# Syllabus for CSE 712 SEM: Seminar on Optimization for Modern Machine Learning (Fall 2022)

**Instructor**: Kaiyi Ji, kaiyiji@buffalo.edu, Davis Hall 338G

**Location and time:** Davis Hall 113A. Every Tuesday 12:00 am to 2:50 pm.

**Office hours:** On demand. Email me for appointments.

**Course textbook and material:** No required textbooks. Some suggested references:

- S. Boyd and L. Vandenberghe, "Convex Optimization," Cambridge University Press, 2004.
- Y. Nesterov, "Introductory Lectures on Convex Optimization: A Basic Course," Springer, 2004
- L. Bottou, F.E Curtis and J. Nocedal. Optimization methods for large-scale machine learning. Siam Review, 2018.

**Course description:** Optimization is an essential component in modern machine learning and data science applications. In this seminar, we will review and discuss some papers of optimization algorithms, theory and applications in modern machine learning. The topic will include (stochastic) gradient decent, variance-reduced method, adaptive methods, derivative-free methods, bilevel methods, etc. All students in this seminar are expected to read, discuss, present and write summaries of selected papers on such topics.

**Course objective:** This course is to help students understand various algorithm designs and convergence analysis in optimization and their applications in modern machine learning, and further learn how to use them in theory and in practice. Some other skills such as presentation, paper summary are also practiced.

**Prerequisites:** Familiar with linear algebra and probability. Basic knowledge of optimization and machine learning concepts. Students should have taken CSE 474/574 Introduction to Machine Learning or related courses.

**Course requirements:**

- Finish the required reading before each lecture.
- Write a short summary (at most 1 page) of the paper(s) presented in each lecture. It needs to summarize the problem, the algorithms, the assumptions, the technical contributions and the empirical results. The summary is due every Monday, 11:59 pm (1 day before the next lecture). No late submission will be accepted.
- Present one of the selected papers throughout the semester. You are encouraged but not mandatory to share the slides before the presentation and a link to your slides will be posted on the course website if you do.

**Grading Policy:**

- 70% for the short summaries. You can skip the summary of the paper you present.
- 30% for the presentation.

The seminar is graded in S/U. Satisfactory score >= 75% and unsatisfactory score < 75%.

**Course Schedule:** Find the latest schedule on the course website.

**Academic Integrity:** Students are expected to write all summaries and homework independently, based on paper reading, presentation and in-class discussion. Directly paraphrasing others' work or solution is regarded as plagiarism, which will result in an F grade. Any reference (including online resources) used in your presentation must be clearly cited. Academic integrity is required in your learning process. This course follows the departmental and university policies on academic integrity, which can be found at `https://engineering.buffalo.edu/computer-science-engineering/information-for-students/academics/academic-integrity.html`.

**Accessibility Resources.** If you have any disability and need reasonable accommodations, please contact the Office of Accessibility Resources in 60 Capen Hall, 716- 645-2608 and the instructor during the first week of this course. The office will provide you with accommodation information, whose details be found at: `http://www.buffalo.edu/studentlife/who-we-are/departments/accessibility.html`.

**Counseling Services.** You may experience some issues that prevent you from usual study. These might include anxiety, high stress, alcohol/drug issues, health concerns, or unwanted sexual experiences. Counseling, Health Services, and Health Promotion can be helpful here, as listed below.

- Counseling Services:
  - 120 Richmond Quad (North Campus), phone 716-645-2720
  - 202 Michael Hall (South Campus), phone: 716-829-5800
- Health Services: Michael Hall (South Campus), phone: 716- 829-3316
- Health Promotion: 114 Student Union (North Campus), phone: 716- 645-2837

**Sexual Violence.** UB is committed to be against all forms of discrimination and sexual harassment. If you have experienced gender-based violence (intimate partner violence, attempted or completed sexual assault, harassment, coercion, etc.), UB has resources to help. This includes academic accommodations, health and counseling services, housing accommodations, reporting to police, etc. Please contact UB's Title IX Coordinator at 716-645-2266 for more information. For confidential assistance, you may also contact a Crisis Services Campus Advocate at 716-796-4399.