Maryland CTE Programs of Study

Machine Learning & Data Science II (2025)

GENERAL REQUIREMENTS This course is recommended for students in Grades 10-12 1

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INTRODUCTION 2

A Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. 2.A

B The Digital Technology Career Cluster focuses on building linkages in IT and data science occupations for entry-level, technical, and professional careers related to the analysis, processing, and application of data science and machine learning. 2.B

C The Machine Learning and Data Science program of study emphasizes careers and educational pathways related to data analysis, machine learning model deployment, and advanced data science techniques. This program covers data engineering, algorithm optimization, and real- world applications of machine learning in various sectors. 2.C

D Machine Learning and Data Science II focuses on deeper data science concepts, advanced machine learning algorithms, model optimization, and real-world deployment. The course introduces students to complex data processing, model evaluation, and ethical AI practices. 2.D

E Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include virtual internships, mentorship with industry professionals, or project-based learning activities relevant to the program of study. 2.E

F Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland. Note: tandard E.1 can only be met if instructors and students have licensed access to equired analytics and visualization applications (e.g., Tableau, Power BI) 2.F

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KNOWLEDGE AND SKILLS 3

A The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to: 3.A

1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills, particularly in reporting data analysis findings and model evaluations. 3.A.3
4. Solve problems using critical thinking techniques and structured methodologies in data processing, model tuning, and troubleshooting data science pipelines. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member in data science projects, sharing insights and problem-solving strategies. 3.A.5
6. Implement safety and data security procedures, including proper handling of data, adherence to data privacy regulations, and maintaining ethical standards in data use. 3.A.6

B The student identifies various career pathways in the information technology field. The student is expected to: 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in data science and machine learning. 3.B.1
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations relevant to data science. 3.B.2
3. Demonstrate effective interview skills for roles in data science and machine learning, focusing on technical and analytical expertise. 3.B.3

C The student develops technology and digital literacy skills. The student is expected to: 3.C

1. Use technology as a tool for research, organization, communication, and problem solving in data-related tasks. 3.C.1
2. Utilize digital tools, including computers, cloud platforms, collaboration tools, and data visualization software, to manage, process, and analyze information. 3.C.2
3. Demonstrate proficiency in using industry-standard technologies, including programming languages (Python, R), data processing libraries, and cloud computing platforms. 3.C.3
4. Understand ethical and legal considerations for technology use, including data privacy principles, intellectual property, and responsible AI practices. 3.C.4

D The student integrates core academic skills into data science practices. The student is expected to: 3.D

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1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards in data presentation and reporting. 3.D.1
2. Apply mathematical concepts such as statistics, probability, and linear algebra in data analysis and machine learning model development. 3.D.2
3. Use scientific principles, such as data collection methods and hypothesis testing, in data- driven problem-solving. 3.D.3

E Students will develop skills to design and implement advanced data processing architectures, including hybrid and scalable data pipelines. The student is expected to: 3.E

1. Differentiate and configure cloud and on-premises data storage solutions, such as databases, data lakes, and data warehouses. 3.E.1
2. Explain and design data partitioning strategies for scalable data processing (e.g., sharding, chunking). 3.E.2
3. Create data flow diagrams that include hybrid and cloud-based components, focusing on scalability and fault tolerance. 3.E.3

F Students will understand and apply advanced data modeling techniques to support complex data analysis. The student is expected to: 3.F

1. Implement data schemas, normalization, and entity-relationship models to organize data effectively. 3.F.1
2. Configure and analyze machine learning models (e.g., regression, clustering, neural networks) for various applications. 3.F.2
3. Troubleshoot data preprocessing and model performance issues using diagnostic tools and evaluation metrics. 3.F.3
4. Teachers should receive professional development on diagnostic tools prior to delivering course. 3.F.4

G The student applies machine learning algorithms and models to data. The student is expected to: 3.G

1. Compare algorithms such as linear regression, decision trees, clustering, and neural networks, understanding differences in their application and effectiveness. 3.G.1
2. Design and apply machine learning models that include feature selection, model training, validation, and evaluation. 3.G.2
3. Configure and verify model parameters for effective predictions in both supervised and unsupervised learning tasks. 3.G.3
4. Troubleshoot model performance issues and interpret model results using tools. 3.G.4