University of Toronto, Department of Computer Science, Spring 2017

csc2545 – Kernel Methods and Support Vector Machines

Description: The introduction of Support Vector Machines (SVMs) in the 1990s led to an explosion of applications and deepening theoretical analysis that have established SVMs as one of the standard tools for machine learning and data mining. This course provides a comprehensive introduction to SVMs and other kernel methods, including theory, algorithms and applications. Topics covered will be selected from the following: support vector classification and regression; novelty detection and feature extraction; non-linear dimensionality reduction; reproducing kernel maps; regularization; statistical learning theory and robust estimation; convex optimization and implementation; kernel design and applications. Homework assignments will be a mix of theory and programming.

The Department of Computer Science classifies this course as Research Area 12 (Machine Learning) and Methodology 2 (Continuous Models).

Prerequisites: Linear algebra, calculus (including partial derivatives), basic, and a willingness to program in Matlab and/or Python. A previous course in machine learning is not required but would be helpful. Mathematical maturity will be assumed.

Grading Scheme: There will be three assignments, which will be a mix of theory and programming. On all work, 20% of the mark will be for quality of presentation, including the use of good English. Late assignments will not be accepted.

Instructor: Anthony Bonner, email: `bonner [at] cs [dot] toronto [dot] edu`, office hours: by appointment. office: BA5230, phone: `416-978-7441`, web site: `www.cs.toronto.edu/~bonner`.

Lectures: Thursday 2–4pm in OI 4414 (OISE, 252 Bloor St W).

Course Web Page: `www.cs.toronto.edu/~bonner/courses/2017s/csc2545/`

Text: Bernhard Scholkopf and Alex Smola, *Learning with Kernels*, MIT Press, 2002.

Additional References:

- Cristianini and Shawe-Taylor, *An Introduction to Support Vector Machines*, Cambridge University Press, 2000.
- Shawe-Taylor and Cristianini, *Kernel Methods for Pattern Analysis*, Cambridge University Press, 2004.
- Steinwart and Christmann, *Support Vector Machines*, Springer, 2008.
- Hastie, Tibshirani and Friedman, *The Elements of Statistical Learning*, Springer, 2001.