CS 64201/74201 – Advanced Artificial Intelligence
Spring 2021
Mondays and Wednesdays:
2:15 PM – 3:30 PM
Remote

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Motivation
Most of the real world problems (more than 90% as a rule of thumb) are NP-hard that means that it is very
difficult and computationally prohibitive to execute algorithmic solution on computers. Artificial
Intelligence has become quite theoretical with wide applications. While one advanced course is
not enough to cover all the advances, this course will teach you key concepts and expose you to
various advances in AI

AI has been extensively used in diagnostics systems, simulating what-if scenarios, game playing,
decision support systems with human in loop to assist humans, automated control of machines,
automobiles, aircrafts, spacecrafts, intelligent industrial machines for specific functions, learning new
trends from stock market and traffic and sales understanding systems for multimedia objects, more
recently in phone based automated voice interactions, intelligent routing of the messages in the
computer networks, human like human-computer interaction, and development of humanoids to
assist humans in hazardous and mundane tasks.

Learning Outcome
The motivation of this course is to help you learn various AI techniques and concepts as explained above to
solve the real world problems in realistic time. The course will teach you advanced concepts and their
implementation. It is my assumption that you have learnt sufficient AI based programming in the
introductory course, or have sufficient programming background (preferably AI based
programming). Hence the focus will be on learning new concepts not learnt before, and not on
honoring your AI programming capacity.

Course Outline (total 24 lectures by instructor + one midterm (1 lecture) + 2 student team
seminars (4 lectures) + Final project presentation – Examination day)

1. Introduction and review of AI first course (3 lectures);
2. Clustering, feed forward and back propagation neural networks, Entropy and Decision trees; and
Hidden Markov Models (3 lectures); Linear regression (1 lecture). This topic will be replaced by
other self-study topics for those who have already done it.
3. Bioinspired algorithms and metaheuristics algorithms (3 lectures): Ant colony, evolutionary
computing, Bee algorithm, Firefly algorithm, bat inspired search algorithm, particle swarm
optimization algorithm, harmony search algorithms;
4. Utility Theory, Bayesian Decision Networks and Complex Decision Problem (2 lectures);
Midterm Tutorial (1 lecture); Midterm Examination (1 lecture)
5. Probabilistic Reasoning Over Time (2 lectures)
6. Game Theory (1 lecture);
7. Theory of Learning (3 lectures); Reinforcement learning; Support Vector Machines, Knowledge in Learning; Random forest; inductive logic; Learning Probabilistic Models; Deep learning; Convoluted Neural Networks; FCN (Full Convolutional Network); Recursive neural network and LSTM (Long and Short Term Memory ANN), Integrating HMM and LSTM; Transfer Learning; Federated Learning, Generated Adversarial network (GAN)
8. Vision: Object recognition, scene analysis and tracking (1 lecture)
9. Speech Understanding (1 lecture)
10. Intelligence in Health Informatics and Data Science (1 lecture)
11. Final Presentation (1 lectures - 10 minutes each student hard timing) - December first week
12. Final Exam for those who did not get more than 80% in the first midterm and did not finish programming homework completely. Final exam will also be for the advanced students who have already covered first mid part in earlier courses.

**Textbook**

**Metaheuristics book (before first mid)**

In addition, specific topics will be covered from many journal review articles, monographs and web tutorials in specific field. Available articles and book chapters will be made accessible on CDROM for you to copy in your flash drives.

**Notes and Slides**
Numerous notes and my slides and other resources will be available to you in Blackboard site. Slides will also be regularly e-mailed to you at least one day before the classes. Please check the site and your university flashpoint e-mail regularly. It is your responsibility to download them, and print them out, if needed.

**Grading**
The final evaluation strategy will be discussed in the first class to incorporate maximum flexibility while retaining the commitment. Since class will have different background, programming assignment would be such that students do not repeat what they have already done. There will be one closed book closed notes midterm, one final two presentations, three theory assignments, one programming assignment.

*Letter grades: A > 85%; A - > 82%; B+ > 78%; B > 75%; B - > 72%; C+ > 68%; C > 65%; C- > 62%; D+ > 58%; D > 55%, D- > 50%*

**Grade breakup**
Theory Assignments: 3 X 5% = 15%; Programming project = 10%; midterm: 1 X 10%, Presentations: 2 X
10%, Final: 15%, Final Project with presentation – 30%. Those who have already done a similar programming assignment can either have higher weight Final project.

The programming assignment will be given after lecture 7, and will be due in the last week of the course. Papers and topics for presentation would be provided to avoid selection of vague papers. Please check with me your choice of papers. Papers published in Indian and Asian conferences are generally discouraged due to poor quality. Even some of the recent journals suffer from the same problem. Presentation team will have two members. Presentations will be made using PowerPoint, and will have four page report in formal IEEE format that should explain the concepts presented in the slides. Each team presentation would be for 20 minutes, and will carry 10% weight (5% for talking and 5% for the report).

Sample tests and the exams from the previous years will be provided to get you a flavor of the examination.

*I do not entertain haggling for the grade at the end of the semester. I do not assign any extra work at the end of the semester to improve your grade. Please work hard during the semester, and come during office hours to get help. Do not take extra load just to save some money. It reflects upon your grade. Normal loads are 9 credit hours (3 courses).*

**Code of Conduct in the Class**

The following protocols will be strictly followed to make the class conducive for learning.

1. Students must come to the class before the class starts. However, if due to some unforeseen reason, they are delayed they can enter the class. Regular delays are strongly discouraged. It is the student’s responsibility to cover the material they have missed.

2. **No food or drinks will be allowed in the class** unless there is an established medical condition certified by the physician that forces the student to do otherwise. In case of medical conditions, the student should seek prior permission from the instructor before the class starts.

3. **The students will not get into any form of altercation or cross-talks.** All questions will be asked while maintaining the decorum in the class. During the class, the interaction will be between the student and teacher only. Anyone showing any form of violent behavior (such as abusive language or loud voice) in the class will be asked to immediately leave the class, and his case will be reported to the department administration for further action.

4. There will be complete radio silence during the class that means all the cell phones and/or PDAs will be turned off during the class unless there is an emergency situation and instructor has already given permission for the cell phone to be on for the specific student. Even in the case of emergency, student will have to go out to receive the call.

5. **Nobody will be allowed to surf the Internet or check e-mails or listen to music or perform any form of activity involving PDAs or cell phones while in the class.** PDAs will be turned off and put away in the backpack.

**Academic Integrity**
Student-teacher relationships are built on trust. Students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments which students turn in are their own effort. Acts that violate this trust undermine the educational process. Academic dishonesty in any form will be penalized up to assigning grade F, and reporting to the department for university action.

Academic Dishonesty in Homework Assignments and Programming Projects

Learning is encouraged, and cheating is discouraged. Unfortunately, there is a fine line between where learning ends and cheating starts. You are encouraged to get involved in group study to understand the concepts if you do not know how to solve a problem. However, individual problems must be solved by individual students. If the grader finds that two answers are very similar: wordings are very similar and/or sentence structures are very similar, then it is a case of copying. You will be given a warning after the first case of academic dishonesty, your score in that assignment will be 0, and your activity will be reported to the university as mandated. If you repeat the practice of dishonesty, your final grade will be lowered by one scale, your activity will be sent to departmental authorities for the record, and your activity will be reported to the university. For example, if you were getting a ‘B’ after the final calculation, you will be awarded only a ‘C’. After the third incidence, you will be given an ‘F’, and your case will be reported to the university for further disciplinary action. If you are caught copying during the examination, then you will be removed from the examination hall, given an F, and your activity will be reported to the department chair and the university authorities.

The university's plagiarism policy can be found at http://www.kent.edu/policyreg/chap3/upload/3342.3.01.8.pdf. Please read it carefully.

Registration

University policy requires that after the last date of registration, all the students sitting the class must be registered. Students who are not officially registered will not be getting any grades or any credit for the course. It is student’s responsibility to check that (s)he is officially registered for this course.

Students with Disabilities If you have a documented disability and require accommodations, please contact the instructor for necessary classroom adjustments. You may also contact Student Accessibility Services (contact 330-672-3391) or visit www.kent.edu/sas for more information.