

Artificial Intelligence, Automation and the Economy (180.370)
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Johns Hopkins

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Trigger warning: This course may permanently change how you think about what it means to be human.

Course webpage: log in to blackboard.jhu.edu

Lecture: Mon 1:30pm – 4pm in Maryland 114

Office hours: Tue 2:30 – 3:30pm

Teaching Assistant: Kyung Min Kang <kkang15@jhu.edu>

TA office hours: Thu 10 – 11:30am in Greenhouse 120

Course description:

Advances in artificial intelligence and automation have proceeded rapidly in recent years and have reached an inflection point that will have profound implications for the future of mankind.

How does rapid progress in artificial intelligence and automation affect our economy and society? This course analyzes the short- and medium-run implications for unemployment, economic growth, and inequality. It also studies the long-run implications of artificial intelligence rivaling human intelligence.

Learning goals:

At the conclusion of this course, you will be able to:

- assess the implications of the rise of AI for humanity
- evaluate how different sectors of the economy will be affected by automation
- demonstrate your understanding in an in-depth course paper on a specific topic in the field
- devise a plan for how to effectively manage your career in the age of automation and AI

Composition of Grade:

You can choose between two different grading schemes by Feb. 19th. After this date, your choice is final and cannot be updated. For non-econ majors, I recommend that you pick grading scheme B.

Grading Scheme A	Grading Scheme B
24 % Class preparation and participation	30 % Class preparation and participation
20 % Problem sets (10% each)	10 % Problem sets (5% each for participation)
20 % Mid-term quizzes (10 % each)	10 % Mid-term quizzes (5 % each participation)
21 % Course paper	30 % Course paper
15 % Course presentations	20 % Course presentations

There will be no opportunities for extra credit. If at any point during the semester you face circumstances which may prevent you from handing in an assignment, making a presentation and/or

participating in an exam, please contact your TA as soon as possible to discuss ways to manage the situation. There is little that can be done after an unsatisfactory grade has been assigned.

Class Preparation, Attendance, and Participation:

Class participation is an essential part of your learning experience. Each week, I will assign preparatory readings that we will discuss in the following week. Preparing these materials will help you to actively and effectively participate in classroom discussions, which counts for a significant part of your grade.

Regardless of your comfort level with the materials, there are many effective ways to participate in the classroom, including asking good questions or articulating ideas and insights that help others understand better.

Here are some suggestions for effective classroom participation:

- The best contributions are well-formulated analyses or questions that relate directly to the preparatory readings. Look for ways to discuss the questions at hand that help others understand the material and the fundamental concepts behind it.
- If your own understanding of the concepts is a bit murky, you can still participate by presenting some of the key facts in the preparatory readings.
- If engaging in discussion is natural for you, think about ways to make your comments precise, on topic, and helpful for fellow students.
- If you are normally reluctant to engage in classroom discussion, try to push yourself a bit, or discuss with me how to best include you.
- You are expected to be prepared for each lecture by studying the textbook chapters and/or any additional reading materials that are assigned.

Policy on Use of Electronics:

The use of electronics in the classroom is highly discouraged, and laptops are forbidden because they interfere with effective learning (see <https://nyti.ms/2hVMrVo>).

If you need to use your smartphone, please step outside the classroom – you are welcome to do so for urgent matters and do not need to excuse yourself.

Problem Sets:

There will be two short problem sets, which will be due *at the beginning of class* on 2/19 and 4/9. The problem sets will help you to digest the materials covered in class and will be useful in preparing for the quizzes. You are allowed to collaborate in teams of up to four students. If you do so, then please list at the beginning of the problem set who the other members of your team were. Nonetheless, you are responsible for handing in your own assignment and will be graded solely on what you hand in yourself.

Mid-term Quizzes:

There will be two quizzes on 2/26 and 4/16. Each quiz will cover the materials (including preparatory readings) of the three preceding classes.

Course Presentations:

In weeks 6 & 7 of the semester (Mar 5 & 12), we will organize student group presentations on how different sectors and areas of the economy are revolutionized by AI. We will ask you to start forming groups with like-minded classmates in week 2 (Feb 5), with the objective of having finalized the assignment by the beginning of week 3. Each group should consist of 2 – 4 students.

After picking your topic and forming a group, please proceed as follows:

(i) identify sources on which you can base your research – I am happy to assist you in finding relevant materials, and you can include e.g. materials from the books in our reading list

(ii) create draft slides for the team (in a single file), which we shall discuss in office hours during the week of Feb 26

(iii) present your findings to the entire class on Mar 5 and 12 – each person is expected to speak for about 7 – 8 minutes

Your presentation will be grade based on the following factors (points indicated for Grading Scheme A):

6 pt: Depth of preparation (explanation of mechanisms, multitude of sources)

3 pt: Quality of slides and preparedness

3 pt: Coordination among team members

3 pt: Timing (stay within 7 – 8min range per team member)

Course Paper:

At the end of the semester, each student is expected to submit a course paper (individual work) that focuses on a topic related to the course. An excellent choice of topic would be to analyze the implications of artificial intelligence for your chosen career path. Alternatively, you can build on the topic that you presented during the group presentations, or choose a different topic. To be sure, please confirm the topic you choose with me by 3/26 and tell me about the sources that you plan to draw on.

The paper should be about 4000 – 5000 words long (about 8 to 10 pages using standard formatting), and should arrive at actionable solutions to the extent possible, for example by providing original suggestions for how to prepare yourself for a successful career in the age of AI.

The suggested due date for the course paper is our last class meeting on Apr 30. However, I will accept submissions until May 10 at 12pm (final deadline) without subtracting points. Any submission received after that will lose 25% of the points if submitted within the first 24 hrs of the deadline, 50% if submitted within 48 hrs, 75% if submitted within 72 hours, and will receive a zero grade if submitted later than that.

Medical Excuses and Religious Holidays:

Students or a guardian must email me *prior* to class to inform me if they will miss a class assignment, presentation, quiz, or other deadline due to illness or injury. In the very next class session that you are in attendance, please present me with written documentation of your illness/injury (a copy of your medical notes is acceptable). If you do not inform me or if you do not present me with timely

documentation, you will obtain zero points for the missed assignment. If you are unable to meet a deadline due to a religious holiday, make sure to notify me as early in the semester as possible.

If you will have to miss a class for an excused reason as per university policy (religious holiday or illness), please notify me by email as soon as you find out about the circumstance that will prevent you from attending.

Disability Services:

Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu.

Make sure to hand in this letter at the beginning of the semester so we can plan in advance how to accommodate your needs. Unsatisfactory grades cannot be changed retroactively.

Academic Integrity:

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.

In addition, there are two specific ethics guidelines for the course:

- (1) In problem sets, you are allowed to collaborate in teams of up to four students. If you do so, you must list at the beginning of the problem set who the other members of your team are.
- (2) In your course paper, make sure to avoid any form of plagiarism. In particular, cite the resources that you draw on. Do not use any of your sources verbatim, except if you explicitly quote up to two sentences "in quotation marks."

Report any violations you witness to the instructor. You may also consult the associate dean of student affairs and/or the chairman of the Ethics Board beforehand. See the guide on "Academic Ethics for Undergraduates" and the Ethics Board Web site (<http://ethics.jhu.edu>) for more information.

Course Evaluations:

At the end of the semester, please let me know what you liked and what you disliked about this class. I really appreciate your feedback – incorporating your suggestions will help me to improve the course for future generations of students.

Tentative course outline:

What is Intelligence? (Weeks 1 – 2, Jan. 29 and Feb. 5)

- First take: how can you prepare for a successful career in the age of AI?
- What is Intelligence? What is AI?
- What makes us humans special? For how long will we be special?
- What is the role of intelligence in evolution?
- Recent trends
- Singularity & potential scenarios for the future
- What are we to do about it?

History and Implications for Macroeconomics, Labor markets & Inequality (Weeks 3 – 5, Feb 12 – 26):

Guest speaker on 2/26: Andy Berg, PhD, IMF Economist

- History of technological progress and automation
- Recent labor market developments
- Digitization and the superstar phenomenon
- Technological progress and growth
- Effects on labor markets and inequality
- Broader perspective: which are the scarce factors?
- Are these changes economically efficient?
- What are we to do about it?

Student Group Presentations (Week 6 & 7, Mar 5 & 12): Sectors and Areas Revolutionized by AI:

Pick a sector and provide us with an overview, for example:

- Financial markets (algorithmic trading, ...)
- Transportation (driverless cars, ...)
- Medicine
- Education
- Cryptocurrency
- ...
- [pick your own, subject to my approval]

Inequality, Redistribution and Subsistence Income (Week 8, Mar 26):

- redistributive policies to replace income
- broader issues: deriving meaning & dignity from work
- subsistence income
- the return of Malthus
- What are we to do about it?

Artificial Intelligence, the Human Brain, and Consciousness (Week 9, Apr 2):

Guest speaker on 4/2: Sister Ilia Delio, OSF, PhD

- effects of AI on our brains and minds
- from homo sapiens to techno sapiens

- AI and the nature of consciousness

The Future of Humanity and Artificial Intelligence (Weeks 10 – 12, Apr 9 – 23):

Guest speaker on 4/9: Pablo Winant, PhD, AI researcher

- Scarcity of resources
- Role of competition in evolution
- Cyber warfare
- Life 3.0
- What are we to do about it?

Conclusions (Week 13, Apr 30): What are we to do?

- Getting Ready for the Age of AI

Reading List:

Books:

(*)Barrat, James (2013), *Our Final Invention: Artificial Intelligence and the End of the Human Era*, Thomas Dunne Books.

(*)Bostrom, Nick (2014), *Superintelligence: Paths, Dangers, Strategies*, Oxford University Press.

(*)Brynjolfsson, Erik and Andrew McAfee (2015), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W.W. Norton.

Domingos, Pedro (2015), *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World*, Basic Books.

Gordon, Robert (2016), *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War*, Princeton University Press.

Ford, Martin (2015), *Rise of the Robots: Technology and the Threat of a Jobless Future*, Basic Books.

Harari, Yuval Noah (2017), *Homo Deus: A Brief History of Tomorrow*, Harper.

Kaplan, Jerry (2015), *Humans Need Not Apply: A Guide to Wealth and Work in the Age of Artificial Intelligence*, Yale University Press.

Kurzweil, Ray (2005), *The Singularity Is Near: When Humans Transcend Biology*, Viking.

Moravec, Hans (1988), *Mind Children: The Future of Robot and Human Intelligence*, Harvard University Press.

(*)Tegmark, Max (2017), *Life 3.0: Being Human in the Age of Artificial Intelligence*, Knopf.

Academic Articles:

Autor, David (2014), "Why Are There Still So Many Jobs? The History and Future of Workplace Automation," *Journal of Economic Perspectives* 29(3), pp. 3-30.

Berg, Andrew, Edward F. Buffie, and Luis-Felipe Zanna (2017), "Robots, Growth, and Inequality: Should We Fear the Robot Revolution? (The Correct Answer is Yes)," forthcoming, *IMF Working Paper*.

Freeman, Richard B. (2015), "Who Owns the Robots Rules the World," *IZA World of Labor*.

(*)Frey, Carl Benedikt, and Michael A. Osborne (2013), "The Future of Employment: How Susceptible Are Jobs to Computerisation?" Oxford University paper.

Keynes, John Maynard (1930), "Economic Possibilities for our Grandchildren," in *Essays in Persuasion*, Harcourt Brace, pp. 358-373.

Korinek, Anton and Joseph Stiglitz (2017), "Artificial Intelligence and Its Implications for Income Distribution and Unemployment," NBER Working Paper w24174.

(*)Alan M. Turing (1950), "Computing Machinery and Intelligence," *Mind* 59(236), pp. 433-460.

Reports:

Bureau of Labor Statistics (2017):

Industry Output and Employment Projections https://www.bls.gov/emp/ep_data_industry_out_and_emp.htm

Occupational Employment Projections https://www.bls.gov/emp/ep_data_occupational_data.htm

McKinsey Global Institute (2017), "What the future of work will mean for jobs, skills, and wages,"

November: <https://www.mckinsey.com/global-themes/future-of-organizations-and-work/what-the-future-of-work-will-mean-for-jobs-skills-and-wages>

World Economic Forum (2016), "The Future of Jobs," Davos: Global Challenge Insight Report:

<http://reports.weforum.org/future-of-jobs-2016/>