May 11, 2011

MEMORANDUM

TO: Steve Halperin
    Dean, College of Computer, Mathematical and Natural Sciences

FROM: Elizabeth Beise
    Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to Modify the Curriculum of the BS in Computer Science (PCC log no.10055).

On May 6, 2011, the Senate Committee on Programs, Curricula, and Courses approved your proposal to modify the curriculum of the BS in Computer Science. A copy of the approved agreement is attached.

The change is effective Fall 2011. The College should ensure that the change is fully described in the Undergraduate Catalog and in all relevant descriptive materials, including the program’s four-year plan (contact Lisa Kiely at lkiely@umd.edu for more information), and that all advisors are informed.

MDC/

Enclosure

cc: David Salness, Chair, Senate PCC Committee
    Sarah Bauder, Office of Student Financial Aid
    Reka Montfort, University Senate
    Erin Howard, Data Administration
    Donna Williams, Institutional Research & Planning
    Anne Turkos, University Archives
    Linda Yokoi, Office of the Registrar
    James Dietz, Undergraduate Studies
    Paul Smith, College of Computer, Mathematical and Natural Sciences
    Larry Davis, Computer Science
The Department of Computer Science proposes that a new course be added to the options from which Computer Science students can choose for their Upper Level Computer Science Requirements. In Area 2, Information Processing, students would now have the option of including CMSC 422 - Machine Learning, which is being made a permanent course after being introduced as a Special Topics offering. The course description is below:

CMSC 422 Machine Learning

Machine Learning studies representations and algorithms that allow machines to improve their performance on a task from experience. This is a broad overview of existing methods for machine learning and an introduction to adaptive systems in general. Emphasis is given to practical aspects of machine learning and data mining.
Proposal

The Department of Computer Science proposes allowing a new course to count toward the BS degree.

Rationale

As Computer Science is a constantly- and quickly-evolving discipline, the department must continually evaluate what is the best and most essential information for our students to have to continue to be the innovators of the field, versus what topics are transitory and/or short-lived. This proposed curriculum change will not change the number of credits required in the Computer Science Curriculum, it would only broaden the options our students have to complete the existing requirements.

CMSC 422, Machine Learning, has been taught here at the University of Maryland as a special topics course to good reception from Computer Science students. As all topics related to Artificial Intelligence are growing in application and importance in the field of Computer Science, it is appropriate that the course now be used as an option in the Information Processing Area of Concentration.

<table>
<thead>
<tr>
<th>Current Requirements</th>
<th>Proposed Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students select 5 courses from at least 3 of the Areas of Concentration below (requirement remains the same)</td>
<td></td>
</tr>
<tr>
<td><strong>Area 1: Systems (up to 2 courses)</strong></td>
<td><strong>Area 1: Systems (up to 2 courses)</strong></td>
</tr>
<tr>
<td>CMSC 411</td>
<td>CMSC 411</td>
</tr>
<tr>
<td>CMSC 412</td>
<td>CMSC 412</td>
</tr>
<tr>
<td>CMSC 414</td>
<td>CMSC 414</td>
</tr>
<tr>
<td>CMSC 417</td>
<td>CMSC 417</td>
</tr>
<tr>
<td><strong>Area 2: Information Processing (up to 2 courses)</strong></td>
<td><strong>Area 2: Information Processing (up to 2 courses)</strong></td>
</tr>
<tr>
<td>CMSC 420</td>
<td>CMSC 420</td>
</tr>
<tr>
<td>CMSC 421</td>
<td>CMSC 421</td>
</tr>
<tr>
<td>or CMSC 423</td>
<td>or CMSC 422</td>
</tr>
<tr>
<td>or CMSC 424</td>
<td>or CMSC 423</td>
</tr>
<tr>
<td>or CMSC 426</td>
<td>or CMSC 424</td>
</tr>
<tr>
<td>or CMSC 427</td>
<td>or CMSC 426</td>
</tr>
<tr>
<td><strong>Area 3: Software Engineering and Programming Languages (up to 2 courses)</strong></td>
<td><strong>Area 3: Software Engineering and Programming Languages (up to 2 courses)</strong></td>
</tr>
<tr>
<td>CMSC 430</td>
<td>CMSC 430</td>
</tr>
<tr>
<td>CMSC 433</td>
<td>CMSC 433</td>
</tr>
<tr>
<td>CMSC 434</td>
<td>CMSC 434</td>
</tr>
<tr>
<td>CMSC 435</td>
<td>CMSC 435</td>
</tr>
<tr>
<td>CMSC 436</td>
<td>CMSC 436</td>
</tr>
<tr>
<td><strong>Area 4: Theory (up to 2 courses)</strong></td>
<td><strong>Area 4: Theory (up to 2 courses)</strong></td>
</tr>
<tr>
<td>CMSC 451</td>
<td>CMSC 451</td>
</tr>
<tr>
<td>CMSC 452</td>
<td>CMSC 452</td>
</tr>
<tr>
<td>or CMSC 456</td>
<td>or CMSC 456</td>
</tr>
<tr>
<td><strong>Area 5: Numerical Analysis (up to 1 course)</strong></td>
<td><strong>Area 5: Numerical Analysis (up to 1 course)</strong></td>
</tr>
<tr>
<td>CMSC 460</td>
<td>CMSC 460</td>
</tr>
<tr>
<td>CMSC 466</td>
<td>CMSC 466</td>
</tr>
</tbody>
</table>
Current Full Requirements for the Major

The course of study for a Computer Science major must include all of the following requirements:

1. A grade of C or better in each of the following courses:
   a. CMSC 131 or a score of 5 on A version of the JAVA Advanced Placement exam or a score of 4 or 5 on the AB version of the JAVA Advanced Placement exam or an acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.
   b. CMSC 132 or acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.
   c. CMSC 216 or acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.
   d. CMSC 250 or acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.
   e. At least 27 credit hours at the 300-400 levels. These must include CMSC 330, CMSC 351, and at least 15 credit hours from the following CMSC courses with no more than two courses from a single category:

   - Computer Systems: Up to two of 411, 412, 414, 417
   - Information Processing: 420, one of 421 or 423 or 424 or 426 or 427
   - Software Engineering/Programming Languages: Up to two of 430, 433, 434, 435, 436
   - Algorithms and Computation Theory: 451, one of 452 or 456
   - Numerical Analysis*: One of 460 or 466.

   *Note: Courses in Numerical Analysis require MATH 240 and 241 as additional prerequisites. Students without both of these prerequisites must choose their 15 credit hours from the remaining courses in the other four areas.

3. MATH 140 and 141. A STAT course which has MATH 141 (or a more advanced mathematics course) as a prerequisite, and one other MATH, STAT, or AMSC course which has MATH 141 (or a more advanced mathematics course) as a prerequisite. A grade of C or better must be earned in each of the courses. No course that is cross-listed with CMSC may be counted in this requirement.

4. A minimum of 12 additional credit hours of 300-400 level courses in one discipline outside of computer science with an average grade of C or better. No course that is cross-listed as CMSC may be counted in this requirement. Note: The following general guidelines should be observed when selecting courses for this upper level supporting sequence:
   a. Courses must have all the same four-letter acronym
   b. Each course should be a minimum of 3 credits.
   c. Only 1 special topics or independent study course (such as courses numbered 498 or 499) may be used.
   Any variations must be approved by the Undergraduate Program Director. No course used to fulfill another requirement (other than CORE Advanced Studies) can be counted in this requirement.
Proposed Full Requirements (change shown in italics):

The course of study for a Computer Science major must include all of the following requirements:

1. A grade of C or better in each of the following courses:

   a. CMSC 131 or a score of 5 on a version of the JAVA Advanced Placement exam or a score of 4 or 5 on the AB version of the JAVA Advanced Placement exam or an acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.

   b. CMSC 132 or acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.

   c. CMSC 216 or acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.

   d. CMSC 250 or acceptable score on the appropriate Department exemption examination, which is to be taken at the time of entry into the program.

   e. At least 27 credit hours at the 300-400 levels. These must include CMSC 330, CMSC 351, and at least 15 credit hours from the following CMSC courses with no more than two courses from a single category:

      Computer Systems: Up to two of 411, 412, 414, 417
      Information Processing: 420, one of 421 or 422 or 423 or 424 or 426 or 427
      Software Engineering/Programming Languages: Up to two of 430, 433, 434, 435, 436
      Algorithms and Computation Theory: 451, one of 452 or 456
      Numerical Analysis*: One of 460 or 466.

      *Note: Courses in Numerical Analysis require MATH 240 and 241 as additional prerequisites. Students without both of these prerequisites must choose their 15 credit hours from the remaining courses in the other four areas.

3. MATH 140 and 141. A STAT course which has MATH 141 (or a more advanced mathematics course) as a prerequisite, and one other MATH, STAT, or AMSC course which has MATH 141 (or a more advanced mathematics course) as a prerequisite. A grade of C or better must be earned in each of the courses. No course that is cross-listed with CMSC may be counted in this requirement.

4. A minimum of 12 additional credit hours of 300-400 level courses in one discipline outside of computer science with an average grade of C or better. No course that is cross-listed as CMSC may be counted in this requirement. Note: The following general guidelines should be observed when selecting courses for this upper level supporting sequence:

   a. Courses must have all the same four-letter acronym

   b. Each course should be a minimum of 3 credits.

   c. Only 1 special topics or independent study course (such as courses numbered 498 or 499) may be used. Any variations must be approved by the Undergraduate Program Director. No course used to fulfill another requirement (other than CORE Advanced Studies) can be counted in this requirement.

Transition to new curriculum

As soon as approved, student may count this course to the major as indicated above.
Return to VPAC Menu

University of Maryland Course Proposal Form

Department/Program: CMSC
College/School: CMPS
Action: add

Course Prefix and Number: CMSC422
Transcript Title: INTRO MACHINE LEARNING

Title: Introduction to Machine Learning

Credits: Minimum 3 Maximum 3
Repeatable to a maximum of 0 if content differs

Hour commitment per week: Lecture: 3 Internship: Discussion: Laboratory: Seminar:

Can this course be waived through an AP exam? No

Has this course been approved to fulfill a CORE distribution requirement? No

Grading Method: Regular (R)
Formerly:

Prerequisite(s): CMSC 330 and 351 with a grade of C or better

Corequisite(s):

Recommended course(s): STAT 400

Restrictions:

Crosslisted with:

Shared with:

Credit will be given for only one of the following courses:

Will this course be offered at another location or through an alternate delivery method? No

Catalog Description: Machine Learning studies representations and algorithms that allow machines to improve their performance on a task from experience. This is a broad overview of existing methods for machine learning and an introduction to adaptive systems in general. Emphasis is given to practical aspects of machine learning and data mining.

Reason for proposal/comments: Enhancing the CMSC curriculum, providing more depth on an important and emerging area of Computer Science. The course has been taught for several semesters as a special topics course, and has had excellent response and a continuing high level of interest from CMSC students.

Proposal affects degree requirements? No
If so, has PCC proposal been submitted? No

Early Warning Grades: Yes
Inclement Weather Procedures: Yes

Academic Integrity / Honor Pledge: Yes
Accomodations for students with disabilities: Yes

Learning Outcomes: Students will learn basic algorithmic and mathematical foundations of different machine learning paradigms; obtain practical experience using machine learning algorithms to analyze data; and learn how to evaluate the effectiveness and efficiency of learning algorithms

Assessment Policy: Students will be evaluated via homework assignments, implementation projects, and exams.


Course Pedagogy and Format: The course is primarily a lecture format. Tentative syllabus:

1 week - Introduction: A conceptual framework for thinking about machine learning. Covers definitions, terminology, an introduction to different paradigms, history, basics of human learning, example applications, and a course overview.

7 weeks: Supervised Learning. Basic Concept Learning (inductive learning, version spaces, candidate elimination algorithm, and inductive bias); Rule Induction (decision tree induction, sequential covering algorithms, inducing first order rules); Instance-Based Learning (k-nearest neighbors, IBn algorithms, case-based methods); Statistical Methods (naive Bayesian classifiers, Bayesian networks, support vector machines, Bayesian Learning, etc.); Neural Networks (linear models, perceptrons, error backpropagation, radial basis function networks); Ensemble Learning (bagging, boosting, and related techniques); Methodology/Practice (data pre-processing, measuring performance, cross-validation, overfitting, comparative experimental studies, online resources); Theoretical Foundations (PAC Learning, VC dimension, no free lunch theorem).

2 weeks: Reinforcement Learning. Q learning, temporal difference learning.

1.5 weeks: Unsupervised Learning. Clustering methods, visualization via self-organizing maps, expectation
maximization, automated discovery.

1 week: Evolutionary Computation. Genetic algorithms/programs and their application to machine learning, classifier and other rule-based systems, scientific discovery, Baldwin effect.

.5 week: Analytical Learning. Explanation-based learning, skill acquisition.

1 week, time permitting: Advanced Topics and Current Issues. Semi-supervised learning, active learning, hybrid systems, self-organizing systems in general, sample applications, etc.