MICHIGAN
ROSS SCHOOL OF BUSINESS

TO 433 Course Syllabus   **Winter 2024**

Artificial Intelligence for Business

Course Description

We are living in fast changing world. The amount of information we generate, receive and process is increasing at an exponential rate. This information explosion is empowering a wave of smart, automated functionalities like face recognition, tumor detection, automatic inventory control systems, self-driving cars, virtual assistants, robo-advisors, automated product/service recommendations and so on. These technologies and tools will be even more important in the future for individuals, businesses and other organizations since they drive innovation, save costs, increase quality for products and services, and simplify daily life for humans.

The mechanism behind these new technologies and tools is artificial intelligence (AI), which allows computers and machines to automate the business logic – to work, react and engage like humans. The basic premise is to use data and mathematical models to predict and prescribe to obtain better outcomes. AI comes with a great promise for individuals, organizations and societies but at the same time there are considerable risks and unsolved implications such as reduction in employment, responsibility determination when AI fails (e.g., crash of a self-driving car, a wrong disease diagnosis) and ethical dilemmas (e.g., a patient death, automatic missile launch).

Future business leaders need to understand and leverage the potential of AI, its capability for consumers and organizations as well as its risks and ethical considerations. **AI based products and tools will not only be an advantage for businesses but a necessity to remain competitive in the future.** This course aims to provide students with a conceptual introduction of AI, a broad understanding of AI's basic techniques, how AI is applied to problems, how to extract value from AI investments, future applications of AI and an awareness of the challenges, risks and ethical considerations of use of AI in business.

The course is aimed towards general business students and does not require a technical background. Students will be able to connect the conceptual nature of this course with the more technical coverage of AI related material in other Ross TO courses – but they are not expected to be familiar with the technical details of AI as a pre-requisites.

Class Details

Class Schedule: Mon/Wed 4pm – 5:30pm in B1560, 3 Credits.
Instructor Information: **Sanjeev Kumar**, R3443, sankum@umich.edu, @a_teachr, 734-615-7064
Office Hours: See Canvas for Office Hour Appointment Calendar. In case the scheduled office hours are not convenient for you then please send a note to the instructor for scheduling additional office hours at a time more convenient for you.

Course Materials

Customized course material will be posted on Canvas. There are two assigned reference book for the course:

- **Prediction Machines**: The Simple Economics of Artificial Intelligence, Ajay Agrawal, Joshua Gans and Avi Goldfarb, Harvard Business Review Press, Apr 2018 (referred as PM in this document), An online copy of the book is made available for TO633 students through the Univ of Michigan Library – see Canvas for access link.
- **AI: Its Nature and Future**, Margaret Boden, Oxford University Press, July 2016 (referred as AINF in this document).

 The course will include material from several reference sources including:

- **Artificial Intelligence: A Modern Approach**, Stuart Russel and Peter Norvig, 3rd Edition, Pearson (referred as AIAMA in this document)
- **Machine Learning with R**, 2nd Edition, Brett Lantz, Packt Publishing (referred as MLR in this document)
- **The Cambridge Handbook of Information and Computer Ethics**, Luciano Floridi, Cambridge University Press (referred as CHICE in this document)
- **Human + Machine: Reimagining Work in the Age of AI**, Paul and James Wilson, Harvard Business Review Press, Mar 2018. (referred as HM in this document)

Course Grading

As the course involves significant amount of collaborative group work, the course grading is primarily focused on outputs of the group project and collaborative group activities. Group deliverables are complemented by individual assignments focused on specific skills. In-class exercises and tutorials round out our grading with emphasis on class engagement and participation.

Group Project Report and Presentation: 30%

Student groups will be asked to choose an industry to focus on and deep dive into the current and future role of AI in that industry. Students groups will be expected to inform their project work based on material covered in this course while customizing their inferences for their selected industry. Student groups will be asked to submit a project report and make a class presentation of their findings.

Project reports will be 10-15 pages in length, class presentation will be for <10 mins. Project reports will be submitted on Canvas and will be available for reading and discussion by the students.

Following is the tentative schedule of Group Project Deliverables:

1. **Group Deliverable #1: Group Engagement Exercise** – As groups are formed in the beginning of the semester, all the project groups will be asked to do a small exercise for the group members to get to know each other. The exercise will ask the group to meet as a group and decide on a group name. Groups will be asked to build a small ~3 mins video to introduce themselves to the class and to share why they chose their group name and what that represents about how they will approach the course and their project work. **Extra credits for funny and engaging videos!**

2. **Group Deliverable #2: Group Project Industry Selection** – Groups are asked to select an industry to focus on for their group project. The industry choice should be broad enough to accommodate interests of all the group members. Industry choice should also be impactful – should make a meaningful difference to our lives and future. Finally, the industry choice should ideally be one with interesting ongoing transformation using AI technologies. Groups will be asked to make a one page submission detailing the industry they are choosing to study in deep detail and their rationale for choosing the industry.

3. **Group Deliverable #3: Group Project Mid-Term Status Update** – Groups are asked to schedule a 30 min meeting with the instructors to update them on the progress on their group project. The status update meeting will also work as a forum to discuss challenges, potential remediation and potential future directions to focus on. Students will be asked to submit a one page summary of the discussions in the status update meeting.

4. **Group Deliverable #4**: **Draft Report for Discussion and Feedback** – Project groups are asked to submit a draft report for class discussion and peer feedback. The report should have a fully built Table of Contents (ToC) – and much of the ToC should be filled out with draft content. It is fine for some parts of the ToC to be under development for this draft report. Each student will be asked to discuss and critique one draft project report.

5. **Group Deliverable #5: Final Report** – Project groups will submit the final version of their Group Project Reports on Canvas for grading before the last week of classes. Project reports must be submitted before the Group Project Presentations. Final report should address student feedback and discussion based on the Draft Report.

6. **Group Deliverable #6: Group Project Presentations** – Project groups will present their work to class in a ~10 mins presentation.

Homework Assignments: 30%

Each of the course content modules will have an individual homework assignment associated with them. The homework assignments will ask the students to explore the course module content from their own perspective. The homework assignments will take the form of in-depth exploration of topics associated with the module. All homework submissions will be made available to the rest of the class for reading and discussion by the students. Each student will be asked to discuss and critique two homework submissions (randomly assigned). Homework assignments are expected to be no more than 1 page in length.

Following is the tentative schedule of Individual Homework Assignments. The homework schedule is subject to change depending upon the progress of the course and discussion direction taken by students.

1. **Homework #1: What Will Cheap Predictions Bring About?** – As Predictions become cheaper, we will continue to recast various tasks/functions/work as prediction problems so make use of cheaper prediction machines even though right now we don't think of them as typical application domains of AI. For this HW, you are asked to imagine a world where prediction machines are incredibly cheap. You are the asked to identify and discuss a task/role/function/job that you think will be re-cast as a prediction problem and will be automated and performed by prediction machines.

2. **Homework #2: Implementing Predicting Algorithms for Detecting Cancer** – Students will be provided with a dataset of Breast Cancer Diagnosis and associated tumor data. Students will be asked to build a predictive model to predict whether someone has cancer or not based on tumor data. Students will be asked to discuss the business aspects of implementing such a "cancer prediction" model in a hospital to replace existing radiologists who take care of this function today.

3. **Homework #3: Role of Trust in AI Solutions in Mass Media** – AI is a popular element of mass media with several recent depictions such as in movies like Ex Machina (2014), Blade Runner (1982), Blade Runner 2049 (2017), 2001: A Space Odyssey (1968), HBO TV Series WestWorld (2018), Ghost in the Shell (1995, 2017) and I, Robot (2004). Students are asked to critically evaluate their favorite popular depictions of AI in mass-media with a focus on whether those solutions can be trusted. Students can use popular frameworks such as Asimov's Three Laws of Robotics to frame their discussion.

4. **Homework #4: Impact of Autonomous Vehicles** – Autonomous Vehicles are already a reality in specific narrow contexts and are likely to be a widespread reality in general contexts in near future. Students are asked to consider the impact of widespread, reliable, connected, smart and cheap autonomous vehicles on how we live and how businesses operate. Students are challenged to explore beyond the obvious and focus on new products, new business models, impact on non-adjacent industries and potential unintended consequences of autonomous vehicles.

5. **Homework #5: Extracting Value from AI Investments** – Students are asked to search for and explore one example of failure in adopting AI solutions in organizations. Students should first

seek to define what would success and failure mean for a given context. Students should focus on extracting generalizable findings regarding success factors, reasons for failure and best practices from their focus example.

6. **Homework #6: Regulating Artificial Intelligence** – Our final homework askes students to consider regulations that should be considered to make sure that AI solutions are geared towards the common good while considering the trade-off with innovation dampening impact of regulations. Students should contrast the regulatory environment for AI with previous technological disruptions and compare different ongoing regulatory initiatives around AI around the globe.

Learning Journals: 10%

Learning Journals are meant for students to document their own reflections on the class material. LJs can include student reflections on learnings in the course, how does the course content align with their academic and professional aspirations, connections of course content with previous experiences and future career directions and so on. The scope is open ended by design – students are expected to build their LJs based on their unique lived experiences combined with the course content and classroom dialogues. There will be two LJs – a mid-term one and one at the end of the semester. Last LJ submission for the semester will take the form of a Capstone Learning Journal with a larger scope. LJs are expected to be 1-2 pages.

In-Class Exercises, Discussions and Class Participation: 30%

Class will include several in-class exercises to ensure that all students are current with the class material and stay updated with the class progress. Potential exercises include small tutorials to enforce key technical concepts, small thought-pieces to explore key business issues, class exercises to evaluate and give feedback on proposed solutions by student groups.

Class Schedule

The class will be run as a sequence of 6 content modules – each of approx. one week duration – followed by a week of recap, review, guest lectures and project presentations. The course will have a mix of business and technical content for each module. There will be specific Individual and/or group project deliverables for each module.

Module #1: Introduction to Artificial Intelligence

First two weeks will focus on providing a general introduction to the current start of the art in the practice of AI in business. We will also go through a discussion of historical roots of AI's development and the merging of the AI domain with the Big Data domain. After this module, students will have an understanding of the current nature of AI in business and the current and future role of AI in delivering business value and enabling new business models.

Module #2: Decision Making, Machine Learning

In our first deep dive in the "inside" of AI, we will look at the most popular form of AI in business today – the one of prediction, of automating the decision making process, most commonly with the use of large amount of data (Big Data) along with Machine Learning algorithms to get insights from the data. We will discuss both the historical, data-light version of decision making approaches such as Searching, Adversarial Searching and Constraint Satisfaction Problems as well as the Big Data version of automating decision making using Machine Learning and its most recent incarnation – Deep Learning.

Module #3: Natural Language Processing, Transformers, ChatGPT

AI technologies are becoming more "human-like" with advances on natural language processing and cognitive computing. Customer service is being transformed using automated Chatbots while personal digital assistants like Alexa are breaking new grounds in conversational natural language processing. In this module we will discuss the role of language and human-like cognitive processes in the context of AI. We will extend the discussion to more purely-human aspects such as creativity and emptions. Finally, as the distinction between human and machine narrows, we will discuss the role of trust in AI systems.

Module #4: IoT, Autonomous Vehicles, Robotics, Robotic Process Automation

We transition from software to hardware in this module. We connect the AI discussion so far to the ongoing advances in Internet of Things (IoT), Smart Devices and in particular, Autonomous Vehicles. We will discuss the merging of the AI domain with the Robotics domain with the emergence of human-like robots like Boston Dynamics' Atlas. We will extend the robotics discussion to Software Robots, especially those used for RPA (Robotic Process Automation) and making business processes more efficient.

Module #5: Strategic Implications of AI

We go from "what" to "how" in this module. How to implement AI based solutions in an organization? How to make AI adoption successful in an organization? How to think about new business models and new process structures to leverage AI capabilities? What are the main challenges and potential risks of different approaches? We will specifically focus on the role of organizational culture and transformative leadership in managing the digital transformation process.

Module #6: Challenges, Risks and Ethical Considerations, Regulating AI

We conclude the course content by looking at the "other side" of AI. We will look at potential risks that organizations face by automating decision making and removing or reducing human oversight of automated tools. We will broaden our enquiry to consider the impact of AI on society, specifically the labor force. We will also explore regulatory responses to various challenges posed by AI.

Module #7: Course Conclusion, Group Presentations

We will hold the last week of the class for potential guest speakers from industry and for holding project presentation for the group projects. We will conclude the class with one final Learning Journal submissions – a capstone submission to capture overall reflections on the course content.

Learning Approach

This is a very fast paced course where we cover a significant amount of material. Further, as a discussion oriented course, we rely on students doing their readings ahead of class and coming to class prepared so that we can spend class time productively.

For most classes, you will be asked to come to class having read the assigned readings and having done a small exercise. The class time will be used to expand the discussion beyond the exercise and learn from our collaborative discussion.

Recordings

All class sessions will be recorded and class recording will be made available on Canvas soon after the class ends. Note that class recordings are a poor substitute for in-person class experience and discussion. Students are urged to attend class in-person unless there are significant barriers to attending the live class.

Class Conduct Guidelines

- Stay fully engaged in the classroom. **Live class sessions are No Laptops, No Cellphones zones** unless we are doing specific class exercises that require you to be on your machines.
- Participate in class discussions. All students are expected to be active participants in the class discussions. Instructor will (gently) cold call students to ensure that class discussions include all students.
- Come prepared to the class. Readings and cases for class sessions will be posted at least one week in advance. Students are expected to have read and reflected on the material to better participate in collaborative learning experience in the classroom.

Late Submission Guidelines

Any late submissions will be assessed a 10% late submission penalty per day. All submissions will be closed one week after the deadline. Exceptions to the late submission penalty will be made in case students have a significant hardship and reach out to the instructor **before the deadline to get a waiver** of the late submission penalty.