## **NOVA College-wide Course Content Summary**

## **ITD 195 – Machine Learning I (3 cr.)**

**Course Description**

This is an introductory course in artificial intelligence and machine learning and that covers basic theory, algorithms, and applications. It focuses on feature engineering and machine learning applications within the larger world of artificial intelligence. Lecture 3 hours per week.

**General Course Purpose**

To give the student competence in describing, choosing, training and testing basic machine learning algorithms through applications to common use cases.

**Course Prerequisites/Co-requisites**

Prerequisites: ITE 115 (or equiv.) and MTH 154 or higher

Co-requisite: ITD 256 Advanced Database Management

**Course Objectives**

1. Describe and identify basic artificial intelligence approaches.
2. Describe and differentiate between supervised and unsupervised learning techniques.
3. Identify and explain basic types of machine learning algorithms for both supervised and unsupervised machine learning.
4. Describe and apply feature extraction and engineering techniques.

**Major Topics to be Included**

1. Overview of artificial intelligence approaches
2. Supervised learning with example implementations
3. Unsupervised learning with example implementations
4. Feature extraction and engineering

**Student Learning Outcome**

1. Machine Learning
   1. Define and explain the purpose of machine learning
   2. Define and explain the purpose of Artificial Neural Networks
2. Feature Engineering
   1. Define Feature Engineering, Imputation
   2. Define and explain the purpose of cold- and hot-deck imputation
   3. Define mean substitution
   4. Define raw features
   5. Define and explain how to create derived features, and define:
      1. Binarization, Rounding, Binning, Fixed-Width Binning, Numerical Data
   6. Create and use numerical data
   7. Define a qualitative variable as it applies to Machine Learning
   8. Define a quantitative variable as it applies to Machine Learning
      1. Define a continuous quantitative variable as it applies to Machine Learning
      2. Define a discrete quantitative variable
   9. Define, create and use categorical data
   10. Define and use one-hot encoding
   11. Define simple feature scaling, and demonstrate the ability to scale features
   12. Define Normalization
   13. Define Min-Max Scaling
   14. Define loss functions
       1. Define L1 Norm and L2 Norm (Euclidean Distance)
       2. Define soft-max
       3. Define, explain the purpose of, and calculate edit distance
   15. Define and explain the purpose of inner product
3. Supervised Learning
   1. Define and explain the purpose of supervised learning
   2. Identify supervised learning algorithms and when they should be used
   3. Decision Tree Learning
      1. Define and explain the purpose of decision tree learning
      2. Define classification as a supervised learning prediction task
      3. Identify when it is appropriate to use classification
      4. Use classification on a dataset
   4. Deep Learning
      1. Define and explain the purpose of deep learning
4. Unsupervised Learning
   1. Define and explain the purpose of unsupervised learning
   2. Identify unsupervised learning algorithms and when they should be used
   3. Clustering
      1. Define and explain the purpose of clustering
      2. Identify when clustering is appropriate

**Required Time Allocation per Topic**

To standardize the core topics of this course, the following student contact hours per topic are required. Each syllabus should be created to adhere as closely as possible to these allocations. Topics are not necessarily to be taught in the order shown.

There are normally 45 student contact-hours per semester for a three-credit course (14 weeks of instruction, excluding final exam week: 14\*3.2 = 45 hours). Sections of the course offered in alternative formats (i.e. not standard 15-week) still meet for the same number of contact hours. The final exam is not included in the timetable.

The quickly evolving nature of artificial intelligence—and machine learning in particular—means that some content noted in this document may be superseded or made obsolete. As such, it is important to include such changes in individual syllabi. Additionally, time is allocated for additional and optional topics to provide flexibility to instructors in tailoring the course to special needs or resources.

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| **Topics** | **Hours** | **Percentage** |
| Overview of artificial intelligence approaches | 3 | 7% |
| Supervised learning | 12 | 27% |
| Unsupervised learning | 9 | 20% |
| Feature extraction and engineering | 15 | 33% |
| Testing to include quizzes, tests and exams (excluding final exam) | 3 | 7% |
| Other optional topics | 3 | 7% |
| **Total** | **45** | **100%** |