Algonquin College

CST8504
Applying Artificial Intelligence Techniques
Course Outline
2025-2026

Pre-requisite(s)	N/A
Co-requisite(s)	N/A
Prepared by	Todd Kelley
Approved by	Jennifer Lexmond, Chair, ICT - Applications & Programming
Approval date	Monday, June 9, 2025
Normative hours	70.00
Grading system	A+ Through F

Applicable Program(s)	Level	Core/Elective
1535X01FWO - AI Software Development	1	Core
1535X03FWO - AI Software Development	1	Core

Land Acknowledgement

Algonquin College campuses in Ottawa, Perth and Pembroke are located on the traditional unceded, and unsurrendered territory of the Anishinàbe Algonquin People. The Algonquin People have inhabited and cared for these lands since time immemorial. We take this time to express our gratitude and respect to them and to the land for all that it has provided and will continue to provide.

As a post-secondary institution, we acknowledge the harms done to Indigenous Peoples and are committed to learning from the past. We pledge to promote healing and resilience as we move forward in partnership with the Algonquin Nations, First Nations, Métis, and Inuit Peoples in a spirit of reconciliation.

While we recognize that territorial acknowledgements are only one step in cultivating greater respect and inclusion of Indigenous Peoples, we commit to accompanying these words with actions. We are dedicated to building a future and community that is better for all.

We pledge to continue exploring and making meaningful contributions to the Truth and Reconciliation Commission of Canada's Calls to Action.

Learn more about the College's commitment to Truth and Reconciliation: https://www.algonquincollege.com/tri

Course Description

An effective AI practitioner needs familiarity with the various techniques in the AI landscape in order to match appropriate techniques to the problem at hand. Students explore a range of examples of the different types of AI techniques that can be applied. Students deploy a selection of the current popular implementations on sample problems.

Vocational Learning Outcomes

This course provides the opportunity for you to achieve the following outcomes:

1535X01FWO - AI Software Development

VLO 1 Analyze, design, and implement secure Artificial Intelligence (AI) software systems through the application of systematic approaches and methodologies to meet organizational needs. (T)

VLO 3 Prepare and communicate analysis, reports and recommendations, in a variety of formats, for various audiences, stakeholders and purposes. (T)

VLO 6 Evaluate and deploy custom-made and commercial AI software components for the purpose of integration into software solutions. (T, A)

VLO 7 Identify and apply discipline-specific practices that contribute to the local and global community through social responsibility, economic commitment and environmental stewardship. (T)

1535X03FWO - AI Software Development

VLO 1 Analyze, design, and implement secure Artificial Intelligence (AI) software systems through the application of systematic approaches and methodologies to meet organizational needs. (T)

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VLO 6 Evaluate and deploy custom-made and commercial AI software components for the purpose of integration into software solutions. (T, A)

VLO 7 Identify and apply discipline-specific practices that contribute to the local and global community through social responsibility, economic commitment and environmental stewardship. (T)

Assessment Levels —T: Taught **A**: Assessed **CP**: Culminating Performance

Course Learning Outcomes / Elements of Performance

When you have earned credit for this course, you will have demonstrated the ability to:

1. Differentiate between the nature of problems that are best approached with AI techniques versus those that are best approached with non-AI algorithms.

- Explain the practical programming concepts behind applying a supervised machine learning model to a problem
- Explain the practical programming concepts behind applying a traditional non-AI algorithm to a problem
- Compare the patterns in data found by machine learning techniques to traditional data processing patterns
- Given a data processing example problem, determine the origins of the patterns in the data

2. Solve problems from different problem categories, using current popular implementations of AI techniques.

- Implement ROS 2 nodes for vision-related processing with Python on a Linux-based robotics system
- Implement ROS 2 nodes for audio-related processing with Python on a Linux-based robotics system
- Use the Linux command line interface to launch and control robotics processes on a Linux system
- Implement ROS 2 nodes for controlling motion on a Linux-based robotics system
- Implement AI-related solutions with Python libraries such as Mediapipe and Whisper

3. Deploy an existing convolutional neural network design to solve a problem.

- Explain the terms convolution and pooling
- Explain the role of convolution layers, pooling layers, and fully connected layers in CNN solutions
- Explain the concept of filter kernels in a convolution layer
- Explain the concept of padding and its role in applying convolutions
- Deploy vision-related processing with an existing CNN-based solution

4. Deploy an existing sequence-processing design to solve a problem.

- Describe the general category of problems to which sequence processing with RNNs or Transformers can be applied
- Describe the purpose of a self-attention mechanism
- Explain the purpose of Long Short-Term Memory cells in an RNN
- Deploy an existing sequence problem solution for speech recognition in a robotics system

5. Implement AI techniques using appropriate software development tools and libraries.

- Use pip to find and install packages to create different Python virtual environments
- Write object-oriented Python programs that include appropriate Python libraries and Python features like comprehensions and slicing
- Install Python/IPython, PyCharm IDE, and Jupyter to view, write, and run Python programs
- Install the Numpy library and use its features to represent multidimensional array objects
- Install the Pandas library and use dataframes to perform basic data analysis operations
- Install the Matplotlib library and use its features to perform data visualization operations

Learning Resources

Required Textbooks:
Deitel, P., & Deitel, H. (2020). Intro to Python for Computer Science and Data Science. Pearson.

https://jakevdp.github.io/PythonDataScienceHandbook/

Hardware and Software:
Ubuntu Server Linux 22.0.4.5: https://ubuntu.com/download/server
Anaconda distribution (freely downloadable) https://www.anaconda.com/download
SWI Prolog 9.2.9 or later (freely downloadable) https://www.swi-prolog.org/download/stable

To access your course list, learning resources and costs, visit Booklist.
Please note that a learner must be registered in a specific course or program to view this information.
Program tuition and fees can be found on the Tuition and Fees Estimator for Full-time Programs page.

Learning Activities

- Lectures and demonstrations
- Hybrid learning activities
- Class discussions
- Presentations
- Assignments
- Quizzes
- Tests

Pre-defined Evaluation / Earning Credit

The following list provides evidence of this course's learning achievements and the outcomes they validate:

Assignment(s) (30%)

Validates Outcomes: CLO 1, CLO 2, CLO 3, CLO 4, CLO 5

Lab Activity(ies) (15%)

Validates Outcomes: CLO 1, CLO 2, CLO 3, CLO 4, CLO 5

Final Exam (20%)

Validates Outcomes: CLO 1, CLO 2, CLO 3, CLO 4, CLO 5

Midterm Exam(s) (20%)

Validates Outcomes: CLO 1, CLO 2, CLO 5

Presentation(s) (5%)

Validates Outcomes: CLO 1, CLO 2, CLO 3, CLO 4, CLO 5

Quiz(zes) (10%)

Validates Outcomes: CLO 1, CLO 2, CLO 3, CLO 4, CLO 5

Prior Learning Assessment and Recognition

Students who wish to apply for Prior Learning Assessment and Recognition (PLAR) need to demonstrate competency at a post-secondary level in all outlined course learning outcomes. Evidence of learning achievement for PLAR candidates includes:

- Challenge Exam
- Project/Assignment

Course Related Information

Please refer to the Course Section Information (CSI) / weekly schedule for specific course-related information as provided by your professor.

Students must have a grade of at least 50% (or "D-") on both the theory component (Final Exam and Midterm) as well as in the practical (Labs, Assigments, Practical Assesments and Hybrids) component in order to achieve a passing grade in the course. i.e. Even if your combined grade exceeds 50% for the entire course, if you fail either the theory component or the practical component, you will not achieve a passing grade in the course.

Program Information

Department Information

STUDENT ACADEMIC RESPONSIBILITIES
Each student is responsible for:
• Knowing the due dates for marked out-of-class assignments.
• Attending all classes and knowing the dates of in-class marked assignments and exercises.
• Maintaining a folder of all work done in the course during the semester for validation claims in cases of disagreement with faculty.
• Keeping both paper and electronic copies of all assignments, marked and unmarked, in case papers are lost or go missing.
• Regularly checking both Brightspace announcements as well as one's Algonquin e-mail account for important messages from both professors and college administration.
• Participating in on-line and classroom exercises and activities as required.
• Retaining course outlines for possible future use to support applications for transfer of credit to other educational institutions.
Department Grading Policy - For all courses that have both a theory and practical (lab) component, students must have a grade of at least 50% (or "D-") on both the theory component as well as in the practical (i.e. lab) component in order to achieve a passing grade in the course. i.e. Even if your combined grade exceeds 50% for the entire course, if you fail either the theory component or the practical component, you will not achieve a passing grade in the course.
Lab/Practical Assessment Demonstration "Demo" Requirements - Certain courses require students to demo their work after it has been submitted. These will be scheduled by the professor and involve 1-2 rudimentary questions to assure the professor that the work submitted by the student is their own. Demos are not graded items - the work submitted is graded. However, where demos are required, if a student does not demo their work or if the professor deems the answers to the questions unsatisfactory, the work will not be graded (i.e. grade of 0 on the lab or practical assessment).
Department Academic Dishonesty Policy - Academic Integrity is very important to all of our faculty and administrative staff and as such, measures have been put into place to detect all forms of academic dishonesty, including plagiarism of code. If plagiarism is detected by a professor, the incident will be reported and investigated. If the findings of the investigation are that a student has submitted plagiarized work as their own, they will be subject to the following policy:

1. The first offence will result in the plagiarized assessment being assigned a grade of 0.
2. The second offence will result in the assignment of a grade of F for the course.
3. The third offence will result in removal of a student from the program of study.

Harassment/Discrimination/Violence will not be tolerated. Any form of harassment (sexual, racial, gender or disability-related), discrimination (direct or indirect), or violence, whether involving a professor and a student or amongst students, will not be tolerated on the college premises. Action taken will start with a formal warning and proceed to the full disciplinary actions as outlined in Algonquin College Policies - HR22 and SA07.
Harassment means one or a series of vexatious comment(s) (whether done verbally or through electronic means), or conduct related to one or more of the prohibited grounds that is known or ought reasonably to be known to be unwelcome/unwanted, offensive, intimidating, derogatory or hostile. This may include, but is not limited to: gestures, remarks, jokes, taunting, innuendo, display of offensive materials, offensive graffiti, threats, verbal or physical assault, stalking, slurs, shunning or exclusion related to the prohibited grounds.
For further information, a copy of the official policy statement can be obtained from the Student Association.
Violation of the Copyright Act
General – The Copyright Act makes it an offence to reproduce or distribute, in whatever format, any part of a publication without the prior written permission of the publisher. For complete details, see the Government of Canada website at http://laws.justice.gc.ca/en/C-42 . Make sure you give it due consideration, before deciding not to purchase a textbook or material required for your course.
Software Piracy - The Copyright Act has been updated to include software products. Be sure to carefully read the licensing agreement of any product you purchase or download, and understand the terms and conditions covering its use, installation and distribution (where applicable). Any infringement of licensing agreement makes you liable under the law.

Disruptive Behaviour is any conduct, or threatened conduct, that is disruptive to the learning process or that interferes with the well being of other members of the College community. It will not be tolerated. Members of the College community, both students and staff, have the right to learn and work in a secure and productive environment. The College will make every effort to protect that right. Incidents of disruptive behaviour must be reported in writing to the departmental Chair as quickly as possible. The Chair will hold a hearing to review available information and determine any sanctions that will be imposed. Disciplinary hearings can result in penalties ranging from a written warning to expulsion.
For further details, consult the Algonquin College Policies AA32, SA07 and IT01 in your Instaguide.

College Related Information

Algonquin College's policies have been developed to ensure the health, safety and security of all students, faculty and staff, and the proper and fair operation of the College as an academic institution and employer. Please refer to the Algonquin College Policies website for the most current policy information available at http://www.algonquincollege.com/policies/.

Students are especially encouraged to be aware of the following College expectations

Academic Integrity
Algonquin College is committed to the highest standards of academic integrity, and students are expected to uphold these standards throughout their learning journey with the College and post-graduation. Any academic work submitted by a student is expected to be their own work, unless designated otherwise, all human and technological assisted generated sources must be attributed. Refer to the College's Library web site for attribution support and resources. All students are expected to be familiar with the College's AA48: Academic Integrity policy which outlines student and staff roles and responsibilities, the process for addressing, determining and ruling final academic decisions regarding violations of academic integrity as well as what represents academic misconduct. Students with any questions about academic integrity course expectations including but not limited to use of technology, generative AI and other resources to support completion of coursework, are encouraged to speak to their professor and refer to the course weekly schedule, assessment instructions, course announcements and materials.

Centre for Accessible Learning (CAL)
Students with visible and/or non-visible disabilities are encouraged to register with the Centre for Accessible Learning (CAL) in order to be eligible for appropriate learning supports and/or accommodations. Students are strongly encouraged to make an appointment with the Centre for Accessible Learning as early as possible when starting a program. Once your needs are identified, a Letter of Accommodation (LOA) will be issued which you can share with your professors through the CAL Student Portal. If you are a returning student, please ensure that professors are given a copy of your LOA each semester.

Test Accommodations for Students Registered with CAL
Students who require testing accommodations will book their tests/exams through the CAL Student Portal. It is important to note the posted test/exam booking deadlines for the term. Test booking deadlines are communicated through CAL Disabilities Counsellors, CAL Testing Services, and other college wide communication. Additional information on the steps to book accommodated tests/exams with CAL Test Services can be found at Step-by-Step Overview.

Retroactive Accommodations
Students are expected to meet evaluation and completion deadlines as stated in course outline and weekly schedule documents. In circumstances where evaluation deadlines are missed or student performance has been affected by a temporary, significant and/or unanticipated change in functional ability related to disability (including mental health), interim or retroactive accommodations may be considered. For these instances it is advised you reach out to CAL or your professors as soon as possible. For other situations where deferral of evaluations may be warranted, please consult Algonquin College Policy AA21: Deferred Evaluation.

Network Credentials and College Email
Students at Algonquin College are provided with a college email account. This is the address that will be used when the College, your professors, or your fellow students communicate important information about your program or course activities. Your network credentials can be found in the ACSIS portal and you are expected to check your Algonquin email regularly and to use it to send and receive college-related email. Students are required to maintain the privacy of their AC login credentials. Sharing network credentials poses a security risk and is subject to disciplinary action. Your responsibility to protect your login credentials is governed by the Information Security Policy IT01. Support is available through the college Information Technology Service (ITS) at: https://www.algonquincollege.com/its/

Mental Health and Wellness Supports
Canada has launched a national Suicide Helpline at www.988.ca and a wide range of mental health and wellness resources for Algonquin students are available at www.algonquincollege.com/SSS/student-health-wellness.

Student Course Feedback
Algonquin College invites students to share their course experience by completing a student course feedback survey for each course they take. For further details consult Algonquin College Policy AA25: Student Course Feedback.

Use of Mobile Devices in Class

With the proliferation of small, personal mobile devices used for communications and data storage, Algonquin College believes there is a need to address their use during classes and examinations. During classes, the use of such devices unless authorized by your professor can be disruptive and disrespectful to others. During examinations, the use of such devices is generally prohibited unless authorized by your professor. Otherwise use is considered academic dishonesty in the form of cheating. For further details consult Algonquin College Policy AA32: Use of Electronic Devices in Class

Technology Requirements

Students are required to have access to a computer and to the internet. There may also be additional technology-related resources required to participate in a course that are not included in the course materials fee, such as headphones, webcams, specialized software, etc. Details on these requirements can be found in the Weekly Schedule document of the course for each course available on Brightspace.

Transfer of Credit

It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Safe Harbour

In the event of an unexpected major event (pandemic, etc.), your course may have changes that are not reflected in the Course Outline. Should this happen, the Weekly Schedule document will have updated information about your course.