RECURRENT NEURAL NETWORKS AND OPTICAL CHARACTER RECOGNITION
SPECIAL TOPICS COURSE PROPOSAL
FALL 2019

MAREK RYCHLIK
PROFESSOR OF MATHEMATICS

COURSE CONTENT

In recent years Deep Learning with Recurrent Neural Networks (RNN) became a preferred technique for many applied problems, e.g., speech and handwriting recognition, YouTube algorithms for video recommendation, control of landing spacecraft, and many others. One of the applications is Optical Character Recognition (OCR), which is the art of converting images of text (scanned or photographs) to text. Leading OCR systems use a special kind of RNN called Long-Short Memory RNN (LSTM) for the challenging task of recognizing cursive scripts, such as printed and handwritten Arabic, and handwritten English.

The course will introduce the theory of RNN and illustrate its applications with examples mostly drawn from OCR. Throughout the course MATLAB will be used. The most recent versions of MATLAB come with a rich neural computing toolkit, including Recurrent Neural Networks, done within the framework of Deep Learning.

WHAT WILL ONE LEARN BY TAKING THIS COURSE?

The student will learn the theory behind RNN and gain hands on experience solving problems in neural computing utilizing MATLAB. The relevant theory will be introduced, using a variety of resources, including textbooks and papers. The specific topics may include:

(1) The historical development of RNNs, beginning around 1990.
(2) The modern Deep Learning architecture, including the theory of major layers: fully connected (perceptron) layer, convolutional neural network (CNN), LSTM, soft-max layer, classification layer and regression layer.
(3) Applications to example classification problems (sequence-to-label and sequence-to-sequence).
(4) Topics in image processing.
(5) Topics in parallel programming (threads, thread pools, synchronisation, locking, GPU computing).

Recently the National Endowment for Humanities (NEH) funded a project directed by the instructor, dedicated to OCR of Pashto and Traditional Chinese. Pashto is an example of a language using cursive script similar to Arabic. Many motivating examples will be related to this endeavor, and the students will be given an opportunity to participate in the project.

COURSE INFORMATION

Textbooks and other course materials: Course materials will be provided by the instructor in electronic form as needed.

Assignments and Exams: This course will be project oriented. The grade in the course will be based on a number of assignments and small-to-medium programming projects (dozens to hundreds lines of MATLAB).

Prerequisites: Basic programming skills are required, including familiarity with MATLAB.

Contact information: Please contact the instructor by e-mail at **rychlik@email.arizona.edu**.