72-76.9 C  |            |
| 70-71.9 C- |            |

Deep Learning Systems 14-Week Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
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<tr>
<td>2</td>
<td>Basics of machine learning</td>
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<tr>
<td>3</td>
<td>Traditional neural networks</td>
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<tr>
<td>4</td>
<td>Intro to deep learning hardware/software packages</td>
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<tr>
<td>5</td>
<td>Convolutional neural network (CNN)</td>
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<tr>
<td>6</td>
<td>Representation learning, deep autoencoders</td>
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<tr>
<td>7</td>
<td>Deep Belief Networks (DBN)</td>
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<tr>
<td>8</td>
<td>Recurrent/Recursive neural network (RNN) for sequential data</td>
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<td>9</td>
<td>Image classification/understanding with CNN</td>
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<tr>
<td>10</td>
<td>Natural language understanding using RNN</td>
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<tr>
<td>11</td>
<td>Game and deep reinforcement learning</td>
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<tr>
<td>12</td>
<td>Presentation and discussion of recent research papers 1</td>
</tr>
<tr>
<td>13</td>
<td>Presentation and discussion of recent research papers 2</td>
</tr>
<tr>
<td>14</td>
<td>Final project presentation</td>
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Descriptions of the graded activities

3 Home works: These are programming assignments. Students shall submit both their code and the result of running the code. The work is graded according to the correctness of the code.

Example home work: code a program that uses a LSTM neural network to classify movie reviews from the IMDB website into two groups: those that like the movie and those that don’t.

Paper report: Each student is assigned a recent research paper to read. They shall present and lead the discussion of the paper in class and submit a 2-page paper report summarizing the work in the paper. This assignment is graded by how well the student understand the paper, based on the paper report they submit.

Final project: Students is required to do a project applying, in an innovative way, the technology discussed in the class to an application scenario of their choice. The project is graded by how well the student understand the technology and how innovative the idea is.
**Final exam:** A comprehensive final exam will be given at the time and date published in the LSU scheduling book. The exam grade will be based on the correctness of the answers.

Example of a final exam question: Suppose you are given a convolutional layer which implements both the forward pass and the backward pass. Use this layer as a building block to implement a deconvolution layer that reverses the operation of the convolutional layer (i.e., given the output of the convolutional layer, the deconvolution layer shall output the input of the convolutional layer.)

**Student Class Participation:**
The class meets for a total of 3 hours per week, which constitutes a 3 hour credit course. While notes and reference materials may be posted via Moodle, the class is not designed to be online and students are expected to attend class. Absences should be rare and exceptional. Students are expected to participate in class discussions and think critically about the concepts addressed. Students should expect to spend at least nine hours outside of class each week reading and doing homework/research.

**LSU Student Code of Conduct:**
The LSU Student Code of Conduct explains student rights, excused absences, and what is expected of student behavior. Students are expected to understand this code as described here: [http://students.lsu.edu/saa/students/code](http://students.lsu.edu/saa/students/code)

Any violations of the LSU Student Code will be duly reported to the Dean of Students.

**Disabilities:**
Louisiana State University is committed to providing reasonable accommodations for all persons with disabilities. If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please see a staff member in Disability Services so that such accommodations can be considered. Students that receive accommodation letters, please meet with me to discuss the provisions of those accommodations as soon as possible.
ISDS has no options to the new course.

Laurene Hutchinson, Assistant to the Chair  
Senior Instructor/Advisor  
CISA non-practicing  
ISDS Department  
LSU E. J. Ourso College of Business  
Business Education Complex, Room 2202  

Baton Rouge, LA 70803  
Office 225-578-2508 | fax 225-578-2511  
lhutchi@lsu.edu | lsu.edu

From: Coretta Douglas <douglas@csc.lsu.edu>  
Sent: Wednesday, October 5, 2016 11:19 AM  
To: Laurene L Hutchinson; John D Scalzo  
Cc: Karki, Bijaya; Zhang, Jian  
Subject: CSE: REQUEST REPLY - New Course Proposed CSC 7343 Deep Learning Systems

Dear Laurene (ISDS) and John (EE and ECE),  
Please share the newly proposed course, CSC 7343, with your faculty.  
Judging from the catalog descriptions for EE 4745 and ISDS 4141, Dr. Zhang has  
surmised that duplication of content may be in a brief introduction of  
fundamental content regarding neural networks.  
After reviewing the attached materials for CSC 7343, please send a  
response regarding your approval or disapproval of the proposed new course.  
Thank you,  
Coretta  
Coretta Douglas, Ph.D. Computer Science  
Undergraduate/Instructional Coordinator and Instructor  
School of Electrical Engineering and Computer Science
Date: Fri, 21 Oct 2016 15:56:49 -0500
From: "Dr. Bijaya Karki" <karki@csc.lsu.edu>
To: douglas@csc.lsu.edu
Subject: Fw: Re: Reply Requested- EE/ECE for Proposed Course CSC 7343

The proposed course, CSC 7343 Deep Learning Systems, is fine with ECE.

--Jerry Trahan

Jerry L. Trahan
Chair, Division of Electrical & Computer Engineering
Chevron Associate Professor of Electrical Engineering
School of Electrical Engineering & Computer Science
102A Electrical Engineering Building
Louisiana State University
Baton Rouge, LA 70803
Phone: (225) 578-5243
E-mail: jtrahan@lsu.edu

On Oct 21, 2016, at 2:31 PM, Dr. Bijaya Karki <karki@csc.lsu.edu> wrote:

Jerry,

Could you provide ECE response on the following proposed course CSC 7373. We are trying to get this processed before end of this semester.

Thanks,
Bijay

---------- Forwarded Message ----------
From: "Coretta Douglas" <douglas@www.csc.lsu.edu>
To: "Zhang, Jian" <zhang@csc.lsu.edu>, koppel@ece.lsu.edu, srai@lsu.edu
Cc: "Karki, Bijaya" <karki@csc.lsu.edu>, "Scalzo, John D" <jscalzo@lsu.edu>, "Trahan, Jerry" <jtrahan@lsu.edu>
Sent: Mon, 17 Oct 2016 09:05:23 -0500
Subject: CSE: Reply Requested- EE/ECE for Proposed Course CSC 7343

Dear Dr. Rai and Dr. Koppelman,

Attached is the revised Courses & Curriculum proposal for CSC 7343 Deep Learning Systems by CSE professor Dr. Jian Zhang.

Thank you for your suggestions. Per your feedback, the justification for CSC
7343 has been revised; small adjustments to the course description have been made also. See attached.
Please reply to this email and copy to Mr. Scalzo with your approval of adding CSC 7343 to the LSU General Catalog. If you would like further engagement with CSE, please contact Dr. Jian Zhang directly to refine the C&C materials.
Regards,
Coretta
Coretta Douglas, Ph.D. Computer Science
Undergraduate/Instructional Coordinator and Instructor
School of Electrical Engineering and Computer Science
** Division of Computer Science and Engineering **
Electrical Engineering (EE) 150-B
------- End of Forwarded Message -------

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