



# Machine Learning in Practice

A Course for Business Leaders  
Implementing ML in the Real World

# Your Instructors



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# Getting To Know You

**My ML experience level  
is:**

- A. Experienced
- B. Intermediate
- C. Beginner

**My job is:**

- A. More technically-oriented
- B. More business oriented
- C. An equal mix of both

**What are you hoping to learn  
today?**

*Answer in Group Chat*

# Agenda



## Part 1

- Hype versus Reality
- Business Impact of ML
- Business Challenges of ML
- It All Starts with Data
- Insights from the Field (Part 1)
- Q&A/Break

## Part 2

- Evaluating ML Opportunities
- Staffing and Project Planning
- Insights from the Field (Part 2)
- Q&A/Break

## Part 3

- Addressing Workforce Concerns
- Building a Data-Centered Organization
- Being Prepared for the Future
- Final Q&A

# HFS Research

HFS Research

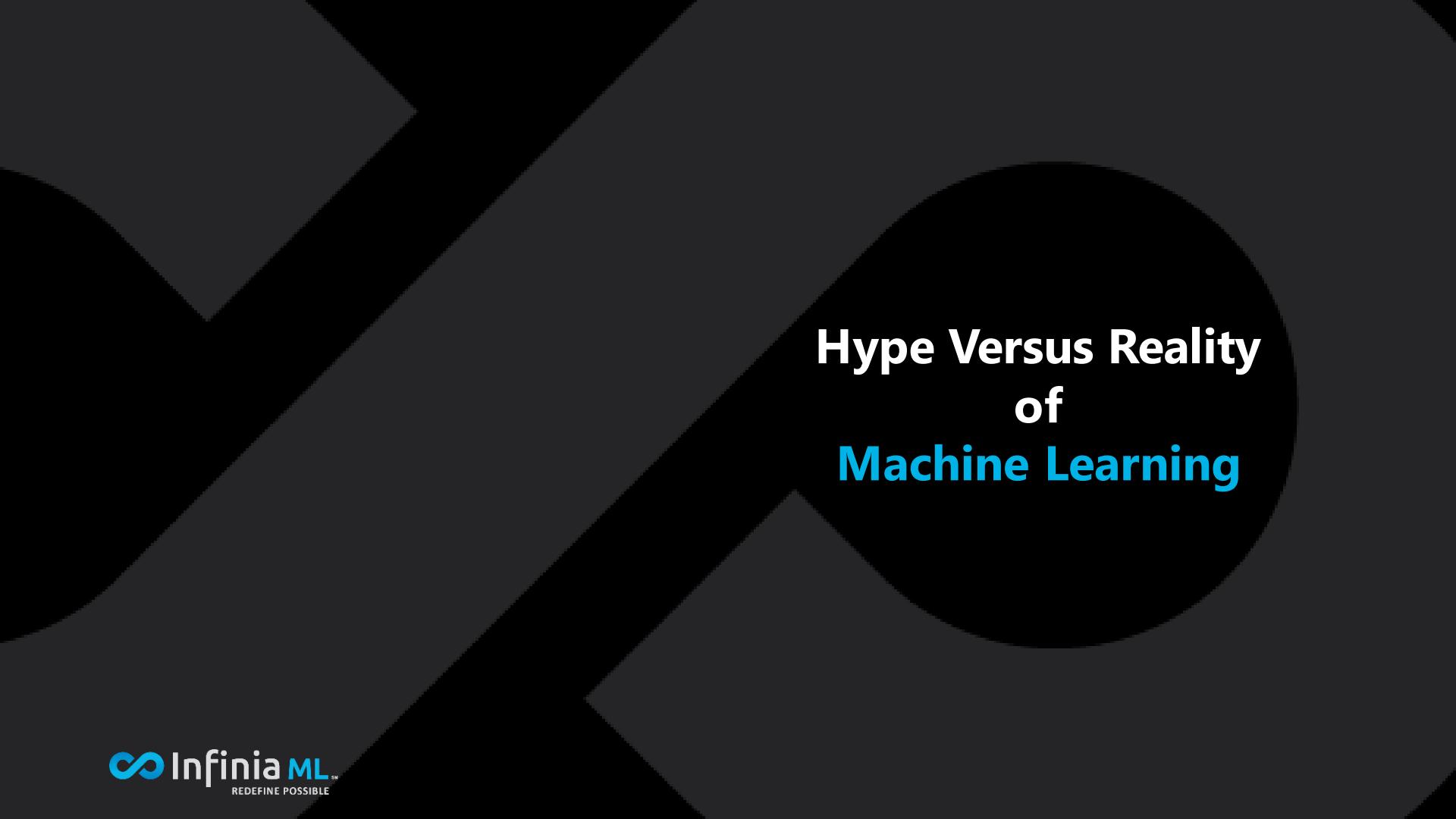
## How to Avoid Your Looming Machine Learning Crisis

Machine learning is critical to bringing your company's data swamps out of the dark ages, but several challenges await

July 2018 | HFS Research Authors:

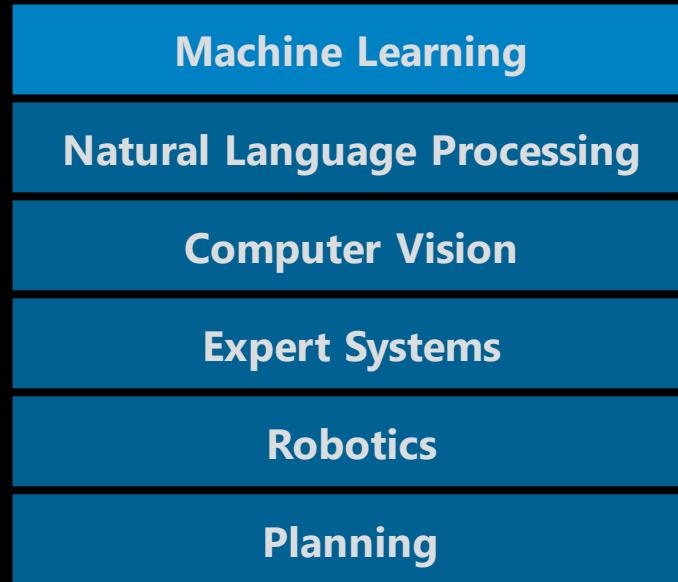
Reetika Fleming, Research Director, HFS Research; Phil Fersht, CEO & Chief Analyst, HFS Research

- A study of 153 data science decision makers across the Global 2000
- Read for free at [InfiniaML.com/report](http://InfiniaML.com/report)



# **Hype Versus Reality of Machine Learning**

# ARTIFICIAL INTELLIGENCE



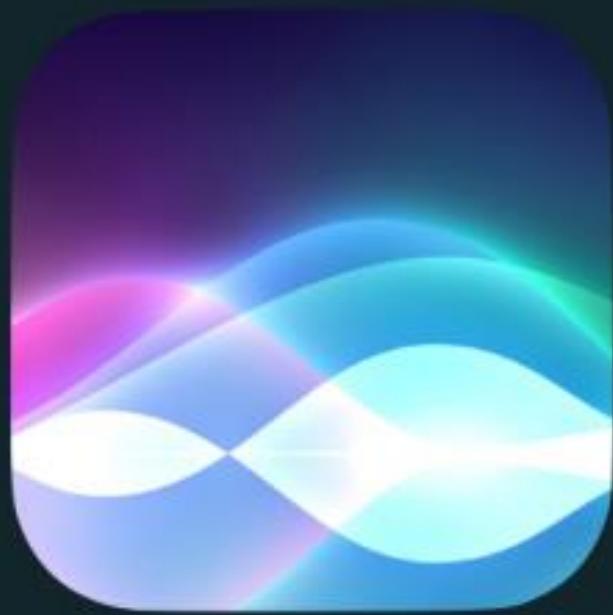
Supervised Learning

Unsupervised Learning

Transfer Learning

Reinforcement Learning

And More . . .



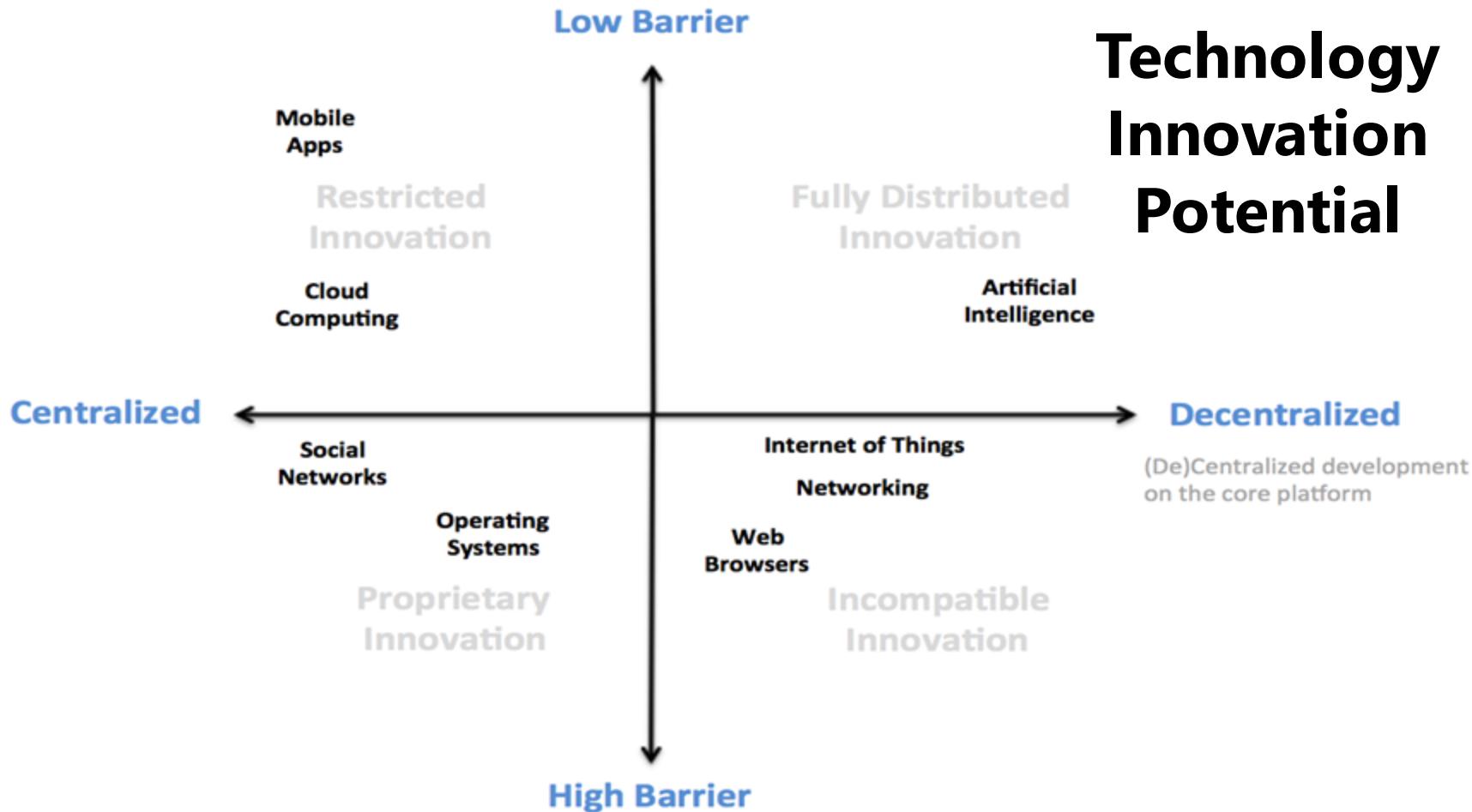
Siri



**Machine learning “gives computers the  
ability to learn without being explicitly  
programmed.”**

ARTHUR SAMUEL, 1959

# Technology Innovation Potential



# Four Industrial Revolutions

1780-1870



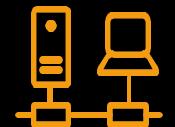
Steam

1870-1960



Electricity

1960-2010



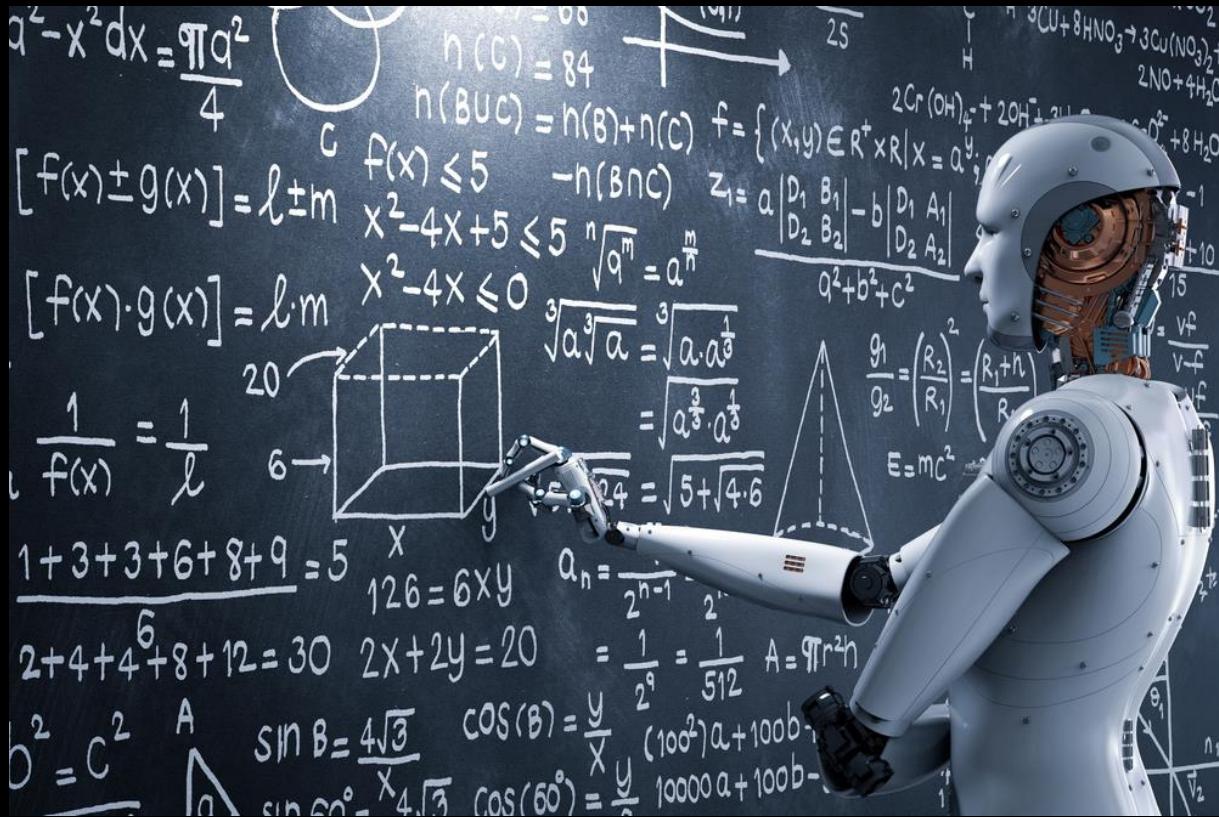
Computing

2010-today



Intelligence

# No Path to Artificial General Intelligence

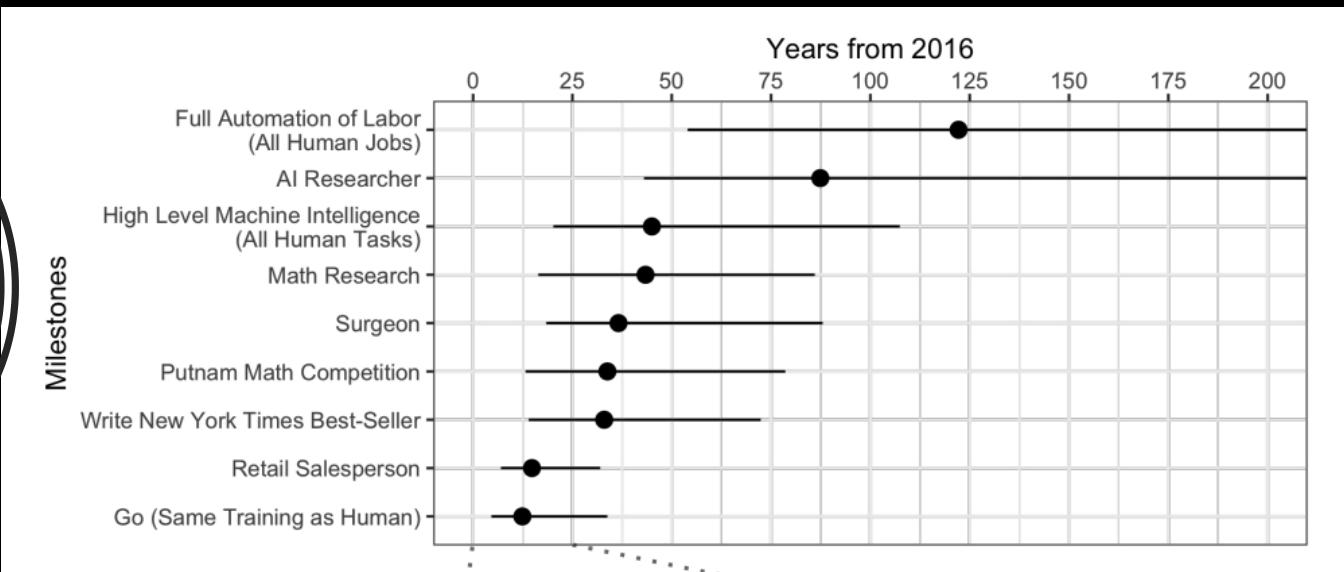






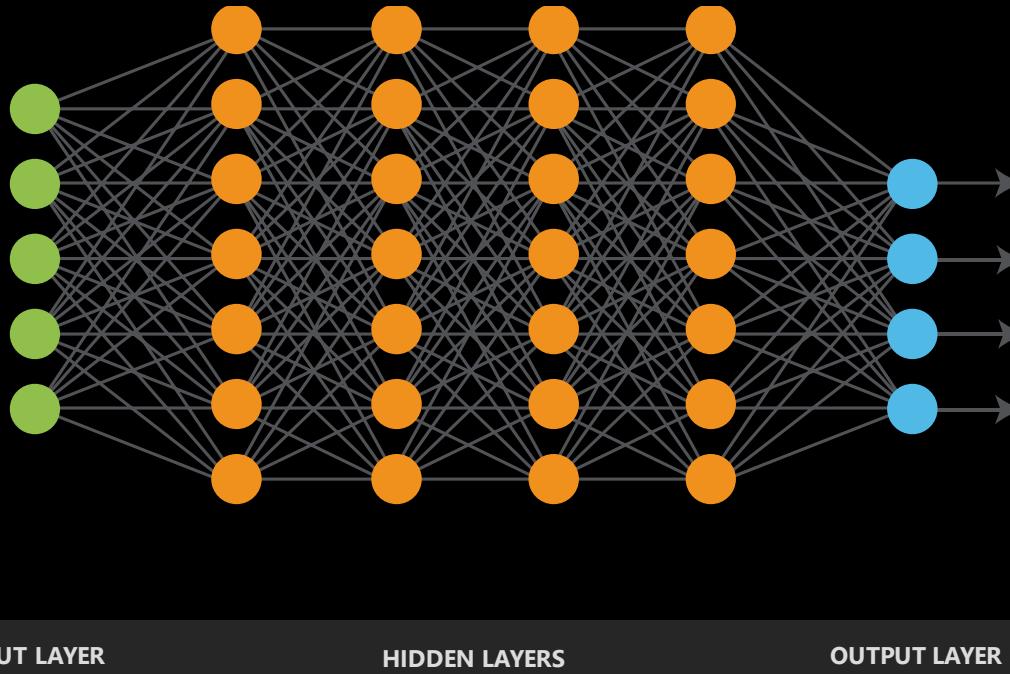
YouTube

Fully  
autonomous  
robots are  
far away



**"When Will AI Exceed Human Performance? Evidence from AI Experts"**  
Journal of Artificial Intelligence Research 2018

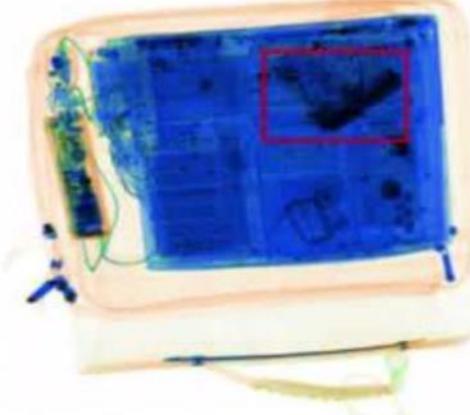
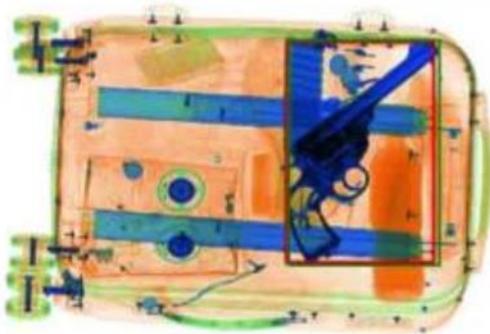
# Deep Learning / Deep Neural Networks



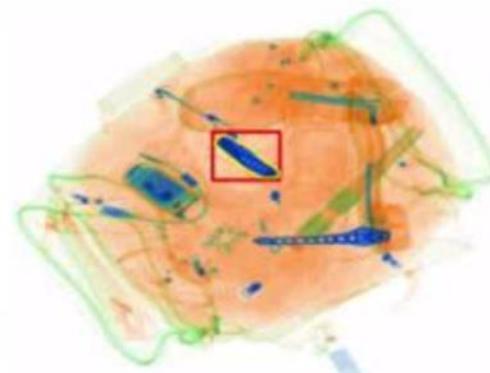
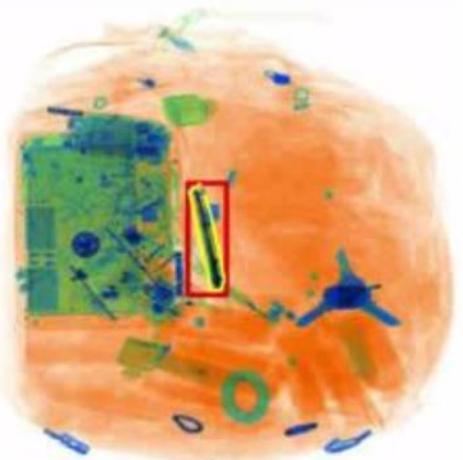
# Advances in Object Recognition



Firearms



Sharps



REDEFINE POSSIBLE

# Advances in Translation

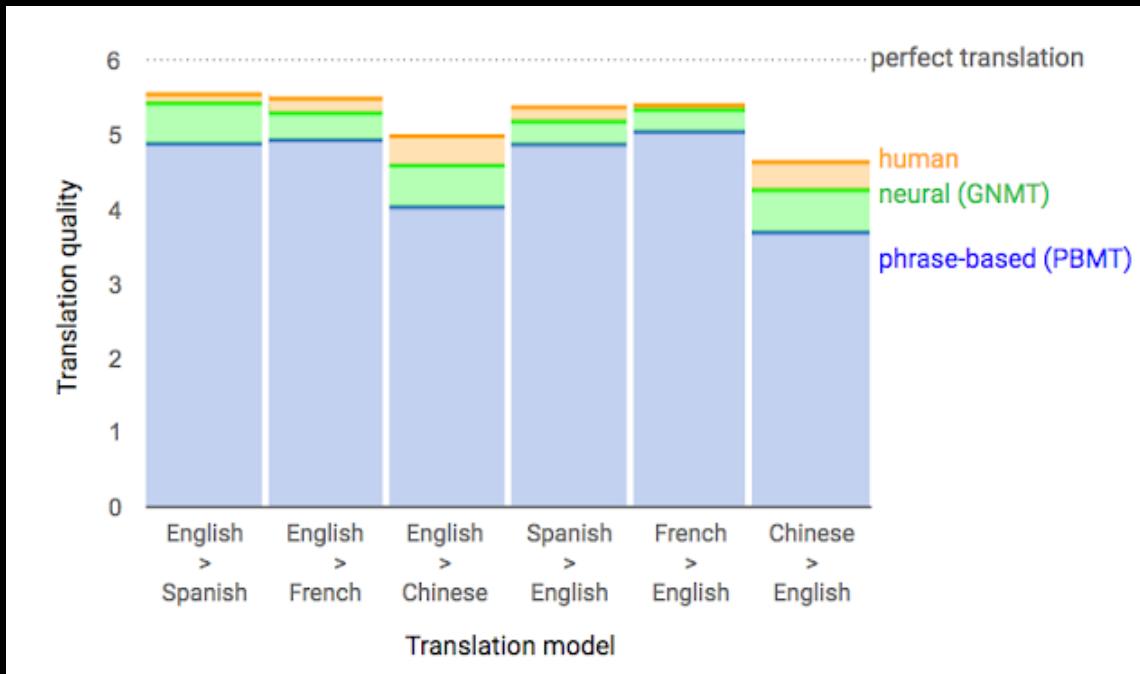


Image from "A Neural Network for Machine Translation, at Production Scale"  
Google AI Blog, September 2016

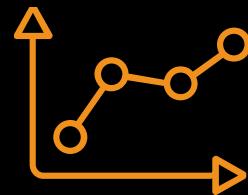
# **Business Impact of Machine Learning**

# Types of Business Impact

Reduce  
Costs



Increase  
Efficiency



Achieve  
Breakthroughs



*Even if all new machine learning innovation stopped today, the business world would take a decade to digest all that could be done with today's technology.*

# Poll

**Machine learning is impacting my business today.**

- A. Agree
- B. Disagree
- C. Not Sure

# Business Impact

How much you agree or disagree with these statements? N=153

Machine learning is making business impact in our industry today



Machine learning is making business impact in our company today



I feel optimistic about the business value of machine learning



We would not be able to 'experiment' with machine learning- we must have clear visibility of likely ROI



There is a growing epidemic of so called ML 'experts' who are just capitalizing on industry hype



Experts make it harder to understand machine learning when they speak in buzzwords



It's too early to tell the full business value of machine learning



I suspect that many so called machine learning 'experts' don't really know what they're talking about



I have been disappointed in the past by a machine learning project that underdelivered



I don't understand machine learning as well as I should



Machine learning is overhyped



- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

# Automated Contract Analysis



GLOBAL LEGAL SERVICES



## QUESTION

Can Axiom analyze more legal contracts without increasing headcount?



## PROCESS

Natural language processing helps identify a contract's contents.



## DESIRED RESULT

Major efficiency gains as a single analyst can process more contracts.

(4)

## ARTICLE II - TERMINATION

The Service Period will be for five (5) years from the Effective (7) Date (The 'Initial Term'). The agreement is considered to be terminated in October 16, 2014 . (8)

(4)

## ARTICLE III - PAYMENT - FEES

During the service period monthly payments should occur. The estimated fees for the Initial Term are £154,800 . (9)

(4)

## ARTICLE IV - GOVERNING LAW

This agreement shall be governed and construed in accordance (10) the Laws of England & Wales . Each party hereby irrevocably submits to the exclusive jurisdiction of the courts sitting in Northern London . (11)

# Automated Ultrasound Nerve Detection



## QUESTION

Can ultrasound equipment automatically detect a certain nerve?



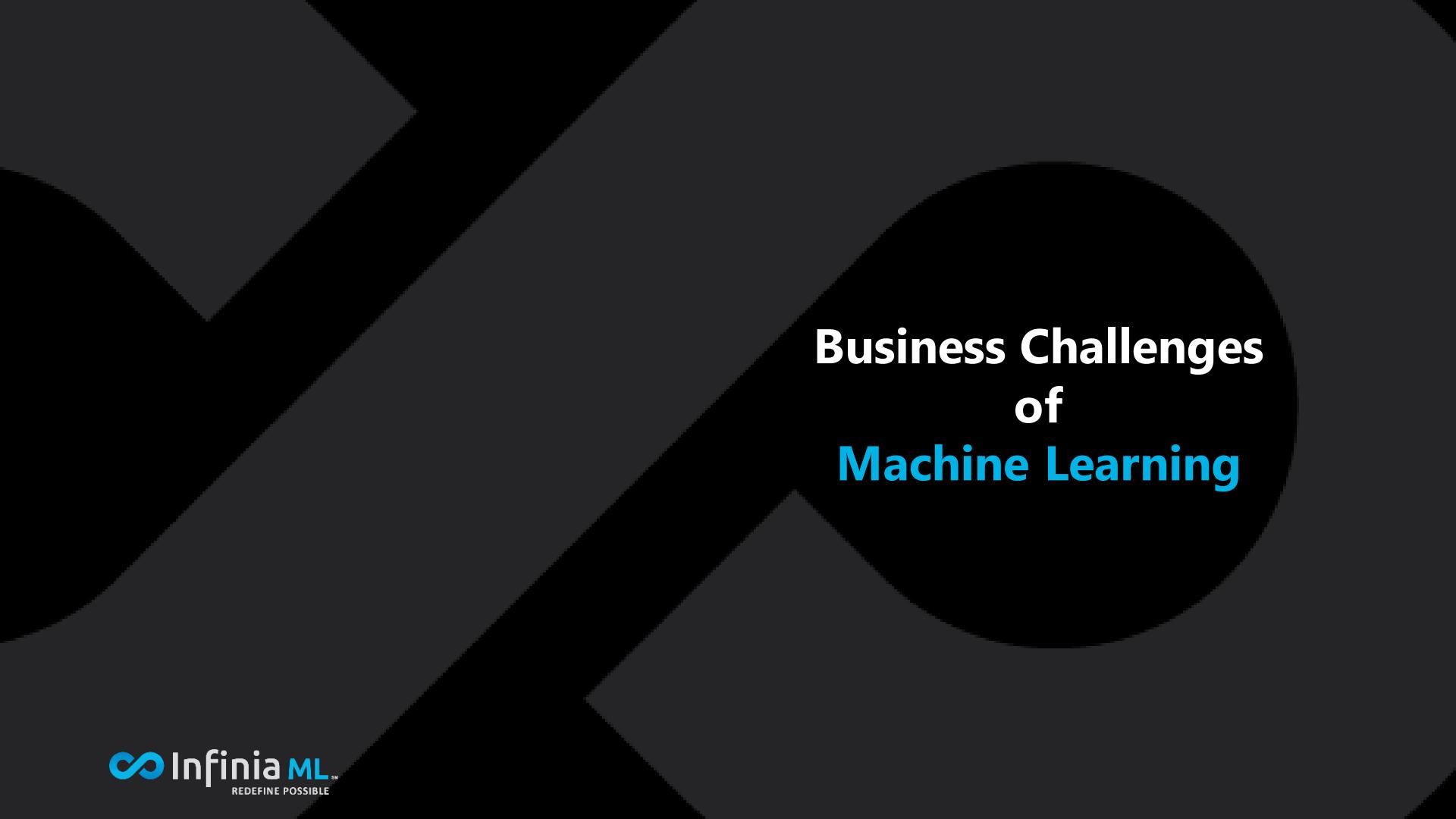
## PROCESS

Machine learning algorithm draws a bounding box around the nerve in question.



## RESULT

Nerves identified to aid medical practitioners.



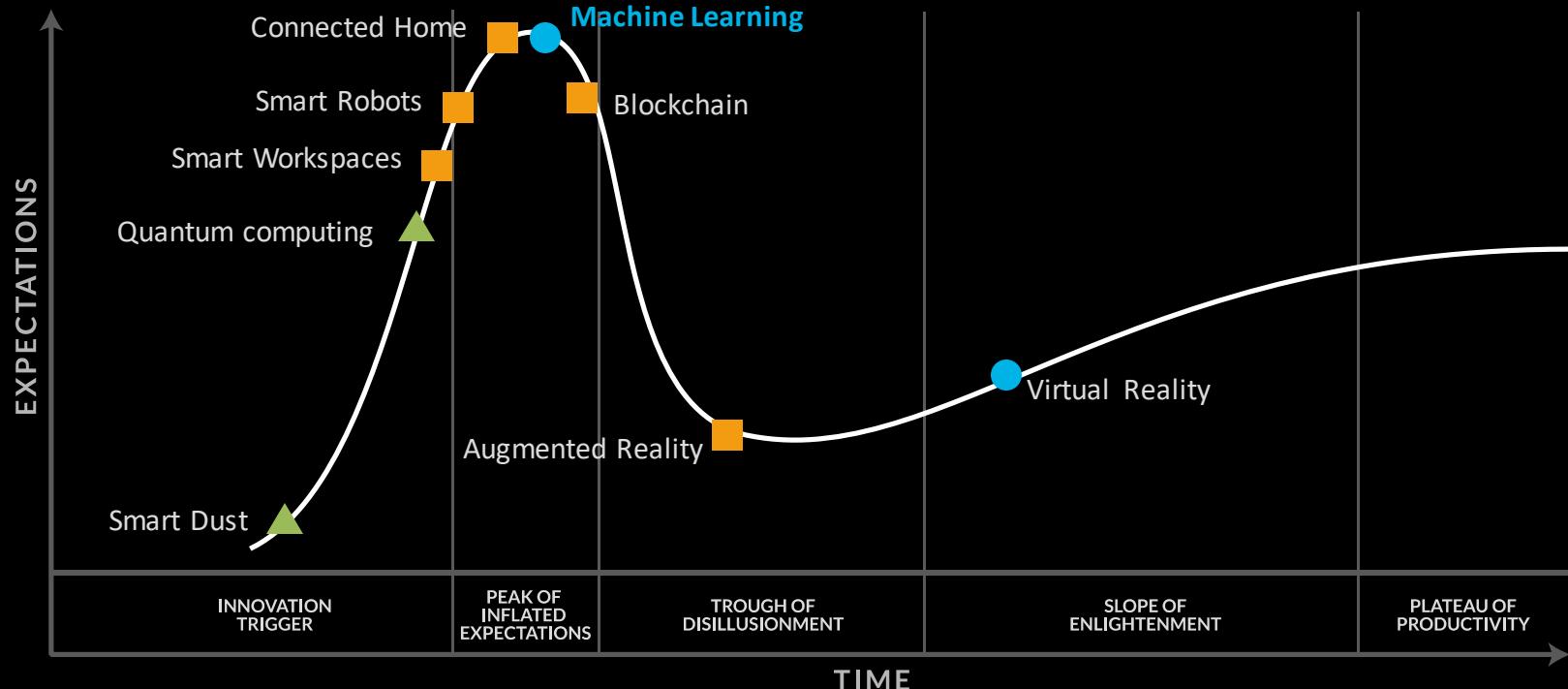
# **Business Challenges of Machine Learning**

# Poll

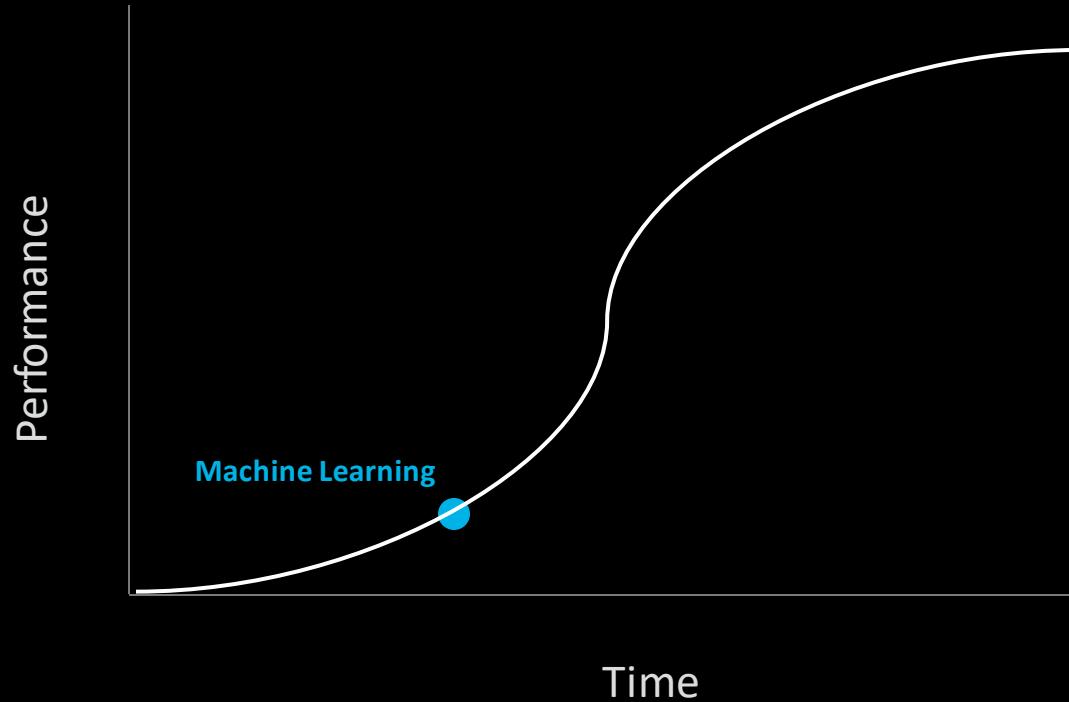
**Machine learning is overhyped.**

- A. Agree
- B. Disagree
- C. Not Sure

# Gartner Hype Cycle Chart



# Technology Maturity S-Curve



# The Talent Backlog

Bloomberg

Technology

## Demand for AI Talent Turns Once-Staid Conference Into Draft Day

Academic NIPS gathering is now a recruiting frenzy for tech giants, banks and hedge funds

By [Jeremy Kahn](#)

December 6, 2017, 5:00 AM EST *Updated on December 6, 2017, 6:56 AM EST*

# The Talent Backlog

*“Buying data science capability is likely a more successful path than hiring it in today’s market. The talent pool is very limited, and thus expensive.”*

— Axiom CTO Doug Heenthal, quoted in  
“How to Avoid Your Looming Machine Learning Crisis”, HFS Research

# Prohibitive Processing Speeds



# Interpretability



# Not Enough Data



# The Good News



# The Good News

- Hype will inevitably subside
- ML will get easier as technology matures
- Better tech + more training = more trained professionals
- GPUs/TPUs will become more available
- Increasing options for explainable models



**It All Starts With  
Data**

# Accessible



Sizable

# Usable

Color 1	Color 2	Color 3	Color 4	Color 5
Purpul	Greene	Biege	Yeloh	Whyte
Redd	Bluck	Porple	Greeeen	Bayge
Bleu	Brohwn	Rid	Blick	Parple
Yello	Whiiite	Bloo	Brawn	Rad

# Understandable

Column 1	Number 2	Cat. 3	Data 4	Data 5
234523	ASD23r	CPAD	DCCSD	0000
23rdc	D\$%\$%\$%	DILC	D3234	0000
3ds	23423	EDCF	1112	333
DCCD	234523	IDDF8	ASD23r	234523

# Maintainable



# Data Checklist

A-ccessible

S-sizeable

U-sable

U-nderstandable

M-aintainable

# Audience Poll

**Is your team's data ready for machine learning?**

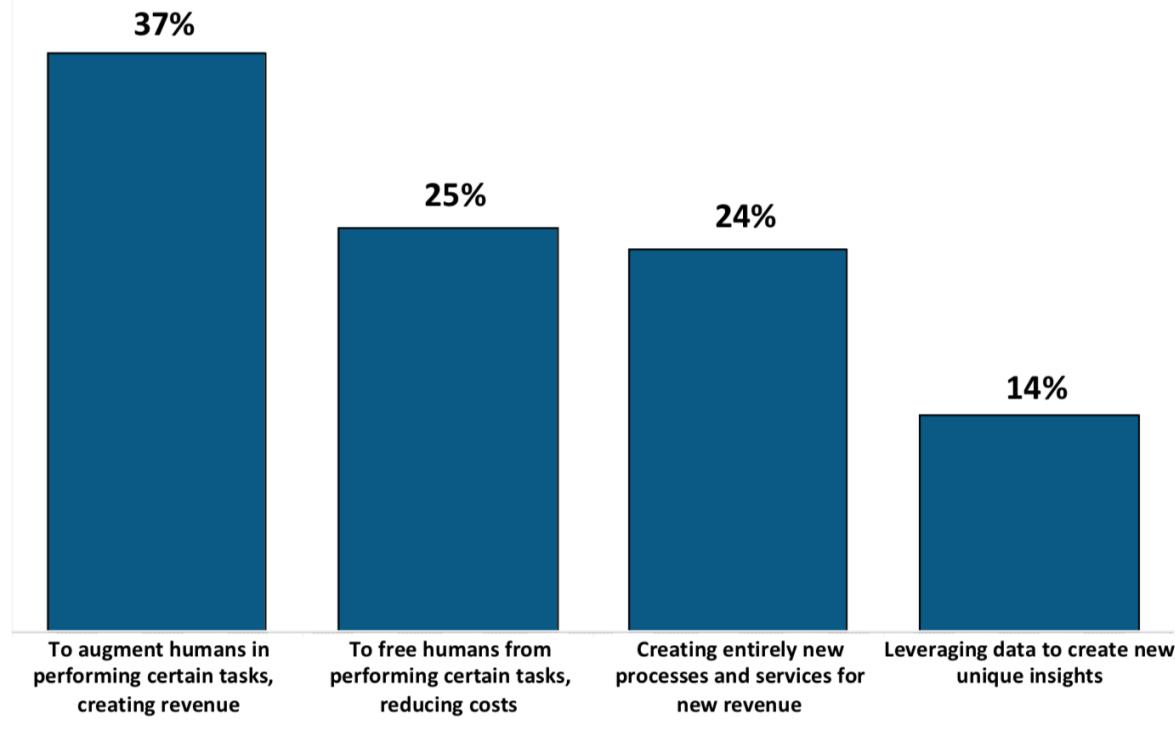
- A. Yes
- B. No
- C. Not Sure



# Insights from The Field

# Perceived ML Benefits

What do you believe to be the greatest potential benefit of Machine Learning? N=153



# Business Impact

How much you agree or disagree with these statements? N=153

Machine learning is making business impact in our industry today



Machine learning is making business impact in our company today



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We would not be able to 'experiment' with machine learning- we must have clear visibility of likely ROI



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I suspect that many so called machine learning 'experts' don't really know what they're talking about



I have been disappointed in the past by a machine learning project that underdelivered



I don't understand machine learning as well as I should



Machine learning is overhyped



- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

# Don't Believe The Hype?

**Over 50% Agree:**

"There is a growing epidemic of so-called ML 'experts' who are just capitalizing on industry hype."

**Q&A**

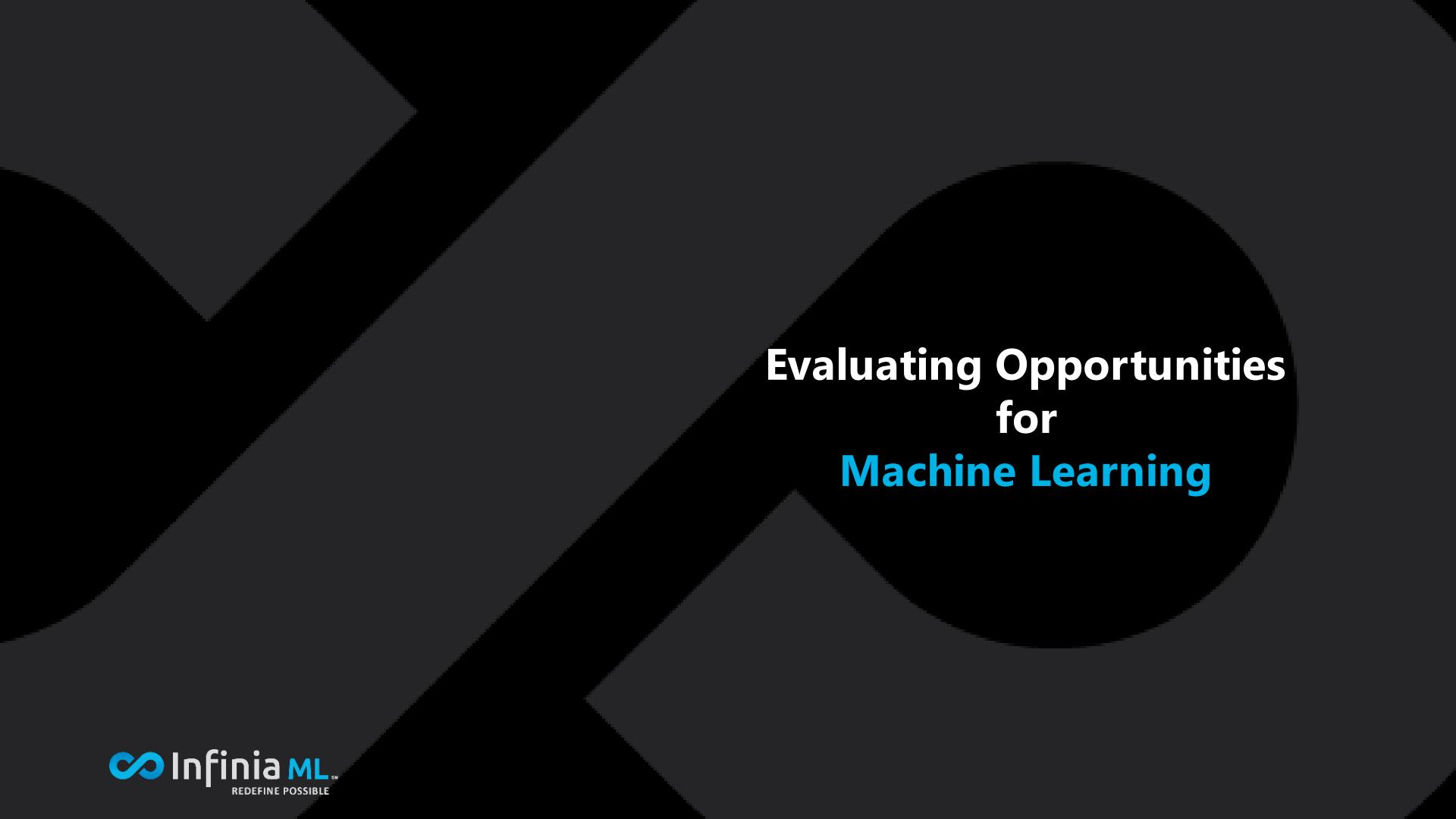
# 5 Minute Break

# Agenda



## Part 2

- Evaluating ML Opportunities
- Staffing and Project Planning
- Insights from the Field (Part 2)
- Q&A/Break



# Evaluating Opportunities for **Machine Learning**

# Poll

**Are your confident your team can pick the right ML projects?**

- A. Yes
- B. No
- C. Not Sure

# Risk vs. Reward



# Assessing Internal Support

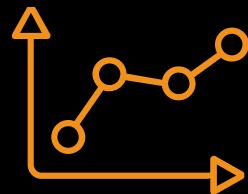
- Is it your first project?
- Do you need a quick win?
- Do you want to go for a breakthrough?
- Can you measure the business impact?

# Types of Business Impact

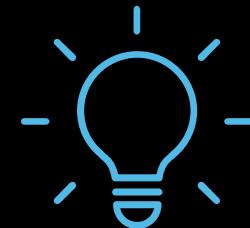
Reduce  
Costs



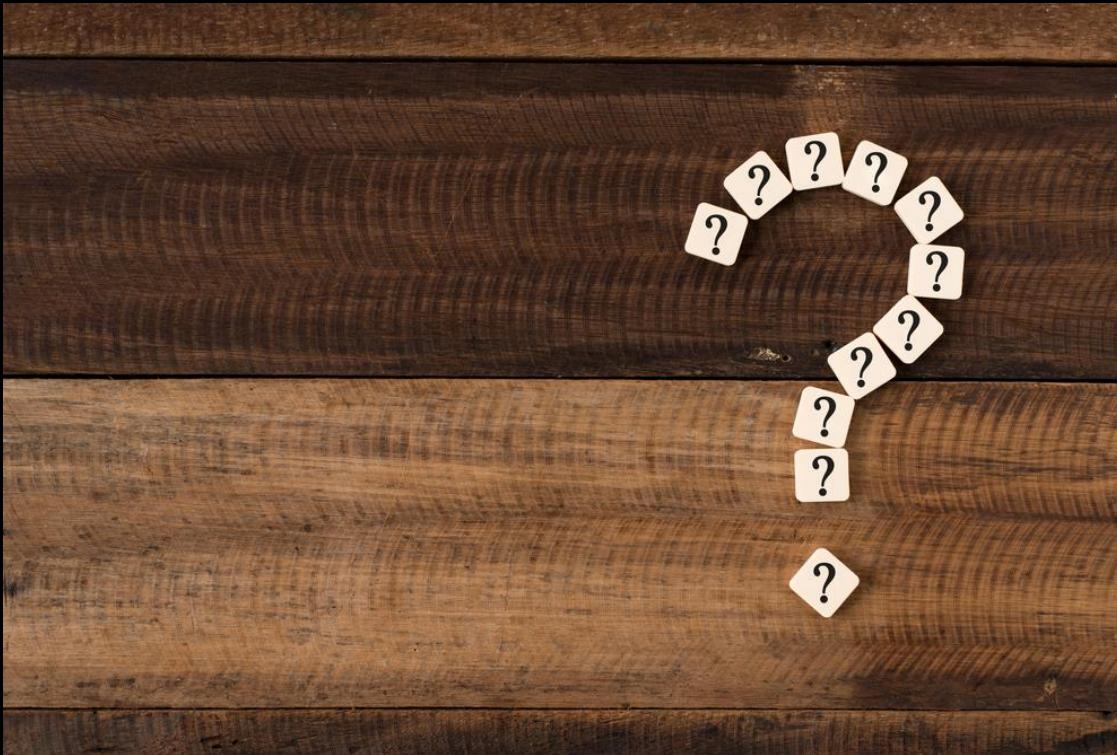
Increase  
Efficiency



Achieve  
Breakthroughs



# Can The Business Question Be Defined in ML Terms?



# Data Readiness



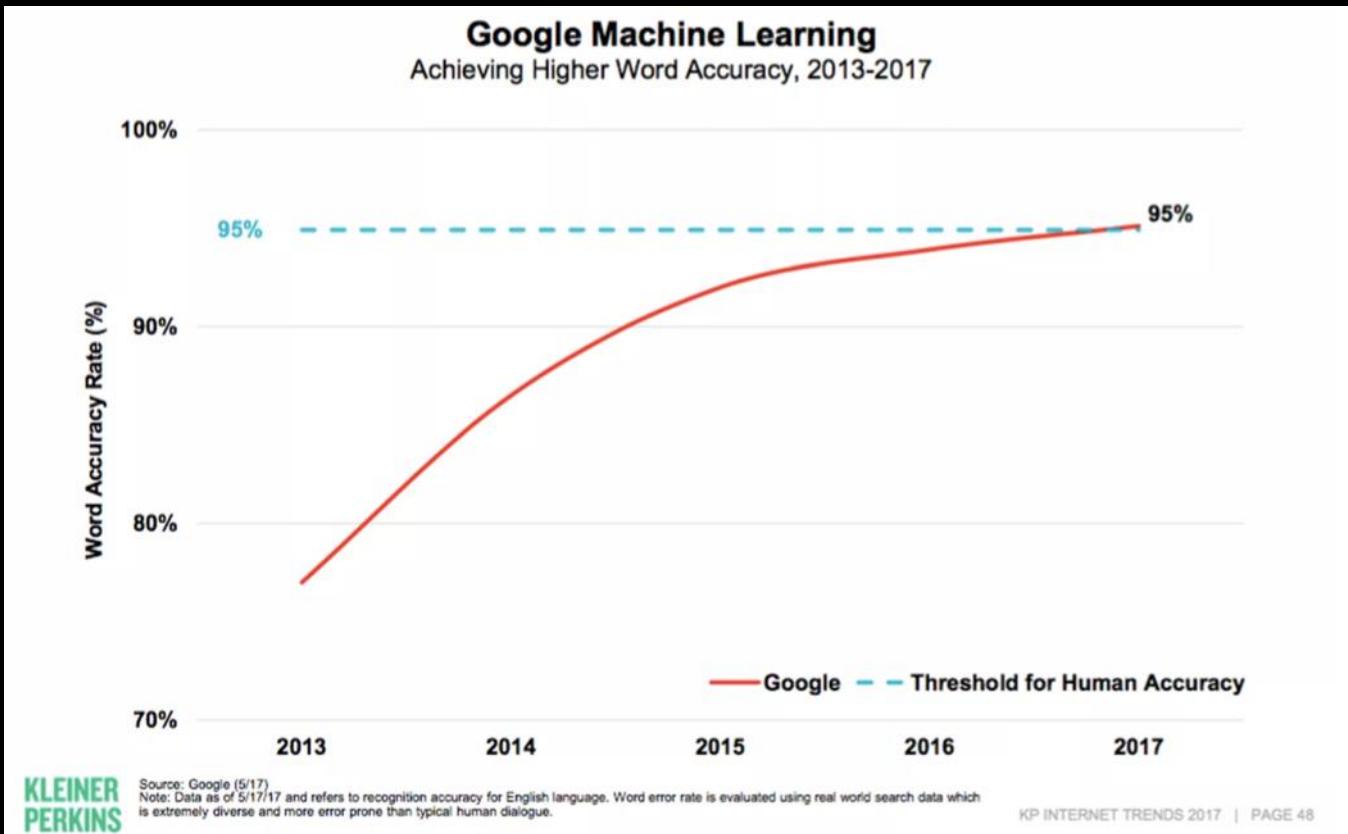
# Assessing Your Data

- Who owns the data (your company, a third party, the public domain, etc.)?
- What kind of data is it? (Numeric, Text, Images, Video, Other )
- How quickly can your team access the data?
- How often is your data updated?
- How big is the data set?
- Who manages the data?
- How is the data stored (local MySQL, AWS S3, Hadoop, etc.)
- How sensitive is the data?

# Team Readiness

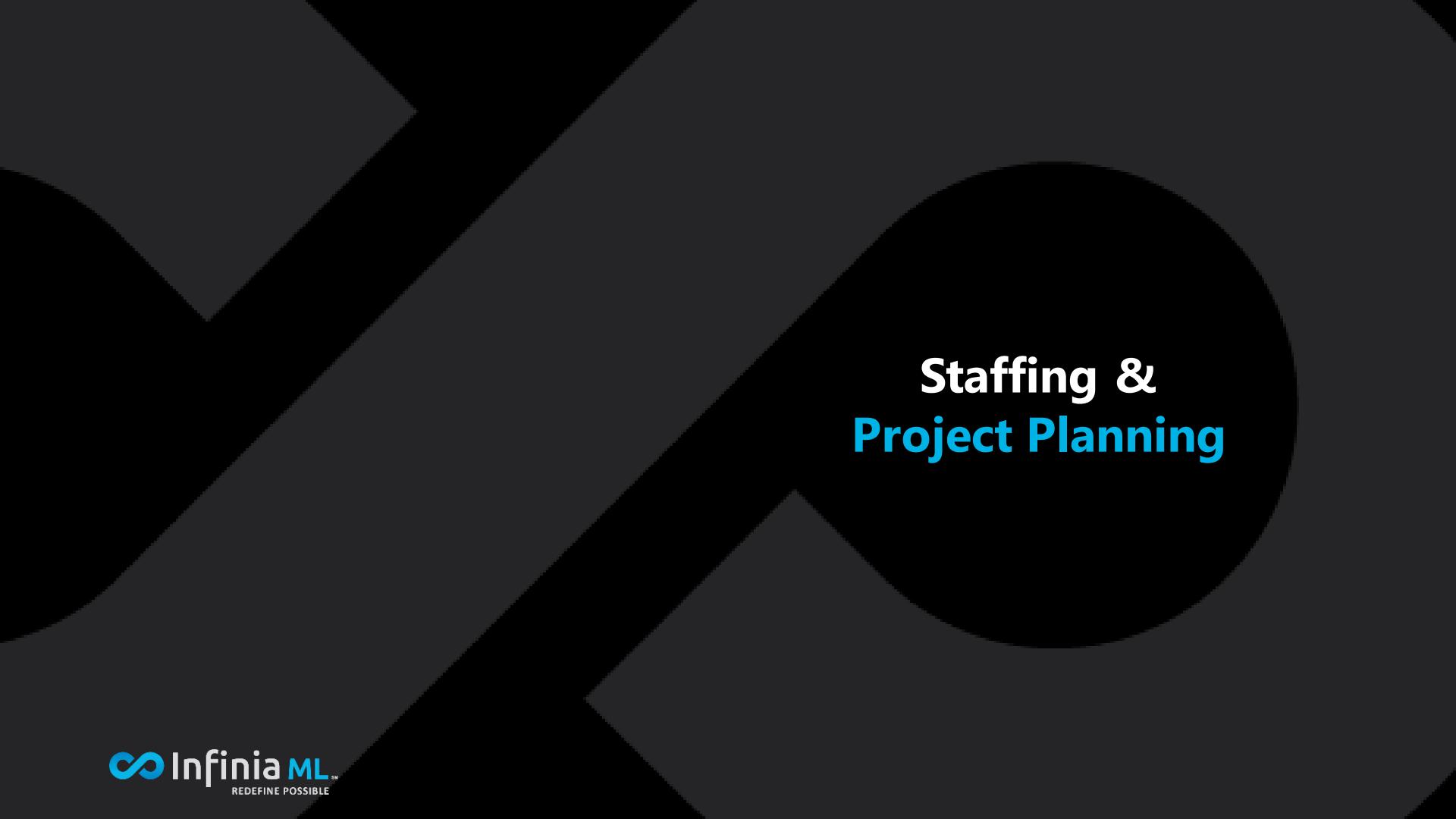


# Realistic Expectations for Accuracy



# The Best ML Projects Have:

- Measurable Business Impact
- Data Readiness
- Team Readiness
- Well-Defined Question
- Realistic Expectations



# **Staffing & Project Planning**

# Academic-Business Chasm



# Audience Poll

**Have you experienced a gap between academia  
and business?**

- A. Yes
- B. No

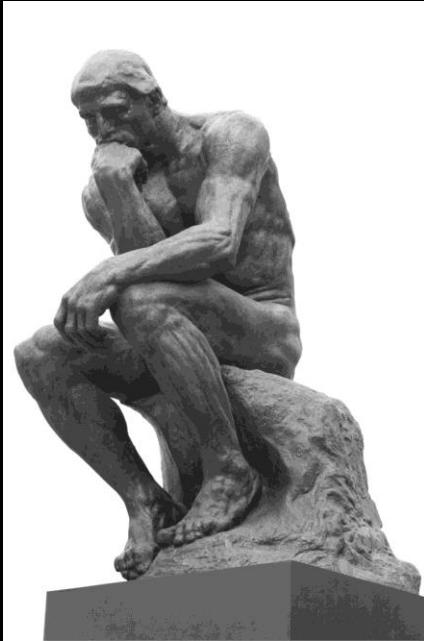
# Chasm Solution 1: Centralize the Team



# Chasm Solution 2: Create Lab Environment



# Chasm Solution 3: Hire for Business Goals



VS.



# Project Roles

- Business Owner
- Data Scientists
- Technical Lead
- Software Developers
- Project Manager
- Data Engineers

# Evaluating Data Scientists

- ❑ Academic Credentials
- ❑ ML Experience
- ❑ Practical Deployment Experience
- ❑ Communication

# 3D Approach to Machine Learning



## DATA PREPARATION

STEP 1

- Conduct Assessment
- Resolve Roadblocks
- Confirm Readiness



## DEVELOPMENT

STEP 2

- Design Algorithms
- Train Models
- Test Results



## DEPLOYMENT

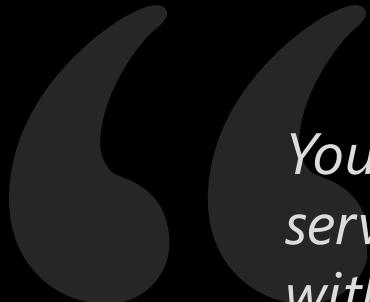
STEP 3

- Build Robust Software
- Integrate Solutions
- Confirm Impact



# Insights from The Field

# Using ML To Change Market Perception



*You won't just think of us as a [legal services] company that you go do projects with. You'll think of us as a company who knows everything about what's in your contracts.*

- Edited interview with Infinia ML client

# Using ML To Change Market Perception



*Machine learning could change the way our customers view [us]. Instead of a customer thinking of our technology as just confirming the quality of their product at the end, we want them to see our technology as a productivity tool to enhance the quality of their process.*

- Edited interview with Infinia ML client

**Q&A**

# 5 Minute Break

# Agenda



## Part 3

- Addressing Workforce Concerns
- Building a Data-Centered Organization
- Being Prepared for the Future
- Final Q&A



# Addressing Workforce Concerns

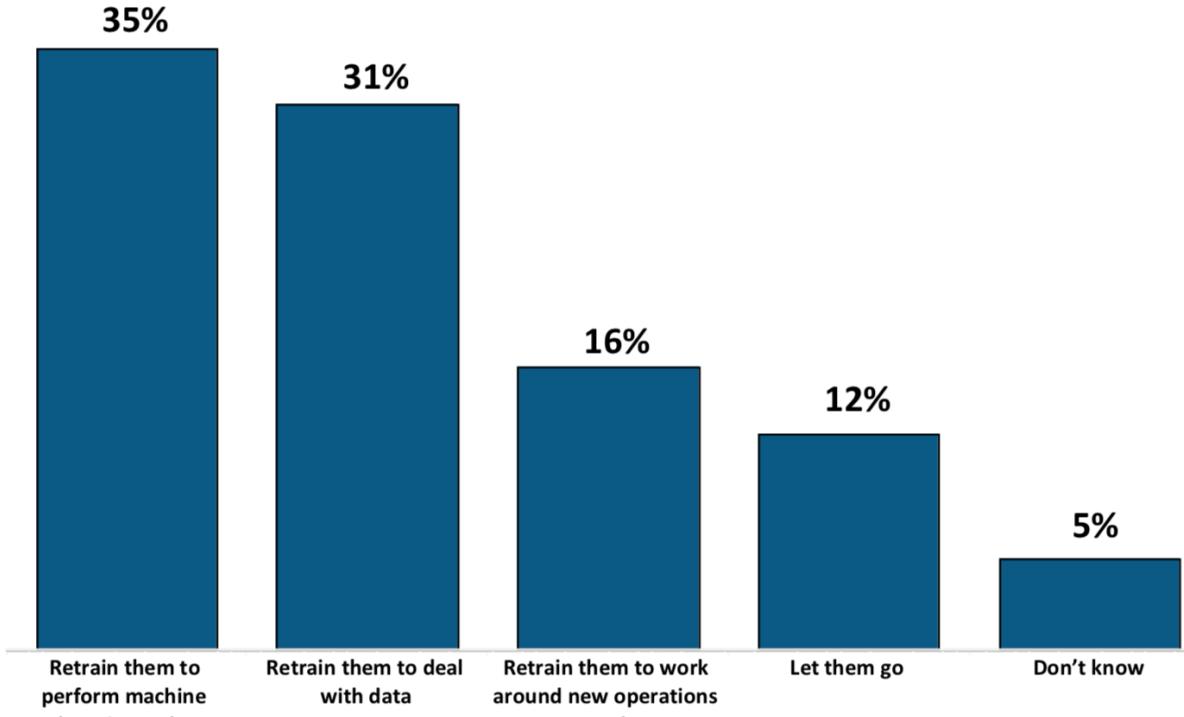
# Audience Poll

**Do you think machine learning will disrupt your workforce?**

- A. Yes
- B. No

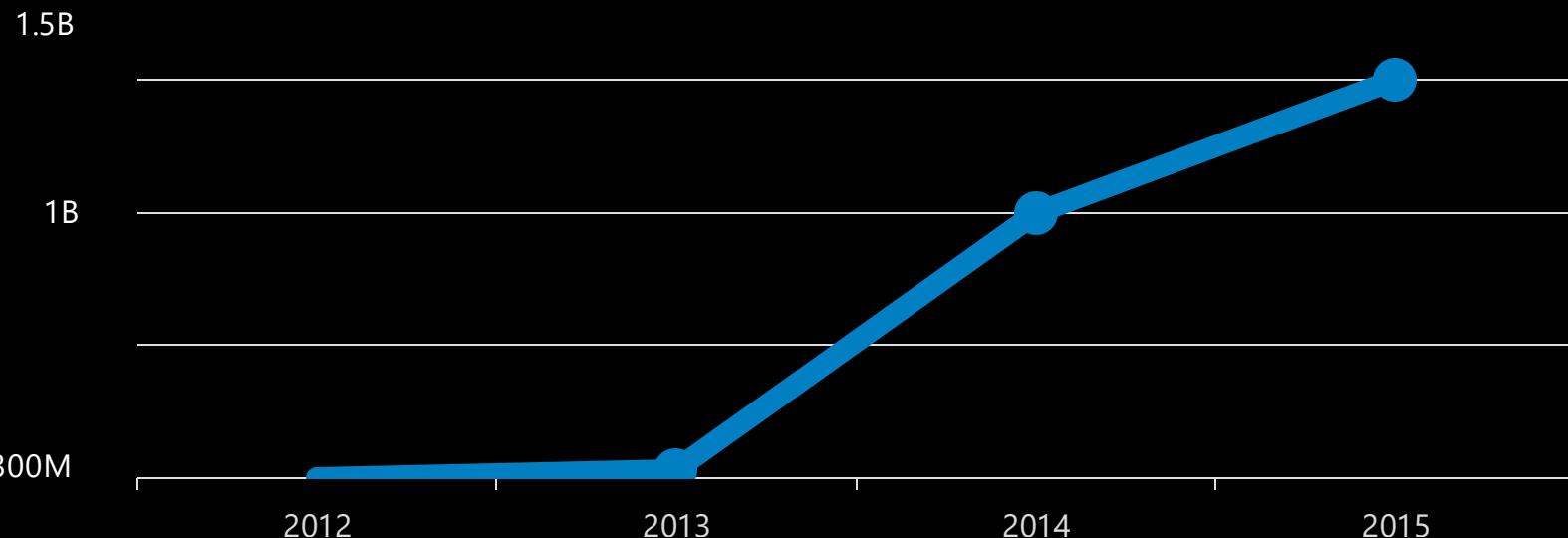
# Dealing with retraining

How will your enterprise likely deal with displaced people? N=153



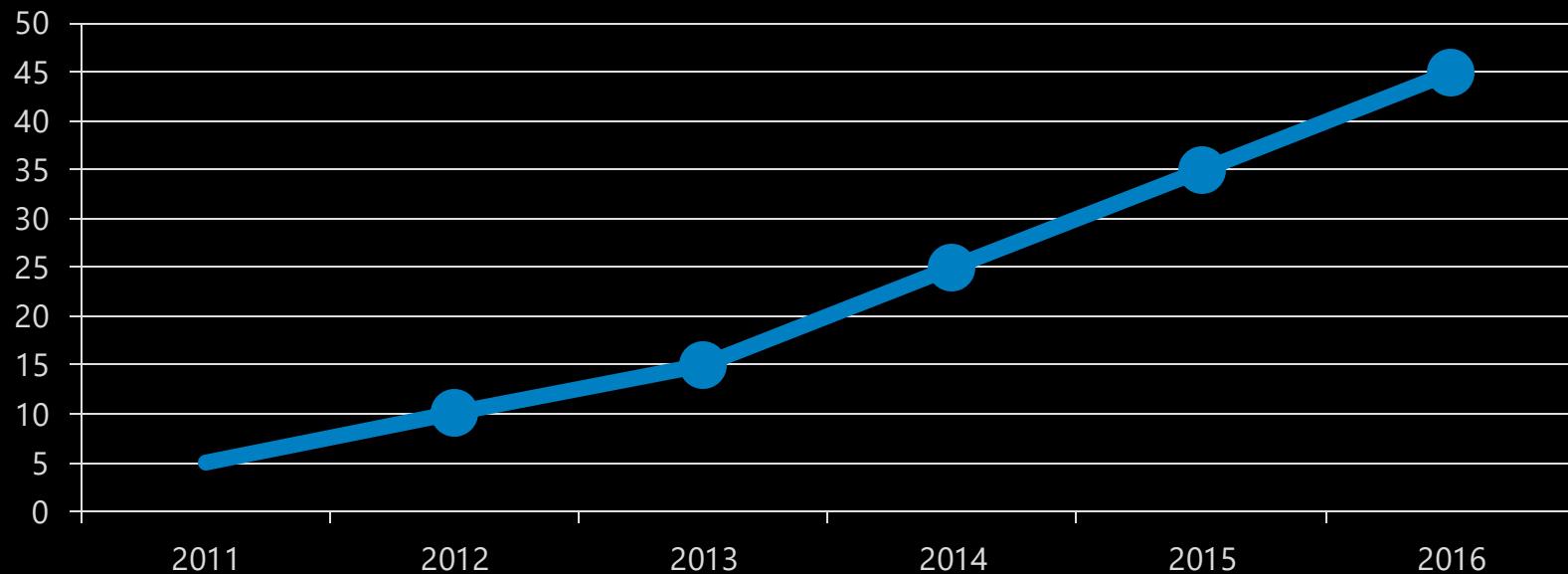
# Number of Articles Produced by Wordsmith

ai AUTOMATED  
INSIGHTS



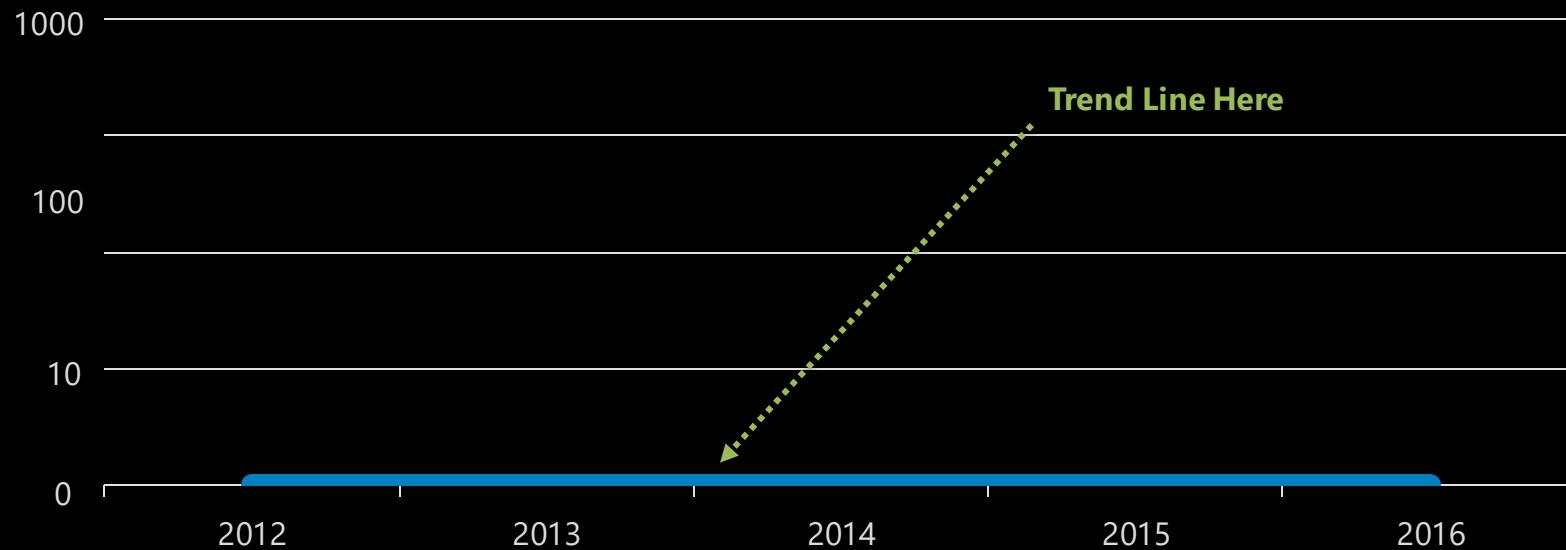
# Number of Interviews About Wordsmith Taking Jobs

ai AUTOMATED  
INSIGHTS



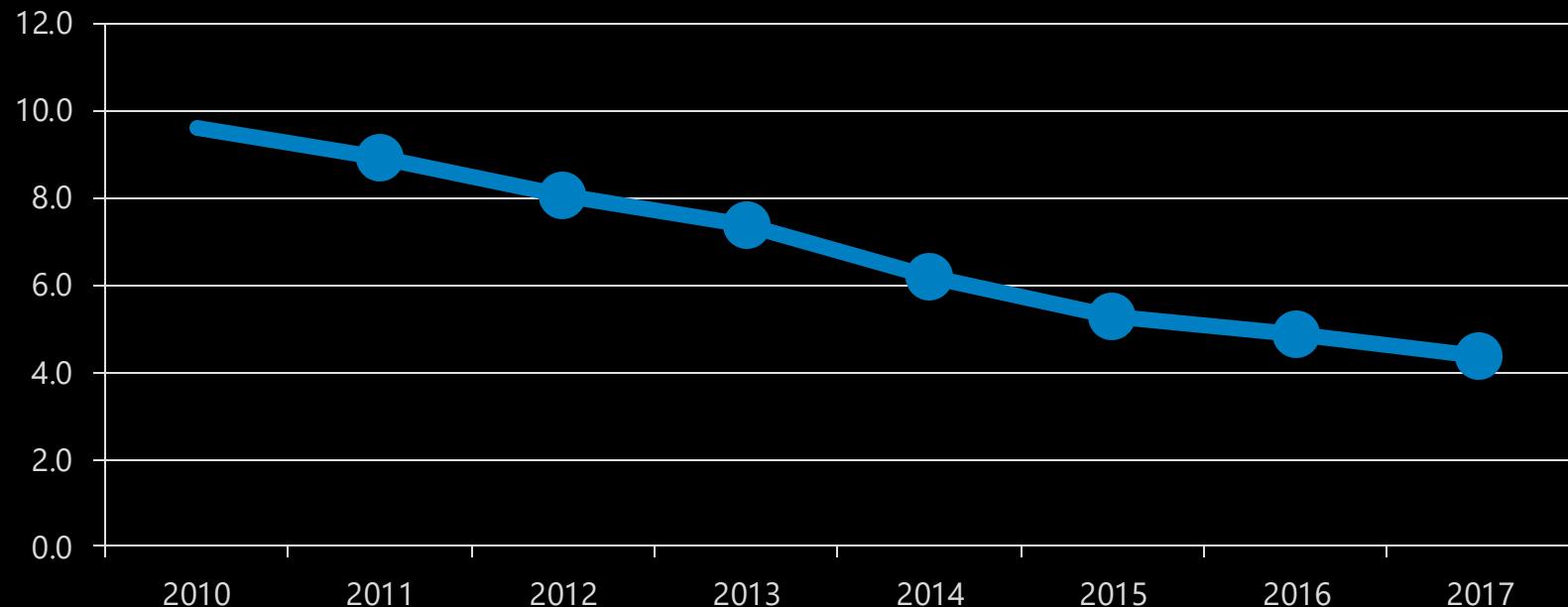
# Number of Jobs Lost Due to Wordsmith

ai AUTOMATED  
INSIGHTS



# US Unemployment Rate

Source: Bureau of Labor Statistics



# Some Jobs Weren't Meant for People



## MACHINE LEARNING...

- Doesn't get tired or disgruntled
- Maintains a consistently high throughput
- Doesn't exhibit unconscious bias

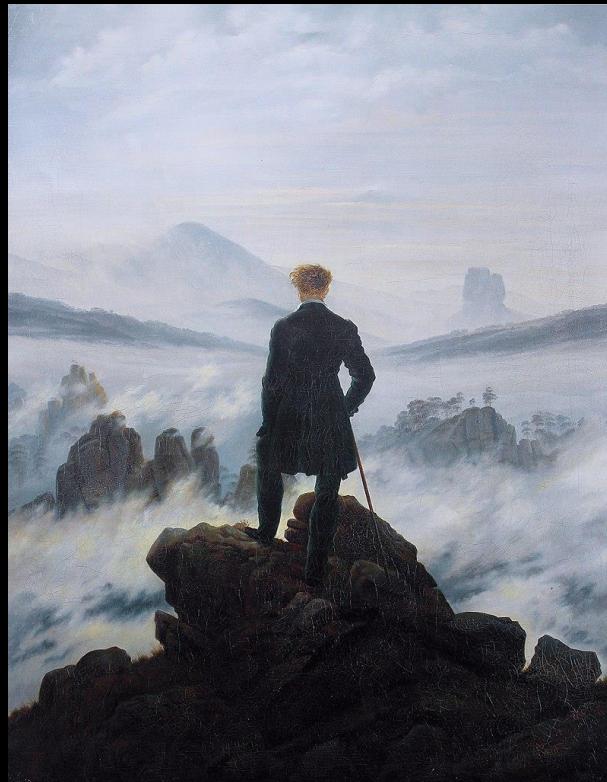
# You Can Find People a New Place



# Your Team + Automation = More Value



# Plan Proactively



# **Building a Data- Centered Organization**

# Poll

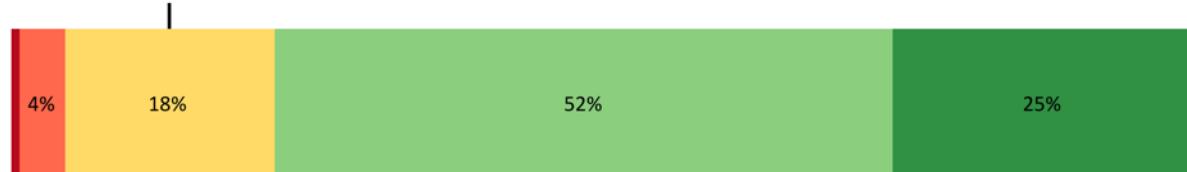
**Does your team have the organization and infrastructure you need for advanced machine learning?**

- A. Yes
- B. No

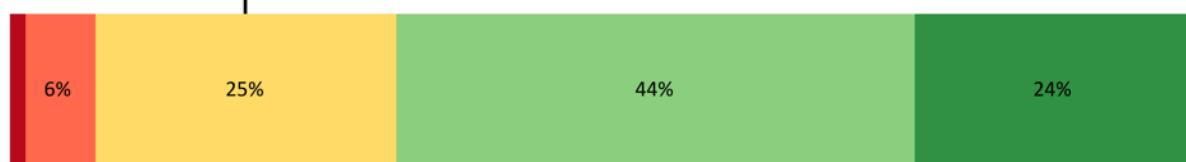
# Do enterprises make the most of data?

How much you agree or disagree with the statements about your use of data? N=153

We make the most of the customer data we have, and it informs, drives changes within our overall strategy



We have world class systems and processes for collecting, storing, and accessing our data



We believe that our current use of the data resources we have limits our ability to acquire new business



Legend

■ Strongly disagree

■ Disagree

■ Neutral

■ Agree

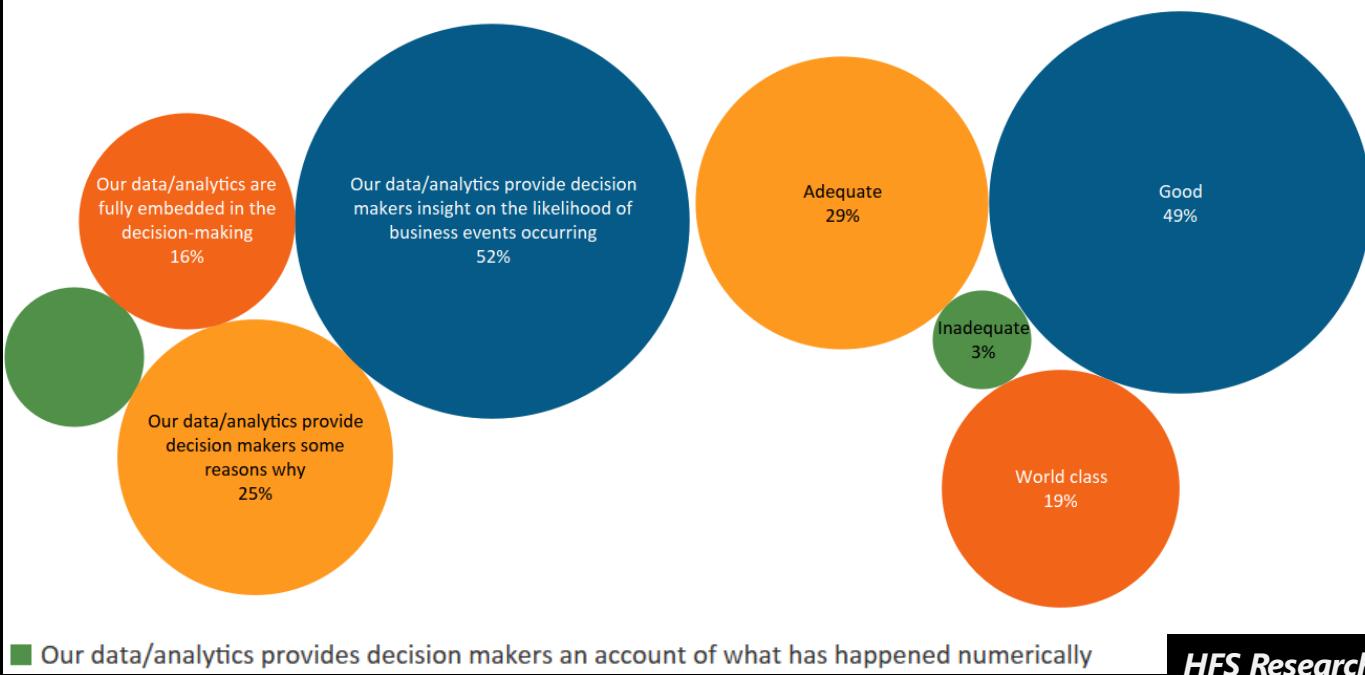
■ Strongly agree

# Maturity of data

*Please choose the categories that best fit the maturity of your data management processes and the ability to draw insight and value from the data? n=153*

Data insight / business value

Data management processes for collecting, storing and accessing data



**HFS Research**

# Everyone Has a Role in Data Culture



# Ownership and Privacy Issues

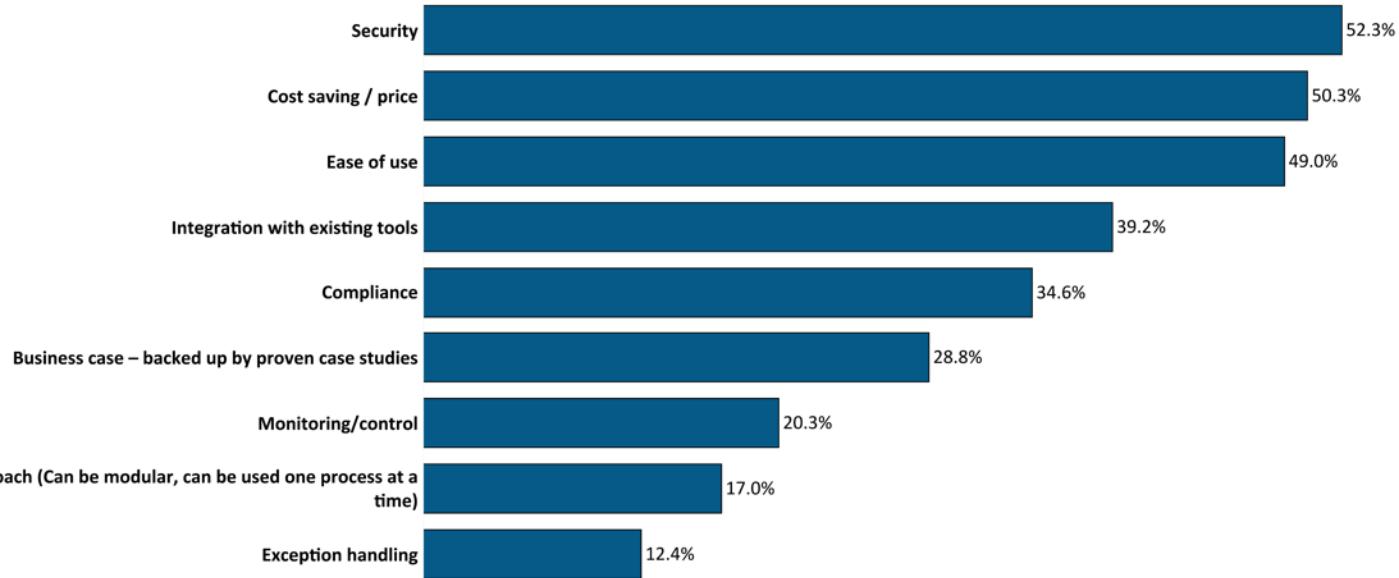


# Data Security



# What proof points are required for using ML

**Which of the following would ML have to be able to demonstrate before your organization considers using it? N=153**



# What Good Governance Looks Like

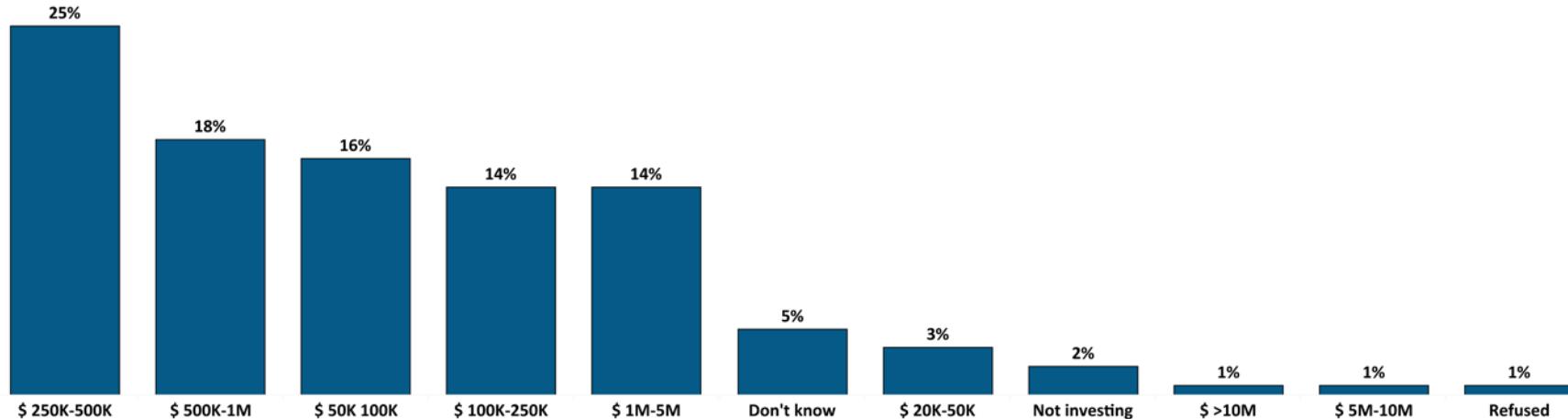




**Preparing for  
The Future**

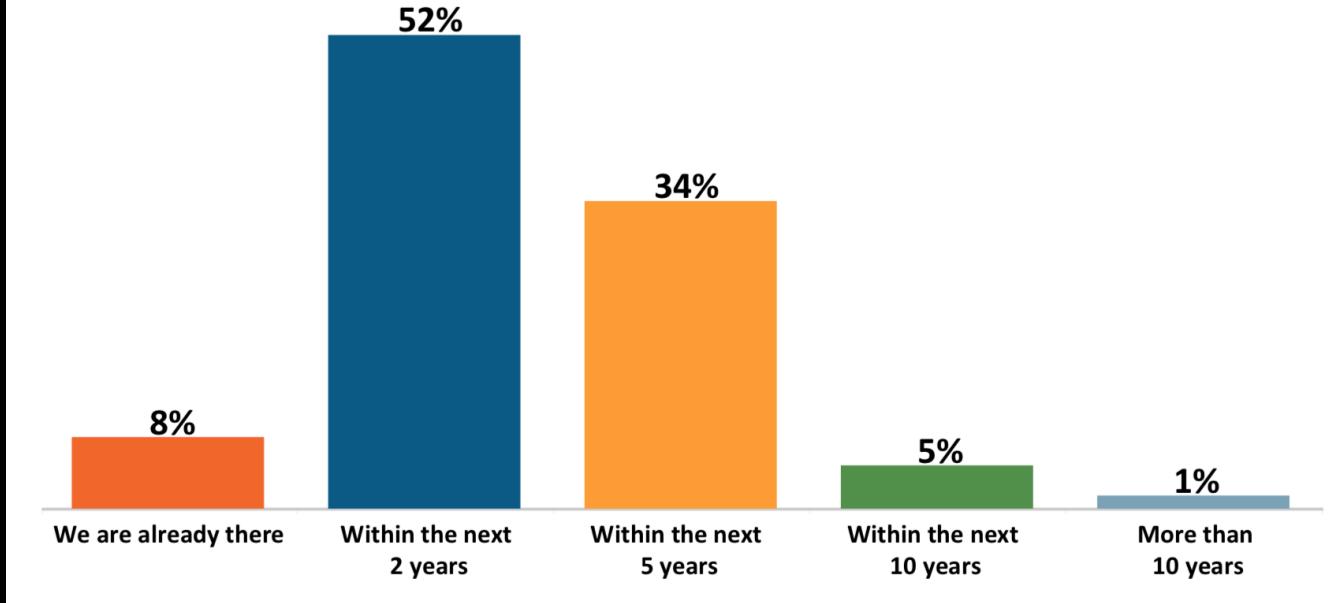
# Spending on ML

*Please estimate how much will you spend overall on ML over the next 12 months? N=153*



# A Core Business Technology In <2 Years?

Q: What is your estimated timeline for ML becoming a core technology implemented in all relevant aspects of your business?



# What's Next for Image Processing

In a few years, there won't be any jobs that involve manual visual inspection.



# What's Next for NLP

In a few years, all document analysis jobs will have machine assistance.



# What's Next for Data

Over the next five years, the same amount of money spent installing source data **entry** systems like SAP, Oracle, or Cerner/Epic in the healthcare space will be spent getting data **out** of the systems and making use of it.



# Eventually, ML Will Be Just Another Tool



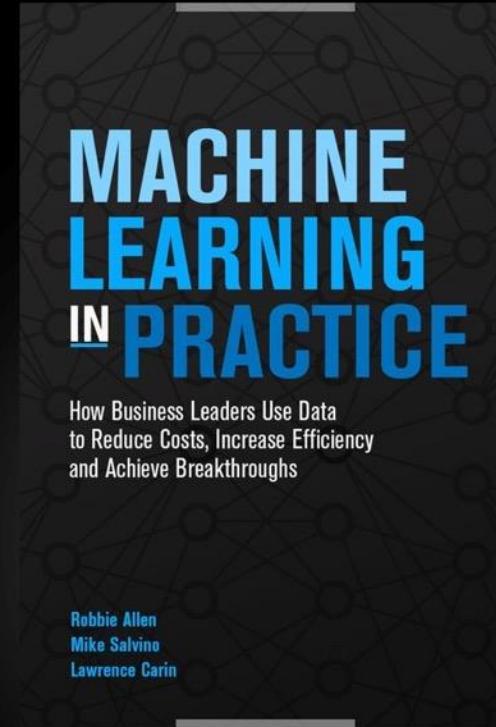
# What's Next for Your Career: We're Hiring!

- Data Engineers
- Data Scientists
- Project Managers
- Web Developers

[InfiniaML.com/careers](https://InfiniaML.com/careers)

# Educating Business Leaders

- Book for executives, managers, & project managers
- Pub date: Feb 2019
- Publisher: Addison-Wesley
- Read early chapter drafts:  
[machinelearninginpractice.com](http://machinelearninginpractice.com)



# Question

**“One day, machine learning will help me/us to \_\_\_\_\_.”**

*Answer in Group Chat.*

# Stay In Touch

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[James.Kotecki@InfiniaML.com](mailto:James.Kotecki@InfiniaML.com)

**Sign up for our mailing list:**

[infiniaml.com/email](http://infiniaml.com/email)

**Watch for our next Safari class  
coming this fall!**

**Q&A**



Thank You!

[Robbie.Allen@InfiniaML.com](mailto:Robbie.Allen@InfiniaML.com)

[James.Kotecki@InfiniaML.com](mailto:James.Kotecki@InfiniaML.com)