Datalytica's courses in AI and Machine Learning, Cyber Security Fundamentals, Data Science and Knowledge Discovery, and Digital Modeling, Serious Games, and Metaverse Technologies support SUNY ESF's mission to educate and inspire leaders in environmental science and forestry. These courses align with SUNY ESF's commitment to sustainability and innovation, equipping students with the vital technological skills needed to analyze and solve complex environmental issues. By incorporating these state-of-the-art subjects, SUNY ESF will enhance its curriculum, providing students with practical tools and knowledge to drive sustainable management and conservation efforts. The integration of immersive and interactive technologies will also foster deeper engagement and understanding among students.

Artificial Intelligence and Machine Learning
AI and machine learning technologies are increasingly integral to environmental science and forestry. Proficiency in AI enables students to handle and analyze complex datasets, improving their ability to assess environmental conditions and predict changes. These skills are highly valued by employers looking to leverage technology for sustainable management and conservation efforts. Additionally, expertise in AI and machine learning enhances a student's ability to innovate and implement advanced solutions to environmental challenges.

Cyber Security Fundamentals
A student with cybersecurity skills is better prepared for careers in environmental science and forestry due to the increasing reliance on digital tools and data. These skills ensure that critical environmental data and systems are protected from cyber threats, maintaining data integrity. Cybersecurity expertise also enables the safe use of advanced technologies like remote sensing and IoT devices in environmental monitoring. Additionally, it helps safeguard proprietary information, essential for innovative environmental solutions.

Data Science and Knowledge Discovery
A student with data science and knowledge discovery skills is better prepared for careers in environmental science and forestry because they can effectively analyze complex environmental datasets. This ability helps uncover patterns and insights for sustainable management and conservation. Proficiency in data science enables the development of predictive models to monitor environmental changes and assess ecosystem health.

Digital Modeling, Serious Games, and Metaverse Technologies
These tools enable immersive visualization and simulation of complex environmental systems. They can create interactive models and simulations to better understand and communicate environmental processes and impacts. These technologies also facilitate innovative training and education methods, enhancing learning and engagement. Additionally, such skills are increasingly valued by employers looking for advanced solutions to environmental challenges.

Artificial Intelligence and Machine Learning (AI/ML)			
Course Learning Objectives	Modular Objectives	Example Learning Activities	Assignments/ Assessment
Students who complete the AI/ML course will: 1. Understand core concepts in AI and ML, including the distinction between AI and ML. 2. Differentiate between supervised and unsupervised learning and comprehend the applications and impacts of bonded 3 and unbonded learning. 3. Evaluate AI assurance aspects such as reliability, safety, and ethics, and 4 understand the legal, ethical, and policy 5 frameworks governing AI technologies. 6 4. Develop skills in modeling, simulation, and implementing learning functions within AI algorithms, and explore distributed artificial intelligence. 5. Investigate the convergence of AI with blockchain technologies and prepare for advanced studies or professional roles in AI, emphasizing both technical skills and ethical considerations.	Module 1: [Fundamentals of Machine earning and AI] . The Learning Process . Machine Learning vs. AI i. Turing's Test ii. Perceptions iii. The AI Illusion . Types of Learning i. Supervised, Unsupervised, Semi-supervised, reinforcement learning . Training Techniques . Common Applications . Distance Metrics	**Learning Activity: Forest Health Monitoring with Supervised Learning** 1. Provide students with a labeled dataset of forest health statuses and various features 2. Guide students through the process of data preprocessing, selecting an appropriate supervised learning model, and training the model using the provided dataset. 3. Evaluate the model's performance using cross-validation and hyperparameter tuning techniques. 4. Discuss how machine learning models perceive and interpret data and compare the model's predictions to actual outcomes to highlight the importance of critical evaluation. **Learning Activity: Clustering Tree Species with Unsupervised Learning** 1. Provide students with an unlabeled dataset of tree species with various features 2. Guide students through the process of applying clustering algorithms (e.g., K-means) to group similar tree species. 3. Calculate different distance metrics to measure similarities between tree species. 4. Discuss the results and the concept of the AI illusion.	Pre-Assessment
	Module 2: [Advancements in Technology] 1. Assurance in Artificial Intelligence 2. Modeling and Simulation 3. Determining Learning Functions	**Learning Activity: Hands on with modeling and simulation programs** Students will use modeling and simulation programs and implement learning functions and interpret	Post-Assessment

	5. Distributed AI	outcomes.	

Cybersecurity Fundamentals			
Course Learning Objectives	Modular Objectives	Example Learning Activities	Assignments/ Assessment
Students who complete the Cybersecurity Fundamentals course will: 1. Understand cybersecurity principles, network security fundamentals, and key terminology. 2. Assess strategies for securing physical and network infrastructures, such as Environmental Information Science and Data Analysis. 3. Apply basic cryptographic methods and secure communication techniques. 4. Recognize various cyber threats, attack strategies, and develop effective cyber defense mechanisms 5. Analyze ethical and legal considerations in cybersecurity, apply best practices for maintaining cyber hygiene, and evaluate the impact of emerging technologies on cybersecurity practices.	Module 1: [Basics of Cybersecurity and Network Security] 1. Introduction to essential concepts, terminology, and principles 2. Strategies for securing physical and network infrastructures 3. In-depth exploration of cryptographic methods 4. Secure communication techniques	**Learning Activity: Encrypting Environmental Data** 1. Provide an environmental dataset 2. Guide students through the process of encrypting the data using both symmetric (e.g., AES) and asymmetric (e.g., RSA) encryption methods. 3. Demonstrate how to securely share encrypted data **Learning Activity: Implementing Secure Communication in Forestry Management Systems** 1. Students are guided through setting up secure communication channels using SSL/TLS for data transmission and VPNs for remote access.	1. Pre-Assessment 2. Prepare initial security plan
	Module 2: [Recognizing and Responding to Cyber Threats] 1. Detailing common cyber threats and attack strategies 2. Outlining effective cyber defense mechanisms 3. Incident response techniques 4. Best practices for cyber hygiene 5. Ethical and legal considerations in cybersecurity 6. Impact of emerging technologies	**Learning Activity: Securing a Forestry Research Network** 1. Students are provided with a network layout of a forestry research facility, including sensors, data collection points, and communication networks. 2. They identify physical and network security measures that can be implemented to protect the infrastructure (e.g., firewalls, intrusion detection systems, secure access points). 3. Students develop a security plan that includes both physical (e.g., restricted access to sensitive areas) and network security strategies. 4. Simulate a breach and practice incident response protocols.	

Data Science and Knowledge Discovery			
Course Learning Objectives	Modular Objectives	Example Learning Activities	Assignments/ Assessment
Students who complete the course will: 1. Achieve technical proficiency in data collection, data cleaning, feature extraction and selection, data storage, integration, temporal dependencies, model selection, and knowledge presentation for complex data sets across biological technologies. 2. Apply their knowledge to real-world projects, showcasing their ability to use data science tools in practical settings and engage in interdisciplinary collaboration. 3. Gain insights into leveraging data science for impactful environmental research and policy-making, enhancing their communication skills to effectively share technical findings with diverse audiences. 4. Emphasize ethical data use, ensuring responsible and sustainable data management. 5. Be well-prepared for careers in data science and environmental science, equipped with the skills and knowledge necessary to excel in professional roles within industry and research institutions.	Module 1: 1. Data Mining i. What is it? ii. What kind of data? iii. Functionality 4. Knowledge Discovery from Data (KDD) 5. Strategies and types of data mining systems 6. Major issues in data mining	**Learning Activity: Air Quality Data and Health Impacts** **Objective:** Students will practice knowledge discovery from data (KDD). **Dataset Selection:** Students are provided with an air quality dataset and health data sets. **Data Preprocessing and Integration:** Students are guided in merging the datasets. **Data Mining Strategies:** Students apply association rule mining to find correlations between pollutant levels and health issues. Use regression analysis to predict health outcomes. **Interpreting Results:** Students interpret the rules and models generated. **Group Discussion:** Groups discuss their findings with the class and propose data-driven solutions.	1. Pre-Assessment 2. Students are given homework to find their own datasets related to biodiversity.
	Module 2: 1. Data Preprocessing 2. Data Correlations and Interpretations 3. Review of the Knowledge Discovery Process 4. Data Mining Definitions i. Characterization ii. Discrimination iii. Data Cleaning Iv. Data Noise v. Discretization vi. Binning	**Learning Activity: Biodiversity Data Mining Project** Students apply techniques to explore their own data sets and present as groups for discussion.	1. Post-Assessment

	vii. Integration viii. Redundancy		

Digital Modeling, Serious Games, and Metaverse Technologies			
Course Learning Objectives	Modular Objectives	Example Learning Activities	Assignments/ Assessment
Students who complete the course on "Introduction to Digital Modeling" and "Metaverse Technologies and Serious Games" will: 1. Develop proficiency in digital modeling and simulation techniques, including tool selection, AI application, and technology assessment. 2. Gain hands-on experience in developing realistic digitally rendered models and simulations, preparing them for innovative applications in environmental sciences. 3. Learn to create accurate digital twins and synthetic environments, understanding the impact of serious games in the metaverse. 4. Encourage interdisciplinary knowledge integration and adaptability, promoting lifelong learning to stay abreast of advancements in digital technologies. 5. Be well-prepared for careers in environmental science, equipped with the skills and knowledge necessary to excel in professional roles utilizing	Module 1: [Introduction to Digital Modeling] 1. Basics of Digital Modeling i. Digital Modeling Types Overview ii. Model Selection a. Is AI needed? b. Is another tool better for the job? 2. Tools and Technologies 3. Modeling and Simulation 4. Applications of Digital Modeling i. Digital Twins	**Learning Activity: Digital Modeling** **Objectives:** Students will use tools and applications to make and assess models.	1. Pre-Assessment 2. Students learn ECO game rules and limitations to prepare for module 2 learning activity.
	Module 2: [Metaverse Technologies and Serious Games] 1. Introduction to the Metaverse i. Synthetic Environments and ii. Metaverse Technologies iii. Key technologies behind the metaverse: VR, AR, blockchain, AI Blockchain and Metaverse iv. Metaverse Technologies 2. Introduction to Serious Games i. Serious Metaverse ii. Evaluation and Impact of Serious Games	**Learning Activity: Eco Challenge** **Objective:** Students will practice using Serious Games to explore the utility of these games in environmental science. **ECO game is introduced:** Proctor streams game and introduces rules. **Conservation plan**: Students write plan and proctor executes plan **Evaluation and discussion** Students discuss the efficacy of the game and potential of these games to impact conservation efforts.	1. Post-Assessment

digital technologies.			