CGS Agenda Item:17-22
Effective Fall 2017

Eastern Illinois University
New Course Proposal
CSM 4985, Artificial Intelligence and Machine Learning

Banner/Catalog Information (Coversheet)

1. **_X_ New Course or _____Revision of Existing Course**

2. **Course prefix and number:** CSM 4985

3. **Short title:** AI

4. **Long title:** Artificial Intelligence and Machine Learning

5. **Hours per week:** _3_ Class _0_ Lab _3_ Credit

6. **Terms: _X_** Fall ___ Spring ___ Summer ___ On demand

7. **Initial term**: **_X_** Fall ___ Spring ___ Summer Year: 2017

8. **Catalog course description:** Survey of methods and applications of artificial intelligence (AI) and machine learning. Topics could include: knowledge representation, neural networks, genetic algorithms, unsupervised learning, and ethical issues related to the use of AI.

9. **Course attributes:** N/A

   General education component: _____None_____

   ___ Cultural diversity ___ Honors ___ Writing centered ___ Writing intensive ___Writing active

10. **Instructional delivery**
    Type of Course:

    _X_ Lecture ___ Lab ___ Lecture/lab combined ___ Independent study/research

    ___ Internship ___ Performance ___ Practicum/clinical ___ Other, specify: _____

    Mode(s) of Delivery:

    _X_ Face to Face ___ Online ___ Study Abroad

    ___ Hybrid, specify approximate amount of on-line and face-to-face instruction_____

11. **Course(s) to be deleted from the catalog once this course is approved. _____**

12. **Equivalent course(s):** None.

    a. Are students allowed to take equivalent course(s) for credit? ___ Yes **_X_** No

13. **Prerequisite(s):** 'C' or better in MAT 2345 or MAT 2800, *and* 'C' or better in CSM 2670, *and* 'C' or better in MAT 3701.

    a. Can prerequisite be taken concurrently? ___ Yes **_X_** No

    b. Minimum grade required for the prerequisite course(s)? _C_

    c. Use Banner coding to enforce prerequisite course(s)? _X_ Yes ___ No

d. Who may waive prerequisite(s)?

___ No one **_X_** Chair **_X_** Instructor ___ Advisor ___ Other (specify)

14. Co-requisite(s): None.

15. Enrollment restrictions

a. Degrees, colleges, majors, levels, classes which may take the course: All.

b. Degrees, colleges, majors, levels, classes which may not take the course: None.

16. Repeat status: **_X_** May not be repeated ___ May be repeated once with credit

17. Enter the limit, if any, on hours which may be applied to a major or minor: No limit.

18. Grading methods: **_X_** Standard **__** CR/NC **__** Audit ___ ABC/NC

19. Special grading provisions:

___ Grade for course will not count in a student's grade point average.

___ Grade for course will not count in hours toward graduation.

___ Grade for course will be removed from GPA if student already has credit for or is registered in: _____

___ Credit hours for course will be removed from student's hours toward graduation if student already has credit for or is registered in: _____

20. Additional costs to students:
Supplemental Materials or Software_____

Course Fee: **_X_** No ___Yes, Explain if yes_____

21. Community college transfer:

___ A community college course may be judged equivalent.

_X_ A community college may not be judged equivalent.

Note: Upper division credit (3000+) will not be granted for a community college course, even if the content is judged to be equivalent.

Rationale, Justifications, and Assurances (Part I)

1. **_X_** Course is required for the major(s) of Computer Science.

   ___Course is required for the minor(s) of _____

   ___Course is required for the certificate program(s) of _____

   __ Course is used as an elective for

2. **Rationale for proposal**: Artificial intelligence (AI) is used in many computer applications, from playing games to machine vision. This pervasive nature makes the study of AI a necessity for computer science students. Furthermore, as the answers found via AI are often "fuzzy," studying AI provides a counterpoint to the exact algorithms presented in most computer science courses, e.g., CSM 4880.

3. **Justifications for (answer N/A if not applicable)**

   Similarity to other courses: N/A

   Prerequisites: This course requires maturity and experience in both mathematics and computer science. These requirements are typically attained by completing MAT 2345 or MAT 2800 and CSM 2670, respectively. Moreover, statistical techniques are pervasive in the study of AI, hence MAT 3701 is required.

   Co-requisites: N/A

   Enrollment restrictions: N/A

   Writing active, intensive, centered: N/A

4. **General education assurances (answer N/A if not applicable)**

   General education component: N/A

   Curriculum: N/A

   Instruction: N/A

   Assessment: N/A

5. **Online/Hybrid delivery justification & assurances (answer N/A if not applicable)**

   Online or hybrid delivery justification: N/A

   Instruction: N/A

   Integrity: N/A

   Interaction: N/A

Model Syllabus (Part II)

1. Course number and title

CSM 4985: Artificial Intelligence and Machine Learning

2. Catalog description:

Survey of methods and applications of artificial intelligence (AI) and machine learning. Topics could include: knowledge representation, neural networks, genetic algorithms, unsupervised learning, and ethical issues related to the use of AI.

3. Learning objectives:

Students will be able to:

- Create and interpret appropriate knowledge representations for different problems (QR-2, QR-3, GLG-1, GLG-2)
- Apply decision tree learning and evaluate the results (QR-2, QR-3, GLG-1, GLG-2, GLG-3)
- Recognize and mitigate overfitting of training data (QR-3, QR-4, GLG-1, GLG-2)
- Apply various *supervised* learning techniques (e.g., artificial neural networks, genetic algorithms) to problems and evaluate the results (QR-2, QR-3, QR-6, GLG-1, GLG-2, GLG-3)
- Apply various *unsupervised* learning techniques (e.g., self-organizing maps, principal component analysis) to problems and evaluate the results (QR-2, QR-3, QR-6, GLG-1, GLG-2, GLG-3)
- Analyze the difference between supervised and unsupervised learning, and be able to distinguish which is appropriate for various problems (QR-4, GLG-1, GLG-2)
- Form cogent arguments regarding the ethical implications of AI (QR-5, GLG-2, GLG-3)

4. Course materials:

- Russell and Norvig (2015). *Artificial Intelligence: A Modern Approach (Third edition).* Pearson.
- Mitchell, T. M. (1997). *Machine Learning.* WCB/McGraw-Hill.
- Mitchell has provided digital (free) copies of new chapters to his book. http://www.cs.cmu.edu/~tom/NewChapters.html

5. Weekly outline of content:

Week 01: Overview of AI & Machine Learning
Week 02: Knowledge Representation and Concept Learning
Week 03: Decision Trees
Week 04: Backpropagation Neural Networks
Week 05: Recurrent Neural Networks
Week 06: Self-Organizing Maps; Exam #1
Week 07: Statistical Review
Week 08: Naïve Bayes Classifiers
Week 09: Regression Analyses
Week 10: Principal Component Analysis
Week 11: *k*-Nearest Neighbors Learning; Exam #2

Week 12: Genetic Algorithms
Week 13: Genetic Programming
Week 14: Ethical Implications of Using AI
Week 15: Artificial Moral Agency
Week 16: Final Exam

6. Assignments and evaluation, including weights for final course grade:

Weekly Homework (10%)
Programming Assignments (30%)
Two in-class Exams (30%)
Final Exam (30%)

Graduate students will be expected to do the same work as the undergraduates. In addition, the exercises and projects will include more challenging problems, focusing on theoretical exercises requiring additional reading. Weekly homework assignments will include two additional graduate-student-only exercises, and exams will include an additional graduate-student-only question.

7. Grading scale:

Final grades will be given on a standard A, B, C, D, F scale:

90-100% A 80-89% B 70-79% C 60-69% D Below 60% F

8. Correlation of learning objectives to assignments and evaluation.

	Weekly Homework (10%)	Programming Assignments (30%)	Two in-class Exams (30%)	Final Exam (30%)
Create and interpret appropriate knowledge representations for different problems (QR-2, QR-3, GLG-1, GLG-2)	x	x	x	x
Apply decision tree learning and evaluate the results (QR-2, QR-3, GLG-1, GLG-2, GLG-3)	x		x	x
Recognize and mitigate overfitting of training data (QR-3, QR-4, GLG-1, GLG-2)	x		x	x
Apply various *supervised* learning techniques (e.g., artificial neural networks, genetic algorithms) to problems and evaluate the results (QR-2, QR-3, QR-6, GLG-1, GLG-2, GLG-3)	x	x	x	x
Apply various *unsupervised* learning techniques (e.g., self-organizing maps, principal component analysis) to problems and evaluate the results (QR-2, QR-3, QR-6, GLG-1, GLG-2, GLG-3)	x	x	x	x
Analyze the difference between supervised and unsupervised learning, and be able to distinguish which is appropriate for various problems (QR-4, GLG-1, GLG-2)	x		x	x

Form cogent arguments regarding the ethical implications of AI (QR-5, GLG-2, GLG-3)	x		x	x

Date approved by the department or school: November 28, 2016
Date approved by the college curriculum committee: February 3, 2017
Date approved by the Honors Council *(if this is an honors course):*
Date approved by CAA: February 23, 2017 CGS: