Syllabus
CSC131
The Beauty and Joy of Computing
Professor Leon Tabak
Block 1
August 27, 2018 to September 19, 2018

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1 Description of course

In this course we will explore how computer scientists are building machines that augment human intelligence. These machines interpret images, generate and recognize spoken words, discern patterns in the habits of consumers and voters, navigate in the physical world, offer advice to experts as they try to solve complex problems, and tutor students.

We will ask...

- Can these machines learn? What does "learning" mean when we speak of machine learning?
- How are they changing the ways in which people learn?
- What are the keys to effective learning for machines and people?
- How can we adapt to a world in which technology plays an ever larger role?

As we study machine learning, we will also acquaint ourselves with what psychologists have discovered about how human beings learn. This study will give us a foundation and perspective that will aid our efforts to evaluate the prospects of learning in machines. It will at the same time give us knowledge that we can apply in efforts to make ourselves better students in this and future courses.

The course will introduce students to resources at Cornell College from which they can draw help in this block and in blocks to follow.

A gentle introduction to methods of creating software will include practice creating our own applications for the Web.

2 Our meeting times and places

- My office is in Law 206C.
- You may call me in my office at (319) 895 4294.
- You may send me electronic mail at l.tabak@ieee.org.
- I will be in my office and available to meet with you Monday through Friday from 3:00 p.m. until 3:30 p.m.
- We will all meet together in the classroom in the mornings and in the laboratory in the afternoons.

	Where	**When**
Laboratory	Law Hall 113	9 a.m. to 11 a.m.
Classroom	Law Hall 121	1 p.m. to 3 p.m.

3 Textbooks

- Make It Stick: The Science of Successful Learning, Peter C. Brown, Henry L. Roediger III, and Mark A. McDaniel, The Belknap Press of Harvard University, Cambridge, MA, 2014, ISBN-13: 978-0674729018 / ISBN-10: 0674729013
  (Listen to The Science of Smart)
- How We Learn: The Surprising Truth About When, Where, and Why It Happens, Benedict Carey, Random House Trade, New York, 2015, ISBN-10: 0812984293 / ISBN-13: 978-0812984293
  (Hear an interview with the author.)
- What to Think About Machines That Think: Today's Leading Thinkers on the Age of Machine Intelligence, John Brockman, Harper Perennial, 2015, ISBN-13: 978-0062425652 / ISBN-10: 006242565X
  (See this list of related podcasts.)

4 Etiquette for the Classroom

Please show respect to your classmates, to me, and to the seriousness of our enterprise by exercising the following courtesies:

- Please give your attention to whomever is speaking. You cannot view unrelated pages on the Web and be part of our class' discussion at the same time.

- You learn from your classmates. Be generous in offering help to classmates in the laboratory. Take interest in your classmates' work. Encourage them. Compliment them for work that is well done. Give them a good audience when they stand at the front of the room to present their work. Show these courtesies to all of your classmates.
- Please do not interrupt the class by late entries or early departures. If you anticipate a need to be absent from all or part of one of our meetings, please notify me in advance of your anticipated absence.
- You may listen to music while working in the laboratory so long as you are still able to hear your name when called and you do not disturb neighbors.
- Please refrain from bringing food or drink into the classroom or laboratory. We can make reasonable exceptions for eating that is not noisy and foods that do not have strong smells.

  Acceptable beverages and foods include water, tea, and granola bars. Bringing breakfast to class is not courteous.

  Please clean up crumbs and spills. Please dispose of empty containers and leftovers.
- Please dress as you might for an employer in the software engineering industry.

  (Software engineers dress casually. You do not need to purchase new clothes. It will be enough that you dress neatly.)

  Please keep your shoes on. Wearing hoods, hats, or sunglasses (except when there is a medical reason for shielding the eyes) that hide your face is not courteous.
- Imagine that you are seeking employment. How will you present yourself to your prospective employer?

  Imagine that you are now employed in a software engineering firm. How will you speak to your teammates, the head of your team, and your company's clients?

  Imagine that your grandmother has purchased the company for which you work. She has joined you in the company's conference room to hear and see you walk through the code that you have written for the company (her company).

  Are there some words that you will keep out of your vocabulary during this hour?

5 Policies

Cornell College is committed to providing equal educational opportunities to all students. If you have a documented learning disability and will need any

accommodation in this course, you *must* request the accommodation(s) from the instructor of the course and no later than the third day of the term. Additional information about the policies and procedures for accommodation of learning disabilities is available on Cornell College's Web site.

Please also familiarize yourself with the college's statement on academic honesty and its policies for dropping courses.

6 Goals

We will give special attention to three of Cornell College's Educational Priorities and Outcomes:

- Inquiry—you will practice and develop the skills that you will use to acquire the knowledge that you need to achieve your goals
- Communication—you will practice and develop the skills that you will use to share what you have learned with fellow learners, teammates, and the people whom you serve through your work
- Well-being—you will become acquainted with the variety of resources that Cornell College offers to you, with some of the many opportunities available to you, and with the importance of living a balanced life

7 Grades

We will begin each day with a short quiz. The score for quizzes that are missed will be zero. Your three lowest scores will not count toward your grade for the course.

The graded exercises at the end of each week may be a mix of...

- work that you will do in our classroom when we are all together
- work that you will do outside of the classroom when we are apart
- work that you will do on your own
- work that will you do in collaboration with classmates
- work in which you will recall from memory what you have learned
- work in which you will make use of books and online resources
- written work
- presentations to the class

Experience presenting work to peers will be a central part of the course. Practice asking your teammates questions during their presentations, critiquing their decisions, and suggesting improvements to their work will be an important part of your education during this term.

	Activity	**Points**
	Daily quizzes	20
	Graded exercise 1 (Friday, 31 August 2018)	20
	Graded exercise 2 (Friday, 07 September 2018)	20
	Graded exercise 3 (Friday, 14 September 2018)	20
+	Graded exercise 4 (Wednesday, 19 September 2018)	20
		100

7.1 Student Success Component

The student success component of your FYS extends beyond the first block, to encompass activities and reflection assignments throughout Blocks 1, 2, and 3. Block 1 focuses on time management with an emphasis on helping you manage their academic responsibilities, campus involvement, and personal wellbeing. Block 2 emphasizes civil discourse and intercultural literacy. Block 3 focuses on academic planning and future opportunities.

Student success assignments will comprise 20% of your final FYS grade. These assignments will be evaluated by your FYS success instructor. You and your academic advisor will be informed of your preliminary in-progress grade at the end of Block 1 (which will not include student success assignments) and you will receive your final comprehensive grade at the end of Block 3.

7.1.1 Evaluation of Student Success Assignments

ALL of the following criteria must be met for each assignment in order to earn full credit (4 points):

- Attendance at associated meetings and activities.
- Thorough and in-depth reflection on all but one question. All questions must be addressed at more than a minimal level.
- The quality of writing does not limit understanding of the reflection.
- Answers are complete sentences and make sense without reading the question.

If any **ONE** of the following criteria is met, then the assignment earns minimal credit (1 point).

- Inattentive or disruptive attendance (being late, not paying attention or not listening to others, talking to neighbors, sleeping, texting, rude comments, et cetera).

- One or more of the responses does not or only minimally addresses the question.

- The quality of writing limits the readers ability to understand the reflection.

- Answers are not complete sentences or do not make sense without reading the question first.

Assignments falling in between these criteria will earn partial credit (2 points). Failing to attend or failing to submit a reflection results in no credit (0 points). See Assignment Rubrics for more details.

Without either prior approval or evidence of a serious emergency: late student success assignments will not be accepted. If an extension is needed, please consult with your FYS success instructor prior to the assignment deadline.

Options for Revising Student Success Assignments

Student may revise up to 3 assignments for which they did not receive full credit. Assignments from Block 3 are not eligible for revision.

For each revised assignment, the following must be completed:

- Students must have attended the relevant activities, participated appropriately, and submitted an initial assignment on time (or if given an extension, by the agreed upon deadline).

- Students must either work with a writing consultant or attend a writing studio workshop on revising their reflection.

- Students must review the rubric and comments provided by the FYS success instructor, make the relevant changes, and submit both a revised reflection and an overview of the revision indicating in bullet points how they addressed each of the concerns raised in the rubric and comments.

- Revisions must be submitted via Moodle within one week of the return of the assignment.

8 Calendar

	Mon	Tue	Wed	Thu	Fri
Week 0	27	28	29	30	31
Week 1	03	04	05	06	07
Week 2	10	11	12	13	14
Week 3	17	18	19	20	21

9 Schedule

9.1 Week 0

During the first week of the course we will identify applications of machine learning and centers of research in the field in universities, national laboratories, and industry.

We will compose an annotated bibliography. This means that, in addition to compiling all of the information need to find an article, you will summarize each article that you find in one, two, or three paragraphs.

9.1.1 Monday, 27 August 2018

Read: For our next meeting: Preface and Chapter 1 of *Make It Stick*[2] (pages ix–xi and 1–22).

Discuss: Your previous learning experiences. Talk about the different kinds of studies that you have undertaken. Comment on courses, curricula, methods of instruction and study, and teachers that you rated most highly.

- Have you studied music?
  - Were you part of a band, orchestra, or choir?
  - Did you study at a school of music?
  - Did you study with the Suzuki curriculum?
- Have competed with an athletic team?
  - Have you attended a sports camp?

  - Did you seek additional play and coaching with a league outside of school?
  - Did you enroll in a program to develop your strength and agility?

- Have you competed in a science fair, Mock Trial, Academic Decathlon, or on a robotics team?
- Did you attend a "college for kids?" (That is, did you attend short courses in the summer at a college or university through which you did not earn academic credit?)
- Have you studied a foreign language in a program like the Concordia Language Villages?
- Have you enrolled in a course at a community college, an online course, or a MOOC (Massive Open Online Course)?
- Are you a certified SCUBA diver? Did you earn merit badges in a Scouting program?

What has made the best of these experiences stand out in your mind?

Write: In class we will listen to a short recorded interview and then write questions that we could use to guide a discussion of the interview.

For our next meeting: 256–512 words about one or more of your best learning experiences.

Return to calendar.

9.1.2 Tuesday, 28 August 2018

Read: For our next meeting: Introduction, Chapter 1, and Chapter 2 of *How We Learn*[3] (pages ix–xvi and 3–41).

Discuss: Preface and Chapter 1 of *Make It Stick*[2] (pages ix–xi and 1–22).

Introduction to the software that we will use: Emacs, Mercurial, HTML, and CSS.

Write: The first day's quiz will test your knowledge of the syllabus.

Due today: 256–512 words about one or more of your best learning experiences.

For our next meeting: Create a Web page that lists 3 or 4 points that you think we should all remember about Chapter 1 of *Make It Stick*.

Return to calendar.

9.1.3 Wednesday, 29 August 2018

Read: For our next meeting: Chapter 2 of *Make It Stick*[2] (pages 23–45) .

Discuss: Introduction, Chapter 1, and Chapter 2 of *How We Learn*[3] (pages ix–xvi and 3–41).

How to use a computer and software as tools for writing. Markup languages. Separation of concerns.

Jennifer Ferrell, a writing and teaching specialist in Cornell College's Writing Studio, will join us today. She will lead us through an exercise.

Write: Due today: Create a Web page that lists 3 or 4 points that you think we should all remember about Chapter 1 of *Make It Stick*.

Return to calendar.

9.1.4 Thursday, 30 August 2018

Read: For our next meeting: Chapter 3 and Chapter 4 of *How We Learn*[3] (pages 45–79).

Discuss: Chapter 2 of *Make It Stick*[2] (pages 23–45) .

What is computer science? How does software differ from other kinds of products that engineers design and build?

Write: For our next meeting: rite 256–512 that touches upon two or more of these topics:

- the Turing Test
- Joseph Weizenbaum's Eliza program
- the Loebner Prize

- IBM's Watson system and its participation in the Jeopardy television game

Return to calendar.

9.1.5 Friday, 31 August 2018

Read: For our next meeting: Chapter 3 of *Make It Stick*[2] (pages 46–66).

Discuss: Chapter 3 and Chapter 4 of *How We Learn*[3] (pages 45–79).

Write: Graded Exercise 0.

Return to calendar.

9.2 Week 1

During the second of our course, we will identify courses on machine learning. We will look at courses that colleges and universities offer with academic credit in conventional, face-to-face formats. We will also look at online courses, including MOOCs (Massive Open Online Courses).

We will combine information from multiple sources. We will begin to review, interpret, and evaluate what we are learning. We will identify experts. We will begin to compose a glossary.

9.2.1 Monday, 03 September 2018

Read: For our next meeting: Chapter 5 and Chapter 6 of *How We Learn*[3] (pages 80–130)

Discuss: Chapter 3 of *Make It Stick*[2] (pages 46–66).

We will meet in the Hedges Conference Room at 9 a.m. today for a discussion of "Time Management for Academic Success."

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.2.2 Tuesday, 04 September 2018

Read: For our next meeting: Chapter 4 of *Make It Stick*[2] (pages 67–101)

Discuss: Chapter 5 and Chapter 6 of *How We Learn*[3] (pages 80–130)

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.2.3 Wednesday, 05 September 2018

Read: For our next meeting: Chapter 7 and Chapter 8 of *How We Learn*[3] (pages 131–171)

Discuss: Chapter 4 of *Make It Stick*[2] (pages 67–101)

We will meet in the Ringer Dining Room at 9 a.m. today for a discussion of "Well-Being and Self-Care."

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.2.4 Thursday, 06 September 2018

Read: For our next meeting: Chapter 5 of *Make It Stick*[2] (pages 102–130)

Discuss: Chapter 7 and Chapter 8 of *How We Learn*[3] (pages 131–171)

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.2.5 Friday, 07 September 2018

Read: For our next meeting: Chapter 9 and Chapter 10 of *How We Learn*[3] (pages 175–222)

Discuss: Chapter 5 of *Make It Stick*[2] (pages 102–130)

Write: Graded Exercise 1.

Return to calendar.

9.3 Week 2

We will describe several widely used machine learning algorithms. Which algorithms should a beginner study first? For what kinds of problems is each algorithm best suited?

We identify software that developers of machine learning programs use. What kinds of software might we want to use at Cornell College in a future course on machine learning?

9.3.1 Monday, 10 September 2018

Read: For our next meeting: Chapter 6 of *Make It Stick*[2] (pages 131–161)

Discuss: Chapter 9 and Chapter 10 of *How We Learn*[3] (pages 175–222)

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.3.2 Tuesday, 11 September 2018

Read: For our next meeting: Chapter 7 of *Make It Stick*[2] (pages 162–199)

Discuss: Chapter 6 of *Make It Stick*[2] (pages 131–161)

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.3.3 Wednesday, 12 September 2018

Read: For our next meeting: Chapter 8 of *Make It Stick*[2] (pages 200–253)

Discuss: Chapter 7 of *Make It Stick*[2] (pages 162–199)

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.3.4 Thursday, 13 September 2018

Read: Select a chapter from *What to Think About Machines That Think*[1]

Discuss: We will write answers to questions about yesterday's reading together in the classroom.

Write: We will write answers to questions about yesterday's reading together in the classroom.

Return to calendar.

9.3.5 Friday, 14 September 2018

Read: Select a chapter from *What to Think About Machines That Think*[1]

Discuss: We will discuss what the chapters that you and your classmates chose to read.

Write: Graded Exercise 2.

Return to calendar.

9.4 Week 3

9.4.1 Monday, 17 September 2018

Read: Select a chapter from *What to Think About Machines That Think*[1]

Discuss: We will discuss what the chapters that you and your classmates chose to read.

Write: There is no written work due today.

Return to calendar.

9.4.2 Tuesday, 18 September 2018

Read: There is no assigned reading today.

Discuss: We will review what we have learned during the term.

Write: There is no written work due today.

Return to calendar.

9.4.3 Wednesday, 19 September 2018

Read: There is no assigned reading today.

Discuss: There is no discussion scheduled for today.

I will answer any questions that you might have.

Write: Graded Exercise 3.

Return to calendar.

9.4.4 Thursday, 20 September 2018

Block Break We will not meet today.

There is no work due today.

Return to calendar.

9.4.5 Friday, 21 September 2018

Block Break We will not meet today.

There is no work due today.

Return to calendar.

References

[1] John Brockman. *What to Think About Machines That Think: Today's Leading Thinkers on the Age of Machine Intelligence*. Harper Perennial, 2015. ISBN-13: 978-0062425652 / ISBN-10: 006242565X.

[2] Peter C. Brown, Henry L. Roediger III, and Mark A. McDaniel. *Make It Stick: The Science of Successful Learning*. The Belknap Press of Harvard University, Cambridge, MA, 2014. ISBN-13: 978-0674729018 / ISBN-10: 0674729013.

[3] Benedict Carey. *How We Learn: The Surprising Truth About When, Where, and Why It Happens*. Random House Trade, New York, 2015. ISBN-10: 0812984293 / ISBN-13: 978-0812984293.

[4] Emerging Technology from the arXiv. Machine learning predicts World Cup winner. *Technology Review*, June 12 2018. Available online.

[5] Will Knight. The dark secret at the heart of AI. *Technology Review*, April 11 2017. Available online.

[6] Mark McDaniel, Henry L. Roediger III, and Peter C. Brown. Make it stick: Six tips for students. *Psychology Today*, June 11 2014. Available online.

[7] MIT Technology Review Insights. Machine learning: The new proving ground for competitive advantage. *Technology Review*, March 16 2017. Available online.

[8] Russ Roberts and Susan Athey. Susan Athey on machine learning, big data, and causation. *EconTalk*, September 12 2016. Audio podcast available online.

[9] Russ Roberts and Peter Domingos. Peter Domingos on machine learning and the master algorithm. *EconTalk*, May 9 2016. Audio podcast available online.

[10] Russ Roberts and David Gelernter. David Gelernter on consciousness, computers and the tides of the mind. *EconTalk*, November 7 2016. Audio podcast available online.

[11] Russ Roberts and Gary Marcus. Gary Marcus on the future of artificial intelligence and the brain. *EconTalk*, December 15 2014. Audio podcast available online.

[12] Ruslan Salakhutdinov. The promise and limitations of machine learning. *EmTech Conference (MIT Technology Review)*, October 18 2016. Video podcast available online.

[13] SAS. Machine learning: What it is and why it matters. Available online.

[14] Tom Simonite. Machine learning for everyone. *Technology Review*, March 28 2016. Available online.

[15] Amy Willis. Continuing conversation... Gary Marcus on the future of artificial intelligence and the brain. *EconTalk*, December 17 2014. Audio podcast available online.

[16] Amy Willis. Bigger is better? *EconTalk*, September 14 2016. Audio podcast available online.

[17] Amy Willis. Where are you on the spectrum? *EconTalk*, November 9 2016. Audio podcast available online.

[18] Amy Willis. Will YOU trust the algorithm? *EconTalk*, May 11 2016. Audio podcast available online.