

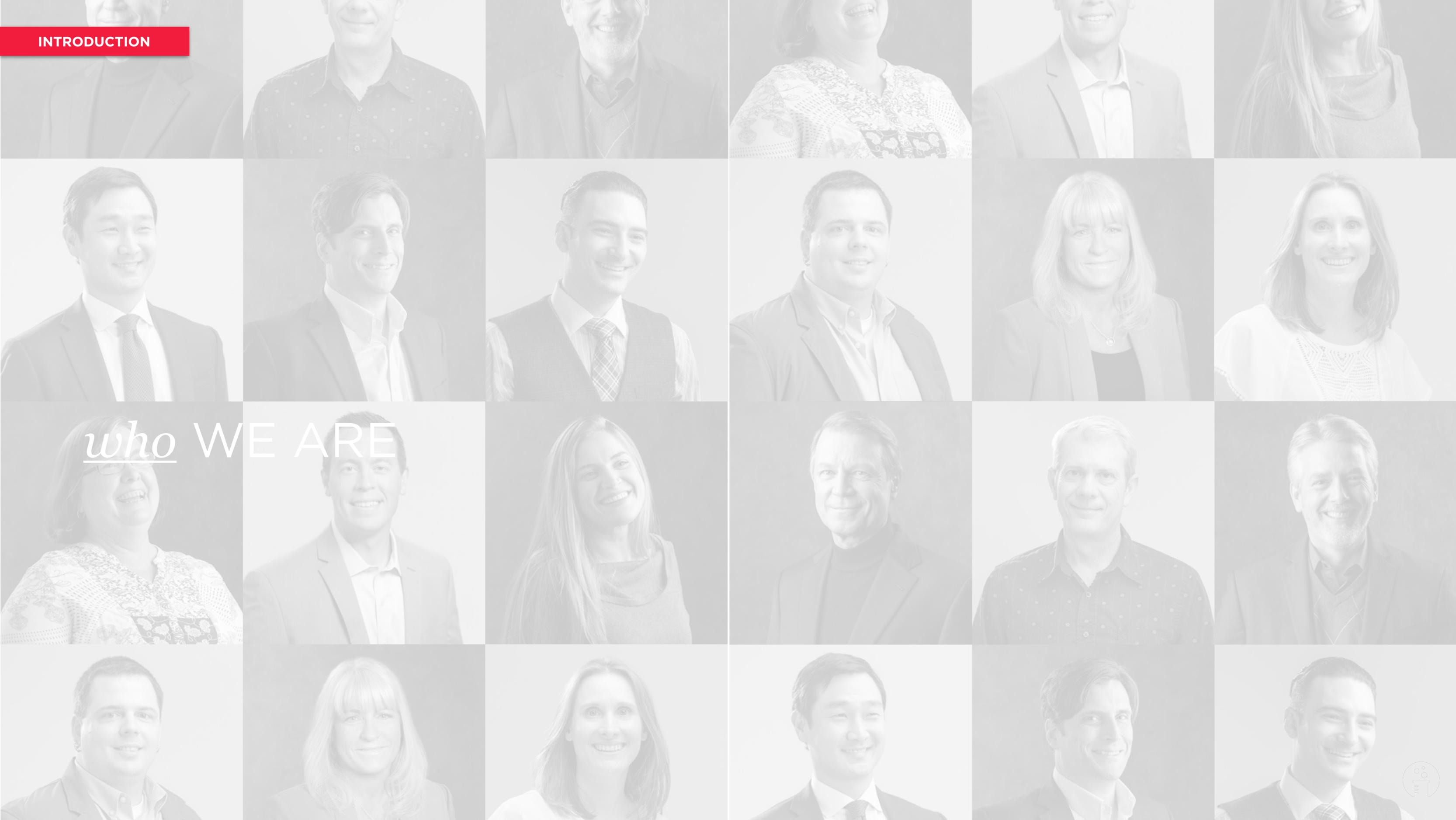
# ARTIFICIAL INTELLIGENCE *and* MACHINE LEARNING *in* HEALTHCARE



MAY 19, 2017



INTRODUCTION



*who* WE ARE



# the AUTHOR



## NEAL EVANS, PH.D.

EXECUTIVE VICE-PRESIDENT/CHIEF TECHNOLOGY OFFICER

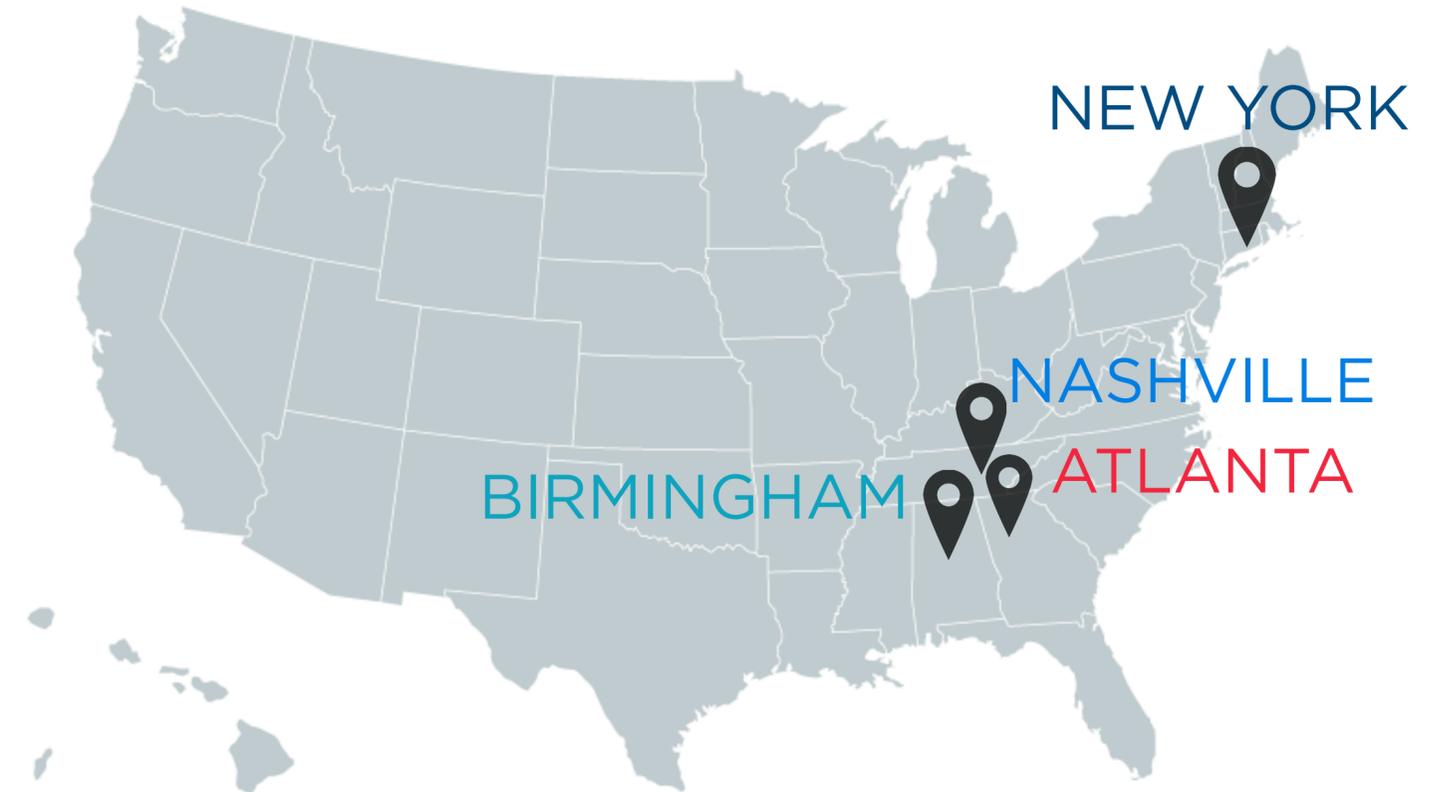
Neal Evans, Ph.D., is chief technology officer and executive vice-president at PointClear Solutions. His interests include artificial intelligence, computational physics, and evolutionary algorithms. His contributions range from the theoretical to the practical, including advances in machine learning, physics, and theoretical optics, and application of these concepts to health informatics. He is a member of the American Physical Society (APS), the Optical Society of America (OSA), and the International Society for Optics and Photonics (SPIE). He has published in scientific journals and books. Neal is a former board member of the A.G. Gaston Boys & Girls Club and volunteers for Carpenter's Hands in Birmingham, Alabama.



# about POINTCLEAR SOLUTIONS

PointClear strategically designs, builds and manages the world's best performing healthcare software and mobile applications. Apps that achieve technology, business and healthcare goals. Solutions that address unsolved or under-solved problems in new, user-friendly ways.

Let's transform Value-based health care together.



SINCE  
**2006**

AWARD WINNING



FULL SERVICE  
IDEA *to*  
IMPLEMENTATION

EXCEPTIONAL  
*talent*

PROVEN APPROACH  
**UX &**  
agile



# our AGENDA

## 1. INTRODUCTION TO AI AND ML

Provide a general introduction to AI and ML for the uninitiated.

## 2. AI AND ML IN HEALTHCARE

How are AI and ML being used in healthcare? What are the possibilities? What are the risks?

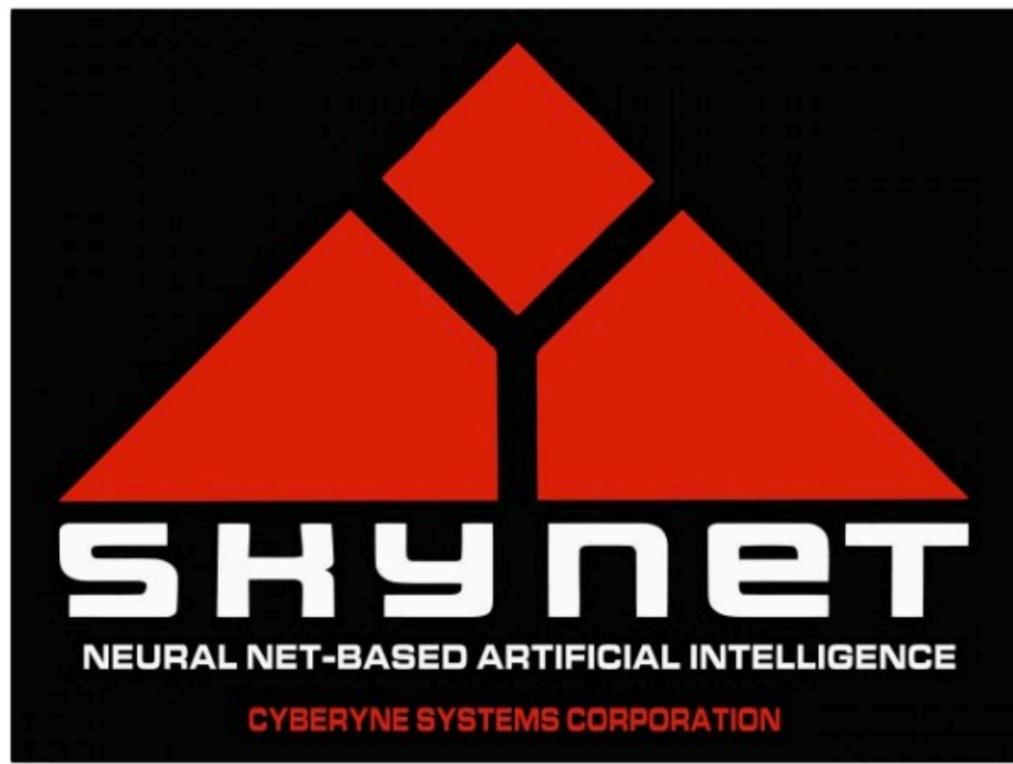
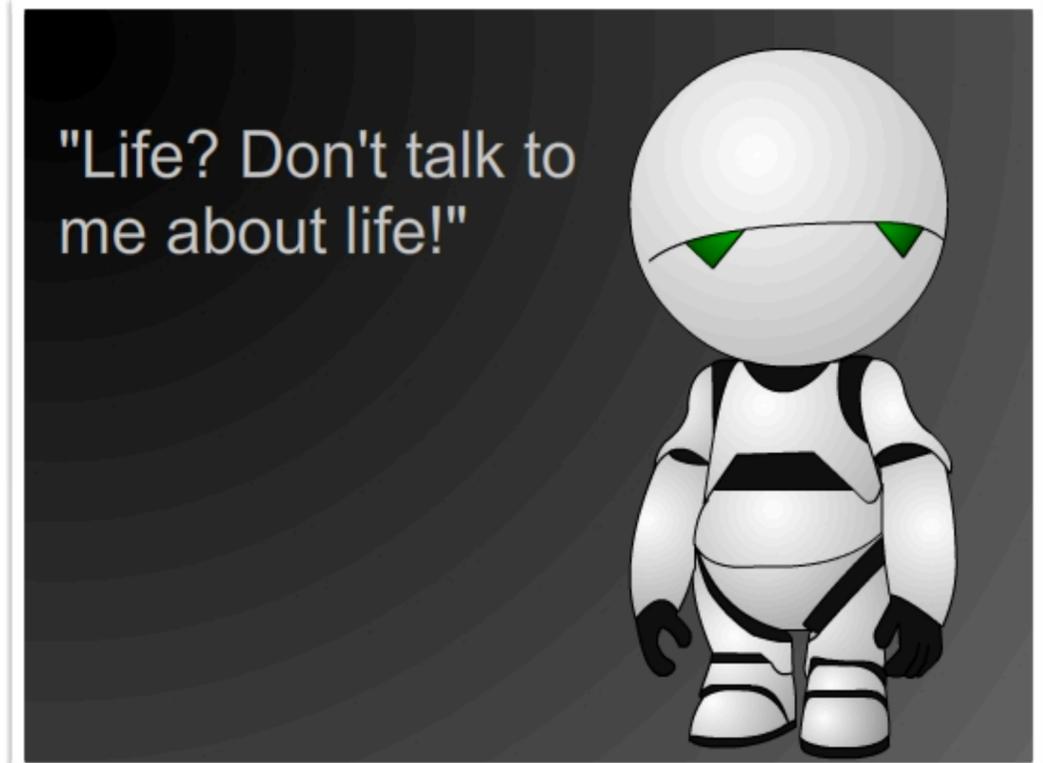
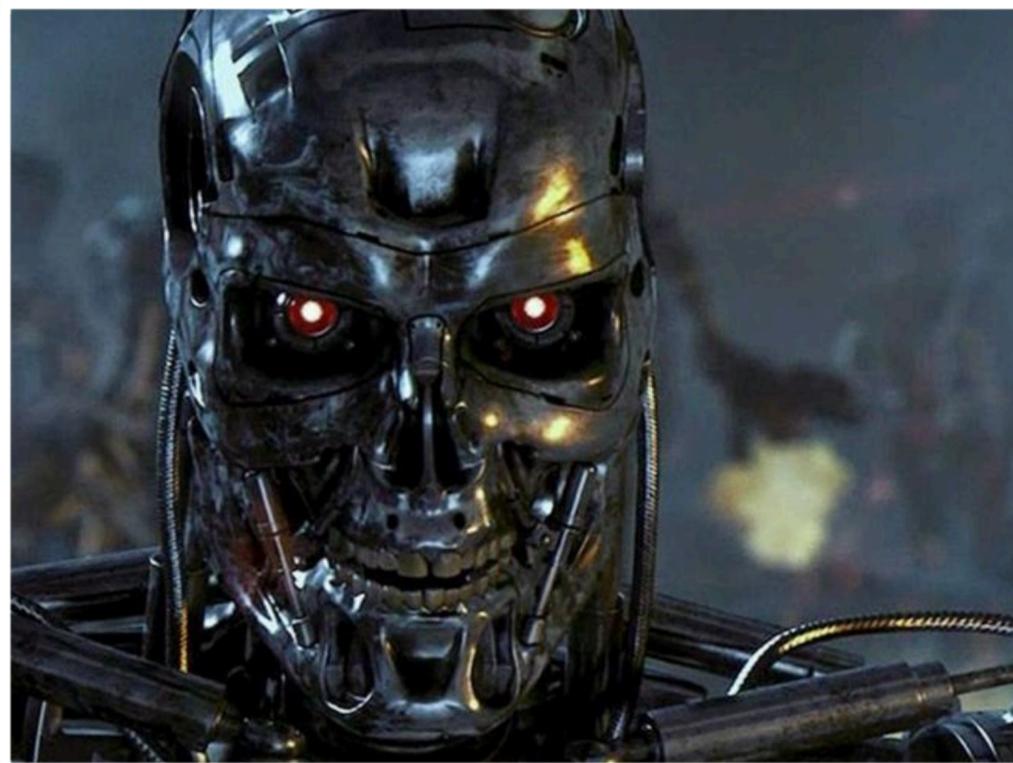
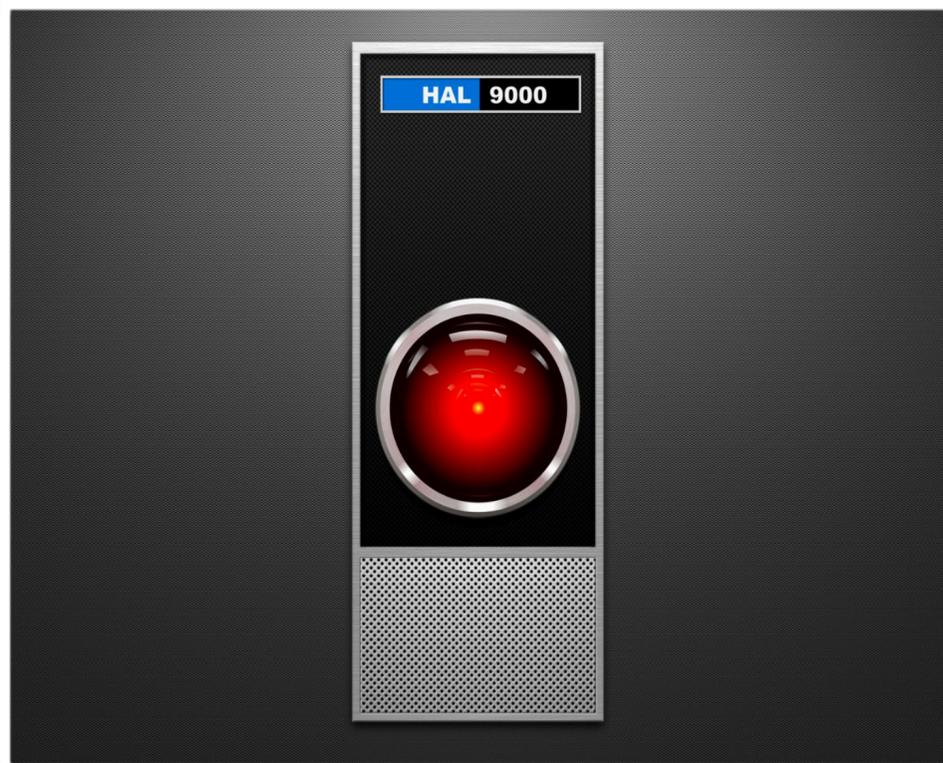
## 3. AI AND ML FOR CONTESSA HEALTH

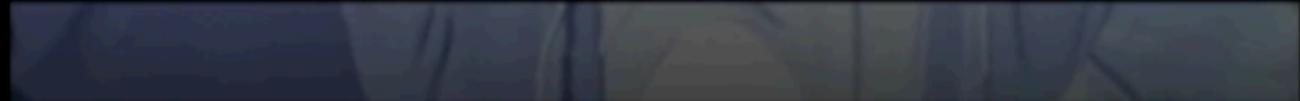
Would AI and ML benefit Contessa and your customers?



# *what* IS ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING?



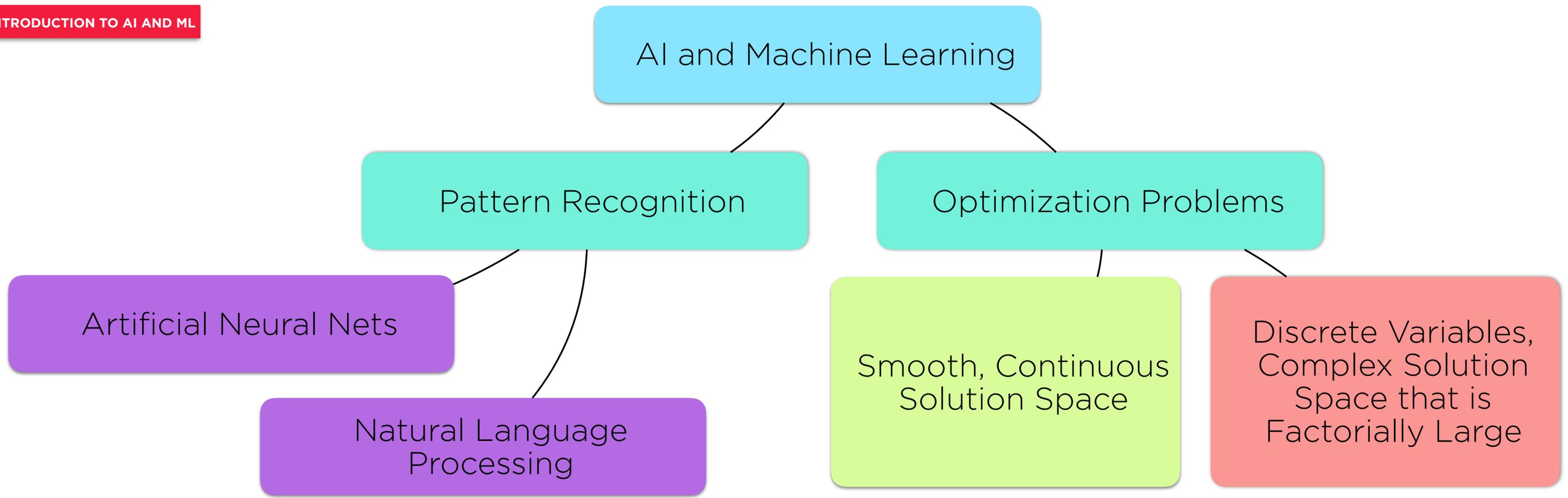


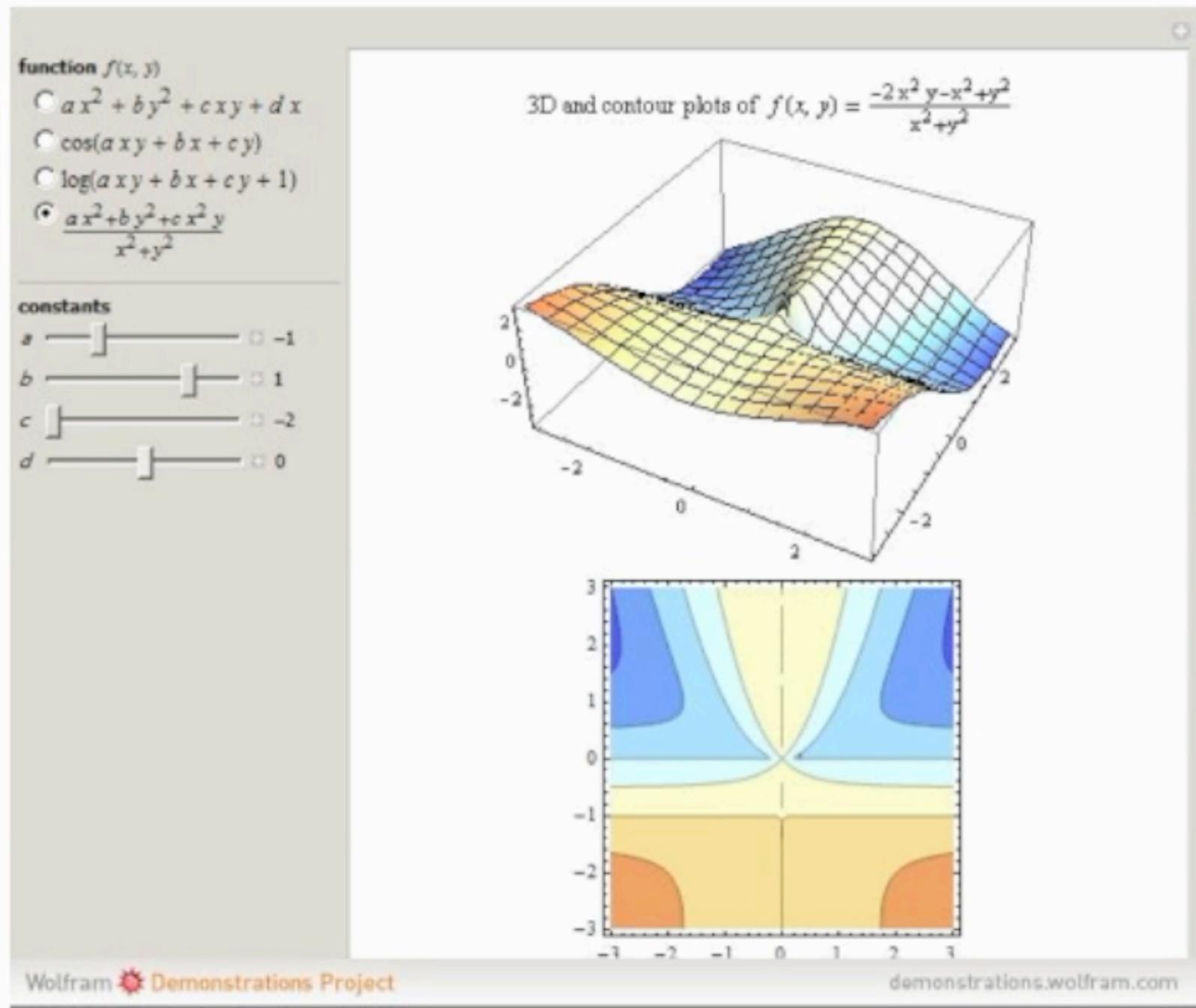


**SHE "DIED  
IN THE CHURCH  
AND WAS BURIED  
ALONG WITH  
HER NAME.  
NOBODY CAME"**

Inside Edition **21**  
NEXT

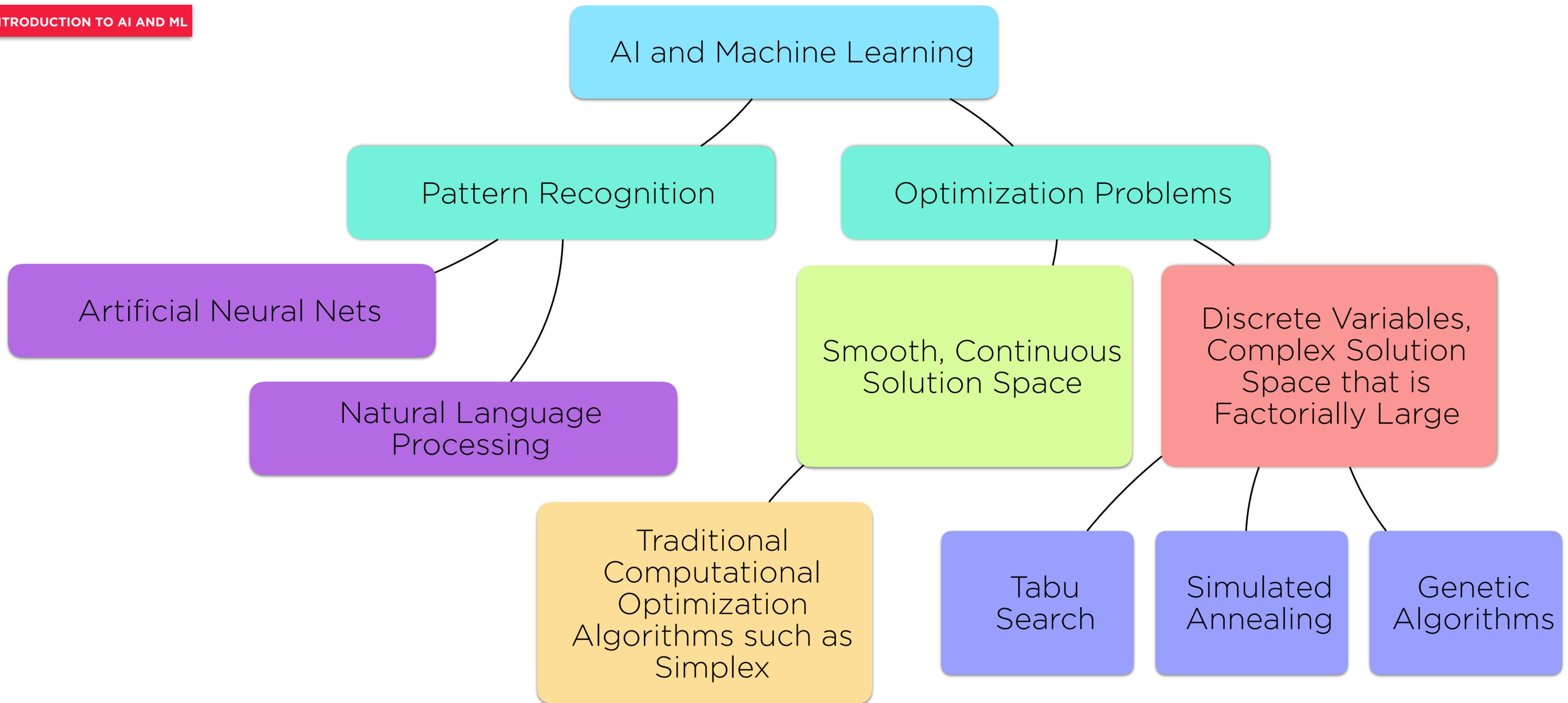






Smooth,  
Continuous  
Solution Space





# Genetic Algorithms



# When will computer hardware match the human brain?

*(Received Dec. 1997)*

*Hans Moravec*

*Robotics Institute  
Carnegie Mellon University  
Pittsburgh, PA 15213-3890, USA  
net: [hpm@cmu.edu](mailto:hpm@cmu.edu)  
web: <http://www.frc.ri.cmu.edu/~hpm/>*

## *ABSTRACT*

This paper describes how the performance of AI machines tends to improve at the same pace that AI researchers get access to faster hardware. The processing power and memory capacity necessary to match general intellectual performance of the human brain are estimated. Based on extrapolation of past trends and on examination of technologies under development, it is predicted that the required hardware will be available in cheap machines in the 2020s.

## **Brains, Eyes and Machines**

*Computers have far to go to match human strengths, and our estimates will depend on analogy and extrapolation. Fortunately, these are grounded in the first bit of the journey, now behind us. Thirty years of computer vision reveals that 1 MIPS can extract simple features from real-time imagery--tracking a white line or a white spot on a mottled background. 10 MIPS can follow complex gray-scale patches--as smart bombs, cruise missiles and early self-driving vans attest. 100 MIPS can follow moderately unpredictable*



*Journal of Evolution and Technology*, 1998, Vol. 1

When will computer hardware match the human brain?

(Revised Dec. 1997)

Hans Moravec

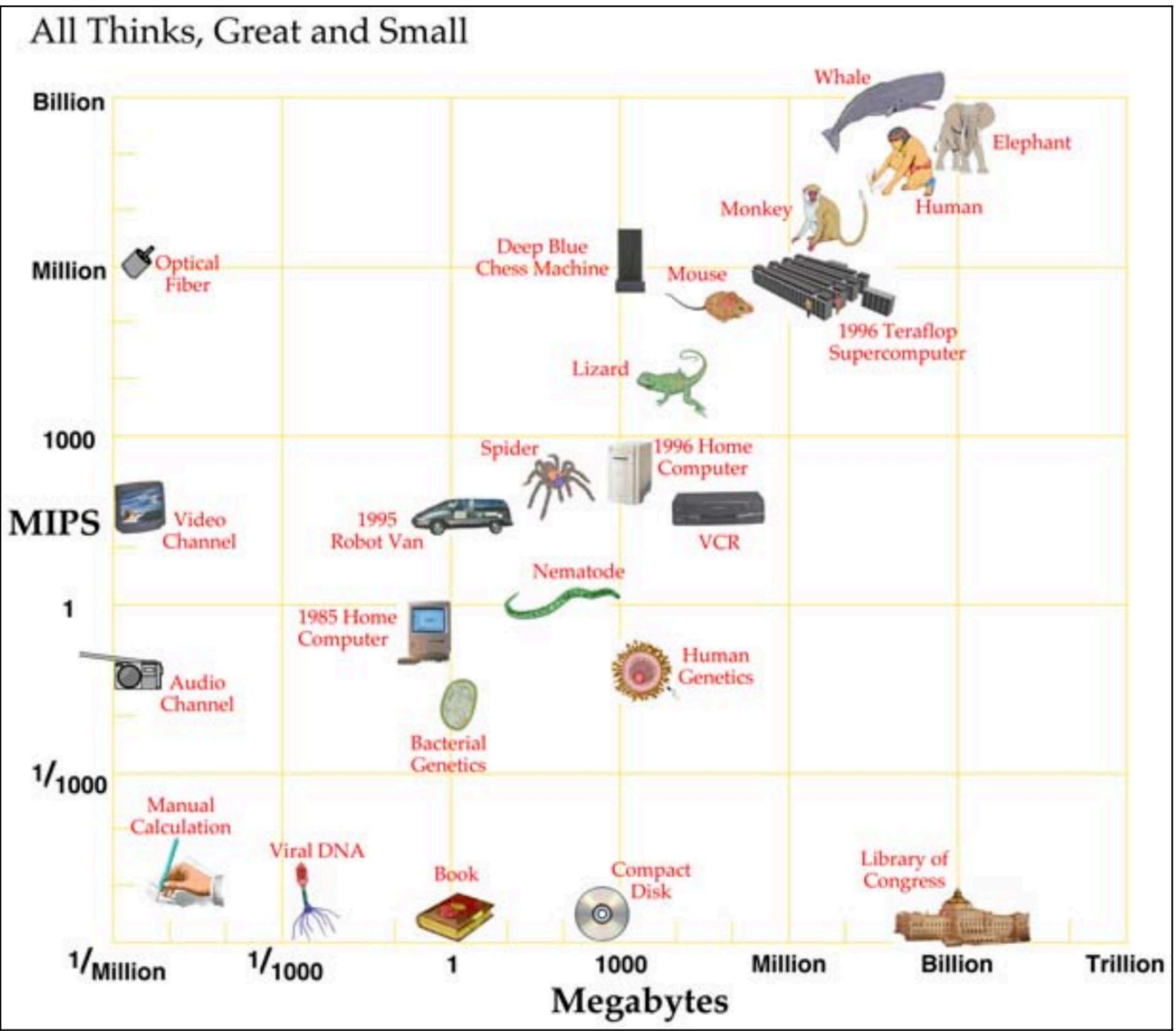
Address Unknown  
 Computer Media Institute  
 Pasadena, CA 91101-1501  
 h.moravec@comedi.com

ABSTRACT

This paper describes how the performance of AI machines tends to improve at the same pace that AI researchers get access to faster hardware. The processing power and memory capacity necessary to match general intellectual performance of the human brain are estimated. Based on extrapolation of past trends and on examination of technologies under development, it is predicted that the required hardware will be available in cheap machines in the 2020s.

Brains, Eyes and Machines

Computers have far to go to match human strengths, and our estimates will depend on analogy and extrapolation. Fortunately, these are grounded in the first bit of the journey, now behind us. Thirty years of computer vision reveals that 1 MIPS can extract simple features from real-time imagery—tracking a white line or a white spot on a red-lined background. 10 MIPS can follow complex gray-scale patterns—go smart bombs, cruise missiles and early self-driving vans afloat. 100 MIPS can follow moderately unpredictable



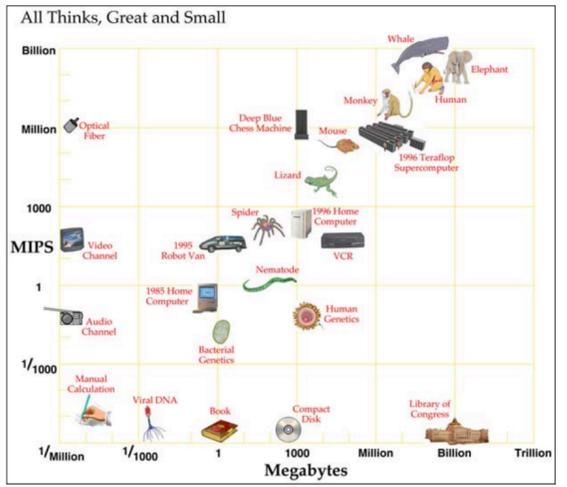
Journal of Evolution and Technology, 1998, Vol. 1

When will computer hardware match the human brain?

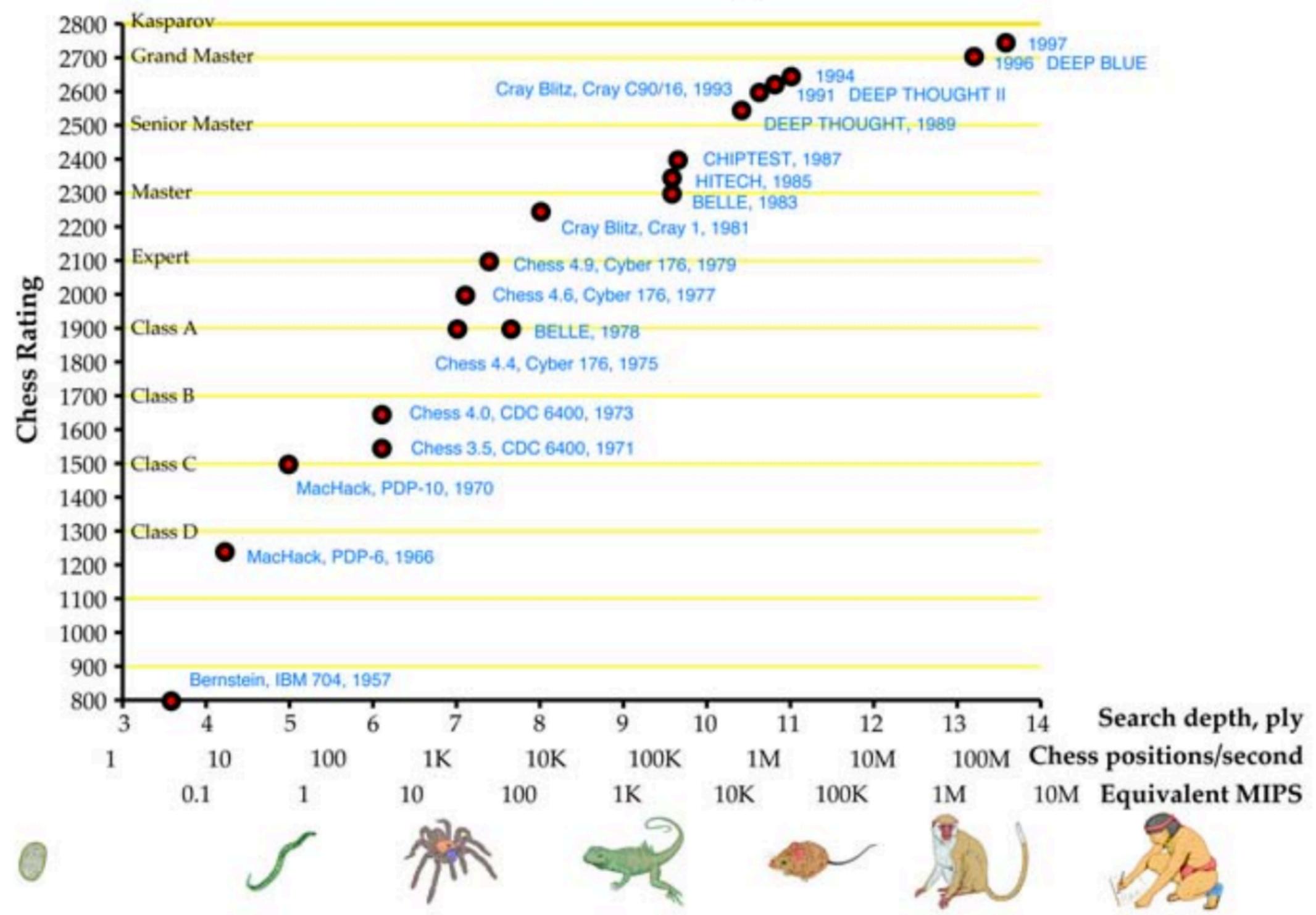
Hans Moravec  
 Address: ...  
 Computer ...  
 ...

**ABSTRACT**  
 This paper describes how the performance of AI machines tends to improve at the same pace that AI researchers get access to faster hardware. The processing power and memory capacity necessary to match general intellectual performance of the human brain are estimated. Based on extrapolation of past trends and on examination of technologies under development, it is predicted that the required hardware will be available in cheap machines in the 2020s.

**Brains, Eyes and Machines**  
 Computers have far to go to match human strengths, and our estimates will depend on analogy and extrapolation. Fortunately, these are grounded in the first bit of the journey, now behind us. Thirty years of computer vision reveals that 1 MIPS can extract simple features from real-time imagery—tracking a white line or a white spot on a red/black background. 10 MIPS can follow complex gray-scale patterns—in smart bombs, cruise missiles and early self-driving vans alike. 100 MIPS can follow moderately unpredictable



# Chess Machine Performance versus Processing Power



Journal of Evolution and Technology 1998, Vol. 1  
 When will computer hardware match the human brain?

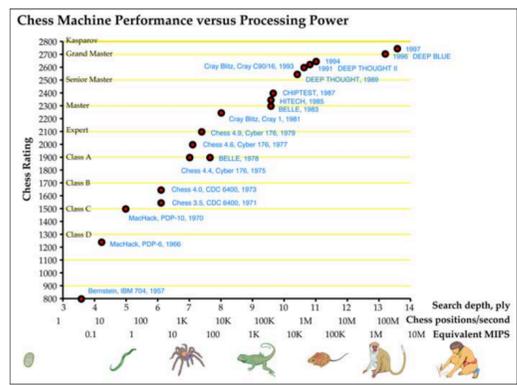
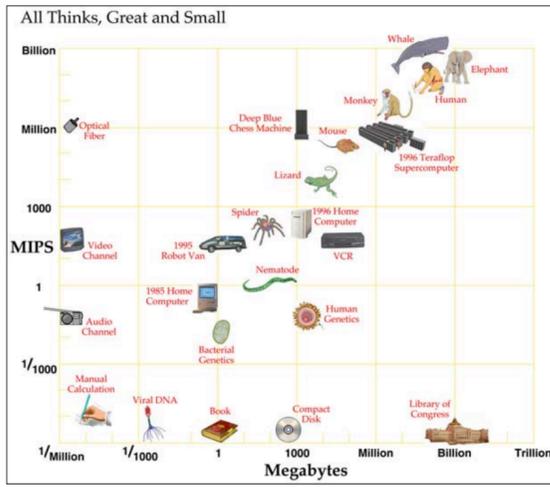
Hans Moravec  
 Address: ...  
 Computer ...  
 ...

ABSTRACT  
 This paper describes how the performance of AI machines tends to improve at the same pace that AI researchers get access to faster hardware. The processing power and memory capacity necessary to match general intellectual performance of the human brain are estimated. Based on extrapolation of past trends and on examination of technologies under development, it is predicted that the required hardware will be available in cheap machines in the 2020s.

Brains, Eyes and Machines  
 Computers have far to go to match human strengths, and our estimates will depend on analogy and extrapolation. Fortunately, these are grounded in the first bit of the journey, now behind us. Thirty years of computer vision reveals that 1 MIPS can extract simple features from real-time imagery—tracking a white line or a white spot on a red/black background. 10 MIPS can follow complex gray-scale patterns—on smart bombs, cruise missiles and early self-driving vans alike. 100 MIPS can follow moderately unpredictable

“At the present rate, computers suitable for humanlike robots will appear in the 2020s. Can the pace be sustained for another three decades? The graph shows no sign of abatement. If anything, it hints that further contractions in time scale are in store.”

-Hans Moravec



“I have a theory that much recent tech development and innovation over the last decade or so has had an unspoken overarching agenda—it has been about facilitating the need for LESS human interaction. It’s not a bug—it’s a feature.”

–David Byrne



“Consciousness [is] ... not something that comes about from complicated calculations.”

–Roger Penrose



# AI *and* MACHINE LEARNING IN HEALTHCARE

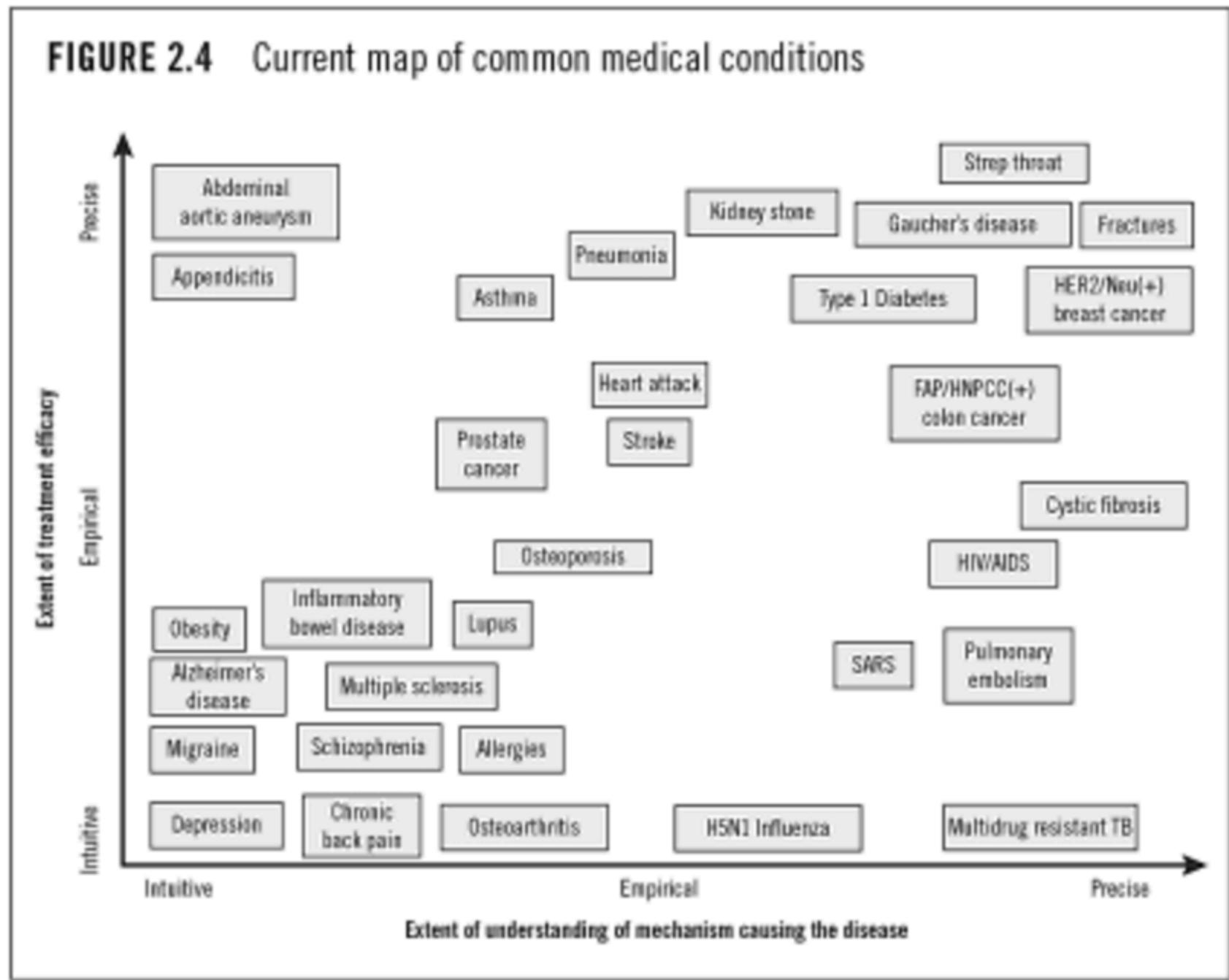




“A prophet is not someone with special vision, just blind to most of what others see.”

**-Nassim Taleb**





-Christensen, Clayton M., Jerome H. Grossman, M.D. and Jason Hwang, M.D. *The Innovator's Prescription: A Disruptive Solution for Health Care*. New York: McGraw-Hill, 2009.



Puzzle: bureaucratic quagmire

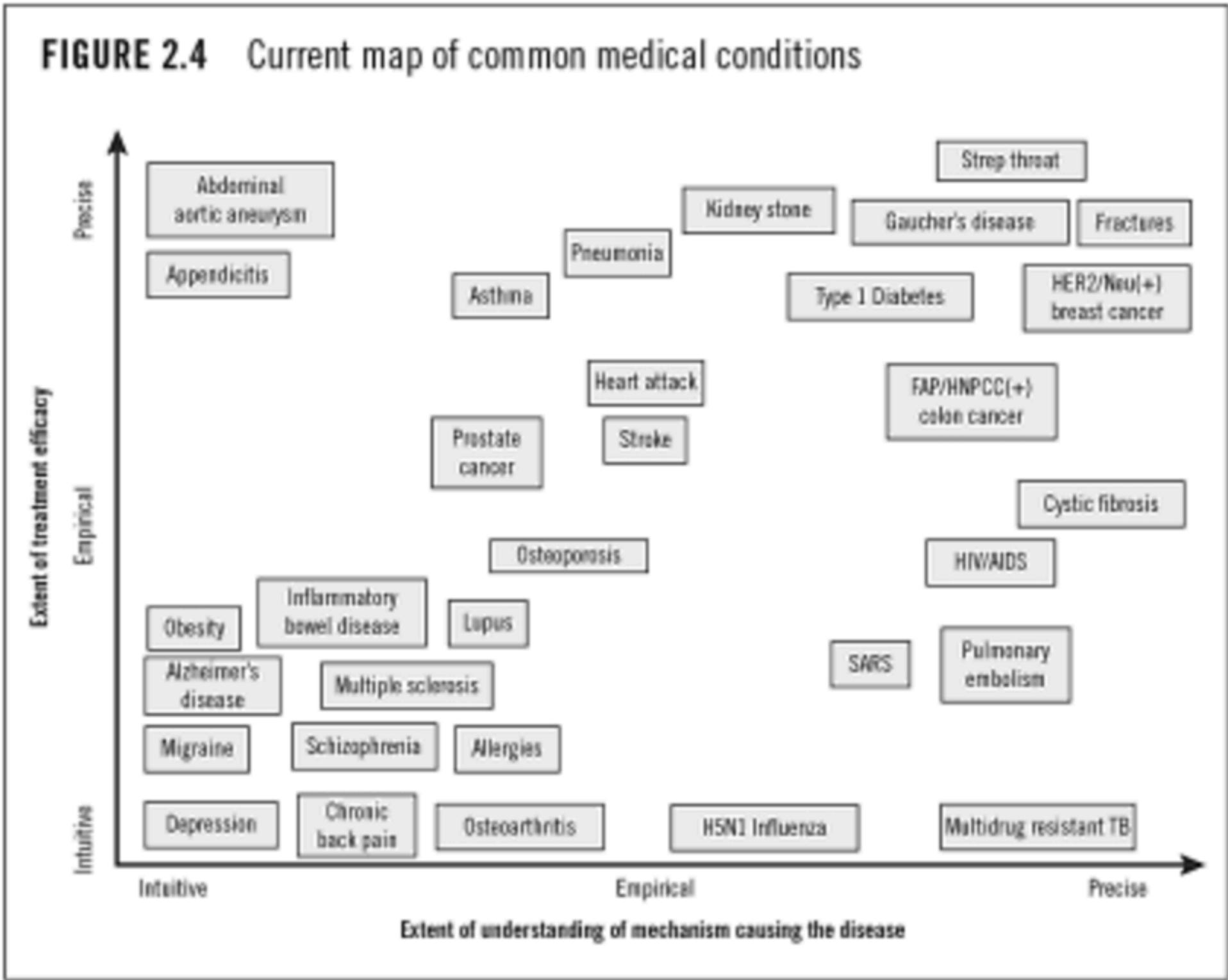
Triage and pre-screening can be offloaded to AIs, allowing doctors to focus on the hard problems

Puzzle: Ludic Fallacy or 'stuck in the dominant paradigm'

Learning algorithms can introduce randomness into decision search for diagnosticians

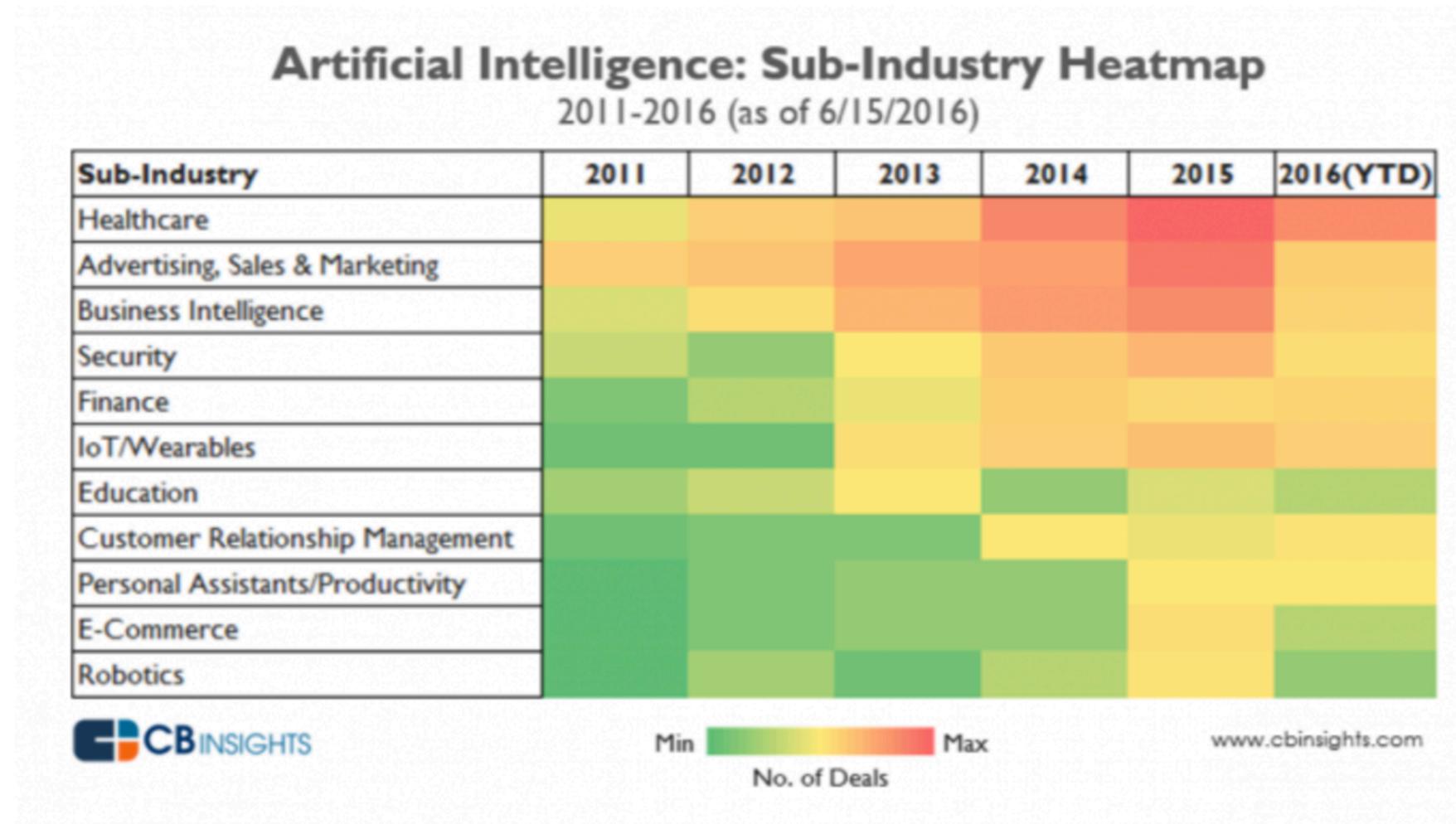
Puzzle: Information Overload

AIs can pre-sift data to find what is likely most relevant



## AI AND ML IN HEALTHCARE SITREP

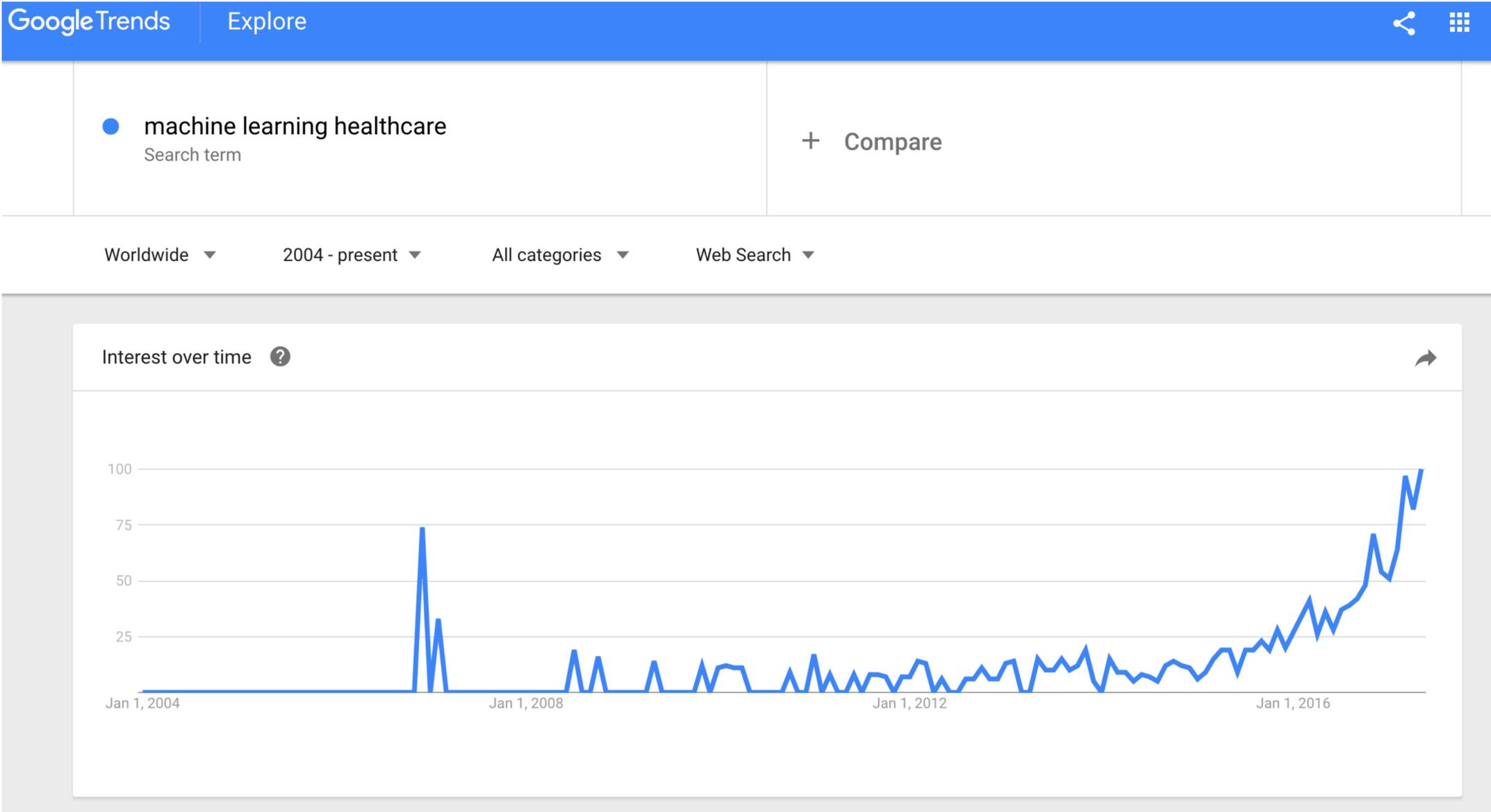
Number of seed/angel deals are for AI peaking in Healthcare as a sub-industry.



Source: CB Insights



# AI AND ML IN HEALTHCARE SITREP



## AI AND ML IN HEALTHCARE SITREP

Analytics

## Healthcare data: A beast best tamed by machine learning?

Mercy Health took a cue from its supply chain management machine learning success to bolster clinical pathways. The result: \$14 million saved the first year, and Mercy is already on track to surpass that. But a VP says it's not just about money.

By **Tom Sullivan** | January 04, 2017 | 07:19 AM



Todd Stewart, MD, vice president of clinical integrated solutions at Mercy, said



# AI AND ML IN HEALTHCARE SITREP

## Healthcare IT News

Analytics

### Healthcare data: A beast best tamed by machine learning?

Mercy Health took a cue from its supply chain management machine learning success to bolster clinical pathways. The result: \$14 million saved the first year, and Mercy is already on track to surpass that. But a VP says it's not just about money.

By Tom Sullivan | January 04, 2017 | 07:19 AM



Todd Stewart, MD, vice president of clinical integrated solutions at Mercy, said



Topic

## FEATURES

### How Do Artificial Intelligence, Machine Learning Differ in Healthcare?

Machine learning is a necessary first step towards artificial intelligence in healthcare, but they aren't the same thing.



Source: Thinkstock

If the futurists, visionaries, and venture capitalists are to be believed, artificial intelligence is right on the cusp of becoming the most important breakthrough for healthcare since penicillin.

Self-driving cars, scary-smart advertising, and virtual home assistants are just the beginning, they proclaim. Hospitals must brace themselves for a complete transformation – a revolution – a total makeover of every aspect of patient care.

If the amount of money riding on "artificial intelligence" breakthroughs is any guide, it won't be long before the first chat bot bursts through the barrier of the Turing Test.

A new report (<http://www.prnewswire.com/news-releases/artificial-intelligence-in-healthcare-market-worth-79888-usd-million-by-2022-621169953.html>) from MarketsandMarkets pins the healthcare artificial intelligence sector at 7.98 billion dollars in 2022, accelerating at a wild compound annual growth rate (CAGR) of 52.68 percent over the forecast period.

Machine learning powerhouses like Google, IBM, and Microsoft will continue to stretch their lead in the lucrative healthcare AI market, the report predicts, as they develop and refine the deep learning techniques that are already being applied to pathology, predictive analytics, and precision cancer care.

All three industry leaders have recently made headlines for innovative machine learning and artificial intelligence projects focused on specific healthcare use cases.

Microsoft is tackling cancer, **vision problems** (<http://healthitanalytics.com/news/microsoft-takes-on-blindness-eye-care-with-ai-machine-learning>), and imaging analytics, while Google recently published **research** (<http://healthitanalytics.com/news/googles-machine-learning-imaging-analytics-flag-breast-cancer>) on the role of machine learning in pathology and cancer diagnosis.

**IBM has committed** (<http://healthitanalytics.com/news/ibm-watson-expands-role-in-imaging-analytics-population-health>) extensive cognitive computing resources to imaging analytics, genomics, pharmaceuticals, and population health management.



# AI AND ML IN HEALTHCARE SITREP



BLOG

Tue Feb 14, 2017 · Neal Evans

It is a familiar scenario explored in science fiction novels and movies: the computing power of machines expands exponentially in all dimensions. Machines are developed having a near limitless capacity for processing information, possessing immediate access to the totality of human knowledge, and sensing reality in a way that approaches real-time omniscience. Based on the assumption that consciousness can be reduced to computation,<sup>[1]</sup> this process works relentlessly towards a threshold where machines become self-aware and indistinguishable from the human mind. Consider the wonderful characters developed in this genre: Skynet from the *Terminator*, Data from *Star Trek*, HAL9000 from *2001: A Space Odyssey*, the replicants from *Blade Runner*, and so many others.

5/16/2017 How Do Artificial Intelligence, Machine Learning Differ in Healthcare?



Topic FEATURES

Health Analytics  
**Health tamed**  
Mercy Health machine learning result: \$14 million on track to save money.

## How Do Artificial Intelligence, Machine Learning Differ in Healthcare?

Machine learning is a necessary first step towards artificial intelligence in healthcare, but they aren't the same thing.



Source: Thinkstock

If the futurists, visionaries, and venture capitalists are to be believed, artificial intelligence is right on the cusp of becoming the most important breakthrough for healthcare since penicillin. Self-driving cars, scary-smart advertising, and virtual home assistants are just the beginning, they proclaim. Hospitals must brace themselves for a complete transformation – a revolution – a total makeover of every aspect of patient care. If the amount of money riding on “artificial intelligence” breakthroughs is any guide, it won't be long before the first chat bot bursts through the barrier of the Turing Test. A new report (<http://www.prnewswire.com/news-releases/artificial-intelligence-in-healthcare-market-worth-79888-usd-million-by-2022-62169953.html>) from MarketsandMarkets pins the healthcare artificial intelligence sector at 7.98 billion dollars in 2022, accelerating at a wild compound annual growth rate (CAGR) of 22.68 percent over the forecast period. Machine learning powerhouses like Google, IBM, and Microsoft will continue to stretch their lead in the lucrative healthcare AI market, the report predicts, as they develop and refine the deep learning techniques that are already being applied to pathology, predictive analytics, and precision cancer care. All three industry leaders have recently made headlines for innovative machine learning and artificial intelligence projects focused on specific healthcare use cases. Microsoft is tackling cancer, vision problems (<http://healthitanalytics.com/news/microsoft-takes-on-blindness-eye-care-with-ai-machine-learning>), and imaging analytics, while Google recently published research (<http://healthitanalytics.com/news/google-machine-learning-imaging-analytics-flag-breast-cancer>) on the role of machine learning in pathology and cancer diagnosis. IBM has committed (<http://healthitanalytics.com/news/ibm-watson-expands-role-in-imaging-analytics-population-health>) extensive cognitive computing resources to imaging analytics, genomics, pharmaceuticals, and population health management.



Todd Stewart

http://healthitanalytics.com/features/how-do-artificial-intelligence-machine-learning-differ-in-healthcare?cqid=9778aa49484412ab0673635500f046&clp=0bb... 1/7



# AI AND ML IN HEALTHCARE SITREP



Saudi Computer Society, King Saud University  
**Applied Computing and Informatics**  
(http://computer.org.sa)  
www.ksu.edu.sa  
www.sciencedirect.com



## ORIGINAL ARTICLE

# A machine learning system for automated whole-brain seizure detection

P. Fergus <sup>a,\*</sup>, A. Hussain <sup>a</sup>, David Hignett <sup>a</sup>, D. Al-Jumeily <sup>a</sup>,  
Khaled Abdel-Aziz <sup>b</sup>, Hani Hamdan <sup>c</sup>

<sup>a</sup> Applied Computing Research Group, Liverpool John Moores University, Byrom Street, Liverpool L3 3AF, United Kingdom

<sup>b</sup> The Walton Centre NHS Foundation Trust, Lower Lane, Fazakerley, Liverpool L9 7LJ, United Kingdom

<sup>c</sup> Supelec, Department of Signal Processing and Electronic Systems, Plateau de Moulon, 3 rue Joliot-Curie, 91192 Gif-sur-Yvette Cedex, France

Received 13 October 2014; revised 27 January 2015; accepted 27 January 2015  
Available online 9 February 2015

**KEYWORDS**  
Seizure;  
Non-seizure;  
Machine learning;  
Classification;  
Electroencephalogram;  
Oversampling

**Abstract** Epilepsy is a chronic neurological condition that affects approximately 70 million people worldwide. Characterised by sudden bursts of excess electricity in the brain, manifesting as seizures, epilepsy is still not well understood when compared with other neurological disorders. Seizures often happen unexpectedly and attempting to predict them has been a research topic for the last 30 years. Electroencephalograms have been integral to these studies, as the recordings that they produce can capture the brain's electrical signals. The diagnosis of epilepsy is usually made by a neurologist, but can be difficult to make in the early stages. Supporting para-clinical evidence obtained from magnetic resonance imaging and electroencephalography may enable clinicians to make a diagnosis of epilepsy and instigate treatment earlier. However, electroencephalogram capture and interpretation is time consuming and can be expensive due to the need for trained specialists to perform the interpretation. Automated

5/16/2017 How Do Artificial Intelligence, Machine Learning Differ in Healthcare?

HealthITAnalytics  
(http://healthitanalytics.com/)

Topic: FEATURES

**Health Analytics**

**Health tamed**

Mercy Health machine learning result: \$14 million on track to save money.

By Tom Sullivan

**THE ETHICS OF ARTIFICIAL INTELLIGENCE**

Source: Thinkstock

If the futurists, via breakthrough for...  
Self-driving cars, a complete transfo...  
If the amount of m...  
barrier of the Tur...  
A new report (b...  
million-by-2022...  
accelerating at a v...  
Machine learning...  
report predicts, as...  
precision cancer...  
All three industry...  
healthcare use cas...  
Microsoft is tackli...  
machine-learnin...  
machine-learnin...  
IBM has commit...  
extensive cognitiv...

**BLOG**  
Tue Feb 14, 2017 · Neal Evans

It is a familiar scenario explored in science fiction novels and movies: the computing power of machines expands exponentially in all dimensions. Machines are developed having a near limitless capacity for processing information, possessing immediate access to the totality of human knowledge, and sensing reality in a way that approaches real-time omniscience. Based on the assumption that consciousness can be reduced to computation, this process works relentlessly towards a threshold where machines become self-aware and indistinguishable from the human mind. Consider the wonderful characters developed in this genre: Skynet from the *Terminator*, Data from *Star Trek*, HAL9000 from *2001: A Space Odyssey*, the replicants from *Blade Runner*, and so many others.

http://healthitanalytics.com/it



# AI AND ML IN HEALTHCARE SITREP

# IBM Acquires Merge Health To Supplement Watson Healthcare



**Great Speculations**  
*Buys, holds, and hopes* **FULL BIO**

Opinions expressed by Forbes Contributors are their own.

**Trefis Team, Contributor**

**International Business Machines** recently announced that it was acquiring Merge Healthcare, a leading provider of medical image handling and processing, interoperability and clinical systems for roughly \$1 billion. The company plans to integrate Merge Healthcare's capabilities with its Watson high performance computing and analytics platform, which is an artificial intelligence system capable of answering questions posed in natural language. It was developed by IBM's DeepQA project and is one of IBM's most powerful computing platforms. Initially developed some years ago to play the television game-show Jeopardy (which it handily won), Watson (names after founder Thomas Watson), has since been commercialized and is now gain traction. We believe that, as IBM works to overcome the difficult markets faced by its enterprise hardware and software, Watson is of critical importance.

Applied Computing and Informatics (2016) 12, 70–89

Saudi Computer Society, King Saud University  
**Applied Computing and Informatics**  
 (http://computer.org.sa)  
 www.ksu.edu.sa  
 www.sciencedirect.com

ORIGINAL ARTICLE

## A machine learning system for automated whole-brain seizure detection

P. Fergus <sup>a,\*</sup>, A. Hussain <sup>a</sup>, David Hignett <sup>a</sup>, D. Al-Jumeily <sup>a</sup>, Khaled Abdel-Aziz <sup>b</sup>, Hani Hamdan <sup>c</sup>

<sup>a</sup> Applied Computing Research Group, Liverpool John Moores University, Byrom Street, Liverpool L3 3AF, United Kingdom  
<sup>b</sup> The Walton Centre NHS Foundation Trust, Lower Lane, Fazakerley, Liverpool L9 7LJ, United Kingdom  
<sup>c</sup> Supélec, Department of Signal Processing and Electronic Systems, Plateau de Moulon, 3 rue Joliot-Curie, 91192 Gif-sur-Yvette Cedex, France

Received 13 October 2014; revised 27 January 2015; accepted 27 January 2015  
 Available online 9 February 2015

**KEYWORDS** Seizure; Non-seizure; Machine learning; Classification

**Abstract** Epilepsy is a chronic neurological condition that affects approximately 70 million people worldwide. Characterised by sudden bursts of excess electricity in the brain, manifesting as seizures, epilepsy is still not well understood when compared with other neurological disorders. Seizures often happen unexpectedly and attempting to predict them has been a research topic for the last

## THE ETHICS OF ARTIFICIAL INTELLIGENCE

Source: Thinkstock

If the futurists, via breakthrough for

Self-driving cars, a complete transfo

If the amount of barrier of the Tur

A new report (b million-by-2022 accelerating at a

Machine learning report predicts, as precision cancer

All three industry healthcare use cas

Microsoft is tackling machine-learning

IBM has committed extensive cognitiv

**BLOG**  
 Tue Feb 14, 2017 · Neal Evans

It is a familiar scenario explored in science fiction novels and movies: the computing power of machines expands exponentially in all dimensions. Machines are developed having a near limitless capacity for processing information, possessing immediate access to the totality of human knowledge, and sensing reality in a way that approaches real-time omniscience. Based on the assumption that consciousness can be reduced to computation, this process works relentlessly towards a threshold where machines become self-aware and indistinguishable from the human mind. Consider the wonderful characters developed in this genre: Skynet from the *Terminator*, Data from *Star Trek*, HAL9000 from *2001: A Space Odyssey*, the replicants from *Blade Runner*, and so many others.

**Health**  
 Analytics  
**Health tamed**  
 Mercy Health machine learning result: \$14 million on track to save money.  
 By Tom Sullivan  
 Todd Stewart

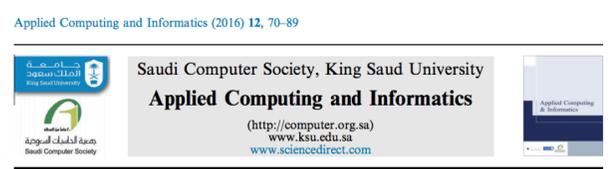


# AI AND ML IN HEALTHCARE SITREP

## Transaction Details

IBM's acquisition of Merge is to be structured as follows: Merge shareholders are to receive \$7.13 per share in cash, or 29.7x consensus 2015 EPS of \$0.24. The roughly \$1 billion in consideration comprises outstanding debt of \$219 million and close to \$800 million in equity (roughly 3.2x consensus 2015 revenue of \$251 million). Merge offers software solutions to integrate medical images with the IT infrastructure present in medical facilities. It offers both on-premise and Cloud solutions. Most notably, its robust network management tools **allow it to access the image repositories of its 7,500 customers as an anonymized research pool of roughly 30 billion images, including x-rays, CAT- and MRI-scans.** The sheer scale of the sample size well suits the data capabilities of Watson, though the specific subtleties of medical image analysis are likely to make for a fairly steep learning curve. That said, the potential is huge. We note this is IBM's third recent acquisition, coming in the wake of its purchase of Phytel and Explorys.

## Machine Learning Through Picture Integration Is Key To Success In The Medical Vertical



ORIGINAL ARTICLE

### A machine learning system for automated whole-brain seizure detection

P. Fergus <sup>a,\*</sup>, A. Hussain <sup>a</sup>, David Hignett <sup>a</sup>, D. Al-Jumeily <sup>a</sup>, Khaled Abdel-Aziz <sup>b</sup>, Hani Hamdan <sup>c</sup>

<sup>a</sup> Applied Computing Research Group, Liverpool John Moores University, Byrom Street, Liverpool L3 3AF, United Kingdom  
<sup>b</sup> The Walton Centre  
<sup>c</sup> Supelec, Department 91192 Gif-sur-Yvette

Received 13 October 2015  
 Available online 9 January 2016

**KEYWORDS**  
 Seizure;  
 Non-seizure;  
 Machine learning;  
 Classification

International Business Machines recently announced that it was acquiring Merge Healthcare, a leading provider of medical image handling and processing, interoperability and clinical systems for roughly \$1 billion. The company plans to integrate Merge Healthcare's capabilities with its Watson high performance computing and analytics platform, which is an artificial intelligence system capable of answering questions posed in natural language. It was developed by IBM's DeepQA project and is one of IBM's most powerful computing platforms. Initially developed some years ago to play the television game-show Jeopardy (which it handily won), Watson (names after founder Thomas Watson), has since been commercialized and is now gain traction. We believe that, as IBM works to overcome the difficult markets faced by its enterprise hardware and software, Watson is of critical importance.

It is a familiar scenario explored in science fiction novels and movies: the computing power of machines expands exponentially in all dimensions. Machines are developed having a near limitless capacity for processing information, possessing immediate access to the totality of human knowledge, and sensing reality in a way that approaches real-time omniscience. Based on the assumption that consciousness can be reduced to computation, this process works relentlessly towards a threshold where machines become self-aware and indistinguishable from the human mind. Consider the wonderful characters developed in this genre: Skynet from the *Terminator*, Data from *Star Trek*, HAL9000 from *2001: A Space Odyssey*, the replicants from *Blade Runner*, and so many others.

**Health**  
 Analytics  
**Health tamed**  
 Mercy Health machine learning result: \$14 million on track to save money.

By Tom Sullivan  
 Todd Stewart



## AI AND ML IN HEALTHCARE RISKS

# MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine



**Matthew Herper**, FORBES STAFF ✓

*I cover science and medicine, and believe this is biology's century.* [FULL BIO](#) ▾



Virginia "Ginni" Rometty, chief executive officer of International Business Machines Corp. (IBM) Photographer: [+]

It was one of those amazing “we’re living in the future” moments. In an [October 2013 press release](#), IBM declared that MD Anderson, the cancer center that is part of the University of Texas, “is using the IBM Watson cognitive computing system for its mission to eradicate cancer.”



# AI AND ML IN HEALTHCARE RISKS

## MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine



Matthew Herper, FORBES STAFF  
*I cover science and medicine, and believe this is biology's century. FULL BIO*



Virginia "Ginni" Rometty, chief executive officer of International Business Machines Corp. (IBM) Photographer: [+]

It was one of those amazing “we’re living in the future” moments. In an [October 2013 press release](#), IBM declared that MD Anderson, the cancer center that is part of the University of Texas, “is using the IBM Watson cognitive computing system for its mission to eradicate cancer.”

We often call out overly optimistic news coverage of drugs and devices. But information technology is another healthcare arena where uncritical media narratives can cause harm by raising false hopes and allowing costly and unproven investments to proceed without scrutiny.

A case in point is the recent collapse of M.D. Anderson Cancer Center’s ambitious venture to use IBM’s Watson cognitive computing system to expedite clinical decision-making around the globe and match patients to clinical trials.

Launched in 2013, the project initially received glowing mainstream media coverage that suggested Watson was already being deployed to revolutionize cancer care—or soon would be.

But that was premature. By all accounts, the electronic brain was never used to treat patients at M.D. Anderson. A University of Texas [audit](#) reported the product doesn’t work with Anderson’s new electronic medical records system, and the cancer center is now seeking bids to find a new contractor.

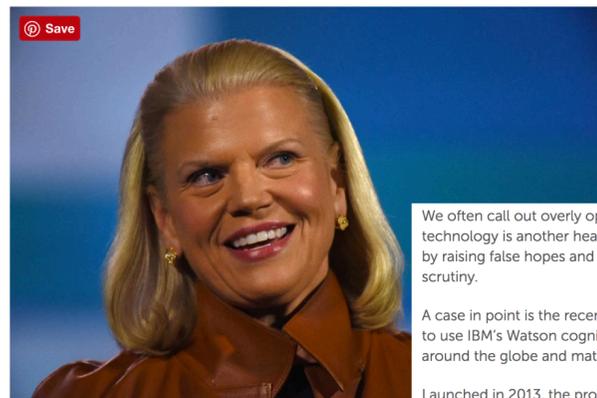


# AI AND ML IN HEALTHCARE RISKS

## MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine



**Matthew Herper**, FORBES STAFF  
*I cover science and medicine, and believe this is biology's century. FULL BIO*



Virginia "Ginni" Rometty, chief executive officer of International Business Machine

It was one of those amazing "we're living in the future" moments. In an [October 2013 press release](#), IBM declared the cancer center that is part of the University of Texas at MD Anderson the first to use the Watson cognitive computing system for its mission to revolutionize cancer care.

We often call out overly optimistic news coverage of drugs and devices. But information technology is another healthcare arena where uncritical media narratives can cause harm by raising false hopes and allowing costly and unproven investments to proceed without scrutiny.

A case in point is the recent collapse of M.D. Anderson Cancer Center's ambitious venture to use IBM's Watson cognitive computing system to expedite clinical decision-making around the globe and match patients to clinical trials.

Launched in 2013, the project initially received glowing mainstream media coverage that suggested Watson was already being deployed to revolutionize cancer care—or soon would be.

But that was premature. By all accounts, the electronic brain was never used to treat patients at M.D. Anderson. A University of Texas [audit](#) reported the product doesn't work with Anderson's new electronic medical records system, and the cancer center is now seeking bids to find a new contractor.

"IBM spun a story about how Watson could improve cancer treatment that was superficially plausible."  
--David Howard, Department of Health Policy and Management at Emory University

# IBM's Watson Has Already Failed

Sep. 6.16 | About: International Business (IBM)



**Robert X. Cringely**   
Tech, software, internet, Angel investor  
I, Cringely

Follow

(639 followers)

## Summary

- IBM is staking its future on several new technologies, especially its Watson artificial intelligence business.
- Internal IBM documents suggest that Watson sales after three years are dismal.
- Even if Watson and the other CAMSS businesses were profitable, they would each have to generate \$20 billion annually to reach IBM's goals.
- Such a 100 percent success rate has never happened before at IBM and it is not happening now.

As a reader of Seeking Alpha, I've seen several posts about IBM's (NYSE:[IBM](#)) Watson Artificial Intelligence technology and how Watson is an important differentiator that will drive IBM's growth in coming years. You can read such posts [here](#), [here](#) and [here](#). Unfortunately for IBM, these SA writer conclusions appear to me to be precisely wrong. I fear Watson is already a major failure for Big Blue.



# AI AND ML IN HEALTHCARE RISKS

## MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine



Matthew Herper, FORBES STAFF  
I cover science and medicine, and believe this is biology's century. FULL BIO



We often call out overly optimistic news coverage of drugs and devices. But information technology is another healthcare arena where uncritical media narratives can cause harm by raising false hopes and allowing costly and unproven investments to proceed without scrutiny.

A case in point is the recent collapse of M.D. Anderson Cancer Center's ambitious venture to expedite clinical decision-making.

### IBM's Watson Has Already Failed

Sep. 6, 16 | About: International Business (IBM)

It was one an October cancer cen Watson co; cancer."

Robert X. Cringely  
Tech, software, internet, Angel investor  
I, Cringely

Follow (639 followers)

#### Summary

- IBM is staking its future on several new technologies, especially its Watson artificial intelligence business.
- Internal IBM documents suggest that Watson sales after three years are dismal.
- Even if Watson and the other CAMSS businesses were profitable, they would each have to generate \$20 billion annually to reach IBM's goals.
- Such a 100 percent success rate has never happened before at IBM and it is not happening now.

As a reader of Seeking Alpha, I've seen several posts about IBM's (NYSE:IBM) Watson Artificial Intelligence technology and how Watson is an important differentiator that will drive IBM's growth in coming years. You can read such posts [here](#), [here](#) and [here](#). Unfortunately for IBM, these SA writer conclusions appear to me to be precisely wrong. I fear Watson is already a major failure for Big Blue.

"IBM spun a story about how Watson could improve cancer treatment that was superficially plausible."  
--David Howard, Department of Health Policy and Management at Emory University

## So-Called 'AI' Is A House of Cards

[Comments enabled]

2017-05-12 10:35 by Karl Denninger  
in Technology , 405 references

Let's dispose of the commonly-spewed horsecrap right up front: **There is no such thing as "artificial intelligence" or "machine learning."**

What **does** exist is **pattern recognition** and the price of doing it well has gone down *very rapidly* as the cost and power of computing devices has gone down and up, respectively.

Decades ago doing it "well" required *mainframes* and then only in certain segments -- because it was simply impossible to analyze a larger data set. AC Nielsen *made their business* out of analyzing supermarket checkout scanner data. So did IRI. Both did it using *big iron* and they were only looking at *specific* data from a *specific* source, which they paid for (frequently by subsidizing the installation of all that hardware in the grocery stores) and then sold back to the *suppliers* of those stores (food companies like Heinz.)

That was a *symbiotic* relationship. The grocery store got *helped* twice: First with the capital cost for installation of (at the time) extremely expensive checkout line scanners, which allowed them to bust the checker's union and hire people at *half* their previous salary -- and then again in that the overriding goal of a grocery store is, of course, *to sell more groceries*. As such empowering the food suppliers in figuring out what sold and what didn't *had no negative impact on the stores* and in fact it was to their **benefit**. While two potato chip companies fighting over an endcap might be amusing to a store manager it didn't do violence to the store's sales numbers and actually *might* improve them.

**Today running *much* more complex pattern analysis requires only some server racks full of Xeon processors and SSDs -- a tiny fraction of the cost of a big IBM or Amdahl mainframe for *much more* capability.**

But this belies a far larger problem when it comes to companies like *Salesforce*, *Amazon* and others: **Essentially no firm, even the behemoths like Amazon and Salesforce, have enough data of their own to provide the enormous data sets that lead to better and better pattern recognition. In fact companies like Salesforce have, for all intents and purposes, no data of their own upon which to apply said algorithms at all!**

**Equally important: NOR DO ANY OF THEIR CUSTOMERS STANDING ALONE.**

To put it in simple terms: **There is no symbiotic relationship**, as will become clear in a moment. In fact *being a part of and plugged into these systems is actually likely to screw you as a company.*



# AI AND ML IN HEALTHCARE RISKS

## MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine



Matthew Herper, FORBES STAFF  
I cover science and medicine, and believe this is biology's century. FULL BIO



We often call out overly optimistic news coverage of drugs and devices. But information technology is another healthcare arena where uncritical media narratives can cause harm by raising false hopes and allowing costly and unproven investments to proceed without scrutiny.

A case in point is the recent collapse of M.D. Anderson Cancer Center's ambitious venture to expedite clinical decision-making.

### IBM's Watson Has Already Failed

Sep. 6, 16 | About: International Business (IBM)

It was one an October cancer cen Watson co cancer."

Robert X. Cringely  
Tech, software, internet, Angel investor  
I, Cringely

Follow

(639 followers)

#### Summary

- IBM is staking its future on several new technologies, especially its Watson artificial intelligence business.
- Internal IBM documents suggest that Watson sales after three years are dismal.
- Even if Watson and the other CAMSS businesses were profitable, they would each have to generate \$200 million in sales.
- Such a 100 percent success rate is not happening now.

As a reader of Seeking Alpha, I've seen Watson Artificial Intelligence technology differentiator that will drive IBM's growth posts here, here and here. Unfortunately, it appears to me to be precisely wrong. I'm not for Big Blue.



2017-05-12 10:35 by Karl Denninger in Technology, 405 references

So-Called 'AI' Is A House of Cards [Comments enabled]

Let's dispose of the commonly-spewed horseshit right up front: There is no such thing as "artificial intelligence" or "machine learning."

What does exist is pattern recognition and the price of doing it well has gone down very rapidly as the cost and power of computing devices has gone down and up, respectively.

Decades ago doing it "well" required mainframes and then only in certain segments -- because it was simply impossible to analyze a larger data set. AC Nielsen made their business out of analyzing supermarket checkout scanner data. So did IRI. Both did it using big iron and they were only looking at specific data from a specific source, which they paid for (frequently by subsidizing the installation of all that hardware in the grocery stores) and then sold back to the suppliers of those stores (food companies like Heinz).

That was a symbiotic relationship. The grocery store got helped twice: First with the capital cost for installation of (at the time) extremely expensive checkout line scanners, which allowed them to bust the checker's union and hire people at half their previous salary -- and then again in that the overriding goal of a grocery store is, of course, to sell more groceries. As such empowering the food suppliers in figuring out what sold and what didn't had no negative impact on the stores and in fact it was to their benefit. While two potato chip companies fighting over an endcap might be amusing to a store manager it didn't do violence to the store's sales numbers and actually might improve them.

Today running much more complex pattern analysis requires only some server racks full of Xeon processors and SSDs -- a tiny fraction of the cost of a big IBM or Amdahl mainframe for much more capability.

But this belief is a far larger problem when it comes to companies like Salesforce, Amazon and others. Essentially no firm, even the behemoths like Amazon and Salesforce, have enough data of their own to provide the enormous data sets that lead to better and better pattern recognition. In fact companies like Salesforce have, for all intents and purposes, no data of their own upon which to apply said algorithms at all!

Equally important: NOR DO ANY OF THEIR CUSTOMERS STANDING ALONE.

To put it in simple terms: There is no symbiotic relationship, as will become clear in a moment. In fact being a part of and plugged into these systems is actually likely to screw you as a company.

# Some AI Lessons from Watson's Failure at MD Anderson

Last week, The Wall Street Journal (WSJ) broke a story about the failure of a \$62 million implementation of IBM Watson at the University of Texas MD Anderson Cancer Center. The reasons outlined in the article don't question the capabilities of the Watson platform but rather the inability to develop the project by a joined team of MD Anderson specialists, IBM and PwC engineers.

According to the report, the goal of the project was to build an Oncology Expert Advisor (OEA) that will improve recommendations about cancer care and treatment options. OEA was supposed to integrate with MD Anderson electronic medical records (EMR) as well as medical literature in order to build knowledge that feeds the AI models.

The WSJ article describes that the project was initially focused on leukemia treatments but MD Anderson decided to shift the attention towards lung cancer in the middle of the project. According to an audit conducted by the University of Texas System Audit Office, MD Anderson paid about \$39 million in fees to IBM and another \$23 million to PwC for implementation services. The audit declared the project "not ready" citing challenges



# AI AND ML IN HEALTHCARE RISKS



**Jesus Rodriguez**  
Hackerpreneur in residence, Managing Partner at Tellago .  
Angel Investor, Startup Advisor, Columnist at CIO.com,  
Board Member of Several Software Companies

## Some AI Lessons from Watson’s Failure at MD Anderson

Last week, The Wall Street Journal(WSJ) broke a story about the failure of a \$62 million implementation of IBM Watson at the University of Texas MD Anderson Cancer Center. The reasons outlined in the article don’t question the capabilities of the Watson platform but rather the inability to develop the project by a joined team of MD Anderson specialists, IBM and PwC engineers.

According to the report, the goal of the project was to build an Oncology Expert Advisor( OEA) that will improve recommendations about cancer care and treatment options. OEA was supposed to integrate with MD Anderson electronic medical records(EMR) as well as medical literature in order to build knowledge that feeds the AI models.

The WSJ article describes that the project was initially focused on leukemia treatments but MD Anderson decided to shift the attention towards lung cancer in the middle of the project. According to an audit conducted by the University of Texas System Audit Office, MD Anderson paid about \$39 million in fees to IBM and another \$23 million to PwC for implementation services. The audit declared the project “not ready” citing challenges

## PRACTICAL LESSONS ABOUT AI PROJECTS WE CAN LEARN FROM THE MD ANDERSON EXPERIENCE

### 1 — Data Quality Matters

The MD Anderson audit repeatedly refers to outdated data as one of the main roadblocks of the project. This challenge highlights the importance of incorporating data curation and quality processes as part of AI projects. Modern data quality platforms such as Trifacta, Tamr or Paxata should be considered in these efforts.

### 2 — Data Integration is Key

The MD Anderson experience shows the importance of streamlining the integration of AI platforms and back office systems. Interoperability with modern ETL-ELT platforms should be considered as an important aspect of the implementation of AI solutions.

### 3 — Lean and Continuous Delivery

AI projects are notoriously long and complex but 4 years and \$62 million before detecting a problem seems a bit overkill. Aligning the new generation of AI platforms with established lean and continuous delivery methodologies. should help in this area.

### 4 — Regular Model Training & Performance Monitoring

Establishing the mechanisms to regularly train and validate the performance of AI models is an essential and often ignored aspect of AI solutions. The MD Anderson project clearly shows the importance of incorporating training and monitoring tools and processes as part of the AI solution delivery lifecycle.





Thank you.



## WORK CITED AND RECOMMENDED READING

Byrne, David. "Eliminating the Human." 15 May 2017. *davidbyrne.com*. 15 May 2017. <<http://davidbyrne.com/journal/eliminating-the-human>>.

Christensen, Clayton M., Jerome H. Grossman, M.D. and Jason Hwang, M.D. *The Innovator's Prescription: A Disruptive Solution for Health Care*. New York: McGraw-Hill, 2009.

Denninger, Karl. "So-Called 'AI' Is A House of Cards." 12 May 2017. The Market Ticker ® - Commentary on The Capital Markets. 16 May 2017. <<https://market-ticker.org/akcs-www?post=232053>>.

Moravec, Hans. "When will computer hardware match the human brain?" *Journal of Evolution and Technology* 1 (1998).

Penrose, Roger. *Shadows of the Mind: A Search for the Missing Science of Consciousness*. Oxford: Oxford University Press, 1994.

—. *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics*. Oxford: Oxford University Press, 1989.

Taleb, Nassim. *The Bed of Procrustes: Philosophical and Practical Aphorisms (Incerto)*. New York: Random House, 2015.

