New Program Proposal
Changes saved but not submitted
Viewing: BS-AI : Bachelor of Science in Artificial Intelligence

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Requestor argamon@iit.edu	Name	Shlomo Argamon	E-mail	
Origination Date	2018-9-21			
Is this an interdisciplinary program?	No			
Academic Unit College of Science	Computer Science		College	
Program Title	Bachelor of Science in Artificial Intelligence			
Effective Academic Year	2019 - 2020	Effective Term	Fall 2019	
Academic Level	Undergraduate			
Program Type	Degree			
Degree Type	Bachelor of Science(BS)			
CIP Code 11.0102 - Artificial Intelligence.				
Is there more than one Academic Unit proposer?				
No				
Program Code	BS-AI			
Program Attribute				
Total Program Credit Hours	127			

Program Narrative and Justification

Narrative description of how the institution determined the need for the program. For example, describe what need this program will address and how the institution became aware of that need. If the program is replacing a current program(s), identify the current program(s) that is being replaced by the new program(s) and provide details describing the benefits of the new program(s). If the program will be offered in connection with, or in response to, an initative by a governmental entity, provide details of that initiative.

Artificial intelligence is one of the top growth areas in tech industry, and is projected to continue growing in size and importance for the foreseeable future. Bureau of Labor Statistics doesn't break down employment categories sufficiently, but projects significant growth in computer science jobs at the master's level over the next ten years, which will include a large number of AI opportunities. AI is a fundamental component of four of Gartner's ten strategic technology trends in 2018 - AI Foundations, Intelligent Apps and Analytics, Intelligent Things, and Conversational Platform. They predict that "AI technologies will be the most disruptive class of technologies over the next 10 years due to radical computational power, near-endless amounts of data and unprecedented advances in deep neural networks," implying significant employment opportunities in the area. They predict growth of over 450% in global business value derived from AI over the next five years.

In the CS department, we have seen enormous growth in student interest in AI at both the undergraduate and the master's level, partly fueled by an understanding of the employment opportunities in AI. Courses in AI, machine learning, computer vision, natural language processing, and so on have garnered enormous enrollment - the demand for AI education is clearly there.

References:
https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2018/
https://www.gartner.com/smarterwithgartner/top-trends-in-the-gartner-hype-cycle-for-emerging-technologies-2017/
https://www.gartner.com/newsroom/id/3872933

Narrative description of how the program was designed to meet local market needs, or for an online program, regional or national market needs. For example, indicate if Bureau of Labor Statistics data or State labor data systems information was used, and/or if State, regional, or local workforce agencies were consulted. Include how the course content, program length, academic level, admission requirements, and prerequisites were decided; including information received from potential employers about course content; and information regarding the target students and employers.

> The program is designed to meet local and national needs for artificial intelligence professionals. The course of study teaches the foundational concepts, methods, and skills of artificial intelligence, machine learning, and big data analytics, as well as the mathematical foundations, ethics, and AI application areas needed for professional success in the area. The program was designed by a committee of AI experts in the CS department, with reference to the current and projected job market in AI, comparison with other similar programs at top universities, and consultation with industry representatives.

Narrative description of any wage analysis the institution may have performed, including any consideration of Bureau of Labor Statistics wage data related to the new program.

> Salaries are high, with Indeed.Com giving an average national salary of $138K for Machine Learning Engineers. We also see other top universities opening bachelor's programs and specializations in AI, including Carnegie-Mellon, Stanford, University of Michigan, and others.

Narrative description of how the program was reviewed or approved by, or developed in conjunction with, one or more of the following: a) business advisory committees; b) program integrity boards; c) public or private oversight or regulatory agencies (not including the state licensing/authorization agency and accrediting agency); and d) businesses that would likely employ graduates of the program. For example, describe the steps taken to develop the program, identify when and with whom discussions were held, provide relevant details of any proposals or correspondence generated, and/or describe any process used to evaluate the program.

> The program was developed by a committee in the CS department including faculty specializing in AI within the department, over a long period. The committee considered the fundamental knowledge required in the field, potential employers' recruiting requirements, and similar programs recently developed at top universities. The final proposal was discussed and approved by the CS undergraduate graduate committee and subsequently by the CS faculty.

What are the enrollment estimates?

Year 1	5	Year 2	10	Year 3	20

Attach Additional
Program
Justification
Document(s)

Academic Information

Advising

Since quality advising is a key component of good retention, graduation, and career placement, how will students be mentored? What student professional organizations will be formed? How will the department work with the Career Services office to develop industry connections?

Students will be advised in the same manner as our regular BS CS students, first year advised by CS Director of UG Programs, and then by CS faculty doing research in AI related fields (currently 4 full time faculty). CS faculty have between 15-20 undergraduate advisees each.Formation of a chapter of the Association for the Advancement of Artificial Intelligence (AAAI) will be encouraged, subject to student interest. The department will work with career services and the CS advisory board to develop and expand relevant industry connections and collaborations.

Program Resources

Which program resources are necessary to offer this program?

Proposed Bulletin Entry

Admission Requirements

Program Outcomes and Assessment Process

What are the learning goals for this program?

Learning goal	Courses/student work used to assess achievement of this goal
Graduates will have an ability to explain the goals, main theoretical constructs, and key algorithmic methods of artificial intelligence, including machine learning, knowledge representation and reasoning, natural language processing, and planning.	Theoretical assignments and term papers in CS422 or CS480 or CS481 or CS584
Graduates will have an ability to choose and implement appropriate algorithms and system architectures to build intelligent systems to solve real applications.	Course projects or final exams in CS422 or CS480 or CS481 or CS487 or CS584

Learning goal	Courses/student work used to assess achievement of this goal
Graduates will have an ability to recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	CS485 assignments
Graduates will have an ability to understand and explain the opportunities for artificial intelligence in the field of their chosen minor.	Exit interview survey

In what semesters will the data be collected to assess this learning goal, and by whom?

Every academic year we will collect a random sample of student assignments (probably final exams or final projects) from one CS course required in the program. We will gauge student achievement of applicable Program Expected Outcome by applying rubrics to the assignments. Initial mapping of Program Expected Outcomes to courses is shown.

Provide the name of the rubric that will be used to assess the extent to which students are achieving this learning goal.

1. Graduates will have an ability to explain the goals, main theoretical constructs, and key algorithmic methods of artificial intelligence, including machine learning, knowledge representation and reasoning, natural language processing, and planning.
Doesn't Meet - Is able to satisfactorily explain only one of these three "goals, main theoretical constructs, and key algorithmic methods of AI"
Meets - Is able to satisfactorily explain two of these three "goals, main theoretical constructs, and key algorithmic methods of AI"
Exceeds - Is able to satisfactorily explain all three "goals, main theoretical constructs, and key algorithmic methods of AI"

2. Graduates will have an ability to choose and implement appropriate algorithms and system architectures to build intelligent systems to solve real applications.
Students demonstrate an ability to choose appropriate algorithms or system architectures.
Doesn't Meet - Is not able to choose adequate algorithms or system architectures..
Meets - Is able to choose adequate algorithms or system architectures.
Exceeds - Is able to choose appropriate algorithms or system architectures.
Students demonstrate an ability to implement appropriate algorithms and system architectures.

Doesn't Meet - Is not able to implement adequate algorithms or system architectures..
Meets - Is able to implement adequate algorithms or system architectures.
Exceeds - Is able to implement appropriate algorithms or system architectures.

3. Graduates will have an ability to recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
Doesn't Meet - Is not able to explain the social issues and responsibilities of a given situation involving computing and artificial intelligence.
Meets - Is partially able to explain the social issues and responsibilities of a given situation involving computing and artificial intelligence.
Exceeds - Is able to comprehensively explain the social issues and responsibilities of a given situation involving computing and artificial intelligence.

4. Graduates will have an ability to understand and explain the opportunities for artificial intelligence in the field of their chosen minor.
Doesn't Meet - Is not able to explain the application of AI knowledge and skills in the field of their chosen minor.
Meets - Is partially able to explain the application of AI knowledge and skills in the field of their chosen minor.
Exceeds - Is able to explain the application of AI knowledge and skills in the field of their chosen minor.

How often and by whom will the data be analyzed? What benchmarks or targets will be used to interpret your results?

Each academic year data will be analyzed by faculty on the CS undergraduate curriculum committee specializing in AI. The initial benchmarks will be 80% of the sample averaging "meets" or better on the assignment components scored using the rubric.

Briefly describe the process that will be used to share the results with faculty and use these to motivate program improvement.

The AI faculty will meet with the CS undergraduate curriculum committee to discuss adjustments to course contents and requirements, as well as the potential need for new courses or other overall adjustments to program curriculum.

Attach Additional Assessment Document(s)

Undergraduate Program Requirements

Undergraduate Degree Requirements

Minimum credit hours   127

Specialization required?
  No

Minor required?
  Yes

How many credit hours are required for the minor?   15

Details about the minor requirement
  Any minor outside the Computer Science Department.

Proposed General Curriculum

List Major Course Requirements

Course List

Code	Title	Credit Hours
CS 100	Intro to the Profession	2
CS 115	Object-Oriented Programming I	4
& CS 116	and Object-Oriented Programming II	
or CS 201	Accelerated Intro to Cmptr Sci	
CS 330	Discrete Structures	3
CS 331	Data Structures and Algorithms	3
CS 340	Programming Paradigms/Patterns	3
CS 422	Data Mining	3
or CS 584	Machine Learning	
CS 425	Database Organization	3
CS 430	Introduction to Algorithms	3
CS 480	Artificial Intelligence	3
CS 481	Intllgnc Txt Analys Knwldg Mgm	3
CS 485	Computers and Society	3
CS 487	Software Engineering	3
AI Depth Course:		
CS 512	Computer Vision	3

Code	Title	Credit Hours
or CS 522	Advanced Data Mining	
or CS 578	Interact/Trans Mach Learning	
or CS 583	Probabilistic Graphical Models	
or CS 584	Machine Learning	
or CS 585	Natural Language Processing	
or ECE 442	Internet of Things/Cyber Phys	
or MATH 569	Statistical Learning	
or MATH 574	Bayesian Computational Stats	
AI Breadth Course:		
PHIL 326	Philosophy of Language	3
or PHIL 342	Philosophy of Mind	
or COM 301	Intro Linguistics	
or PSYC 423	Learning Theory	
or PSYC 426	Cognitive Science	
or BIOL 440	Neurobiology	

List Mathematics Requirements

Course List		
Code	Title	Credit Hours
MATH 151	Calculus I	5
MATH 152	Calculus II	5
MATH 251	Multivariate & Vector Calculus	4
MATH 332	Elementary Linear Algebra	3
MATH 474	Probability and Statistics	3
or MATH 475	Probability	
MATH 476	Statistics	3
or MATH 486	Mathematical Modeling I	

List Science Requirements

Course List		
Code	Title	Credit Hours
Select one of the following science sequences:		8
PHYS 123	General Physics I: Mechanics	8
& PHYS 221	and Gen Physics II: Elect&Magntism	
BIOL 107	General Biol Lecture	8
& BIOL 109	and General Biology Lab	
& BIOL 115	and Human Biology	
& BIOL 117	and Human Biology Lab	
Science elective (different field)		3
Total Credit Hours		11

List Computer Science Requirements

Included in Major Course Requirements.

List Humanities and Social Sciences Requirements

Course List

Code	Title	Credit Hours
HUM 200-level course		3
Human Sciences Module		18

List Interprofessional Project (IPRO) Requirements

2 IPRO electives

Course List

Code	Title	Credit Hours
IPRO 397	IPRO I	6
or IPRO 497	Interprofessional Project	

List Technical Elective Course Options

9 credits from the following:

Course List

Code	Title	Credit Hours
CS 350	Cmptr Org&Asmbly Lang Prgmmg	3
CS 351	Systems Programming	3
CS 422	Data Mining	3
CS 429	Information Retrieval	3
CS 451	Parallel/Distributed Computing	3
CS 458	Intro to Information Security	3
Any CS 500 level course		3
MATH 252	Introduction to Diff Equations	4
MATH 350	Intro to Computational Mathe	3
MATH 400	Real Analysis	3
MATH 402	Complex Analysis	3
MATH 481	Intro to Stochastic Processes	3
MATH 483	Design and Analysis of Exprmnt	3
MATH 484	Regression	3
MATH 487	Mathematical Modeling II	3

List Free Elective Credit Hours (if applicable)   0

Semester-by-semester plan of

study for the
degree program

Year 1

Semester 1	Credit Hours	Semester 2	Credit Hours
CS 100	2	CS 116	2
CS 115	2	MATH 152	5
MATH 151	5	PHYS 123 or BIOL 115 and BIOL 117	4
HUM 200	3	Social science elective	3
Social science elective	3	Humanities elective	3
	15		17

Year 2

Semester 1	Credit Hours	Semester 2	Credit Hours
CS 330	3	CS 340	3
CS 331	3	CS 430	3
MATH 251	4	MATH 332	3
PHYS 221 or BIOL 107 and BIOL 109	4	Minor course	3
Social science elective	3	Humanities elective	3
	17		15

Year 3

Semester 1	Credit Hours	Semester 2	Credit Hours
CS 425	3	CS 481	3
CS 480	3	CS 487	3
MATH 474	3	Technical elective	3
Humanities/Social science elective	3	Science elective	3
Minor course	3	IPRO 397 or 497	3
		Minor course	3
	15		18

Year 4

Semester 1	Credit Hours	Semester 2	Credit Hours
CS 422	3	AI Depth Course	3
AI Breadth Course	3	CS 485	3
Technical elective	3	Technical elective	3
MATH 486	3	Minor course	3
Minor course	3	IPRO 497 or 397	3
	15		15

Total Credit Hours: 127

Reviewer
Comments

Eunice Santos (esantos2) (09/10/18 3:57 pm): Rollback: Please make changes per CS faculty meeting on 9/10/18