Maryland CTE Programs of Study

Machine Learning & Data Science I (2025)

GENERAL REQUIREMENTS This course is recommended for students in Grades 9-10. 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 visualization of data and machine learning applications. 2.B

C The Machine Learning and Data Science program of study emphasizes careers and educational pathways related to the design and implementation of data processing systems, machine learning models, and artificial intelligence tools. This program covers the analysis and ethical use of data in real-world scenarios, supporting careers in data analytics and artificial intelligence. 2.C

D Machine Learning and Data Science I introduces students to the fundamentals of data science, covering data collection, statistical analysis, and basic machine learning algorithms. The course emphasizes hands-on skills with tools like Python and data visualization software. Students will also explore career pathways in data science, develop employability skills, and integrate academic concepts into practical data-driven scenarios, preparing for entry-level certifications in data analysis. 2.D

E Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews, virtual shadowing, or collaborative projects relevant to the program of study. 2.E

F Students are encouraged to participate in extended learning experiences through ligned Career and Technical Student Organizations (CTSOs). CTSOs are a ocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO

Skip to main content

activities is an expectation for CTE programs in the state of Maryland. Note: Successful implementation of process standards especially E, F & G requires classroom access to modern data-science tools (e.g., Python notebooks, cloud sandboxes) and representative sample datasets. 2.F

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. a. Ensure students have access to technical-writing style guides or integrated documentation platforms (e.g., markdown format). 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. a. Provide structured troubleshooting labs and critical-thinking case studies; and budget licenses for resources. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5

B The student identifies various career pathways in the data science and machine learning fields. 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 reflect skills, projects, certifications, and recommendations. 3.B.2
3. Demonstrate effective interview skills for roles in data science and machine learning. 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. 3.C.1
2. Use digital tools, including computers, cloud platforms, and data science software, to access, manage, and analyze information. 3.C.2
3. Demonstrate proficiency in using emerging and industry-standard technologies, including data visualization tools, programming languages like Python, and data management applications. 3.C.3
4. Understand ethical and legal considerations for technology use, including principles of data protection, intellectual property, and responsible data handling. 3.C.4

Skip to main content

5 Describe limitations and risks (hallucinations, bias, privacy) and apply basic responsible use practices for assignments with Artificial Intelligence. 3.C.5

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

1 Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards. 3.D.1

2 Apply mathematical concepts such as probability, statistics, and algebra in data analysis and machine learning applications. 3.D.2

3 Use scientific principles, such as data collection methodologies and hypothesis testing, in data-driven decision-making. 3.D.3

E The student understands and operates data science workflows. The student is expected to: 3.E

1 Describe the functions and characteristics of data science tools and environments, including Jupyter notebooks, Python libraries, and cloud-based data services. 3.E.1

2 Identify components required for modern data science projects, including data storage, data pipelines, and processing power. 3.E.2

3 Select the appropriate data analysis techniques based on the type and scale of the data and project requirements. 3.E.3

4 Explain the importance of data cleaning, preparation, and validation in building accurate and reliable machine learning models. 3.E.4

5 Discuss the impact of data science applications, such as predictive analytics, natural language processing, and computer vision, on industries and society. 3.E.5

6 Interpret data visualizations and documentation to understand data trends and patterns. 3.E.6

F The student implements data collection, analysis, and visualization techniques. The student is expected to: 3.F

1 Select appropriate data sources and collection methods for different types of data science projects, including structured and unstructured data. 3.F.1

2 Explain data storage standards, data processing concepts, and database management techniques. 3.F.2

3 Configure data pipelines to ingest, clean, and transform data for analysis. 3.F.3

4 Perform data analysis tasks, including descriptive statistics, data transformations, and exploratory data analysis. 3.F.4

5 Use data visualization tools to represent data in meaningful ways, facilitating data-driven insights. 3.F.5

6 Implement security measures for data protection, including access controls and data encryption. 3.F.6

Skip to main content

Diagnose and resolve data-related issues such as incomplete data sets, data drift, and inconsistencies. 3.F.7

8 Application of Machine Learning Algorithms a. Application of Introductory Machine-Learning Algorithms (scaled with beginner datasets). 3.F.8

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

1 Explain the purpose and structure of machine learning models, including supervised, unsupervised, and reinforcement learning. 3.G.1

2 Configure and verify model parameters for effective predictions in both supervised and unsupervised learning tasks. 3.G.2

3 Explain tokens, tokenization, and embeddings, and describe how decoder-only transformers use self-attention to predict the next token. 3.G.3