COMP-SCI 5565-002: Introduction to Statistical Learning

Dept. Computer Science and Electrical Engineering
School of Computing and Engineering
University of Missouri - Kansas City
5100 Rockhill Rd.
Kansas City, MO 64110

FS 2017
Class Times: Tue., Thu., 5:30 pm - 6:45 pm
Ref. No. 48325 - 0002
Room – FH 557
Instructor: Dr. Ken Mitchell
Office: Flarsheim 570C
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Office hours: Tuesday and Thursday TBD or by appointment
Phone: 235-1227

Catalog description:
Introduction to Machine Learning; Review of Probability & Statistics; Multivariate Distributions; Hypothesis Testing; Introduction to Information Theory; Linear Algebra (Eigen analysis), Supervised/Unsupervised Learning, Classification/Regression, Linear/Non-linear Learning, Sequential/Concurrent Methods; Introduction to Bayesian Learning (Bayes rule, Prior, Posterior, Maximum Likelihood); Parametric/Non-parametric Estimation.

Prerequisites:
Applied Probability (CS394R) OR Consent of instructor.

Course Objectives, Goals or Learning Outcomes:
A student who takes this course will have an opportunity to learn and attain some general student learning outcomes (some specific outcomes and their performance indicators follow below).

This is a Senior/Graduate level course suitable for science majors that introduces students to the field of data science and machine learning. Students passing the course will have the ability to solve real world problems involving prediction and inference, and be better prepared for graduate courses on Machine Learning & Big Data.

Required Text:
Required: An Introduction to Statistical Learning: with Applications in R,
Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, 2013, Springer.
 http://www-bcf.usc.edu/~gareth/ISL/
ISBN-10: 1461471370
ISBN-13: 978-1461471370
Recommended: A First Course in Machine Learning, Simon Rogers & Mark Girolami, CRC Press.

Course Topics:

- **Intro to Statistical Learning**
  What is statistical learning? Assessing Model Accuracy, Introduction to R
- **Linear Regression**
  Simple Linear Regression, Multiple Linear Regression, Other Considerations in the Regression Model
- **Classification**,
  Logistic Regression, Linear Discriminant Analysis, Comparison of Classification Methods
- **Resampling Methods**
  Cross-Validation, Bootstrap
- **Linear Model Selection and Regularization**
  Subset Selection, Shrinkage Methods, Dimension Reduction Methods, Considerations in High Dimensions
- **Moving Beyond Linearity**
  Polynomial Regression, Step Functions, Basis Functions, Regression Splines, Smoothing Splines, Local Regression, Generalized Additive Models
- **Tree Based Methods**
  Decision Trees, Bagging, Random Forests, Boosting
- **Support Vector Machines**
- **Unsupervised Learning**

Semester Schedule of Tests/Homework:

Homework: There will be a number of homework assignments. Hard copy is due by beginning of class on specified due date. Homework may be uploaded to Blackboard by midnight of the specified due date. Late homework will be graded at 80%. Homework will not be accepted more than 24 hours after the deadline.

Exams: There will be 2 in-class midterm exams covering material up to one week before the exam. *Make-up tests will only be granted on emergency situation and proof of evidence is required. Permission to take any make-up test needs to be arranged before each test.*

Final Exam: There will be a comprehensive final exam held during finals week scheduled for **Tuesday, Dec 12, 5:45-7:45 p.m.**

Evaluation /Assessment Criteria and Grading:

Homework (20%), Midterm exams (20%) each, Final exam (30%), Projects (20%),

Grading scale

- A, B, C, or D according to a ≥ 90%, ≥ 80%, ≥ 70%, or ≥ 60%, of this course grade,
- A−, B−, C−, or D− according to a ≥ 87%, ≥ 77%, ≥ 67%, or ≥ 57%, of this course grade,
- B+, C+, or D+ according to a ≥ 84%, ≥ 74%, or ≥ 64%, of this course grade,
- F if this course grade is < 57%,
- WF if you withdraw with academic assessment and this assessment is failing.
- I Incomplete: According to the university guidelines, *'An incomplete is appropriate only when enough work in the course has been completed for students to finish the remaining work without re-enrolling in the course or attending additional classes. Note, that disappointing performance alone is generally not considered to be included in 'other serious reason beyond their control'*.

 Deviation from this grading scheme, if any, will be to the students' advantage.

Policies and Expectations:

1. **Policies about attendance, late work, missed deadlines and tests, make-up opportunities, delayed grades.**
   With the exception of documented emergencies, medical reasons or out of town travel related to work, extensions or make-ups will not be possible. Advance notification is required. For valid

circumstances that are substantiated by submitted documentation, make-ups will be considered. When applicable, make-up tests must be taken within a week.

2. **Expectations for submitting required work.**
   Assignments are due in hard copy by the beginning of class on the due date. Assignments may be uploaded to Blackboard. All tests are closed book, closed-notes, and to be taken without help or assistance, unless otherwise clearly announced or prearranged. The work you do for all homework is expected to be your own effort unless you are specifically instructed otherwise.

3. **Academic Honesty**
   A student enrolling in any UMKC course is expected to exhibit high standards of academic honesty. The rules governing any suspected violation are clearly spelled out in the UMKC catalog and will be followed to the letter. You are responsible for being attentive to and observant of campus policies about academic honesty as stated in the University's Student Conduct Code posted at www.umkc.edu/umkc/catalog/html/append/policy/0040.html. Examples of what constitutes plagiarism can be found in http://c.faculty.umkc.edu/cowande/plague.htm (Irving Hexham: "The Plague of Plagiarism)." Any work for this class where academic dishonesty is suspected (homework, quiz, exam, project, etc.) will receive a grade of 0. All cases of suspected academic dishonesty will be reported to the Investigative Officer of SCE, as per university policy. The consequences range from a formal warning to dismissal from the University.
   The Board of Curators of the University of Missouri recognizes that academic honesty is essential for the intellectual life of the University. Faculty members have a special obligation to expect high standards of academic honesty in all student work. Students have a special obligation to adhere to such standards. Academic dishonesty, including cheating, plagiarism or sabotage, is adjudicated through the University of Missouri Student Conduct Code and Rules of Procedures in Student Conduct Matters.

Academic Calendar: Students are encouraged to review important add, drop or withdraw dates: http://www.umkc.edu/registrar/acal.asp

Academic Inquiry, Course Discussion and Privacy: (*Choose one of the following to include in the syllabus-- Faculty allowing recording or Faculty not allowing recording.*)

Faculty allowing recording - University of Missouri System Executive Order No. 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in Section 200.015 of the Collected Rules and Regulations. In this class, students may make audio or video recordings of course activity unless specifically prohibited by the faculty member. However, the redistribution of any audio or video recordings of statements or comments from the course to individuals who are not students in the course is prohibited without the express permission of the faculty member and of any students who are recorded, including those recordings prepared by an instructor. Students found to have violated this policy are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

(OR)

Faculty not allowing recording - University of Missouri System Executive Order No. 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in Section 200.015 of the Collected Rules and Regulations. In this class, students may not make any audio or video recordings of course activity (including those recordings prepared by an instructor), except students permitted to record as an accommodation under Section 240.040 of the Collected Rules. All other students who record and/or distribute audio or video recordings of class activity are subject to discipline in accordance with provisions of

Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

Those students who have written permission from the course instructor to record are not permitted to redistribute any audio or video recordings of statements or comments from the course to individuals who are not students in the course without the express permission of the faculty member and of any students who are recorded, including those recordings prepared by an instructor. Students found to have violated this policy are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

Attendance Policy: Students are expected to attend and participate in classes. Advance notice of attendance policies of academic units and individual instructors should be given, and such notice should be in writing. Students should notify instructors of excused absences in advance, where possible. Students who have an excused absence are expected to make arrangements with instructors for alternative or make-up work. Such arrangements should be made in advance of the absence, where possible. Instructors should accommodate excused absences to the extent that an accommodation can be made that does not unreasonably interfere with the learning objectives of the course or unduly burden the instructor. Attendance policies shall be applied in a non-discriminatory manner.

Campus Safety: Inclement weather, mass notification, and emergency response guide: http://www.umkc.edu/umkcalert/

Counseling and Health Services Available at UMKC: UMKC students may experience many challenges in their lives while attending college – stress, depression, suicidality, trauma, relationship issues, health concerns, etc. As your professor I care about your success and well-being, and want to make you aware of some helpful resources on campus. The UMKC Counseling Center (www.umkc.edu/counselingcenter), located at 4825 Troost in Room 206, offers a wide range of supportive services to students. Appointments can be made by calling 816.235.1635. UMKC Student Health and Wellness (http://info.umkc.edu/studenthealth/), located at 4825 Troost in Room 115, offers a full range of health care and promotion services. Appointments can be scheduled online or by calling 816.235.6133. The MindBody Connection (www.umkc.edu/mindbody) is located in the Atterbury Student Success Center in Room 112 and offers a variety of stress-reduction services.

Disability Support Services: To obtain disability related accommodations and/or auxiliary aids, students with disabilities must contact the Office of Services for Students with Disabilities (OSSD) as soon as possible. To contact OSSD, call (816) 235-5696. Once verified, OSSD will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. For more information go to: http://www.umkc.edu/disability/

English Proficiency Statement: Students who encounter difficulty in their courses because of the English proficiency of their instructors should speak directly with their instructors. If additional assistance is needed, students may contact the UMKC Help Line at 816-235-2222 for assistance.

Grade Appeal Policy: Students are responsible for meeting the standards of academic performance established for each course in which they are enrolled. The establishment of the criteria for grades and the evaluation of student academic performance are the responsibilities of the instructor.
The University grade appeal procedure is available only for the review of allegedly capricious grading and not for review of the instructor's evaluation of the student's academic performance. Capricious grading, as that term is used here, comprises any of the following:

• The assignment of a grade to a particular student on some basis other than the performance in the course;
• The assignment of a grade to a particular student according to more exacting or demanding standards than were applied to other students in the course; (Note: Additional or different grading criteria may be applied to graduate students enrolled for graduate credit in 300- and 400-level courses.)
• The assignment of a grade by a substantial departure from the instructor's previously announced standards.

Discrimination Grievance Procedures for Students: Discrimination Grievance Procedures for Students can be found here:
http://www.umsystem.edu/ums/rules/collected_rules/grievance/ch390/grievance_390.010

Statement of Human Rights: The Board of Curators and UMKC are committed to the policy of equal opportunity, regardless of race, color, religion, sex, sexual orientation, national origin, age, disability and status as a Vietnam era veteran. Commitment to the policy is mentored by the Division of Diversity, Access & Equity, but it is the responsibility of the entire university community to provide equal opportunity through relevant practices, initiatives and programs.

Title IX: Under the University of Missouri's Title IX policy, discrimination, violence and harassment based on sex, gender, and gender identity are subject to the same kinds of accountability and support applied to offenses based on other protected characteristics such as race, color, ethnic or national origin, sexual orientation, religion, age, ancestry, disability, military status, and veteran status. If you or someone you know has been harassed or assaulted, you can find the appropriate resources by visiting UMKC's Title IX Office webpage (http://info.umkc.edu/title9/) or contacting UMKC's Title IX Coordinator, Mikah K. Thompson (816.235.6910 or thompsonmikah@umkc.edu). Additionally, you can file a complaint using UMKC's online discrimination complaint form, which is located at http://info.umkc.edu/title9/reporting/report-online/.

While most UMKC employees are required to report any known or suspected violation of Title IX, students may seek confidential guidance from the following campus locations:

UMKC Counseling Service Volker Campus	UMKC Counseling Service Health Sciences Campus	Student Health and Wellness
4825 Troost Ave, Suite 206 Kansas City, MO 64110 Phone – (816) 235-1635	Health Sciences Building 1418 2464 Charlotte Kansas City, MO 64108 Phone – (816) 235-1635 (open Tuesdays, 1-5pm)	4825 Troost Ave., Suite 115 Kansas City, MO 64110 Phone - (816) 235-6133

UMKC Connect: Important information is available to undergraduate students in UMKC Connect accessed through Blackboard. Throughout the term, students may receive emails regarding course grades or academic performance. Students are expected to address information posted in a timely fashion. This information may be shared with the student's Success Network made up his or her academic advisor(s) and other campus resources so that UMKC may fully support the student's success.