Adam Pah  a-pah@kellogg.northwestern.edu

Description

*Human and Machine Intelligence* covers cutting edge research on machine-learning and artificial intelligence and its applications for business leaders. Machines help solve complex problems, lessen decision bias, scale human effort, and spot hidden patterns in big data. However, they lack the creativity and insight that top executives possess. Together, executives and machines have the potential to make powerful “thought partnerships.” Using hands-on cases and applications --- including IBM’s Deep Blue and Google’s AlphaGo that beat Chess and Go Grand Masters --- this course shows how to use a critical set of machine learning decision tools, such as natural language processing, sentiment analysis, and pattern recognition to discover new competitive strategies, turn raw numbers into convincing stories, and make less biased judgments. The overarching goal is to enable you to confidently lead data science and design teams, know the expansiveness and limits of machine-learning complex decision support tools, and be capable of applying human+machine thought partnerships to grow businesses or disrupt Grand Masters in any field.

Grading

*Human and Machine Intelligence* is an exciting, and possibly scary, new topic area in business education. While there has been extensive writing about Artificial Intelligence and Machine Learning in the popular and business press, it is difficult to create a coherent understanding of the field from those pieces-even moreso to understand how humans fit into this new world.

I start from this framing to put you in the correct mindset, namely that this space is still intellectually wide open and experts are few and far between. As a part of this I want you to engage with the assignments in a way that your written work is thorough, explanatory, and reflective -- that what you submit is a professional level document that you would be willing to publish in an effort to establish yourself as a thought leader in this space. While I do not require that you post your assignments to LinkedIn/Medium/etc. (although I do hope that some of you will), I do require that you will prepare them as if they were the final product to be distributed in such a way. As such, basics of writing matter (spelling and grammar) since they contribute to the professional appearance that you project to the world.

**Assignments (70%)** A series of individual and group assignments will give you first-hand experience in understanding how machine-learning is used to make business decisions.

**Attendance and Participation (10%)** Sharing insights and participating in class discussions is integral to success in the course. Attendance will be randomly taken, while participation will be recorded every class. Completing activities that carry no explicit grade (i.e. submitting additional documents or business plans for discussion) are also a part of your participation grade.

**Final exam (20%)** A final exam will test your cumulative understanding of the course.
material.
The exam is a take-home exam and will be turned in through Canvas on the date provided.

**FINAL EXAMS WILL NOT BE ACCEPTED LATE**

**Honor Code**
As with all Kellogg courses, by enrolling in this course you agree to abide by the Kellogg Honor Code ([http://www.kellogg.northwestern.edu/stu_aff/policies/honorcode.htm](http://www.kellogg.northwestern.edu/stu_aff/policies/honorcode.htm)). In this course you may (and are encouraged to) discuss both the individual assignments and group assignment with your fellow students; however, the finished product that you submit should be entirely your own work. If you have any questions regarding how the honor code applies to this course, please ask.

<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Distributed</th>
<th>Due</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Individual Hiring your replacement</td>
<td>April 9 (Monday)</td>
<td>May 16 (Monday)</td>
<td>20%</td>
</tr>
<tr>
<td>3</td>
<td>Group Who are you hiring?</td>
<td>April 16 (Monday)</td>
<td>May 23 (Monday)</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>Individual Final Exam</td>
<td>May 3 (Thursday)</td>
<td>May 6 (Monday)</td>
<td>30%</td>
</tr>
</tbody>
</table>

**Summary of Assignments**
Warning: This schedule is subject to change

**Week 1 — Knowledge**

**Session 1. Why machine-learning?**
What is machine-learning? Where can you use it? Why should we use it? What benefits does it have over other traditional methods of analysis, prediction, and decision-making? What business problems are machine-learning and artificial intelligence most suited to?

*Video: From hacking the iPhone to self-driving – Comma.ai’s maiden voyage*

*Before Class Reading:*
- McAfee and Brynjolfsson. *Machine, Platform, and Crowd.* Ch 2, pgs 28-36

*Before Class Watching:*

**Session 2. How does a machine learn?**
What are the types of machine-learning? How does such an algorithm actually work? How do the limitations of machine-learning compare to traditional knowledge building. Are these limitations different, or a new version of an old problem? What does ‘knowing’ mean in the context of machine-learning? The difference between correlation and causation.

*Before Class Reading:*

**Week 2 — Practicum**

**Session 1. Evaluating machine effort**
How do you judge goodness? Recalling accuracy, precision, and judging the ‘badness’ of bad. Comparing machine-learning to human decision-making. What is bias and variance?

*Before Class Reading:*
- McAfee and Brynjolfsson. *Machine, Platform, and Crowd.* Ch 2, pgs 36-44.

**Session 2. Building machine models**
Predicting customers that will default on their debt. In-class instruction on building machine-learning models on the Microsoft Azure model. Discussing the gap between model predictions and business decisions.

*Dataset: credit_delinquency.csv*
Week 3 — The current frontier and structural gaps

**Session 1. Machines replicating humans**
What is a neural network? What has made it so powerful? What differentiates it from other approaches we have learned? What is the same about this approach? What questions does this create about the future?

Video. AlphaGo

*Before Class Reading:*

*Before Class Watching:*

**Session 2. Ethics, Morals, and Biases**
Judges, bail, and lunch-time. The problem with decision-making biases when it comes to administering justice. Machine-learning and societal outcomes. The ease of red-lining and the danger in not asking questions.

*Before Class Reading:*

Week 4 — Automated Knowledge Building

**Session 1. Watson**
The development of artificial intelligence and its limits. Where are the current boundaries. What can Watson do for us now? What is Watson? How is playing Jeopardy hard when you're a machine? What are the frontiers in utilizing Watson as a decision-making partner.

Videos. Jeopardy

*Before Class Reading:*

*Out of Class Activity* - Submit a plain text file (so a '.txt' file - very important!!) of more than 1,000 words of your writing. This is not new text you are writing, just copy and paste your resume, blog posts you’ve written, etc. into this document and submit it at: [http://bit.ly/hmiwords](http://bit.ly/hmiwords)

**Session 2. Evaluating the machine-learning landscape for adoption**
In-class discussion of *Evaluating the Cognitive Analytics Frontier.*
In-class activity: Who are you hiring data switch and discussion.

*Before Class Reading:*
• Pah, Lazarowich and Snyder. Evaluating the Cognitive Analytics Frontier. *Case*
Week 5 — Iterative change and defining space

**Session 2. Experimentation**
Designing for the X factor. How do you incorporate experimentation at a corporation? What benefit does it bring? Experimentation for everyone, or only the select few? Case studies with Amplero and maximizing customer satisfaction.

*Before Class Reading:*

**Session 2. The last mile**
How do you implement machine-learning and artificial intelligence as solutions in organizations? Where are the pitfalls? How do you know what a good idea looks like?

*Guest Speaker.* Matt Abrams, Seven Peaks Ventures

*Final distributed in class.*