Course Competency | Learning Outcomes
--- | ---
**Competency 1:** The student will demonstrate an understanding of additional terminology and software used in machine learning by:
1. Describing the fundamentals of building machine learning systems for classification.
2. Installing additional Python packages used for machine learning.
3. Partitioning a dataset into separate training and test sets | • Numbers / Data
• Critical thinking
• Computer / Technology Usage

**Competency 2:** The student will use Python to build machine learning algorithms for classification by:
1. Describing and implementing artificial neurons.
2. Implementing and training a perceptron learning algorithm.
3. Implementing adaptive linear neurons.
4. Implementing Adaline in Python.
5. Improving gradient descent through feature scaling.
6. Implementing large-scale machine learning using stochastic gradient descent. | • Numbers / Data
• Critical thinking
• Computer / Technology Usage

**Competency 3:** The student will compare and use existing machine-learning algorithms for classification by: | • Numbers / Data
• Critical thinking
• Computer / Technology Usage
1. Choosing a classification algorithm.  
2. Modeling class probabilities via logistic regression.  
3. Implementing maximum margin classification with support vector machines.  
4. Solving nonlinear problems using a kernel SVM.  
5. Building a decision tree and combining multiple decision trees via random forests.  

**Competency 4:** The student will use Python to implement a multi-layer neural network by:

<table>
<thead>
<tr>
<th>Competency 4: The student will use Python to implement a multi-layer neural network by:</th>
<th>Numbers / Data</th>
<th>Critical thinking</th>
<th>Computer / Technology Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describing the multi-layer neural network architecture.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Describing the difference between forward propagation and backpropagation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Implementing a multilayer perceptron to classify image data.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Updated Spring 2021*