CS 3001-C: Computing, Society, and Professionalism

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Week 14: Future of Work, Automation, and Predictive Technologies

April 10, 2023

Notable Achievements in AI since 1995

- Computer-controlled minivan "drove" on freeways across USA in 1995

- IBM supercomputer Deep Blue defeated chess champion Gary Kasparov in 1997

- Honda's ASIMO android can climb and descend stairs and respond to human gestures and postures

- Electrolux introduced robotic vacuum cleaner in 2001

- Five autonomous vehicles successfully completed 128-mile course in Nevada desert in 2005

- Watson trounced two most successful human *Jeopardy!* champions in 2011

Stanley, the Autonomous Vehicle

Watson Wins *Jeopardy!* Challenge

HEALTH AND SCIENCE

Google's DeepMind A.I. beats doctors in breast cancer screening trial

PUBLISHED THU, JAN 2 2020·8:13 AM EST

David Reid
@DAVYREID73

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KEY POINTS

- Anonymous scans of 29,000 women were used in the trial.

- The biggest improvements over human scanning was found in the U.S. portion of the study.

- Google-owned DeepMind has already used AI to read eye scans and spot neck cancer.

venturebeat.com/2020/03/03/how-people-are-using-ai-to-detect-and-fight-the-coronavirus/

AI

How people are using AI to detect and fight the coronavirus

KHARI JOHNSON   @KHARIJOHNSON   MARCH 3, 2020 12:49 PM

UVD disinfectant robot spreads ultraviolet rays in hospitals to kill bacteria and viruses

wired.com/story/chinese-hospitals-deploy-ai-help-diagnose-covid-19/

WIRED

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TOM SIMONITE   BUSINESS   02.26.2020 07:00 AM

Chinese Hospitals Deploy AI to Help Diagnose Covid-19

Software that reads CT lung scans had been used primarily to detect cancer. Now it's retooled to look for signs of pneumonia caused by coronavirus.

AMA

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ChatGPT passed the USMLE. What does it mean for med ed?

MAR 3, 2023 • 4 MIN READ

Jennifer Lubell
Contributing News Writer

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The medical field is keeping a close eye on ChatGPT (Generative Pretrained Transformer), a large language model developed by OpenAI that leverages huge amounts of data to mimic human conversation and assess language patterns.

Class Discussion 1

- How do we evaluate which AI based automations are worthwhile?

  - IBM Watson winning the Jeopardy Challenge

  - Google AI beating radiologists in cancer diagnosis

  - AI use in China to detect symptoms relating to COVID-19

  - ChatGPT passing the USMLE exam

- Discuss what societal benefits such technology can have. Does it pose any risks?

Business Impact
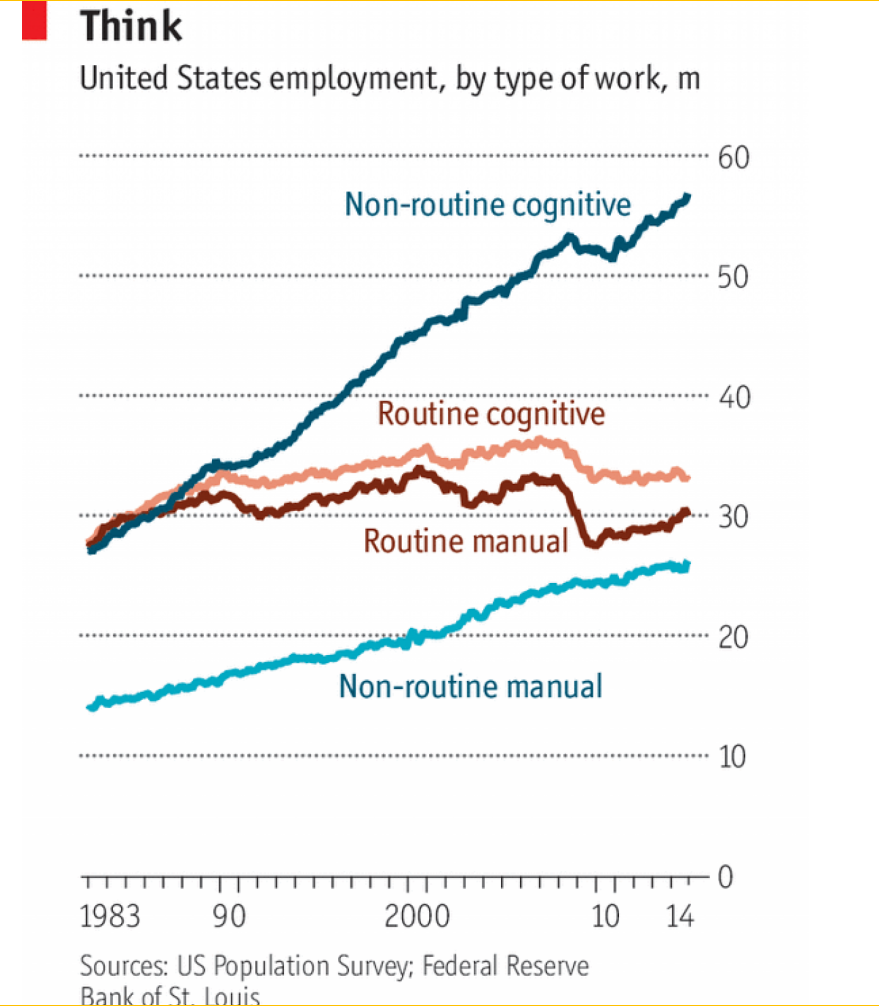
How Technology Is Destroying Jobs

Automation is reducing the need for people in many jobs. Are we facing a future of stagnant income and worsening inequality?

by David Rotman   June 12, 2013
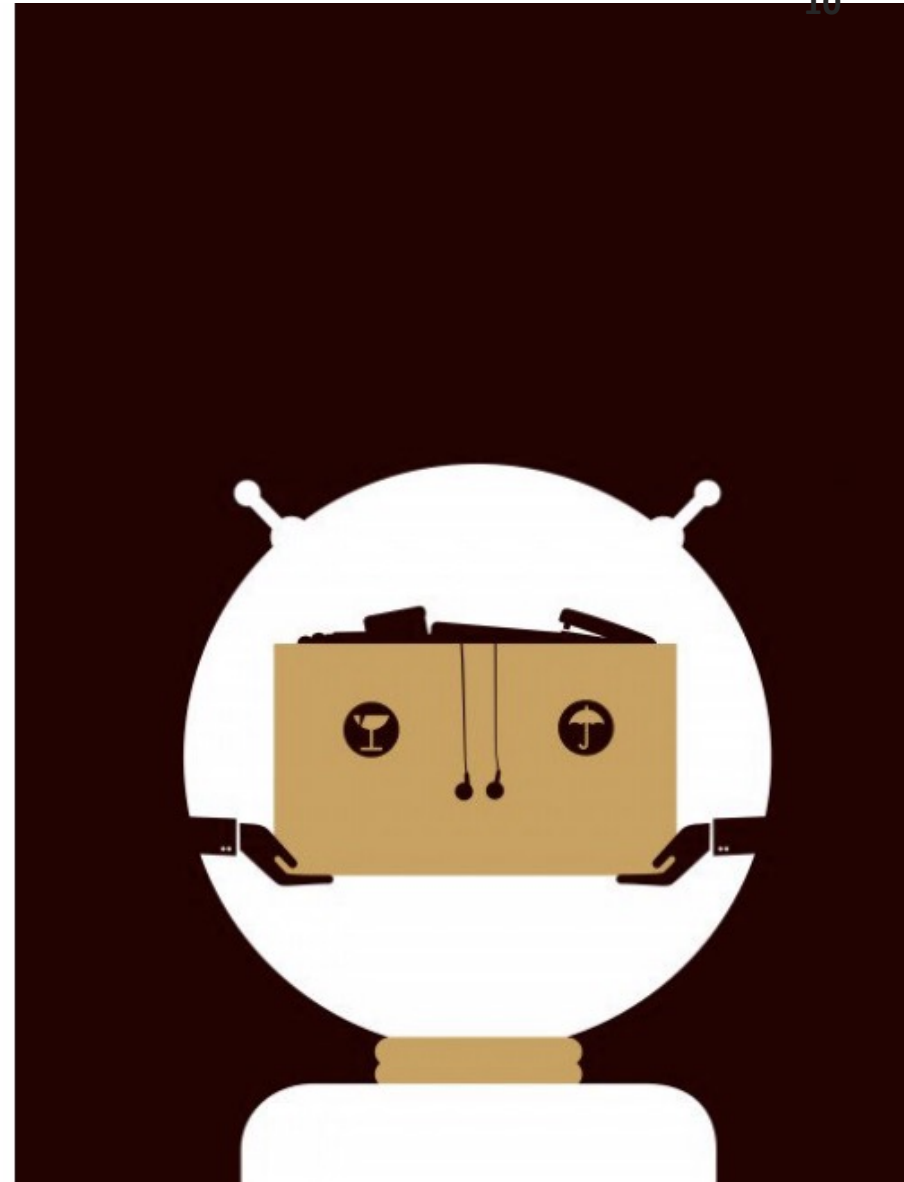
AUTOMATION HAS BEEN CHANGING THE JOB LANDSCAPE FOR MANY YEARS

- Over many decades:
  - Routine jobs (manual or cognitive) have declined.
  - Only non-routine jobs have continued to grow. (Source: Economist)
- Now: The most famous study on Job Loss and AI, by Carl Frey and Michael Osbourne, predicts that 47% of the workforce is in danger.

Think

United States employment, by type of work, m

Non-routine cognitive

Routine cognitive

Routine manual

Non-routine manual

1983   90   2000   10   14

Sources: US Population Survey; Federal Reserve Bank of St. Louis

Economist

WHAT JOBS ARE IN DANGER

- **Previous trends**: high skill and low skill were safe, mid skill has been cut by automation.

- **New Danger is regardless of level**: All logistics, transport, taxi, office support, security people, telemarketing, accounting, auditors, tech writers.

- **Industry Areas Most Effected**: Accommodation/Hospitality, Food Service, Manufacturing, Agriculture, Transportation, Warehousing, Retail, Mining, and Construction

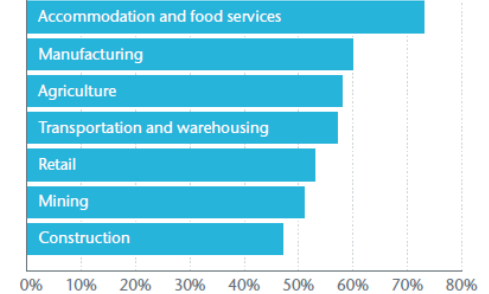Sources: Frey, Osbourne, and US Dept. of Labor

Catalogue of fears
Probability of computerisation of different occupations, 2013
(1 = certain)

Job	Probability
Recreational therapists	0.003
Dentists	0.004
Athletic trainers	0.007
Clergy	0.008
Chemical engineers	0.02
Editors	0.06
Firefighters	0.17
Actors	0.37
Health technologists	0.40
Economists	0.43
Commercial pilots	0.55
Machinists	0.65
Word processors and typists	0.81
Real-estate sales agents	0.86
Technical writers	0.89
Retail salespeople	0.92
Accountants and auditors	0.94
Telemarketers	0.99

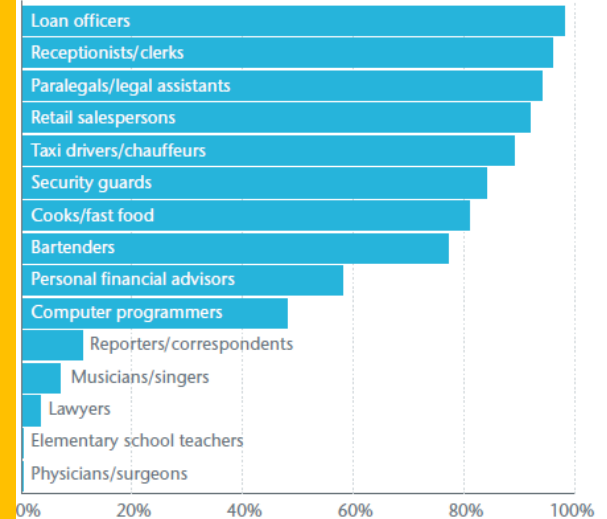Source: "The Future of Employment: How Susceptible are Jobs to Computerisation?", by C. Frey and M. Osborne (2013)
Economist.com

Automation Potential by Industry

Accommodation and food services
Manufacturing
Agriculture
Transportation and warehousing
Retail
Mining
Construction

Source: U.S. Bureau of Labor Statistics, McKinsey Global Institute analysis

Jobs at Risk of Automation

Loan officers
Receptionists/clerks
Paralegals/legal assistants
Retail salespersons
Taxi drivers/chauffeurs
Security guards
Cooks/fast food
Bartenders
Personal financial advisors
Computer programmers
Reporters/correspondents
Musicians/singers
Lawyers
Elementary school teachers
Physicians/surgeons

47 % of U.S. jobs are at risk of being replaced by AI technologies and computerization

Some recent comments

> **Elon Musk** ✔
> @elonmusk
>
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>
> Nothing will affect the future of humanity more than digital super-intelligence. Watch Chris Paine's new AI movie for free until Sunday night at doyoutrustthiscomputer.org/watch
>
> 12:55 AM - 6 Apr 2018
>
> 16,482 Retweets   52,488 Likes
>
> 2.3K   16K   52K

WaPo: Elon Musk, the billionaire inventor and Tesla chief executive — who believes artificial intelligence could help trigger the next world war — has issued another severe warning about how super-intelligent machines could come to dominate the world. Those super computers could become "an immortal dictator from which we would never escape," Musk passionately warns in the new documentary "Do You Trust This Computer?"

The New York Times

Opinion

Andrew Yang: Yes, Robots Are Stealing Your Job

Self-driving trucks will be great for the G.D.P. They'll be terrible for millions of truck drivers.

By Andrew Yang

Mr. Yang is a Democratic candidate for president.
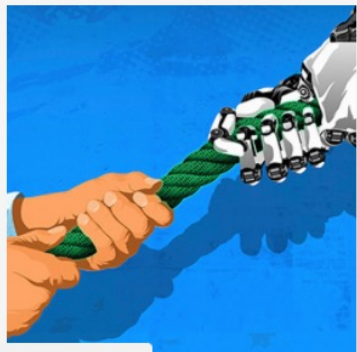
Nov. 14, 2019

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the bmj

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Head To Head

Could artificial intelligence make doctors obsolete?

BMJ talk medicine
HAL will see you now

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0:48   33:23

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Linked patient commentary

Stop hyping artificial intelligence—patients will always need human doctors

COMMENT · 06 APRIL 2018

People must retain control of autonomous vehicles

Legislation on the testing of self-driving cars does not address liability and safety concerns, warn Ashley Nunes, Bryan Reimer and Joseph F. Coughlin.

Ashley Nunes ✉, **Bryan Reimer &** **Joseph F. Coughlin**

Driverless vehicles are being tested on public roads in a number of countries.   Credit: Prostock/Getty

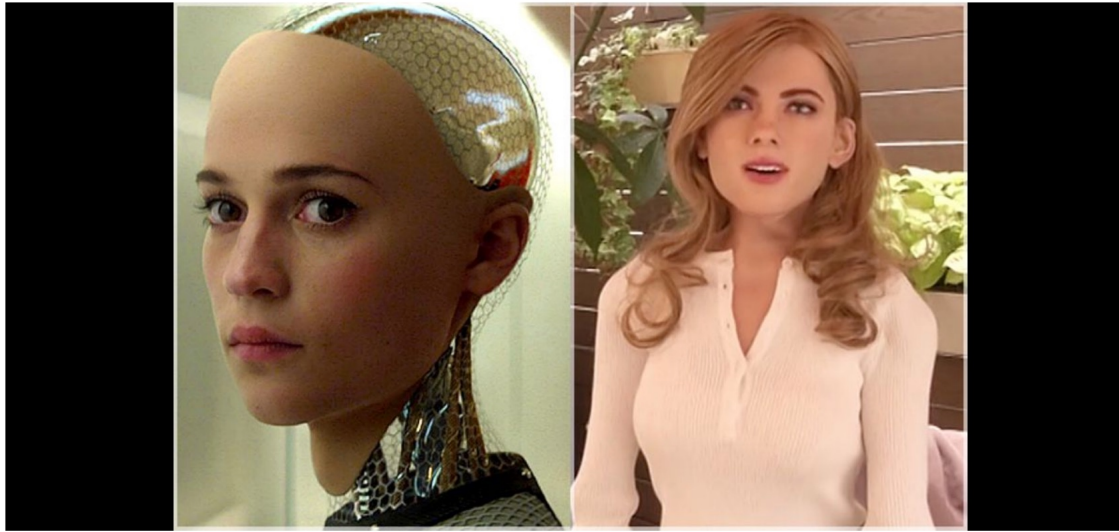PDF version

RELATED ARTICLES

Reboot for the AI revolution

Technology: Use or lose our navigation skills

Autonomous vehicles: No drivers required

Alicia Vikander in "Ex Machina," Scarlett Johansson Robot   (Credit: Universal Pictures)

From Siri to sexbots: Female AI reinforces a toxic desire for passive, agreeable and easily dominated women

From telephone operators to the ScarJo robot, tech's female voice has little to do with empowerment [UPDATED]

[f] 18 [messenger] [twitter] [reddit] [email] [+] 7

JENNIFER SEAMAN COOK
04.08.2016 • 7:00 PM

This story has been corrected since it was originally published.

A recent article titled "Why is AI Female?" made the connection that gendered labor, in service professions in particular, is fueling our expectations for gendered AI assistants and service robots. Furthermore, the author argues, this "feminizing — and sexualizing — of machines" signals a future with a disproportionate use of feminized VR and robots for a male-dominated sex industry. Monica Nickelsburg writes:

> "Sex with robots is a big leap from asking Siri to set an alarm, but the fact that we've largely equated artificial intelligence with female personalities is worth examining. There are, after all, few sexualized male robots or avatars."

Discussion Point 2: Is it wrong to create machines capable of making human labor obsolete? Contrast Kantian and act utilitarian perspectives.

THE ERRORS IN JOB REPLACEMENT LOGIC

- Every machine that replaces a job also creates new work.

- In many cases, we need AI to scale productivity to efficiently meet needs, like healthcare.

- Displaced jobs cause economic growth which creates new demands that are hard to predict.

- Historically, those places that automated increased their efficiency, and actually had very low unemployment rates

A MODIFIED ARGUMENT

- The First Industrial Revolution already replaced repetitive "manual" functions

- Now AI can replace all repetitive "cognitive" functions

- Compare with historic job destruction:
  - Average worker was replaced.
  - New job functions were to "design" the machine, and operate the "machine"

- Most places that automated had higher employment than before.

- Safest jobs*: (simplest argument)
  - Creating the AI machines
  - Operating and developing/designing the process for them to run.
  - Any managing function of people becomes managing of AI tools. *Jobs least likely to be replaced by AI.

Economists and historians claim that job disruption actually helped the economies that participated.

One Caveat: The McKinsey Global Institute estimates that, compared with the Industrial Revolution of the late 18th and early 19th centuries, AI's disruption of society is happening ten times faster and at 300 times the scale.

Reference: Do we understand the impact of artificial intelligence on employment? | Bruegel

Textile vs Hand weaving: During the 19th century, amount of cloth a single weaver in America could produce = 50X gain. Labor required fell by 98%. Result: cloth became cheaper, demand greater, 4X more jobs were created in the same sector.

Auto vs Horse-based transportation: This led to a decline in horse-related jobs. However, the automobile industry itself grew fast. Jobs were also created in different sectors, e.g. motel and fast-food industries that arose to serve motorists and truck drivers.

ATM Machines at Banks: Automated teller machines (ATMs) reduce the number of bank clerks (20/bank in 1988 to 13/bank in 2004) by taking over some of their routine tasks. However, bank branches grew in numbers by 43% and total employees grew.

Only 9% of jobs are at risk of being fully replaced. Majority of jobs to be amplified by AI.

But is job amplification with AI going to be easy? What problems might it raise?

Rise of Robot Radiologists

Deep-learning algorithms are peering into MRIs and x-rays with unmatched vision, but who is to blame when they make a mistake?

By Sara Reardon

tificial intelligence—for natural-language processing. But she had been looking for a new line of research and decided to team up with radiologists to develop machine-learning algorithms that use computers' superior visual analysis to spot subtle patterns in mammograms that the human eye might miss.

Over the next four years the team taught a computer program to analyze mammograms from about 32,000 women of different ages and races and told it which women had been diagnosed with cancer within five years of the scan. They then tested the computer's matching abilities in 3,800 more patients. Their resulting algorithm, published last May in *Radiology*, was significantly more accurate at predicting cancer—or the absence of cancer—than practices generally used in clinics. When Barzilay's team ran the program on her own mammograms from 2012—ones her doctor had cleared—the algorithm correctly predicted she was at a higher risk of developing breast cancer within five years than 98 percent of patients.

AI algorithms not only spot details too subtle for the human eye to see. They can also develop entirely new ways

"AI won't replace radiologists, but radiologists who use AI will replace radiologists who don't," Curtis Langlotz, radiologist at Stanford

Treading with caution

Attention to noise, bias, and "provenance" — broadly, where did data arise, what inferences were drawn from the data, and how relevant are those inferences to the present situation?
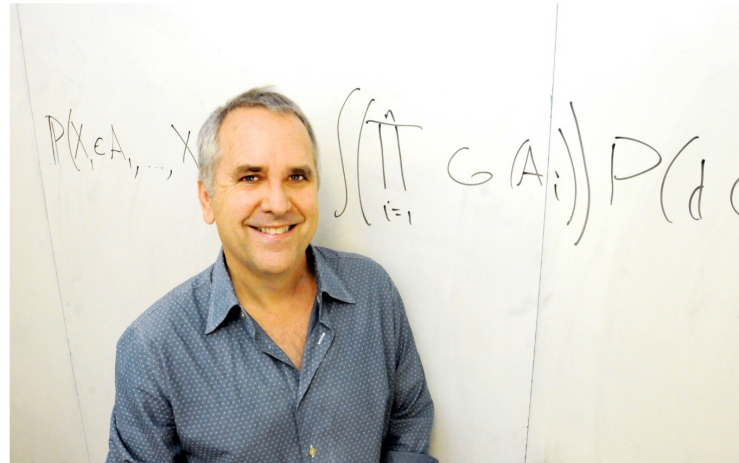

Photo credit: Peg Skorpinski

Artificial Intelligence — The Revolution Hasn't Happened Yet

Michael Jordan Follow
Apr 19, 2018 · 16 min read

Artificial Intelligence (AI) is the mantra of the current era. The phrase is intoned by technologists, academicians, journalists and venture capitalists alike. As with many phrases that cross over from technical academic fields into general circulation, there is significant misunderstanding

Detecting influenza epidemics using search engine query data

Jeremy Ginsberg, Matthew H. Mohebbi ✉, Rajan S. Patel, Lynnette Brammer, Mark S. Smolinski & Larry Brilliant
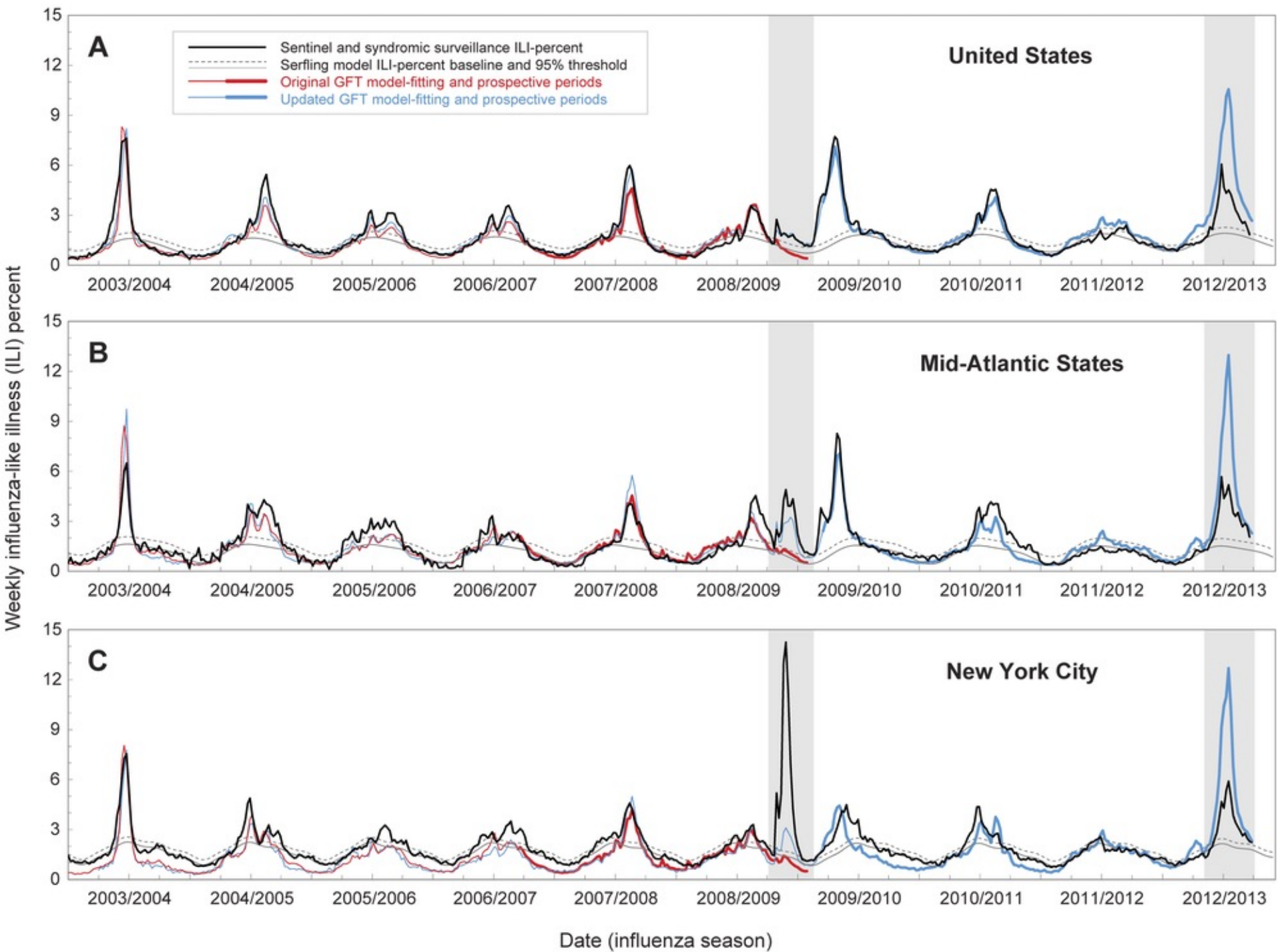
> ⓘ This article has been updated

Abstract

Seasonal influenza epidemics are a major public health concern, causing tens of millions of respiratory illnesses and 250,000 to 500,000 deaths worldwide each year[1]. In addition to seasonal influenza, a new strain of influenza virus against which no previous immunity exists

A United States

B Mid-Atlantic States

C New York City

Legend:
- Sentinel and syndromic surveillance ILI-percent
- Serfling model ILI-percent baseline and 95% threshold
- Original GFT model-fitting and prospective periods
- Updated GFT model-fitting and prospective periods

Y-axis: Weekly influenza-like illness (ILI) percent

X-axis: Date (influenza season)

Seasons: 2003/2004, 2004/2005, 2005/2006, 2006/2007, 2007/2008, 2008/2009, 2009/2010, 2010/2011, 2011/2012, 2012/2013

PLOS COMPUTATIONAL BIOLOGY

Reassessing Google Flu Trends Data for Detection of Seasonal and Pandemic Influenza: A Comparative Epidemiological Study at Three Geographic Scales

Donald R. Olson ✉, Kevin J. Konty, Marc Paladini, Cecile Viboud, Lone Simonsen

Article	Authors	Metrics	Comments	Media Coverage
⌄				

Abstract

The goal of influenza-like illness (ILI) surveillance is to determine the timing, location and magnitude of outbreaks by monitoring the frequency and progression of clinical case incidence. Advances in computational and information technology have allowed for automated collection of higher volumes of electronic data and more timely analyses than previously possible. Novel surveillance systems, including those based on internet search query data like Google Flu Trends (GFT), are being used as surrogates for clinically-based reporting of influenza-like-illness (ILI). We investigated the reliability of GFT during the last decade (2003 to 2013), and compared weekly public health surveillance with search query data to characterize the timing and intensity of seasonal and pandemic influenza at the national (United States), regional (Mid-Atlantic) and local (New York City) levels. We identified substantial flaws in the original and updated GFT models at all three geographic scales, including completely missing the first wave of the 2009 influenza A/H1N1 pandemic, and greatly overestimating the intensity of the A/H3N2 epidemic during the 2012/2013 season. These results were obtained for both the original (2008) and the updated (2009) GFT algorithms. The performance of both models was

POLICY FORUM | BIG DATA

The Parable of Google Flu: Traps in Big Data Analysis

DAVID LAZER , RYAN KENNEDY, GARY KING, AND , ALESSANDRO VESPIGNANI   Authors Info & Affiliations

GET ACCESS

Abstract

In February 2013, Google Flu Trends (GFT) made headlines but not for a reason that Google executives or the creators of the flu tracking system would have hoped. *Nature* reported that GFT was predicting more than double the proportion of doctor visits for influenza-like illness (ILI) than the Centers for Disease Control

Big data hubris

Algorithmic Dynamics

It's Not Just About Size of the Data

danah boyd & Kate Crawford

CRITICAL QUESTIONS FOR BIG DATA
Provocations for a cultural, technological, and scholarly phenomenon

The era of Big Data has begun. Computer scientists, physicists, economists, mathematicians, political scientists, bio-informaticists, sociologists, and other scholars are clamoring for access to the massive quantities of information produced by and about people, things, and their interactions. Diverse groups argue about the potential benefits and costs of analyzing genetic sequences, social media interactions, health records, phone logs, government records, and other digital traces left by people. Significant questions emerge. Will large-scale search data help us create better tools, services, and public goods? Or will it usher in a new wave of privacy incursions and invasive marketing? Will data analytics help us understand online communities and political movements? Or will it be used to track protesters and suppress speech? Will it transform how we study human communi-