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Proposal #
(Academic Affairs use only)

003R Proposal #
(College use only)

REQUEST FOR A NEW COURSE

University of Central Oklahoma

Course Subject (Prefix), Number, and Title:

Course Subject	Recommended Number	Course Title (maximum of 30 characters) *Remember when abbreviating names, this is how they will appear on student's transcripts.
CMSC	5143	Algos for Machine Learning

Course Title: (full title of course if longer than 30 characters)

Algorithms for Machine Learning

For information regarding CIP codes contact your department chair or visit: http://www.uco.edu/academic-affairs/ir/program_inventory.asp

CIP Code: 14.0999

For graduate courses, please attach a syllabus for this course. (See syllabus requirement policy 2.2.)

Course description as it will appear in the appropriate catalog.

Course description only Do not include prerequisites or enrollment restrictions, these should be added under questions 6-12. (Please use standard American English including full sentences.)

Machine learning is concerned with the question of how to construct computer programs that automatically improve their performance through experience. This course provides an in-depth study of modern algorithms for machine learning, such as supervised learning, unsupervised learning, and reinforcement learning. Python is the programming language used in the course.

Computer Science

Department submitting the proposal

Jicheng Fu

Person to contact with questions

ifu@uco.edu

email address

5704

Ext. number

Approved by:

Gang Qian

Digitally signed by Gang Qian
Date: 2020.05.30 16:28:19
-05'00'

Department Chairperson

Date

[Signature]

5/30/20

College Curriculum Committee Chair

Date

(Please notify department chair when proposal is forwarded to dean.)

Amin Caplan

9/22/2020

College Dean

Date

(Please notify the department chair when proposal is forwarded to AA.)

Academic Affairs Curriculum or Graduate Council Date

Office of Academic Affairs

Date

Effective term for this new course

(Assigned by the Office of Academic Affairs.)

1. Does this course have an undergraduate / graduate counterpart?
 Yes No
2. Is this proposal part of a larger submission package including a program change?
 Yes No
3. Does this new course affect a teacher preparation program? (All courses required for any teacher preparation program must have approval from the Council on Teacher Education (CTE) before approval from AACC or Graduate Council.)
 Yes No If yes, send copy of proposal to the Education Curriculum Committee Chair, Dr. Darla Fent.
 CTE Approval (Stamp or initial) _____
4. Has this course been previously taught as a common course (4910 seminar, 4960 institute, etc.)?
 Yes No If yes, when was the most recent offering? Fall 2019
5. Does this course affect majors or minors outside the department?
 Yes No If yes, provide name(s) of department chair(s) contacted, dates, and results of discussion.
Dr. Byrne, Math & Stats Department, 9/9/2019, no concerns about this course
6. Prerequisite courses:
 Example 1: MATH 1213 and (MATH 2165 or MATH 2185) and CHEM 1213 Example 3: 8 hours of biology including BIO 1404
 Example 2: (ACCT 2113 and 2213) and (MGMT 3013 or ISOM 3613)
CMSC 3613
7. Co-requisite(s): Which of the above prerequisite courses, if any, may be taken in the same semester as the proposed new course?
None
8. Concurrent enrollment: Courses that must be taken the same semester. Example: lab courses.
None
9. Will this course have enrollment restrictions?
 Yes No If No, go to question 13.
10. Specify which major(s) may or may not take this course. Specifying a major, excludes all other majors from enrolling.
 Check one: May May not
 Major Code:

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11. Which of the following student classification(s) may enroll in this course?
 Check all that apply:
 Graduate (2) 19 + hours
 Graduate (1) 0-18 hours
 Post Baccalaureate *
 Senior
 Junior
 Sophomore
 Freshman
 * Graduate level courses are not open to Post Baccalaureate students.
12. Check or list other restrictions for this course.

	Admission to Graduate Programs	_____
	Admission to Nursing Program	_____
	Admission to Teacher Education	_____
	Other	_____

13. **Course objectives:** Objectives should be observable, measurable and include scholarly or creative activities to meet the course level characteristics. Course objectives should also be in line with the course description. (Please refer to instructional objectives documents at: <http://www.uco.edu/academic-affairs/faculty-staff/aacc.asp#FAQ/Helpful%20Hints>.)

Upon satisfactory completion of this course, students will be able to

- (1) vectorize and normalize datasets
 - (2) differentiate between supervised, unsupervised, and reinforcement learning tasks
 - (3) evaluate which learning algorithms are appropriate for what kind of tasks
 - (4) use a programming language to implement various supervised, unsupervised, and reinforcement machine learning algorithms
 - (5) employ machine learning algorithms to solve real-world problems
 - (6) optimize various machine learning algorithms
 - (7) assess the limits of machine learning
-

Course Detail Information:

14. Contact Hours (per week)

 3 Lecture hours (in class)

 Lab hours (also studios)

 Other (outside activities)

15. Repeatable course.

 1 Number of times this course can be taken for credit.

16. Schedule type: (select one only)

 Activity P.E. (A)

 Lab only (B)

 Lecture/Lab (C)

 X Lecture only (L)

 Recitation/Lab (R)

 Student Teaching (STU)

 Studio Art/Design (XSU)

17. List existing course(s) for which this course will be a prerequisite. Adding a "new course" as a prerequisite to an existing course will likely cause enrollment problems. (Please submit a prerequisite change form for each course for which this course will serve as a prerequisite.)

 None

18. What resources, technology or equipment must be acquired to teach this course? List items, which must be purchased and estimate cost. (Be specific, e.g., technology software, equipment, computer lab; etc.)

 Existing teaching resources are adequate for the proposed course.

19. The UCO Library has the required library resources available for this new course?

 X Yes No If yes, provide names of Librarian/Faculty Liaisons contacted, dates, and results of discussion.
 Ms. Dawn Holt, Faculty Liaison, has confirmed on September 10, 2019 that ACM and IEEE databases at UCO library are adequate resources for this course.

If no, what additional library resources must be acquired for this new course? List items which must be purchased and estimated cost. (Be specific, e.g., books, magazines, journals, etc.)

20. Names of current faculty qualified to teach this course.

Dr. Jicheng Fu, Dr. Gang Qian

21. Additional faculty (adjunct or full-time) required and specific competencies required to teach this course:

None

22. How will this course be staffed and equipped? Identify the additional costs associated with this new course. If no costs, explain why not.

There will be no additional cost for the proposed course. When this new course is offered, the frequency and the number of sections of elective courses will be adjusted correspondingly so that the total number of hours taught each semester will remain the same. Moreover, the current budget for the department is enough to cover equipment cost (if any) for the proposed course should the need arise.

23. Identify the source(s) of funds for any additional costs for the new course. i.e. internal reallocations, special fees from students, etc. If you plan to propose special fees be assessed for this course, be aware there is a separate approval process for special fees.

N/A

24. Projected enrollment for two academic years following approval of new course:

Semester	2020-2021	2021-2022
Fall	5	10
Spring		
Summer		

25. Using State Regents' definition of liberal arts and sciences (quoted below), characterize the course as follows:

X Non-liberal arts and sciences
 Liberal arts and sciences

"The liberal arts and sciences are defined as those traditional fields of study in the humanities; social and behavioral sciences; communications; natural and life sciences, mathematics; and the history, literature, and theory of fine arts (music, art, drama, dance). Courses in these fields whose primary purpose is directed toward specific occupational or professional objectives, or courses in the arts which rely substantially on studio or performance work are not considered to be liberal arts and sciences for the purpose of this policy. Courses required for the General Educational Program are not necessarily synonymous or mutually exclusive with the liberal arts and sciences." State Regents Policy and Procedures. Chapter 2, Section 5, "Degree Requirements" part 1, (2). P. II-2-86

26. Please provide a concise, yet comprehensive, statement that explains the reasons for requesting the new course. Include documentation or assessment information supporting the specific request (if possible). Indicate the expected source of student enrollment (majors, minors, programs etc.)

The past decade has seen the rapid development of machine learning, which has shifted the focus of AI research from academia to the real-world. The ComputerWorld magazine lists Machine Learning as the most important of "the 12 IT skills that employers can't say no to" (<https://www.computerworld.com/article/2542247/12-it-skills-that-employers-cant-say-no-to.html>). This course will equip students with fundamental knowledge in supervised, unsupervised, and reinforcement learning. Students will develop skills of analyzing and applying machine learning algorithms to solve real-world problems. The successful completion of this course will build a solid foundation for students' future career development. This course is required by the Data Science program. Graduate students pursuing a Computer Science or Applied Mathematics & Computer Science may enroll in this course as an elective course.

- 27 Which of the six transformative learning tenets does this course incorporate? (check all that apply or only those that apply) This question was a directive from the Provost and is used for informational purposes.
- | | |
|---|-------------------|
| Discipline Knowledge | <u> X </u> |
| Leadership | <u> </u> |
| Research, Scholarly and Creative Activities | <u> X </u> |
| Service Learning and Civic Engagement | <u> </u> |
| Global and Cultural Competencies | <u> </u> |
| Health and Wellness | <u> </u> |

28. Clearly explain how the characteristics of this course meet or exceed those outlined in Course Level Characteristics. (Copy and paste table from "Course Level Characteristics" document for the appropriate course level of proposed course. Document may be found on: <http://sites.uco.edu/academic-affairs/files/course-level-characteristics-table.doc> .

5000 Level Course

Course Level Characteristics	Please describe how this course meets this requirement.
1.It is assumed that students in these courses have acquired the ability to use language effectively, to engage in analytical thought and creative processes, and to use information and bibliographic sources with skill.	Graduate students enrolled in this course have a bachelor's degree in a computing-related field or have completed sufficient course work prior to this course. Therefore, students will have the necessary skills in oral and written communication, information analysis and synthesis, literature survey, and creative problem solving prior to this course.
2.It is assumed that students in these courses have achieved a significant level of maturity in the discipline, evidenced by a considerable background of knowledge.	Students enrolled in this course are graduate students with a bachelor's degree in a computing-related field. Through their undergraduate studies, students have achieved a significant level of maturity in the computer science discipline. In addition, the prerequisite of the proposed course is CMSC 3613, which provides a substantial background for the proposed course. The level of maturity in mathematics is ensured by the prerequisites of CMSC 3613, i.e., MATH 2323 and (STAT 2103, 2113, or 4113).
3.These courses should be more than a mere extension of undergraduate courses. Rather, they should be qualitatively different. At a minimum: a.Students should be required to undertake original scholarly/creative activity. b.Students should assume greater responsibility for mastering the subject matter. c.Close working relationships should exist between instructors and students.	a. Graduate students enrolled in this course are required to finish both written and programming assignments, which involve substantial scholarly activities, such as analysis, modeling, and optimization. b. Graduate students enrolled in this course are required to use advanced mathematical knowledge to optimize machine learning algorithms. c. As graduate students need to understand the limits of machine learning and use mathematical knowledge to optimize machine learning algorithms, the instructor will hold weekly meeting during office hours to help graduate students analyze and resolve issues.

Syllabus, CMSC 5143 Algorithms for Machine Learning

Instructor

- Dr. Jicheng Fu, Professor of Computer Science
- Office: STEM 237
- D2L: <http://learn.uco.edu> (Preferred means of contact; D2L forum)
- Phone: 405.974.5704
- Email: jfu@uco.edu

Textbook:

Machine Learning by Tom Mitchell. McGraw-Hill Education ISBN-10: 0071154671

Course Description

Machine learning is concerned with the question of how to construct computer programs that automatically improve their performance through experience. This course provides an in-depth study of modern algorithms for machine learning, such as supervised learning, unsupervised learning, and reinforcement learning. Python is the programming language used in the course.

Prerequisites: CMSC 3613

Course Objectives

Upon satisfactory completion of this course, students will be able to

- (1) vectorize and normalize datasets
- (2) differentiate between supervised, unsupervised, and reinforcement learning tasks
- (3) evaluate which learning algorithms are appropriate for what kind of tasks
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- (6) optimize various machine learning algorithms
- (7) assess the limits of machine learning

Central Six Transformative Learning Tenets

Discipline Knowledge	X
Leadership	
Research, Scholarly and Creative Activities	X
Service Learning and Civic Engagement	
Global and Cultural Competencies	
Health and Wellness	

Grading and Evaluation

Homework assignments (30% of the course grade)

There will be a written as well as a programming assignment for each topic. Since we will be using eLearning (D2L) for submission and grading, you must upload an electronic copy of your assignment by the due date. For written assignments, if you choose not to typewrite your

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assignment, you will need to scan and upload your submission and also provide me with a hardcopy of your submission.

Library assignment (5% of the course grade)

Using UCO library and database search facilities, locate, access, and read one article published within five years by the Association for Computing Machinery (ACM) or by the Institute of Electrical and Electronics Engineers (IEEE). The article must be relevant to topics of Machine Learning.

Midterm exam (30% of the course grade)

There will be one in-class midterm exam.

Final exam (30% of the course grade)

There will be a comprehensive final exam.

Class participation (5% of the course grade)

- A student is allowed to miss two complete classes or team meeting periods without penalty. After that, one percent will be deducted from the final grade for each unexcused absence.
- Tardy (arriving after calling the roll) or early leave is considered as half attendance. Students should expect to document their excuses.
- **For IVE students**, please use your real name to join our class sessions.
- **For IVE students**, if you cannot make the class, you must watch the video within **48 hours** after the class. You must send me a report indicating that you have watched the video.
- To improve the learning quality, students are encouraged to actively ask questions, answer questions, and get involved in discussions. **Attitude is everything.**

Course Outline

1. Python and vectorization
2. Artificial neural network
 - a. Linear regression
 - b. Logistic regression
 - c. Feedforward neural network and Back propagation
3. Decision tree
4. Instance-based learning
5. Clustering
 - a. Hierarchical Agglomerative Clustering
 - b. K-Means
6. Markov Decision Processes
7. Hidden Markov Model
8. Bayesian Learning
9. Reinforcement Learning

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Academic Integrity

You should conduct all of your activities related to the course as a civil and responsible member of the UCO community. Any academic misconduct, including but not limited to cheating or plagiarism, requires a grade of zero for the assignment and that the professor notify the UCO Office of Student Conduct.

You may find a current copy of the Code of Student Conduct from the “Forms & Publication” link of the UCO Office of Student Conduct home page (<http://broncho2.uco.edu/conduct/>)

DSS – ADA Statement

The University of Central Oklahoma complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. Students with disabilities who need special accommodations must make their requests by contacting Disability Support Services, at (405) 974-2516. The DSS Office is located in the Nigh University Center, Room 305. Students should also notify the instructor of special accommodation needs as soon as possible. Per Title IX of the Education Amendments of 1972 (“Title IX”), pregnant and parenting students may request adjustments by contacting the Title IX Coordinator, at (405) 974-3377 or TitleIX@uco.edu. The Title IX Office is located in the Lillard Administration Building, Room 114D.

Student Information Sheet and Syllabus Attachment:

Refer to “Syllabus Attachment” link on <http://www.uco.edu/academicaffairs/>