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| **Stage 1 – Desired Results** | | |
| ESTABLISHED GOALS    By taking this course, students will become “AI literate.” AI literacy means students can confidently understand (grasp fundamental AI, ML, and DL concepts), use (apply AI techniques effectively to preprocess data, build and train models, and solve biological problems), and critically evaluate (interpret the outputs of AI models critically) AI tools and methods in a biological context. | ***Transfer*** | |
| *Students will be able to independently use their learning to…*  Student A will be able to discuss their GenAI aided diagnosis with a patient with full confidence of how the model works, how it was trained, and possible biases. Student B will be able to find and apply the appropriate machine learning technique to their own biological research questions. | |
| ***Meaning*** | |
| UNDERSTANDINGS  *Students will understand that…*  AI is the broader concept of machines performing tasks that mimic human intelligence, while ML involves algorithms that learn patterns from data, and DL is a subset of ML using neural networks for complex tasks. They will grasp key principles such as supervised learning for prediction, unsupervised learning for clustering, and reinforcement learning for decision-making, alongside an awareness of trade-offs like accuracy versus interpretability, model limitations, and the importance of data quality for meaningful results. | ESSENTIAL QUESTIONS  *Students will be able to answer...*  What are the key differences between AI, ML, and DL? Why is data quality critical for the success of AI models in biology? How can machine learning and deep learning techniques be applied to analyze specific types of biological data? How do we choose the right AI model for a particular biological question? How do we assess the reliability and biological relevance of AI model predictions? What are the ethical considerations and potential biases when using AI in biological research? |
| ***Acquisition*** | |
| *Students will know…*  How AI, ML, and DL function, the types of problems they solve, and the principles that govern their application, evaluation, and limitations in biology. | *Students will be skilled at…*  Preprocessing biological data, applying machine learning algorithms, evaluating model performance, interpreting and communicating results. |
| **Stage 2 – Evidence and Assessment** | | |
| **Evaluative Criteria** | **Assessment Evidence** | |
| (1) demonstrate a clear understanding of AI, ML, and DL concepts; (2) effectively apply appropriate AI techniques to preprocess data, build, train, and evaluate models; and (3) critically analyze and communicate AI | PERFORMANCE TASK(S):  **Midterm Presentation**: Students will prepare and deliver a presentation explaining an existing AI method relevant to biological research. This task evaluates their ability to understand and communicate fundamental AI, ML, and DL concepts, including the method's purpose, how it works, its training process, potential biases, and applications in biology.  **Final Project**: Students will apply an AI technique to address their own research question. This task assesses their ability to preprocess data, select and implement an appropriate machine learning or deep learning model, evaluate its performance, and critically interpret the results. The project culminates in a written report and/or presentation detailing their methodology, findings, and reflections on the model's strengths, limitations, and ethicala implications. | |
| OTHER EVIDENCE:  Other evidence includes quizzes, worksheets, and homework assignments to assess foundational knowledge and practical skills; reflective journals and peer reviews to encourage self-assessment and critical evaluation; and coding challenges, concept mapping, and short essays to reinforce application and integration of AI concepts in biological contexts. | |
| **Stage 3 – Learning Plan** | | |
| *Summary of Key Learning Events and Instruction*  Students will engage in a combination of lectures, hands-on workshops, and guided discussions to build foundational knowledge in AI, ML, and DL. Early modules focus on understanding core concepts and principles, reinforced by quizzes and interactive coding challenges. Practical sessions guide students through data preprocessing, model training, and evaluation using biological datasets. Midway, students present on AI methods, demonstrating their grasp of technical and ethical aspects. The course culminates in a final project where students independently apply AI techniques to a research question, synthesize findings in a report, and reflect on the broader implications. | | |