CS 720 (Computational Models of Decision Making), Fall 2018

Meeting location: EMS E 170

Meeting time: This is a partially-online (blended) course with modules posted in D2L accompanied by face-to-face meetings from 4 pm until 5.20 pm on the following Mondays-Sept. 10, Sept. 24, Oct. 8, Oct. 22, Nov. 5, Nov. 26, Dec. 3, and Dec. 10. If there is a change to this, it will be announced in advance, and students who miss a quiz due to a change in these dates will be given a makeup quiz on another day.

(The face-to-face meetings are for answering questions, solving problems, and taking a quiz. Each meeting except the first will involve a quiz and two of the seven quizzes with lowest scores will be dropped. You will have twenty minutes at the end of each meeting for attempting the quiz. The quizzes will be closed-book and closed-notes with all electronic devices turned off except calculators free of course material, only when they are needed for the quiz. Modules and homeworks will be posted in D2L. Though there are fewer face-to-face meetings in the course compared to a 100% face-to-face course, the material covered in the course is same as the material covered in a traditional course. The syllabus for each quiz will be announced via news in D2L.)

Final exam: 3-5 pm, Dec. 18 (Tuesday) (Open-book, open-notes with calculators free of course material allowed. Laptops, tablets, cell phones, and other electronic devices and internet use are prohibited. It will be based only on last six topics (9-14).)

Instructor: Amol D. Mali, mali@uwm.edu, Office: EMS 1055

Office hours: 12.30-2.30 pm on days of face-to-face meeting (You are welcome to e-mail questions at any time or set up another time to meet.)

Course Topics:

1. Introduction to decision making (challenges in decision making, construction of
decision trees)

2. Probability (Laws of probability, Probability distributions, Conditional independence, Naive Bayes model)

3. Bayesian Networks (Inference, Singly-connected networks, multiply-connected Bayes nets, Clustering algorithms, Relational probabilistic models)

4. Bayes' optimal classifier, Naive Bayes classifier

5. Rule-based systems (Forward chaining, Backward chaining, Rule-conflict resolution)

6. Uncertainty management in rule-based systems (odds, likelihood of sufficiency, likelihood of necessity)

7. Certainty factors

8. Fuzzy Logic (operations on fuzzy sets, fuzzy rule-based systems)

9. Decision theory (Utility, Expected utility, Preferences, Axioms of utility theory, utility functions, multi-attribute utility functions, mutual preferential independence, mutual utility independence, Solving decision trees, Sensitivity analysis, EVSI (expected value of sample information), EVPI (expected value of perfect information), decision-theoretic expert systems)

10. Game theory (2-person games, pure strategies, dominated strategies, zero-sum games, constant-sum games, mixed strategies, Maximin strategy, Minimax strategy, Matrix games, value of a game, unstable games, Minimax theorem, Solving for optimal strategies using linear programming)

11. Markov Decision Processes

12. Auctions

13. Additional topics from research articles (Game-SAT, Probabilistic lobbying, Cyber trust, Iterated majority voting, Judgement aggregation, Efficiently
ranking different options)

14. Applications of course topics (also from research articles)
(Hurricane seeding, Plan evaluation, Space missions, Automated software help and others)

There is no required or recommended textbook.

Weights:

In-class quizzes (equally weighted): 40%

(Two lowest quiz scores will be dropped. Also, fifty percent credit will be given for attempting a quiz and the remaining fifty percent will depend on the correctness of the answer.)

Homeworks (equally weighted): 40%

Final exam: 20%

In case of an emergency, contact the instructor at the earliest possible opportunity via e-mail. No arrangements will be made for missed exam or homeworks unless this rule is followed, and an acceptable evidence of legitimate emergency is submitted. Please also be aware of the standard University policies: www4.uwm.edu/secu/news events/upload/Syllabus-Links.pdf. Please see http://www4.uwm.edu/acad aff/policy for various UWM policies about academic affairs.

Submitting homeworks:

I prefer hard copies submitted in class (when the due date is also a meeting date), but it is fine if you submit a soft copy in D2L by 11.59 pm on the due date. If you are submitting a scan of handwritten work, then please make sure that the quality
of scanning is good and your name is written on each page, away from edges. Leave enough margins so that material is not excluded while scanning. Make sure that the material fits on an A4 paper when the scan is printed. If a scan is of poor quality, grading of your work will be delayed as your original handwritten copy will be graded in that case. Preserve the original handwritten copy even after you submit a soft copy in D2L as it may be needed if there are problems in reading or printing the scanned copy. A submission late by up to 24 hours will be accepted with 10 percent penalty. Submit only one pdf file with all solutions (do not submit n files if your solution has n pages).

**Participation by Students with Disabilities** If you need special accommodation in order to meet any of the requirements of this course, please contact me as soon as possible unless you have asked ARC (Accessibility Resource Center) to send your needs to me.

**Accommodation for Religious Observances:** Students will be allowed to complete examinations or other requirements that are missed because of a religious observance. See [https://www4.uwm.edu/secu/docs/other/S1.5.htm](https://www4.uwm.edu/secu/docs/other/S1.5.htm).

**Academic Misconduct:** The university has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. A more detailed description of Student Academic Disciplinary Procedures may be found at [http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/](http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/)

The solutions you submit must be your own. Similarity between solutions will be checked to detect academic misconduct. More academic- misconduct information is provided next.

UWM expects each student to be honest in academic performance. Failure to do so may result in discipline under rules published by the Board of Regents (UWS 14) and the UWM implementation provisions (Faculty Document 1686). Academic misconduct is an act in which a student seeks to claim credit for the work or
efforts of another without authorization or citation, uses unauthorized materials or fabricated data in any academic exercise, forges or falsifies academic documents or records, intentionally impedes or damages the academic work of others, engages in conduct aimed at making false representation of a student’s academic performance, or assists other students in any of these acts. The most common forms of academic dishonesty are cheating and plagiarism.

Cheating includes:

- Obtaining and using unauthorized material, such as a copy of an examination before it is given
- Submitting material that is not yours as part of your course performance, such as copying from another student’s exam, or allowing a student to copy from your exam
- Using information or devices not allowed by the faculty; such as using formulas or data from a computer program, or using unauthorized materials for a take-home exam
- Fabricating information, such as data for a lab report
- Violating procedures prescribed to protect the integrity of an assignment, test, or other evaluation
- Collaborating with others on assignments without the faculty’s consent
- Cooperating with or helping another student to cheat
- Other forms of dishonest behavior, such as having another person take an examination in your place; or, altering exam answers and requesting the exam be re-graded; or, communicating with any person during an exam, other than the exam proctor or faculty

Plagiarism includes:

- Directly quoting the words of others without using quotation marks or indented format to identify them
- Using sources of information (published or unpublished) without identifying them
- Paraphrasing materials or ideas of others without identifying the sources
- Internet Plagiarism
For more information, go to:  http://www4.uwm.edu/acad_aff/policy/academicmisconduct.cfm

**Students called to military service:** Detailed information is available at http://www4.uwm.edu/academics/military.cfm