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| For Academic Affairs and Research Use Only | |
| CIP Code: |  |
| Degree Code: |  |

**New Course Proposal Form**

**[ ] Undergraduate Curriculum Council**

**[X] Graduate Council**

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| **[X] New Course or [ ]Experimental Course (1-time offering) (Check one box)** |

Signed paper copies of proposals submitted for consideration are no longer required. Please type approver name and enter date of approval.

Email completed proposals to [curriculum@astate.edu](mailto:curriculum@astate.edu) for inclusion in curriculum committee agenda.

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| Edward Hammerand 9/24/2017 **Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **COPE Chair (if applicable)** |
| Hung-Chi Su 9/24/2017 **Department Chair:** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Head of Unit (If applicable)** |
| David F. Gilmore 10/6/2017 **College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Undergraduate Curriculum Council Chair** |
| Anne A. Grippo 10/6/2017 **College Dean** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Graduate Curriculum Committee Chair** |
| |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **General Education Committee Chair (If applicable)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Vice Chancellor for Academic Affairs** |

1. Contact Person (Name, Email Address, Phone Number)

Hung-Chi Su, suh@astate.edu, (870)680-8119

2. Proposed Starting Term and Bulletin Year

Spring, 2018

3. Proposed Course Prefix and Number (Confirm that number chosen has not been used before. For variable credit courses, indicate variable range. *Proposed number for experimental course is 9*. )

CS 6443

4. Course Title – if title is more than 30 characters (including spaces), provide short title to be used on transcripts. Title cannot have any symbols (e.g. slash, colon, semi-colon, apostrophe, dash, and parenthesis). Please indicate if this course will have variable titles (e.g. independent study, thesis, special topics).

Machine Learning

5. Brief course description (40 words or fewer) as it should appear in the bulletin.

The theory and practice of machine learning from a variety of perspectives. Topics include supervised learning (classification, regression); unsupervised learning (clustering, dimensionality reduction); reinforcement learning; and computational learning theory.

6. Prerequisites and major restrictions. (Indicate all prerequisites. If this course is restricted to a specific major, which major. If a student does not have the prerequisites or does not have the appropriate major, the student will not be allowed to register).

1. **Yes** Are there any prerequisites?
   1. If yes, which ones?

CS3113 or “B” or better in CS5032, and STAT3233

* 1. Why or why not?

The material covered by the course requires understanding of advanced concepts in data structures (CS3113 or CS5032) and statistics (STAT3233).

1. **No** Is this course restricted to a specific major?
   1. If yes, which major? Enter text...

7. Course frequency(e.g. Fall, Spring, Summer). *Not applicable to Graduate courses.*

Enter text...

8. Will this course be lecture only, lab only, lecture and lab, activity, dissertation, experiential learning, independent study, internship, performance, practicum, recitation, seminar, special problems, special topics, studio, student exchange, occupational learning credit, or course for fee purpose only (e.g. an exam)? Please choose one.

Lecture only

9. What is the grade type (i.e. standard letter, credit/no credit, pass/fail, no grade, developmental, or other [please elaborate])

Standard letter

10. **No** Is this course dual listed (undergraduate/graduate)?

11. **No** Is this course cross listed?

*(If it is, all course entries must be identical including course descriptions. Submit appropriate documentation for requested changes. It is important to check the course description of an existing course when adding a new cross listed course.)*

**11.1** – If yes, please list the prefix and course number of cross listed course.

Enter text...

**11.2** – **Yes / No** Are these courses offered for equivalent credit?

Please explain. Enter text...

12. **Yes** Is this course in support of a new program?

a. If yes, what program?

Data Science Certificate in Computer Science

13. **No** Does this course replace a course being deleted?

a. If yes, what course?

Enter text...

14. **No** Will this course be equivalent to a deleted course?

a. If yes, which course?

Enter text...

15. **Yes** Has it been confirmed that this course number is available for use?

*If no: Contact Registrar’s Office for assistance.*

16. **No** Does this course affect another program?

If yes, provide confirmation of acceptance/approval of changes from the Dean, Department Head, and/or Program Director whose area this affects.

Enter text...

**Course Details**

17. Outline (The course outline should be topical by weeks and should be sufficient in detail to allow for judgment of the content of the course.)

Week 1: Introduction and Prerequisites Review

Week 2: Supervised Learning

Week 3: Parametric Methods

Week 4: Multivariate Methods

Week 5: Dimensionality Reduction

Week 6: Clustering

Week 7: Nonparametric Methods

Week 8: Linear Discrimination

Week 9: Multilayer Perceptrons

Week 10: Support Vector Machine

Week 11: Kernel Machines

Week 12: Graphical Models

Week 13: Hidden Markov Models

Week 14: Bayesian Networks

18. Special features (e.g. labs, exhibits, site visitations, etc.)

N/A

19. Department staffing and classroom/lab resources

1. Will this require additional faculty, supplies, etc.?

No. The course has been in the rotation for several semesters as a special topics subject. Its addition to the bulletin as a regular course will have no impact on department staffing or resources.

20. **No** Does this course require course fees?

*If yes: please attach the New Program Tuition and Fees form, which is available from the UCC website.*

**Course Justification**

21. Justification for course being included in program. Must include:

a. Academic rationale and goals for the course (skills or level of knowledge students can be expected to attain)

There is a great demand in industry and academia for the skills in machine learning, particularly as it relates to data science; this course provides students in-depth study in both its theory and its application. Student will develop an understanding of machine learning techniques and the associated computer programming. Student will also develop improved problem-solving skills and facility with applied mathematics and statistics.

b. How does the course fit with the mission established by the department for the curriculum? If course is mandated by an accrediting or certifying agency, include the directive.

One part of the mission is to maintain the curriculum with updated technologies. The course addresses the department’s ongoing need to add curriculum reflecting new concepts and technologies in computer science. The department must prepare students for work and continuing advancement in the industrial application of and computing research in machine learning. This proposed course will expand the field of data science in the current CS curriculum.

c. Student population served.

Graduate.

d. Rationale for the level of the course (lower, upper, or graduate).

Students should have a comprehensive understanding of analysis of algorithms, data structures, statistics, and programming skills.

**Assessment**

**University Outcomes**

22. Please indicate the university-level student learning outcomes for which this new course will contribute. Check all that apply.

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| * 1. **[ ]** Global Awareness | * 1. **[X ]** Thinking Critically | * 1. **[X ]** Information Literacy |

**Relationship with Current Program-Level Assessment Process**

23. What is/are the intended program-level learning outcome/s for students enrolled in this course? Where will this course fit into an already existing program assessment process?

1. M.S. Computer Science graduate students should have a deeper understanding of the theory and application of algorithms, programming languages, and computer processes.
2. M.S. Computer Science graduate students should have the ability to apply advanced analysis techniques to problem identification and solution in computing applications.
3. M.S. Computer Science graduate students should have the ability to apply advanced implementation techniques to problem identification and solution in computing applications.

The course will be assessed along with other graduate courses on the same schedule.

24. Considering the indicated program-level learning outcome/s (from question #23), please fill out the following table to show how and where this course fits into the program’s continuous improvement assessment process.

*For further assistance, please see the ‘Expanded Instructions’ document available on the UCC - Forms website for guidance, or contact the Office of Assessment at 870-972-2989.*

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| **Program-Level Outcome 1 (from question #23)** | M.S. Computer Science graduate students should have a deeper understanding of the theory and application of algorithms, programming languages, and computer processes. |
| Assessment Measure | Comprehensive examinations and employer surveys |
| Assessment  Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee. |

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| **Program-Level Outcome 2 (from question #23)** | M.S. Computer Science graduate students should have the ability to apply advanced analysis techniques to problem identification and solution in computing applications. |
| Assessment Measure | Comprehensive examinations and employer surveys |
| Assessment  Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee. |

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| **Program-Level Outcome 3 (from question #23)** | M.S. Computer Science graduate students should have the ability to apply advanced implementation techniques to problem identification and solution in computing applications. |
| Assessment Measure | Comprehensive examinations and employer surveys |
| Assessment  Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee. |

*(Repeat if this new course will support additional program-level outcomes)*

**Course-Level Outcomes**

25. What are the course-level outcomes for students enrolled in this course and the associated assessment measures?

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| **Outcome 1** | Students will get familiar with the theory and practice of machine learning |
| Which learning activities are responsible for this outcome? | In-class discussion and illustrations  Demonstration of analysis results in presentations |
| Assessment Measure | Course presentations, exams and projects |

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| **Outcome 2** | Students will master the corresponding analytical skills. |
| Which learning activities are responsible for this outcome? | Accomplish related literature reviews  Perform analytic evaluation of example algorithms |
| Assessment Measure | Course presentations and exams |

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| **Outcome 3** | Students will get experience which will develop implementation skills. |
| Which learning activities are responsible for this outcome? | In-class discussion and illustrations  Accomplish related literature reviews  Conduct effective projects |
| Assessment Measure | Course homework and projects |

*(Repeat if needed for additional outcomes)*

**Bulletin Changes**

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| **Instructions** |
| **Please visit** [**http://www.astate.edu/a/registrar/students/bulletins/index.dot**](http://www.astate.edu/a/registrar/students/bulletins/index.dot) **and select the most recent version of the bulletin. Copy and paste all bulletin pages this proposal affects below. Follow the following guidelines for indicating necessary changes.**  **\*Please note: Courses are often listed in multiple sections of the bulletin. To ensure that all affected sections have been located, please search the bulletin (ctrl+F) for the appropriate courses before submission of this form.**  - Deleted courses/credit hours should be marked with a red strike-through (~~red strikethrough~~)  - New credit hours and text changes should be listed in blue using enlarged font (blue using enlarged font).  - Any new courses should be listed in blue bold italics using enlarged font (***blue bold italics using enlarged font***)  *You can easily apply any of these changes by selecting the example text in the instructions above, double-clicking the ‘format painter’ icon 🡪 , and selecting the text you would like to apply the change to.*  *Please visit* [*https://youtu.be/yjdL2n4lZm4*](https://youtu.be/yjdL2n4lZm4) *for more detailed instructions.* |

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**CS 6433. Natural Language Processing** Data representations used in programming computers to interpret and to generate natural language text. Background from linguistics, theoretical computer science and lexical analysis; structures and algorithms for syntactical analysis, semantic analysis, and knowledge representation. Prerequisite: CS 3113 or “B” or better in CS 5032.

***CS 6443. Machine Learning The theory and practice of machine learning from a variety of perspectives. Topics include supervised learning (classification, regression); unsupervised learning (clustering, dimensionality reduction); reinforcement learning; and computational learning theory.*** ***Prerequisite: CS3113 or “B” or better in CS5032, and STAT3233.***

**CS 6513. Data Compression and Indexing** Compressing, indexing and querying large collections of text and image data. Prerequisite: CS 5123 or CS 5713 or “B” or better in CS 5032 and permission of instructor.

**CS 6713. Advanced Analysis of Algorithms** Theoretical space and time requirements for algorithms. Prerequisite: CS 5713.

**CS 6723. Computability Theory** Turing machines and equivalent models of computation. The universal Turing machine and unsolvability results. Study of computable functions. Problem classification and hierarchy. Prerequisite: CS 5723 or “B” or better in CS 5032 and permission of professor.

**CS 6813. Seminar in Computer Science** Current topics in Computer Science. Prerequisite: CS 3113 or “B” or better in CS 5032.

**CS 6823. Special Topics** Current topics of interest to graduate computer science students. (May be repeated for credit with different subtitle. ONLY six hours with the same course number will count toward the degree.) Prerequisite: CS 3113 or “B” or better in CS 5032.

**CS 688V. Independent Study**