SIU Southern Illinois University
CARBONDALE

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## Artificial Intelligence+

Knowing AI techniques is becoming increasingly important in the job market. AI is no longer limited to tech companies. Industries like healthcare, finance, manufacturing, marketing, education, and logistics are integrating AI to optimize operations, make data-driven decisions, and improve customer experiences. Employers value candidates who understand how to leverage AI tools and techniques. Professionals with AI skills are in high demand, and that often translates to higher salaries and more job opportunities. Roles such as data scientist, machine learning engineer, AI product manager, and business analyst often require or benefit greatly from AI knowledge. Understanding AI allows professionals to automate repetitive tasks, analyze large datasets, create predictive models, and build intelligent systems. This skill set drives innovation and improves efficiency, making employees more valuable to organizations. Even jobs not directly related to AI are likely being impacted by it. For example: marketers use AI for customer segmentation and campaign optimization; HR professionals use AI for talent acquisition and employee engagement; and Finance professionals use AI for fraud detection and risk assessment, among many others.

The Bachelor of Science in Artificial Intelligence+ (BSAIP) program is designed to equip students with core AI principles, algorithms, and models so students are able to apply AI techniques to diverse real-world problems. The curriculum is designed to meet the standards of the Computer Science Curricula 2023 (Artificial Intelligence Chapter) jointly developed by the Association for the Advancement of Artificial Intelligence (AAAI), the Association for Computing Machinery (ACM), and the IEEE Computer Society (IEEE-CS); and the ABET Accreditation Criteria for Computing. This curriculum provides a well-rounded graduate with technical, communication, and applied problem-solving skills, ready to enter the workforce in a position requiring rigorous training in the principles and practice of Artificial Intelligence.

Graduates of the BSAIP program will have access to many exciting job opportunities in Computer and Information Technology related professions, as well as in areas where Artificial Intelligence techniques can be applied. BSAIP graduates will also have a wide range of additional educational opportunities, depending on their career goals, interests, and whether they want to deepen technical expertise, broaden their knowledge, or pivot to another field. Possible options include the pursuit of an MS degree in AI/ML, Computer Science, Data Science, Robotics or Human-Computer Interaction, etc.; an advanced certificate of AI in Healthcare, Business, Education, etc.; an advanced degree in MBA with a tech focus or a Law degree with a focus on tech law or AI ethics; or research opportunities in industry or university affiliated AI labs.

In addition to satisfying the increasingly high need for Artificial Intelligence professionals in the public and private sectors, the BSAIP program aligns well with the missions of both the SIUC and the American Artificial Intelligence Initiative, the Executive Order 13859 signed in 2019 as the United States' national strategy for maintaining American leadership in AI.

### Program Educational Objectives

1. Our graduates will establish themselves as computing professionals or engage in advanced study.
2. Our graduates will have the depth and breadth of knowledge and skill to think creatively, collaborate effectively, and succeed interdisciplinarily.
3. Our graduates will have life-long learning skills to adapt to the evolving technologies throughout their professional careers.
4. Our graduates will bring positive impact on the society responsibly and ethically.

## Student Outcomes

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science, specifically Artificial Intelligence, theory and software development fundamentals to produce computing- based solutions.

## Bachelor of Science (B.S.) in Artificial Intelligence+ Degree Requirements

| Degree Requirements | Credit Hours | |
|---|---|---|
| University Core Curriculum Requirements | | 39 |
| Requirements for Major in Artificial Intelligence+ | | 49 |
| Artificial Intelligence+ Core | 36 | |
| AIP 202, AIP 215, AIP 220, AIP 280 or MATH 282 or STAT 282, AIP 290, AIP 311, AIP 330, AIP 340, AIP 360, AIP 370, CS 437, each with a grade of C or better | | |
| Design Project AIP 498 and AIP 499 | 5 | |
| MATH 150, MATH 250, MATH 221 [1] | 8 | |
| Student Selected Minor [2] | | 12 |
| Major Electives [3] | | 12 |
| General Electives | | 9 |
| Total | | 121 |

[1] *Three credit hours are used to satisfy UCC Quantitative Reasoning.*

[2] *Students in the Artificial Intelligence Plus (AIP) program are required to complete a minor, which typically ranges from 12 to 21 credit hours. To meet the 121 credit-hour graduation requirement, any additional hours needed beyond the minor and major requirements may be fulfilled through free electives. The following minor programs are recommended: Art, Business Analytics, Computer Science, Construction Management & Operations, GIS, Information Technology, Journalism, Marketing, Mathematics, Music, Sustainability, Theater. Any other minor must be approved by the program advisor.*

[3] *Approved major electives include: CS 404, AIP 491, CS434, CS 435, CS 441, AIP 440, CS 480, AIP 480, ECE 411, ECE 458, ECE 470, MATH 349, MATH 421, MATH 483. Any other course requires program approval to be used for major elective.*

## Artificial Intelligence+ Courses

**AIP201 - Problem Solving with Computers and AI** Introduction to Artificial Intelligence (AI) explores the basic theory and practice of creating and working with intelligent systems. The course covers core concepts, major application domains, and AI tools. Students will gain an introductory understanding of key areas including search algorithms, machine learning, deep learning, intelligent agents, and prompt engineering. Emphasis will be on learning through practice with simple code examples, AI tools, and prompt engineering interactions with AI agents. We prevent students from over-relying on AI by requiring AI usage disclosure including declaration of (a), AI tools used and extents of their usage, (b) specific shortcomings with available AI tools, and (c) lessons learned from using AI tools. Credit Hours: 3

**AIP202 - Introduction to AI Programming** This course offers an engaging introduction to programming through the lens of Artificial Intelligence (AI). Designed for beginners, it blends the fundamentals of Python programming with intuitive AI concepts to create a practical, hands-on learning experience. Students will learn core programming constructs while applying them to basic AI tasks such as search, logic, and data handling. The course emphasizes algorithmic thinking, problem-solving, and writing clean, efficient code, preparing students for further study in computer science or AI. We prevent students from over-relying on AI by requiring AI usage disclosure including declaration of (a), AI tools used and extents of their usage, (b) specific shortcomings with available AI tools, and (c) lessons learned from using AI tools. Prerequisite: Mathematics 111 or equivalent with a grade of C or better. Credit Hours: 4

**AIP215 - Discrete Mathematics** Introduction to topics relevant to the study of computer science including: number systems, sets, sequences, summations, logic and truth tables, proofs, functions, relations, matrix operations, combinations, permutations, counting techniques, discrete probability, algorithmic complexity, recurrence relations, Boolean algebra, simple combinational circuits, simplification techniques. Prerequisite: Mathematics 111 or equivalent with a grade of C or better. Credit Hours: 4

**AIP220 - Programming with Data Structures** Introduction to topics relevant to the study of computer science including: number systems, sets, sequences, summations, logic and truth tables, proofs, functions, relations, matrix operations, combinations, permutations, counting techniques, discrete probability, algorithmic complexity, recurrence relations, Boolean algebra, simple combinational circuits, simplification techniques. Prerequisite: (CS 202 or AIP 202) and (CS 215 or AIP 215) with a grade of C or better. Credit Hours: 4

**AIP280 - Computational Statistics I** This course provides a basic introduction to probability and statistics as well as related computational approaches. Topics include basic probability models, combinatorics, random variables, discrete and continuous probability distributions, statistical estimation and hypotheses testing, confidence intervals and linear regression. Some selected computational approaches for statistical problems such as simulation of random variables from probability distributions, the visualization of multivariate data, Monte Carlo integration and methods in inference will also be discussed. The R language will be used for programming assignments. Prerequisite: MATH 106 or MATH 108 with a grade of C or better. Credit Hours: 3

**AIP290 - Ethics, Safety and Security in Computing and AI** This course develops effective writing, reading, presentation, and oral communication skills for computer science professionals. Emphasis is placed on evaluating and communicating technical material clearly to diverse audiences, including stakeholders and team members. Students explore professional ethics and responsibilities in computing, with attention to societal, legal, and sustainability impacts. The course examines emerging ethical, safety, and security challenges in technologies such as Artificial Intelligence (AI), preparing students to engage with complex issues in responsible and trustworthy computing. Assignments and discussions are drawn from technical sources, case studies, and real-world scenarios related to the history, practice, and future of the discipline. Prerequisite: CS 201 or AIP 201 or CS 202 or AIP 202 with a grade of C or better. Credit Hours: 3

**AIP311 - Advanced AI Programming** This course builds on the foundational concepts introduced in Fundamental Programming with AI using Python. It reinforces key Python and AI topics while introducing essential tools and libraries used in modern AI programming workflows. Students will gain practical experience with numerical computing using NumPy, data manipulation using Pandas, and data visualization with Matplotlib. The course also introduces high-level overviews of PyTorch and TensorFlow to prepare students for deeper studies in Machine Learning. The emphasis remains on programming fluency, structured thinking, and the ability to use the Python ecosystem effectively in AI contexts. Prerequisite: CS 220 or AIP 220 with a grade of C or better. Credit Hours: 3

**AIP330 - Introduction to the Design and Analysis of Algorithms** Intensive study of the fundamentals of data structures and algorithms. Presents the definitions, representations, processing algorithms for data structures, general design and analysis techniques for algorithms. Covers a broad variety of data structures, algorithms and their applications including linked lists, various tree organizations, hash tables, strings, storage allocation, algorithms for searching and sorting, and a selected collection of other algorithms. The course will focus on implementation and analysis of algorithms, as well as how Artificial Intelligence (AI) can be utilized when performing comparative analysis. Use of AI tools will be allowed and will be supervised. Prerequisite: AIP 220 or CS 220 with a grade of C or better. Credit Hours: 3

**AIP340 - Introduction to AI Tools** This course introduces various AI tools used in industry and research. Students will explore AI-driven software, frameworks, and APIs for data analysis, automation, machine learning, and others. The course emphasizes practical implementation, ethical considerations, and emerging AI applications. The course also reviews contemporary AI tools to prepare students for implementing real-world applications. Prerequisite: CS 202 or AIP 202 with a grade of C or better. Credit Hours: 3

**AIP360 - Introduction to Large Language Models** This course introduces the foundations and applications of Large Language Models (LLMs). The course covers core concepts such as embeddings, transformer architectures, text classification, semantic search, and multi-modal LLMs. Students will also gain hands-on experience in fine-tuning and evaluating pre-trained models for real-world language understanding tasks. Prerequisite: CS 202 or AIP 202 with a grade of C or better. Credit Hours: 3

**AIP370 - Introduction to Prompt Engineering** This course introduces practical and conceptual foundations of prompt engineering for large language models (LLMs). Students will explore a range of prompting techniques, from basic to advanced, and learn how to design structured, effective prompts for a variety of tasks. Emphasis is placed on iterative design, prompt evaluation, and adapting prompts to specific contexts and goals. The course covers both text and image generation, and highlights real-world applications in writing, coding, planning, education, and more. Prerequisite: AIP 201 or CS 201 or AIP 202 or CS 202 with a grade of C or better. Credit Hours: 3

**AIP440 - Advanced AI Tools and Applications** This advanced course builds upon foundational AI tools knowledge and delves into customized applications, automation pipelines, integration with APIs, and development of intelligent systems using pre-trained models. Students will work on case studies in domains-specific such as education, healthcare, creative arts, business automation and others. The course also reviews contemporary AI tools to prepare students for implementing real-world applications. Prerequisite: AIP 340 with a grade of C or better. Credit Hours: 3

**AIP480 - Computer Vision** This course introduces the fundamentals of computer vision, enabling students to understand theories, algorithms and practical implementation that allow machines to interpret and process visual data. Topics include image formation, feature extraction, image classification, object detection, segmentation, motion analysis, and deep learning for vision. The course also reviews contemporary tools and techniques for computer vision to prepare students for real-world applications. The Python language will be preferred for programming assignments. Prerequisites: (AIP 202 or CS 202) and (AIP 280 or CS 280) with a grade of C or better. Credit Hours: 3

**AIP491 - Special Topics in AI** Selected advanced topics from the various fields of Artificial Intelligence. Prerequisite is determined by instructor. Credit Hours: 3

**AIP498 - 4th Year Design Project in AI I** This course consists of diverse presentations by faculty, students, and invited speakers from industry, and prepares students for AIP 499. Students will select and plan a real-world team project under advisement of a program faculty, and will present a project

proposal. Prerequisite: Completion of or concurrent enrollment in at least two other 400-level AIP courses. Restricted to 4th-Year standing in AIP. Credit Hours: 2

**AIP499 - 4th Year Design Project in AI II** This course is a continuation of AIP 498. Students will design, implement, document, deploy, and present a group project applying AI techniques. Prerequisite: AIP 498. Credit Hours: 3

## Artificial Intelligence+ Faculty

**Ahmed, Khaled,** Associate Professor, Computer Science, Ph.D., Tokyo Institute of Technology, 2004; 2019. Deep learning, big data, computer vision, parallel and distributed computing.

**Bhattacharya, Ansuman,** Assistant Professor, Radio Physics and Electronics, Ph.D., University of Calcutta, 2016; 2024. Broad areas of Networks and Network Security, especially, Next Generation Networks, Internet-of-Things, Cognitive Radio Networks, Software Defined Networks, Green Communication and Wireless Network Security.

**Chen, Zhong,** Assistant Professor, Mathematics and Computer Science, Ph.D., Wuhan University of Technology, 2015; 2023. Development, analysis, implementation, and experimental evaluation of big streaming data mining algorithms, deep learning techniques, and applications in healthcare and medical physics.

**Gupta, Bidyut,** Professor, Computer Science, Ph.D., University of Calcutta, 1986; 1988. Fault-tolerant computing, routing algorithms in computer networks, architecture design of P2P networks, P4P networks, Fog P2P networks.

**Hexmoor, Henry,** Professor, Computer Science, Ph.D., University at Buffalo, 1996; 2006. Artificial intelligence, multi-agent systems, cognitive science, knowledge representation and reasoning, cybersecurity, blockchain.

**Hossain, Md Belayat,** Assistant Professor, Electronic & Computer Science, Ph.D., University of Hyogo, 2018; 2024. Machine Learning, Artificial Intelligence, Generative AI, Computer Vision, Medical Image Processing, and Healthcare Analytics.

**Huang, Chun-Hsi,** Professor and Director School of Computing, Computer Science, Ph.D., State University of New York at Buffalo, 2001; 2019. Extreme-scale computing and data analytics, computational biology, security and applied algorithmics.

**Huang, Xiaolan,** Assistant Professor, Computer Science, Ph.D., Southern Illinois University, 2017; 2019. Bioinformatics, big data analytics, machine learning, high performance computing.

**Jiang, Xiaopeng,** Assistant Professor, Computer Science, Ph.D., New Jersey Institute of Technology, 2024; 2024. Machine Learning, Mobile Computing, Artificial Intelligence, Internet of Things.

**Khalil, Alvi Ataur,** Assistant Professor, Electrical and Computer Engineering, Ph.D., Florida International University, 2025; 2025. Blockchain security, artificial intelligence-based autonomous systems, security of cyberphysical systems.

**Liu, Xiaoqing,** Professor and Dean College of Engineering, Computing, Technology, and Mathematics, Computer Science, Ph.D., Texas A & M University, 1995; 2020. Cyber argumentation based social media and networking, data analytics based recommendation systems, service computing, cyber physical systems, software engineering, applied artificial intelligence, advanced computing and data applications.

**Saifuddin, Khaled Mohammed,** Assistant Professor, Computer Science, Ph.D., Georgia State University, 2024; 2025. Graph mining, geometric deep learning, bioinformatics, network medicine, visual and language reasoning, event understanding, social network analysis.

**Shad, Sayed Chhattan,** Computer and Radio Communications Engineering, Ph.D., Korea University, 2012; 2025. Distributed Systems, Mobile Computing, Ad hoc Networks, Internet of Things.

**Shahid, Abdur Rahman Bin,** Assistant Professor, Computer Science, Florida International University, 2019; 2023. Cybersecurity, artificial intelligence, adversarial machine learning, cyber-physical systems, Internet of Things, Digital Twin, and blockchain.

**Sinha, Koushik,** Associate Professor, Computer Science, Ph.D., Jadavpur University, 2007; 2015. Mobile computing, wireless ad hoc and sensor networks, complex networks, social computing, crowdsourcing systems.

**Tsatsoulis, Constantinos,** Professor and Vice Chancellor for Research and Graduate School Dean, Electrical Engineering, Ph.D., Purdue University, 1987; 2022. Multiagent systems, case based reasoning, machine learning, and intelligent image analysis.

## Emeriti Faculty

**Carver, Norman F., III,** Associate Professor, Emeritus, Computer Science, Ph.D., University of Massachusetts, 1990; 1995.

**Che, Dunren,** Professor, Computer Science, Ph.D., Beijing University of Aeronautics and Astronautics, 1994.

**Danhof, Kenneth J.,** Professor, Emeritus, Ph.D., Purdue University, 1969.

**Hou, Wen-Chi,** Professor, Emeritus, Ph.D., Case Western Reserve University, 1989.

**Mark, Abraham M.,** Professor, Emeritus, Ph.D., Cornell University, 1947.

**McGlinn, Robert,** Associate Professor, Emeritus, Ph.D., Southern Illinois University Carbondale, 1976.

**Mogharreban, Namdar,** Associate Professor, Emeritus, Ph.D., Southern Illinois University Carbondale, 1989.

**Phillips, Nicholas C. K.,** Associate Professor, Emeritus, Ph.D., University of Natal, 1967.

**Wainer, Michael S.,** Associate Professor, Emeritus, Ph.D., University of Alabama-Birmingham, 1987.

**Wright, William E.,** Professor, Emeritus, D.Sc., Washington University, 1972.

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