Intro To Machine Learning & Artificial Intelligence

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# Assessment

## 10% Homework

Homework completion is very important for a number of reasons. First, it helps you to understand the concepts from the lesson that you understood or did not understand. It gives you questions to present in class the next day that initiates discussion of homework. Second, it helps the teacher to know what concepts you understand. The attention to detailed, written explanations sheds light on the level of understanding that you have of course concepts. Additionally, your detailed work and written explanations set you apart from other students, and it is only those students who work the very hardest and who master the content with deep understanding who deserve to make a top grade of an A in an AP course.

## 10% Quizzes

Quizzes are given periodically and are always announced in advance. If the assignment sheet says that there is supposed to be a quiz, then you will have a quiz whether or not I told you in class that there will be a quiz. Quizzes are typically a combination of multiple choice problems and short answer and possibly one free response problem. Quizzes let me know what you very well and what areas we may need to revisit.

## 20% Tests

All tests will be announced. You will receive point grades for each test. Because tests contain cumulative questions that assess not only material learned for a particular unit but also material from past units, an adjusted scale may be used. It is important to understand that you will only be graded according to this scale if *all of your homework for the unit has been completed and on time*. Any lapse in this expectation and your tests will NOT be graded according to this adjusted scale.

## 15% Participation

Active participation in class activities is essential for your learning. This includes speaking in English, bringing your materials every day, taking good notes, doing out of class assignments for discussion the next day, answering questions when asked, and asking questions when needed. Failure to do any of these things detracts from your learning and the learning of those around you. This is an easy 15% **IF** you do what is expected. Many students lose points here by being unprepared for class, not completing the work, sleeping, not paying attention, interrupting the teacher or other students when they are talking, being disrespectful to others, or interrupting the class.

## 15% Projects

Projects are activities that enhance and deepen content knowledge and may be completed in-class or out-of-class. In either case, projects will require you to create a product. Past projects have included students solving a free-response question, creating a scoring guide for their solution, discussing their scoring guides with their classmates and revising them as needed, comparing them to the AP scoring guide, and then reflecting on the process identifying new insights into how they will be assessed on the AP exam; Writing a paper describing how a course concept can be applied in the real-world; creating a presentation or lesson and teaching a topic to the class.

## 30% Exams

**These are cumulative exams as the course builds on prior learning.**

# Absences

I understand you all have busy lives and are often required to leave school to take various assessments including TOFEL, SAT, and SAT 2. It is **YOUR** responsibility to notify me in advance if you are going to miss class due to a planned absence. It is also **YOUR** responsibility to see me *during office hours* to make arrangements to get the work you will miss. If you have a planned absence and email me after the fact, you will not receive credit for any in-class participation grades and your homework will follow the late work policy. In all cases, any tests or quizzes missed must be taken within two days of your return during your lunch break. Please make the appropriate preparations for this.

If you have an unplanned absence due to illness, you will need to make arrangements to get your missing work either by email, through a classmate, or the day you return. If you are going to be out of school for an extended period of time, I suggest you email me or contact your banzhuren to get the assignments you will miss. As this course is preparing you for the AP exam and indicates to universities that you are capable of doing college level work, ***NOTHING is excused, omitted, exempted, or forgiven in this course that directly relates to the content***. I will not give you a passing grade if you miss three weeks of class and do not complete the content that we covered during that time.

# Miscellaneous

You are required to be an active member in the discussion groups. This is included in your participation grade.

Group projects will be done periodically throughout the course. These are designed to improve your academic language skills and to deepen your understanding of the content. They are not frivolous activities to boost your grade and I take them very seriously. It takes a lot of effort to create and monitor these and you are expected to perform at your best. There are no opportunities to make-up or redo these projects.

Concept maps are required for every major topic in this course (4). They are helpful in developing comprehension and deepening your understanding of the material and for review purposes.

# JXFLS Grading Scale

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A+ 97-100 | B+ 87-89 | C+ 77-79 | D+ 67-69 | F <60 |
| A 93-96 | B 83-86 | C 73-76 | D 63-66 |  |
| A- 90-92 | B- 80-82 | C- 70-72 | D- 60-62 |  |

**The table below highlights each of the six grading categories for the school and examples of what is included in each category from this course**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class Participation (15%)** | **Homework (10%)** | **Quizzes (10%)** | **Tests (20%)** | **Exams (30%)** | **Projects (15%)** |
| Participation in class discussion. | Weekly Problems | Formal Quiz | Chapter Tests | Quarter Exams | Individual Projects |
| Use of English | AP Free-Response questions | Occasional in-class review quiz |  | Final Exams | Group Projects |
| Problems for Discussion | Interim project work | Homework Quiz |  |  | Concept Maps |
| Note Taking |  |  |  |  | Writing Assignment |
| Being Prepared for Class |  |  |  |  |  |
| Group Interactions |  |  |  |  |  |

# Schoolwide Classroom Expectations:

Student desks are clear of all materials except subject-class learning materials.

Desks are cleared of food and drinks.

White board is cleaned before and after class.

English is spoken at all times.

Students listen when teacher is talking.

Students who talk while the teacher or another student is talking are being disrespectful and are subject to disciplinary action.

Students should follow instructions and directions given.

Students bring all materials required for this class.

Students behave appropriately.

**NOTE:** Nothing in this document supersedes any school policies. You are expected to follow all school policies that are enacted including the late work policy and technology policy. Cell phones are not permitted in this class. Additionally, any decisions by the administration are final. I cannot give you make-up work or allow a re-take if the administration has decided against it.

# Explore Project

### **Overview**

Artificial Intelligence innovations impact our lives in ways that require considerable study and reflection for us to fully understand them. In this performance task, students will explore an artificial intelligence innovation of their choice. The close examination of an artificial intelligence innovation will deepen the students’ understanding of machine learning and artificial intelligence.

In this task, students select and investigate a artificial intelligence innovation that has had or has impacts on society, economy, or culture, and consumes, produces, and/or transforms data. An artificial intelligence innovation is an innovation that includes an artificial intelligence algorithim or program code as an integral part of its function. Examples of AI innovations could include facial recognition software, or adding Bunny Ears on faces when taking a picture.

As students analyze an A.I. innovation, they will explain its intended purpose or function, describe harmful and beneficial effects, describe data storage, data privacy, and data security concerns. Students will also produce an **artificial intelligence artifact** that illustrates, represents, or explains the innovation’s intended purpose, its function, or its effect, and provide **written responses** to each of the given prompts.

### Components

The following components are formally assessed and must be submitted for the Explore performance task.

#### Computational Artifact (CA)

There are a number of widely available tools students can use to create A.I artifacts for this task. An artificial intelligence artifact is a visualization, a graphic, a video, a program, or an audio recording that students create using a computer. The students’ creations could solve a problem, show creative expression, or provide the viewer with new insight or knowledge. Students must be able to attest that their computational artifact and written responses they are submitting are their own. Students can use work that is not originally created by them (including but not limited to images, video, or program code segments) as long as they provide appropriate acknowledgments

##### **Effective artifacts include:**

* visual, graphical, and/or audio content to help a reader understand the purpose, function, or effect of a computing innovation; and
* the use of communications media, such as animations, comic strips, infographics, and/or public service announcements, to illustrate the purpose, function, or effect of a computing innovation.

##### Ineffective Artifacts Include:

* artifacts that repeat information supplied in the written responses;
* multi-slide presentations with paragraphs of text or bullets; and
* artifacts that have not been created by the student.

#### Written Responses (WR)

Written responses must be based on relevant, credible, and easily accessible sources. Students are required to provide in-text citations for at least three sources that helped them create their computational artifact and/or formulate their written responses. At least two of the sources must be available online or in print; the third source may be either online, in print, or a personal interview with an expert on the computing innovation. At least two of the sources must have been created after the end of the previous academic year. Students must avoid plagiarism by acknowledging, attributing, and/or citing sources throughout their responses and including a bibliography. Sources that should be acknowledged include text, images, video, music, graphs, and program code that are used in the creation of their computational artifacts

# Create Project – A.I. Applications From Ideas

## Overview

Data Science is a collaborative and creative process that brings ideas to life through the analysis of data and the creation of models to describe or solve problems. Data Science programs can help solve problems, enable innovations, or express personal interests. In this performance task, students will be developing a program of their choice. The students’ development process should include iteratively designing, implementing, and testing their program. Students are strongly encouraged to work with another student in their class. Students are permitted to collaborate with another student peer. However, a significant portion of the data science program must be developed independently. Students must provide program code segments that they developed independently as part of their written response. Students must be able to attest to the originality of the program code and the written response they are submitting. Students can use program code segments that are not originally developed by them provided they have included appropriate acknowledgment for these code segments.

## Components

The following components are formally assessed and must be submitted for the Create performance task:

* A video of your program running (V)
* Individual written responses about your program and development process (IWR)
* Program code (PC)

## Students are required to

* iteratively design, implement, and test their program;
* independently create at least one algorithm and one abstraction that are central to the purpose of the program and that can be used to meet the requirements for the written response;
* create a video that displays the running of their program and demonstrates its functionality;
* write responses to questions about their program to demonstrate their understanding of programming concepts; and

# Lessons

## Week 1 – **What is Machine Learning & Artificial Intelligence**

What is machine learning? What is artificial intelligence? Where do we see them in our everyday lives? These questions and more will be answered. Topics covered will be **supervised learning** and **unsupervised learning. Weak AI, AI, and Super AI.**

**Quiz:** Machine Learning & Artificial Intelligence Quiz

**Homework:** Intro to Python Programming Tutorial

## **Week 2 –** **Introduction to Python**

We will do a quick introduction for those who are unfamiliar with python. We will learn how to manipulate python objects, do mathematical expressions, and use python data structures.

**Quiz:** Introduction to Python Quiz

**Homework: Intro to Machine Learning Tutorial**

## **Week 3 –** **Overview of Important Machine Learning Algorithms**

We will be briefly introduced with **decision trees, Naive Bayes, gradient descent, linear regression, logistic regression, SVM, Kernel Method, K-means Clustering, and Hierarchical Clustering.**

We will also use python Machine Learning libraries to use each of the following algorithms with real data.

**Quiz:** Important Machine Learning Algorithms Quiz

**Homework:** Intro to Machine Learning

## **Week 4 –** **Important Machine Learning Libraries**

We will learn about important libraries like **numpy, matplotlib, sklearn, and pandas.**

**Quiz:** Machine Learning Libraries Quiz

**Homework:** Explore Project Homework

## **Week 5 – Explore Project – Impact of Machine Learning & Artificial Intelligence Innovations**

See above Explore Project Heading.

**Quiz:** Explore Project Quiz

**Homework:** Simple Linear Regression – Analysis & Visualization of Data

## **Week 6 –** **Simple Linear Regression – Analysis & Visualization of Data**

We will look at simple linear regression through a dataset. We will use matplotlib to plot the data on a scatterplot in order to see if there is a linear pattern. Then we will examine an independent variable dataset and a dependent variable dataset to see if there is a correlation.

**Quiz:** Simple Linear Regression Quiz

**Homework:** Making Simple Predictions Homework

## **Week 7 - Making Simple Predictions**

We will look at simple linear regression through a dataset. We will use numpy to play around with the data and think of a given problem. How can we predict some continuous measure, the dependent variable. Key-terms will be **Ordinary Least Squares (OLS), SSR, SSE, SST.**

**Quiz:** Making Simple Predictions Quiz

**Homework:** Simple Linear Regression – A Tale of Two Models Homework

## **Week 8 –** **Simple Linear Regression – A Tale of Two Models**

We we will learn how to interpret our results and do statistical analysis. We will discuss concepts such as **rsquared, correlation, standard error,** and model **score**.

**Quiz:** Simple Linear Regression – A Tale of Two Models

**Homework:** Regression Create Project – Kaggle Competition

## **Week 9 – Regression Create Project – Kaggle Competition Day 1**

We will log into Kaggle and learn about their wonderful community of learners, data scientists and machine learning experts. We will create an account and explore dataset kernels, as well as learn about what our Create Project will be.

**Quiz:** Regression Create Project – Kaggle Competition Quiz

**Homework:** Multiple Linear Regression

## **Week 10 – Multiple Linear Regression:**

We have already predicted a continuous dependent variable based on one independent variable. Now we will do it based on two or more. First we have to see which independent variables are most correlated with the dependent variable we wish to predict.

Once we have our list of independent variable we wish to use to for the regression we will need each variable’s **correlation** and **standard deviation** to find the regression function.

**Quiz:** Multiple Linear Regression Quiz

**Homework:** Multiple Linear Regression: Cleaning Data

## **Week 11 – Multiple Linear Regression – Cleaning Data: Log Transform & Outliers**

Data preprocessing is an integral part of building any machine learning model. We will briefly discuss data preprocessing such as log-transforms and handling outliers.

**Quiz:** Cleaning Data Quiz

**Homework:** Feature Engineering

## **Week 12 – Multiple Linear Regression – Feature Engineering**

A very important aspect of machine learning is not only picking the right features and cleaning them if necessary, but also creating new features out of existing data if possible. We will further engineer our features by simplifying and combining existing features.

**Quiz:** Feature Engineering Quiz

**Homework:** Regression Create Project

## **Week 13 – Regression Create Project – Kaggle Competition Day 2**

We will work on the Create Project. See above in Table of Contents.

**Quiz:** Regression Create Project Quiz

**Homework:** Classification: Naive Bayes

## Week 14 – Classification: Naive Bayes

We will learn what classification is, and how it helps machines learn new information from data. Then we will move to discussing Bayes Rule, a popular classification method called Naive Bayes. We will learn important concepts about Bayesian Probabilities like prior and posterior probabilities . We will fire up scikit learn’s GaussianNB Naive Bayes method to help us quickly find posterior and prior probabilities.

**Quiz:** Classification – Naive Bayes Quiz

**Homework:** Naive Bayes – Classifying Emails

## Week 15 – Classification: Naive Bayes Workshop: Classifying Emails

We have a set of emails, half of which were written by one person and the other half by another person at the same company . Our objective is to classify the emails as written by one person or the other based only on the text of the email.

**Quiz:** Classifying Emails Quiz

**Homework:** Support Vector Machines Homework

## Week 16 – Classification: Support Vector Machines (SVM) – Choosing A Good Decision Boundary

We will leave the basics of SVMs. We will use a set of sample data sets and try to find the a line that best separates groups within the dataset. Such line is called the decision boundary. We will learn how to find the margin, or the line that maximizes the distance between the nearest points amongst both groups of data.

**Quiz:** Support Vector Machines Quiz

**Homework:** Choosing a Good Decision Boundary

## Week 17 – Classification: Support Vector Machines (SVM) – Choosing A Good Decision Boundary

We will learn the basics of SVMs. We will use a set of sample data sets and try to find the a line that best separates groups within the dataset. Such line is called the decision boundary. We will learn how to find the margin, or the line that maximizes the distance between the nearest points amongst both groups of data.

**Quiz:** Choosing A Good Decision Boundary Quiz

**Homework:** The Kernel Trick

## Week 18 – Classification: Support Vector Machines (SVM) – The Kernel Trick

Sometimes our data looks like it cannot be separated linearly. However, there something called the kernel trick which allows us to turn data that used to not be separable linearly, to linearly separable data.

**Quiz:** The Kernel Trick