



## Career and Professional Development Non-Credit Programs Course Outline

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**Course Title** Practical Machine Learning

**Course Number** YCBS 258

**Contact Hours:** 35

**Continuing Education  
Units:** 6

**Instructor(s)**  
Nicolas Feller

**Contact Information** nicolas.feller2@mcgill.ca

**Office hours:** upon request

**Course Description** This course aims to introduce participants to essential machine learning methods and techniques in machine learning. The emphasis is placed on practical experience with deep machine learning using Python programming language, scikit-learn, numpy, pandas and keras. The course will provide an introduction to artificial Neural Networks, the mathematical fundamentals for deep learning, and the intuition for aligning algorithms to problems.

**Learning Outcomes**

- o Explain the fundamental concepts of deep learning
- o Understand how and when deep learning should be used
- o Apply effectively different tools that enable deep learning
- o Analyze, diagnose and debug a data science problem to find solutions using deep learning



- o Evaluate the quality and the performance of trained models
- o Create an end-to-end project which transforms raw data into insight
- o Differentiate between different architectures, such as multi layer perceptron, convolution and recurrent neural networks, when it comes to their applications
- o Describe advanced concepts and trends in Machine Learning

## Instructional Methods

Teaching and learning approach is experiential, collaborative and problem/case-based.

## EVALUATION

Item	%	Explanation
Attendance	5%	● <b>A minimum attendance of 75% is required in order to pass the course is 9 classes (8 you go below 75%)</b>
Homework	50%	Assigned in class.
In-Class Assignments	20%	In class quiz: multiple choice quizzes and/or coding exercises will be given each week, covering the previous lecture's material.
Learning Journal	10%	Each class will have assigned reading or video material. Please submit a summary of what you learned from this material. Please provide insight (not a summary of the materia)l. This could be as simple as a few bullets. Submission date by the beginning of the next class.
Final Test	15%	Last Class In-class final assessment
<b>Total</b>	<b>100%</b>	The passing grade is 65%

*In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.*



## ***Academic Integrity***

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see [www.mcgill.ca/integrity](http://www.mcgill.ca/integrity) for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site [www.mcgill.ca/integrity](http://www.mcgill.ca/integrity)).

## ***Right to submit in English or French***

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives.

Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue).

## ***Email Policy***

E-mail is one of the official means of communication between McGill University and its students. As with all official University communications, it is the student's responsibility to ensure that time-critical e-mail is assessed, read, and acted upon in a timely fashion. If a student chooses to forward University e-mail to another e-mail mailbox, it is that student's responsibility to ensure that the alternate account is viable. Please note that to protect the privacy of students, the University will only reply to students on their McGill e-mail account.

## **ADDITIONAL STATEMENTS**

McGill University is on land, which has long served as a site of meeting and exchange amongst Indigenous peoples, including the Haudenosaunee and Anishinabeg nations. We acknowledge and thank the diverse Indigenous people whose footsteps have marked this territory on which peoples of the world now gather.

L'Université McGill est sur un emplacement qui a longtemps servi de lieu de rencontre et d'échange entre les peuples autochtones, y compris les nations Haudenosaunee et Anishinabeg. Nous reconnaissons et remercions les divers peuples autochtones dont les pas ont marqué ce territoire sur lequel les peuples du monde entier se réunissent maintenant.



## RESOURCES

### ***Student Services***

Various services such as Walksafe, McGill Libraries, the Writing Centre, the bookstore, etc., are available to Continuing Education students:

<https://www.mcgill.ca/continuingstudies/current-students-1>

### ***Career Advising and Transition Services***

<https://www.mcgill.ca/continuingstudies/career-advising-and-transition-services>

### ***Students with Disabilities***

Students who have a documented disability and require academic accommodations and services should contact the Office of Students with Disabilities (<http://www.mcgill.ca/osd> or 514-398-6009) early in the term.

### ***Computer Labs***

Free access to computer labs is available at 688 Sherbrooke (12th floor), MACES, the McLennan Library and other locations on campus.

### ***Athena and Online Resources***

Access your personal student information online with Athena

(<https://continuingstudies.mcgill.ca/portal/logon.do?method=load>).

Information regarding online resources such as email, VPN, myCourses, etc. can be found at ([www.mcgill.ca/it](http://www.mcgill.ca/it)).

## **MACES**

The McGill Association of Continuing Education Students, MACES ([www.maces.ca](http://www.maces.ca)), is located at 3437 Peel, 2nd floor, tel. (514) 398-4974.



## GRADING SCHEME

The following grading scheme applies to Non-Credit Professional Development Certificates.

Professional Development Certificates		Grade
Pass	(85-100%)	A
	(80-84%)	A-
	(75-79%)	B+
	(70-74%)	B
	(65-69%)	B-
Failure	(0-64%)	F

**A minimum attendance of 75% is required in order to pass the course.**

## COURSE CONTENT

Date*	Topics & Assignments
Week 1	<p>Review of Data Science and Machine Learning</p> <ul style="list-style-type: none"><li>• Review of the different steps involved in a data science project</li><li>• Review of numpy and pandas in Python</li><li>• History and deep learning in contrast to statistical machine learning</li><li>• Perceptrons</li></ul>
Week 2	<p>Intro to Deep Learning</p> <ul style="list-style-type: none"><li>• Introducing Neural networks from scratch</li><li>• Feature engineering and hyperparameters for neural networks</li><li>• The Tensorflow Playground</li></ul>
Week 3	<p>Intro to Keras</p> <ul style="list-style-type: none"><li>• Intro to deep learning libraries</li><li>• Keras overview</li></ul>



	<ul style="list-style-type: none"><li>• Building and visualizing a neural network</li></ul>
Week 4	<p>Multi Layer Perceptrons</p> <ul style="list-style-type: none"><li>• Feedforward neural networks</li><li>• Classification and regression using MLP</li><li>• Gradients and Flavors of SGD</li><li>• Regularization, Activation functions and batching</li></ul>
Week 5	<p>Convolutional Neural Networks</p> <ul style="list-style-type: none"><li>• Using images in deep learning</li><li>• Transfer learning from</li><li>• Kernels, pooling and padding</li><li>• Pretrained models - resnet, lenet, inception on imagenet</li><li>• Semantic segmentation</li></ul>
Week 6	<p>Auto Encoders and Latent Spaces</p> <ul style="list-style-type: none"><li>• Word embeddings</li><li>• Auto encoders</li><li>• Generation</li><li>• Anomaly detection</li></ul>
Week 7	<p>Recurrent Neural Networks</p> <ul style="list-style-type: none"><li>• Temporal concepts in machine learning</li><li>• Learning long-term dependencies</li><li>• Static and dynamic RNNs</li><li>• LSTMs and GRUs</li></ul>
Week 8	<p>Performance Improvements</p> <ul style="list-style-type: none"><li>• Batches</li><li>• Augmentation</li></ul>



	<ul style="list-style-type: none"><li>• Test time augmentation</li><li>• Cycling gradients</li></ul>
Week 9	<p>Advanced Architectures</p> <ul style="list-style-type: none"><li>• Transformer</li><li>• VAE</li><li>• GAN</li><li>• Meta learning</li><li>• U-Net</li></ul>
Week 10	<p>Deploying Deep Models</p> <ul style="list-style-type: none"><li>• End-to-end deep learning</li><li>• Building neural networks for deployment</li><li>• Lifecycling models: Re-training and Online learning</li></ul> <p>Project coding workshop</p> <p><i>In-class final assessment – Analytics Case Study</i></p>