IE 487/587 Big Data Analytics and Optimization

Fall 2019

Instructor: Guiping Hu

- **Instructor**

  Dr. Guiping Hu,
  3014 Black Engineering Building,
  Office Phone: 515-294-8638,
  Email: gphu at iastate.edu.

- **Lecture Time and Location**

  Mondays and Wednesdays, 1:10 PM -- 2:00 PM, Carver 0008
  Fridays (computer labs), 1:10 PM -- 2:00 PM, Black 0020

- **Instructor Office Hours**

  By appointment

- **Prerequisites**

  MATH 267, IE 312, Stat 231

- **Main Reference Books**
  - "An Introduction to Statistical Learning"; James, G., et al.; *Springer*, 2013.
  - "Deep Learning"; Goodfellow, I., Bengio, Y., Courville, A.; *MIT Press book*, 2016.

- **Required Background**

  Familiar with basic concepts in linear algebra, mathematics analysis, optimization and statistical modeling

  Comfortable in using one of the scientific programming language/environment: MATLAB, R, Python, etc.

- **Course Objectives**

  The main goal of this course is to get you familiar with a range of contemporary optimization methods for big data analysis.

  Specifically, this course will introduce:

  - Basics on machine learning and data modeling
  - Optimization methods and their application in data analytics
  - Popular data modeling techniques and their solution methods
  - Popular applications in big data optimization

- **Learning Outcomes**

  After completing the course, the students will learn the following:

  - To appreciate the role of optimization in data intensive decision making process
  - To appreciate the role of optimization in data intensive applications
  - To solve a real world application by various data analytics and optimization methods
  - To develop mathematical models for data intensive applications

- **The course will cover the following topics:**

  1. The role of optimization in big data
  2. Gradient decent method for data intensive optimization
  3. Introduction to statistical learning: supervised vs non-supervised
  4. Feature engineering including feature construction, extraction, and selection
  5. Multi-linear regression and logistic regression for statistical learning
  6. Neural networks and applications for big data

- **Grading**
  - Numerical grade = Homework (20%) + attendance and class discussion (10%) + exam 1 (25%) + class presentations (20%) + class project (25%)
  - All homework will be submitted electronically, in pdf format, through the Canvas site.
  - After homework or exams are graded, an announcement will be made in class. You will have one week to discuss with the instructor about your grades. After one week, all grades are finalized.

- Late homework and exam will not be accepted or graded.
- If you need to reschedule an exam, you must request a makeup exam and submit evidence of necessity at least 24 hours in advance.
- You will make two class presentations on your project. The presentations will be evaluated by the class, and it is worth 10%+10% of the numerical grade.
- There is zero tolerance on academic misconduct. Individuals suspected of committing academic dishonesty will be directed to the Dean of Students Office as per University policy. Penalty for academic misconduct (up to 100%).
- Your overall letter grade will depend on your numerical grade:

```
95% or above:    A
89% -- 94%:      A-
84% -- 88%:      B+
79% -- 83%:      B
74% -- 78%:      B-
70% -- 73%:      C+
66% -- 69%:      C
62% -- 65%:      C-
59% -- 61%:      D+
56% -- 58%:      D
53% -- 55%:      D-
0% -- 52%:       F
```

- **Class attendance**

Attendance is assumed and mandatory.

- **Collaboration policy**

  - In-class and after-class discussions are strongly encouraged.
  - One homework submission per person. Copying of others' homework is not allowed.
  - No collaborations during the exams.

- **Academic honesty and professionalism**

The IMSE department has an expectation that all students will be honest in their actions and communications. Individuals suspected of committing academic dishonesty will be directed to the Dean of Students Office as per University policy. For more information regarding academic misconduct see http://www.dso.iastate.edu/ja/academic/misconduct.html. The IMSE

department has an expectation that all students will behave in a professional manner during all interactions with fellow students, faculty, and staff. Treating others with respect and having constructive communications are examples of being professional.

- **Disability resources**

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to meet with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes. Eligible students will be provided with a Notification Letter for each course and reasonable accommodations will be arranged after timely delivery of the Notification Letter to the instructor. Students are encouraged to deliver Notification Letters as early in the semester as possible. SAS, a unit in the Dean of Students Office, is located in room 1076 Student Services Building or online at www.sas.dso.iastate.edu. Contact SAS by email at accessibility@iastate.edu or by phone at 515-294-7220 for additional information.