

EENG 101 – The Digital Information Age (Summer Session A - 2021)  
Instructor: Roman Kuc

The goal of this course is to provide an introduction in the area of machine learning using real data. Real data are acquired by each student speaking the ten English digits 0 through 9 into the microphone of a laptop. Programs written in the Matlab programming language convert the microphone speech into numerical features that are then processed to classify the speech sounds into their digit values. Matlab programs are provided by the instructor to illustrate the theory and provide baseline performance. Students will modify the programs to explore issues with current approaches and to evaluate suggestions to improve their performance.

The course covers template matching and artificial neural networks for classifying spoken digits. The performance is monitored and assessed through a confusion matrix that estimates the probability of classification error and whisker plots. The basic theory is presented during the first half of the course. During the second half, progress on student-specific projects tailored to the student's experience and interests will be presented to the class for critique and suggestions.

Tentative lecture topics:

1. Overview
2. Speech acquisition and features
3. Template matching
4. Characterizing speech classification performance
5. Artificial neural network (ANN) implementing linear classification
6. ANN with hidden layers implementing non-linear classification
7. Issues with ANN training

Grading:

- Homework – 20%
- Midterm exam – 30%
- Report progression and presentations – 50%

*Course reading list:*

There is no introductory textbook that covers the material in this course. Instead of a textbook, class notes and reprints of relevant material from the internet will be posted on the class web page. Learning from such on-line material is a valuable technique for continued learning.

*Required preparation:*

1. Laptop with microphone with Matlab installed. Non-Yale students can obtain a free evaluation version can be downloaded from [www.mathworks.com](http://www.mathworks.com). An agreement with Mathworks can extend the 30-day trial period to the course duration.

2. Basic knowledge of any programming language for understanding how to implement an algorithm.
3. Become familiar with Matlab basics by using on-line tutorial *MATLAB Onramp*  
<https://matlabacademy.mathworks.com/>
4. Familiarity with vector calculations (inner product) in matrix algebra.