Metropolitan State University of Denver
Regular Course Syllabus

CS 3120 Machine Learning Spring 2018

Status	completed
Hierarchy Entities	Department of Mathematical and Computer Sciences
Approval Process Name	10. UG New Course No Special Designation (17-18)
Current Step	Registrar's Office
Originator	Steve Beaty
Department	Department of Mathematical and Computer Sciences
Status:	Active-Visible
Prefix:	CS
Course Number:	3120
Course Type:	Computer Science
Course Title:	Machine Learning
Transcript Course Title:	Machine Learning
Equivalent/ Crosslisted?	
List all equivalent courses:	
List all crosslisted courses:	
Check All That Apply:	Elective
Resource Implication Narrative	We've been teaching independent study courses on this subject, and we have the resources to put it in our regular course rotation. The CS group offers a rotating selection of 6-7 upper division electives each semester, according to faculty availability, and this course will be slotted into that selection of electives.
Justification for Proposal	Machine learning is becoming a very important topic in computer science and we need a course that addresses this. It is also the case that machine learning is a part of data science and the statistics professors have requested the computer science faculty create this course.
Credit Hours:	4
Distribution of Credit Hours	4+0
Schedule Type:	Lecture
Grade Mode:	Letter
Lecture:	60
Lab:	
Internship:	
Practicum:	
Other:	
Additional Student Work Hours per course:	120
Variable topics umbrella course:	No
If yes, number of credits/ repeats allowed	
Specified repeatable course:	No
If yes, number of credits/ repeats allowed	

Prerequisite(s):	CS 2050 or MTH 2520, MTH 2140, and MTH 3210 all with a grade of C- or better
Corequisite(s):	
Prerequisite(s) and/or Corequisite(s):	
Banner Prerequisite(s):	CS 2050 or MTH 2520, MTH 2140, and MTH 3210
Minimum Passing Grade for Banner Enforced Prerequisite Courses	C-
Banner Corequisite(s):	
Minimum passing grade for Banner enforced corequisite course(s)	
Banner Prerequisite(s) and/or Corequisite(s):	
Minimum passing grade for Banner enforced pre/co-requisites	
Level	
Class	
Program	
Student attribute	
Major	
Other Registration Restrictions	
Catalog Course Description:	Machine learning is the ability of computers to learn without explicitly programming an algorithm. Machine learning techniques learn about hyper-dimensional spaces with either explicit direction or implicit reinforcement. This course covers a variety of machine learning techniques and their application to actual data. Topics include the clustering of data and the retrieval of related data, the use of machine learning for recommender systems, and the creation of deep learning systems. This course includes both the underlying theory of machine learning and the creation of machine learning software for real-world problems.
Required Reading and Other Materials will be equivalent to:	Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (2017) 1st Edition, Aurélien Géron
Specific, Measurable Student Behavioral Learning Objectives:	1. Evaluate and choose an appropriate machine learning technique for a given problem. 2. Analyze how a neural network model is represented and how it encodes non-linear features. 3. Select appropriate neural networks and deep learning for differing problems. 4. Create and analyze models that reflect real-world data. 5. Perform back propagation for a neural network. 6. Assess how hidden layers contribute to a neural network's capabilities. 7. Compare supervised, unsupervised, and reinforcement learning. 8. Construct a recommender system. 9. Uncover hidden patterns and structures in data with clustering.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/ Internship	I. Biological basis a. Neurons b. Perceptrons i. The XOR problem c. Multi-layer neural networks i. Deep learning II. Training a. Linear regression b. Gradient descent c. Back propagation III. Hyperparameters a. Topology i. Feed forward ii. Convolutional iii. Recurrent b. Weights c. Activation functions i. Sigmoid etc. IV. Data quality a. Dimensionality reduction V. Overfitting and generalization a. Cross validation VI. Learning a. Supervised and unsupervised i. Support vector machines b. Reinforcement c. Ensemble i. Random forests VII. Problem types a. Classification b. Clustering c. Regression i. Lasso d. Text, image, language, etc. recognition e. Recommender systems f. Sentiment analysis
Evaluation of Student Performance	A combination of the following. I. Quizzes II. Exams III. Participation IV. Classwork V. Homework VI. Papers Projects
Learning Objectives	

Steps	**Decision**	**Date**
Originator		
Steve Beaty	approve	02/08/2018 05:35AM

Department Curriculum Committee Chair		
Clark Dollard	approve	02/14/2018 06:59PM
Department Chair		
Lindsay Packer	approve	02/15/2018 08:26AM
Substantive College Level		
Carla Aguilar	approve	04/16/2018 12:01PM
Linda Lang-Peralta	approve	04/16/2018 02:37PM
Steve Beaty	approve	04/09/2018 12:02PM
Curriculum Manager		
Erica Buckland	approve	04/17/2018 12:57PM
AVP Academic and Student Affairs		
Chad Harris	approve	04/27/2018 04:01PM
Registrar's Office		
Connie Sanders	None	
Manny Escarcega	None	
Erica Buckland	restart	04/30/2018 10:46AM
Registrar's Office		
Manny Escarcega	approve	05/08/2018 02:08PM