ARIZONA BOARD OF REGENTS
ASU ◆ NAU ◆ UA

Request to Establish New Academic Program in Arizona

University: University of Arizona

Name of Proposed Academic Program: Bachelor of Science in Artificial Intelligence
Academic Department: Department of Computer Science
Geographic Site: Tucson- Main
Instructional Modality: In-person
Total Credit Hours: 120
Proposed Inception Term: Fall 2024
Brief Program Description: A short outline of the content and skills that the proposed program will deliver. A brief description of how the program fits into the institutional mission of the university. If relevant, please provide succinct information about existing related or complementary academic programming. Emerging Artificial Intelligence technologies need leaders and innovators to meet the rapidly growing needs of the 21st century. Students pursuing a Bachelor of Science in Artificial Intelligence will study methods for constructing systems that display intelligent behavior. Modern applications of AI include autonomous vehicles, fraud detection, healthcare, agriculture, personal assistants, epidemiology, gaming, industrial robots, and smart appliances. The program will provide students with a solid foundation in Computer Science, and the theoretical background and practical training in Artificial Intelligence they need to build systems that transform unstructured data (such as images, video, audio, or natural language) and structured data (databases) into decisions. This degree was designed to meet the needs of students who seek a professional career in AI application development, and who want to join industry as an AI expert upon graduation. The degree is also suitable for those who want to attend graduate school with an emphasis on AI theory or applications, or who want to combine AI with an interest in other fields of study. The BS in Artificial Intelligence degree supports the University's mission, especially in relation to the strategic plan's first two pillars: Pillar 1: The Wildcat Journey and Pillar 2: Grand Challenges. Both of these pillars emphasize the need to build a student body that is prepared to lead by leveraging the advancements of the 4th Industrial Revolution. Developments in artificial intelligence are some of the most important components of the disruptive changes that are driving the 4IR. This program will prepare students for careers in this field and give them the skills, knowledge, and mindsets to create and thrive in this rapidly changing environment.

Learning Outcomes and Assessment Plan:

Learning Outcome #1: Students will design, implement, and test programs that solve significant and meaningful problems, making appropriate design choices that best meet given requirements.
Concepts: Software design, correctness, problem types: classification, clustering, and generation
Competencies: Incorporating artificial intelligence solutions into larger software projects, online learning, reducing real-world problems to problems solvable with artificial intelligence techniques, assessing limitations of existing artificial intelligence techniques
Assessment Methods: coding exercises, written reports and analyses (direct), and student exit survey (indirect)
Measures: instructor grading of coding exercises, reports, homework assignments, and exams, responses to student exit survey
Learning Outcome #2: Students will design and analyze algorithms and reason about their correctness and performance.
Concepts: Runtime and storage complexity, big-O notation, program correctness
Competencies: compare algorithm types for a problem, estimate algorithm complexity, implement and compare sorting and searching algorithms, specify and choose optimal data structures for a given problem
Assessment Methods: programming assignments, analyze pseudo-code, analyze multiple algorithmic solutions to the same problem (direct), and student exit survey (indirect)
Measures: correctness against test cases, instructor grading of homework assignments and exams, responses to student exit survey
Learning Outcome #3: Students will analyze and compare algorithms that learn from data, and evaluate their performance in realistic settings.
Concepts: Statistical analysis, data interpretation, building and evaluating predictive models, domain adaptation
Competencies: estimate decision boundaries, define and apply informative evaluation metrics, conduct hypothesis testing, train and evaluate models in multiple domains
Assessment Methods: implementation of algorithms, theoretical analysis of algorithms, improvements and modifications of known algorithms, experimental design, empirical evaluation (direct), and student exit survey (indirect)
Measures: test cases against benchmarks, instructor grading of homework assignments and exams, responses to student exit survey
Learning Outcome #4: Students will employ the underlying statistical and mathematical foundations of modern artificial intelligence and machine learning algorithms to build predictive models.
Concepts: statistical mathematical foundations, linear algebra, calculus
Competencies: define and calculate conditional probabilities, test for statistical independence, perform operations on vectors and matrices, calculate the gradient for simple functions, define loss functions
Assessment Methods: exams and homework assignments, programming assignments and projects (direct), and student exit survey (indirect)
Measures: instructor grading of exams and homework assignments, responses to student

exit survey
Learning Outcome #5: Students will develop algorithmic solutions using AI techniques for a domain-specific problem and assess their societal impact when deployed.
Concepts: data acquisition and preprocessing, data quality, building models with artificial intelligence techniques, evaluation, consequences of deploying artificial intelligence solutions in the real world
Competencies: collect and clean data, analyze and evaluate the data, establish baselines, build predictive models
Assessment Methods: Capstone project, homeworks and projects with real data, reports describing and justifying decisions that best match the chosen problem (direct), and student exit survey (indirect)
Measures: instructor grading of intermediate and final report, instructor grading of implementation, evaluation against benchmarks, , responses to student exit survey

	LO #1	LO #2	LO #3	LO #4	LO #5
CSC 110: Intro to Computer Programming I	I				
CSC 120: Intro to Computer Programming II	R	I			
CSC 144: Discrete Mathematics for Computer Science I		I			
CSC 210: Software Development	R	R			
CSC 244: Discrete Mathematics for Computer Science II		R			
CSC 2xx: Intro to Artificial Intelligence			I		I
CSC 3xx: Ethics in Computer Science					I/R
CSC 345: Analysis of Discrete Structures		M			
CSC 380: Principles of Data Science			R	I	R
CSC 480: Principles of Machine Learning			M	R/M	R
CSC 498: AI Capstone Project	M/A	A	A	A	M/A

I - Introduced, R - Reinforced, M - Mastered, A - Assessed

Projected Enrollment for the First Three Years:

	1st year	2nd year	3rd year
Number of Students in major	50	100	150

Evidence of Market Demand:

The World Economic Forum (https://www.weforum.org/agenda/2022/05/robots-help-humans-future-jobs) estimates that "97 million new roles will be created by 2025 as humans, machines and algorithms increasingly work together." A 2019 survey by Gartner (https://www.gartner.com/en/newsroom/press-releases/2019-01-21-gartner-survey-shows-37-percent-of-organizations-have) shows that 37% of organizations have implemented AI in some form, and that 54% of respondents view skill shortage as the biggest challenge facing their organization.

We compiled reports of nationwide jobs data for CIP 11.0102 Artificial Intelligence and 11.0804 Modeling, Virtual Environments and Simulation. The data are from Burning Glass, provided by Frederick Lewis in the Office of Curricular Affairs. For students based in the U.S., the marketing report for CIP codes 11.0102 and 11.0804 list a projected average job growth over the next 5 years of 14.3%, with annual earnings of $105,100, and with 135,000 annual openings.

Similar Programs Offered at Arizona Public Universities:

The College of Applied Science & Technology (CAST) at UA offers a *Bachelor's of Applied Science (BAS) degree in Applied Computing*, which includes an Applied Artificial Intelligence Emphasis Area. The CAST degree is fundamentally different from the proposed Computer Science degree because it is very applied in nature, with some emphasis on security-related applications. The Computer Science program will offer a Bachelor's of Science (BS) degree that requires in-depth study of fundamental areas of math and computer science, including 3 required math courses, 3 computer programming courses, 2 discrete math courses, an algorithms course, a machine learning course, plus additional AI courses on advanced topics in computer science (e.g., natural language processing and computer vision).

Objection(s) Raised by Another Arizona Public University? YES NO
Has another Arizona public university lodged a written objection to the proposed program with the proposing university and the Board of Regents within seven days of receiving notice of the proposed program?

If Yes, Response to Objections:
Please provide details of how the proposing university has addressed the objection. If the objection remains unresolved, please explain why it is in the best interests of the university system and the state that the Board override it.

ARIZONA BOARD OF REGENTS
ASU ◆ NAU ◆ UA

New Resources Required? (i.e. faculty and administrative positions; infrastructure, etc.):

Existing support staff available for the proposed program include undergraduate academic advisors, coordinator of career development, and IT staff. Existing computer science faculty can cover most of the planned teaching.

As the BS in AI program progresses and grows, by the third year we estimate that we will need 1 additional faculty member, a 0.5 undergraduate academic advisor, and 2 graduate student teaching assistants. In addition, we estimate approximately $25k in costs for GPU computing infrastructure to support the AI software development for the capstone projects.

Plan to Request Program Fee/Differentiated Tuition? YES NO

Estimated Amount:

Program Fee Justification:
If planning to levy a program fee, please justify the estimated amount.

Note: The fee setting process requires additional steps, and forms need to be completed. Please work with your university and the ABOR Finance team (Leatta.McLaughlin@azregents.edu) to complete a fee request.

Specialized Accreditation? YES NO

Accreditor:
The name of the agency or entity from which accreditation will be sought