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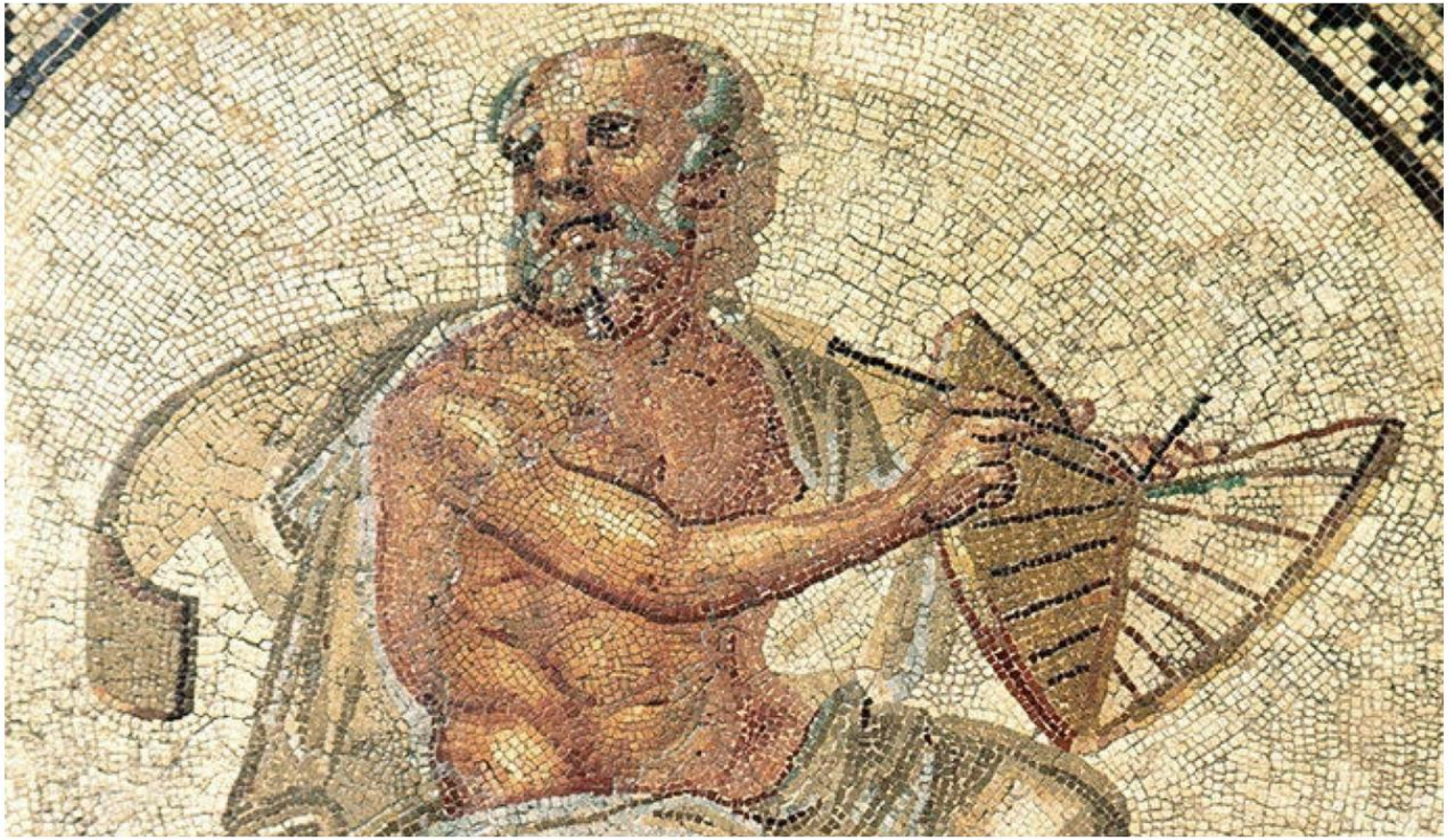
Transforming your Business with AI

Week 1: Taking Stock of AI - The Broader Picture and your AI Strategy

Professor Theodoros Evgeniou



Anaximander, c. 600 BC: our continuous escape from mysticism

Source: https://www.linkedin.com/pulse/part-i-very-brief-technical-history-ai-theodoros-evgeniou-tipfe/

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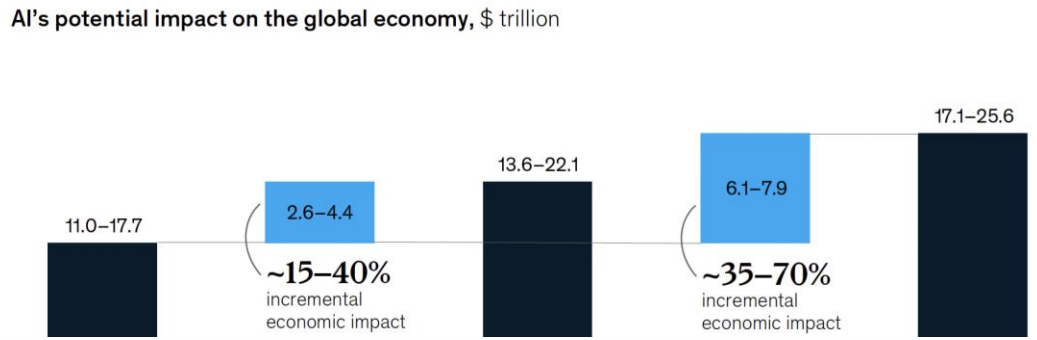
> **Our goal is to solve intelligence, and then use that to solve the other problems of the world.**

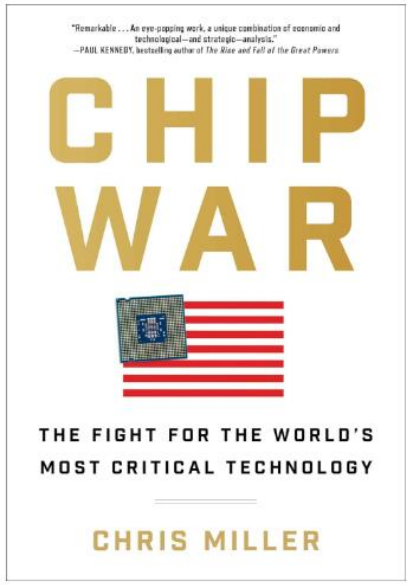
Demis Hassabis, DeepMind
Nobel Prize, 2024

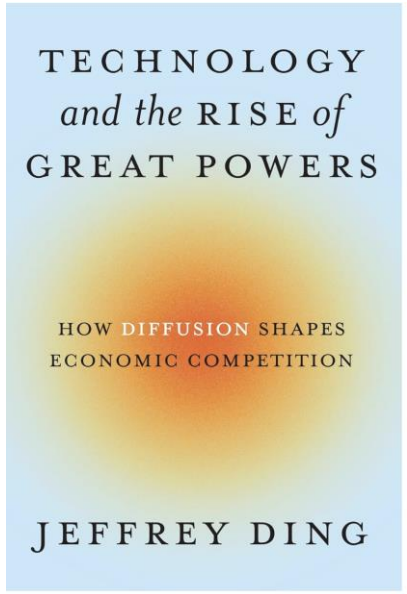
Source: https://www.nobelprize.org

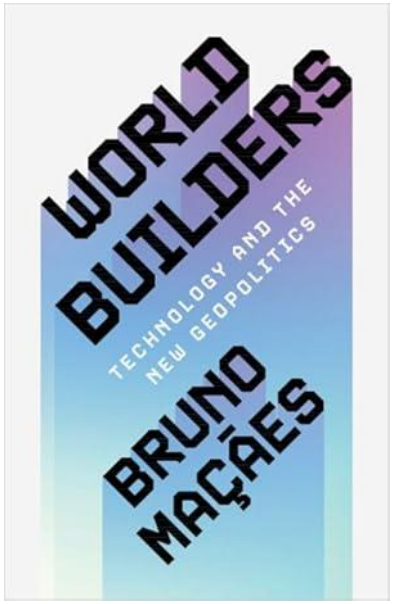
General Purpose Technology

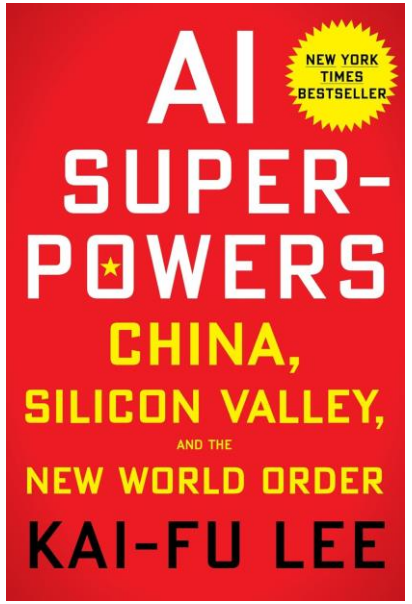
- Pervasive
- Improves over time
- Leads to complementary innovations

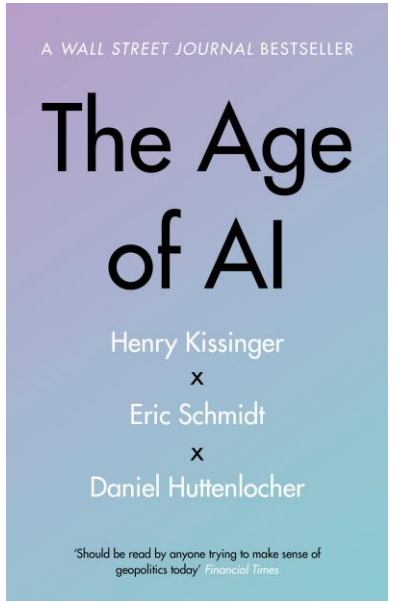












AI Requires a Holistic Approach

4 Stages of Artificial Intelligence

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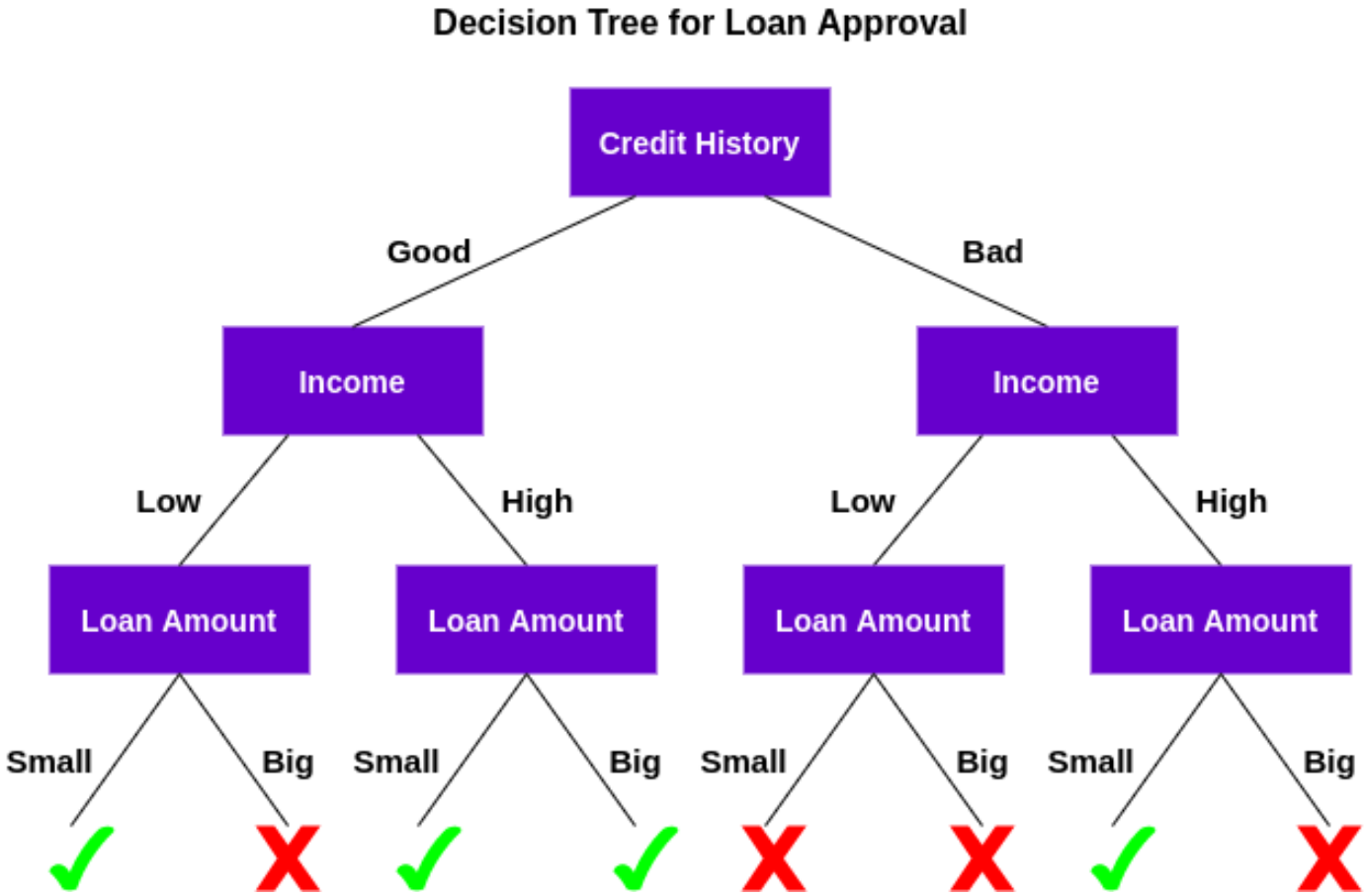
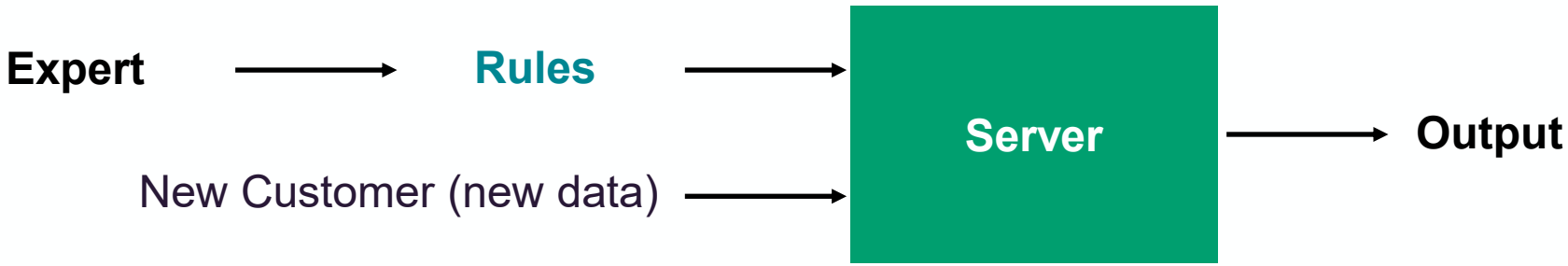
Paper-based rules	Computer-based but human-created rules	Machine learning-based rules	Machine learning-based functions
Not scalable, not carefully tested, human based.	Scalable, not carefully tested, humans think, and AI executes.	Scalable, carefully tested, need careful oversight and risk management, but limited usage.	Scalable, carefully tested, wide usage (speech, vision, etc.), oversight and higher risks, typically “black box”.

You Already Use AI (maybe not the software)

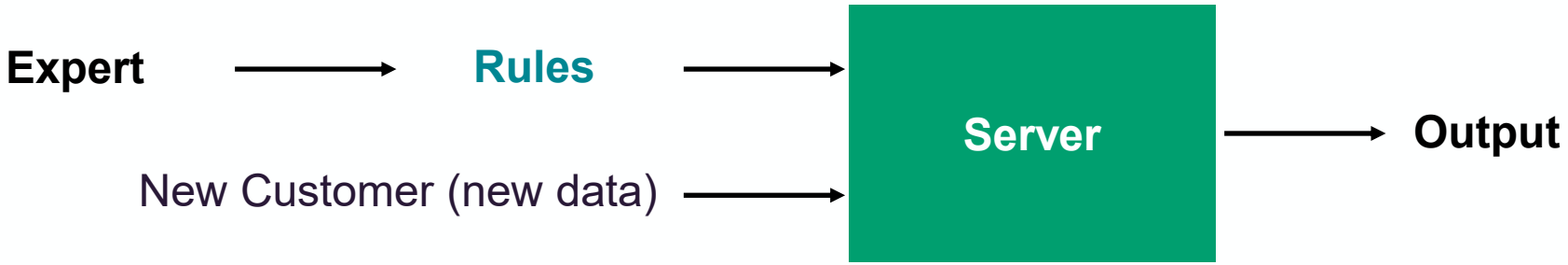


Source: https://www.sciencedirect.com/science/article/pii/S2214785321080585

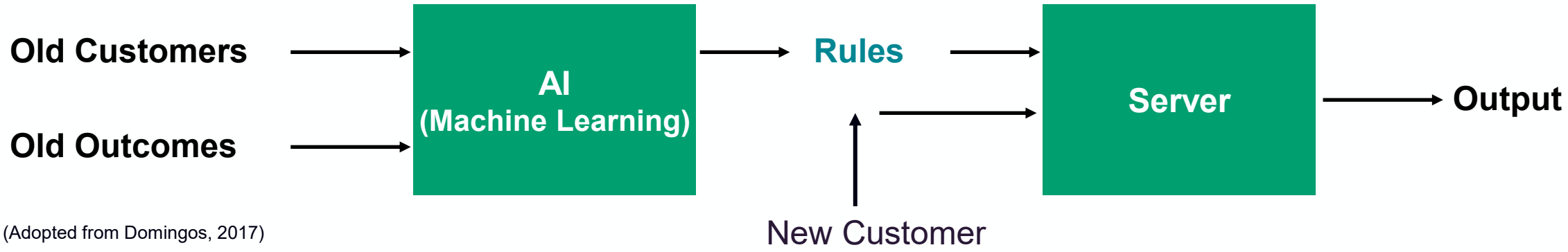
“Old” AI: User Writes the Rules/Programme



"Old" AI: User Writes the Rules/Programme



"New" AI: Machine Learns/Writes the Rules/Programme



(Adopted from Domingos, 2017)

Example: Will a Customer Default?

	Credit Score	Income	Amount	…	…	Default?
Customer 1	4	60k	2k	…	…	0
Customer 2	6	25k	12k	…	…	1
…	…	…	…	…	…	1
Customer 100	…	…	…	…	…	0
…	…	…	…	…	…	…

Hypothetical Exercise

The National Bank of AIB wants to examine methods for predicting sub-par payment performance on loans. They have data on unsecured consumer loans made over a 3-day period in October 2023 with a final maturity of 2 years. There are a total of 348 observations in the sample. The data, which have been transformed to provide confidentiality, include the following:

CBSCORE:	Score generated by the CSC Credit reporting agency from 400 to 8390 with higher values indicating better credit rating
DEBT:	Debt ratio calculated by taking required monthly payments on all debt and dividing it by gross monthly income of applicant and co-applicant. This ratio represents the amount of the applicant's income that will go towards repayment of debt
GROSS INC:	Gross monthly income of applicant and co-applicant
LOAN AMT:	Loan Amount
OVERDUE:	Coded as 1 if the loan payment is past due and zero otherwise

Let’s Ask AI to Develop the Rules

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You are an experienced AI engineer and consultant. Can you train a Classification Tree CART classifier, classifying overdue loans, using the attached .csv file where each row is an observation, the last column of each row is the class of that row, and the first row has the names of the variables? Please develop a tree of depth 3 and display it nicely.

4 Stages of Artificial Intelligence

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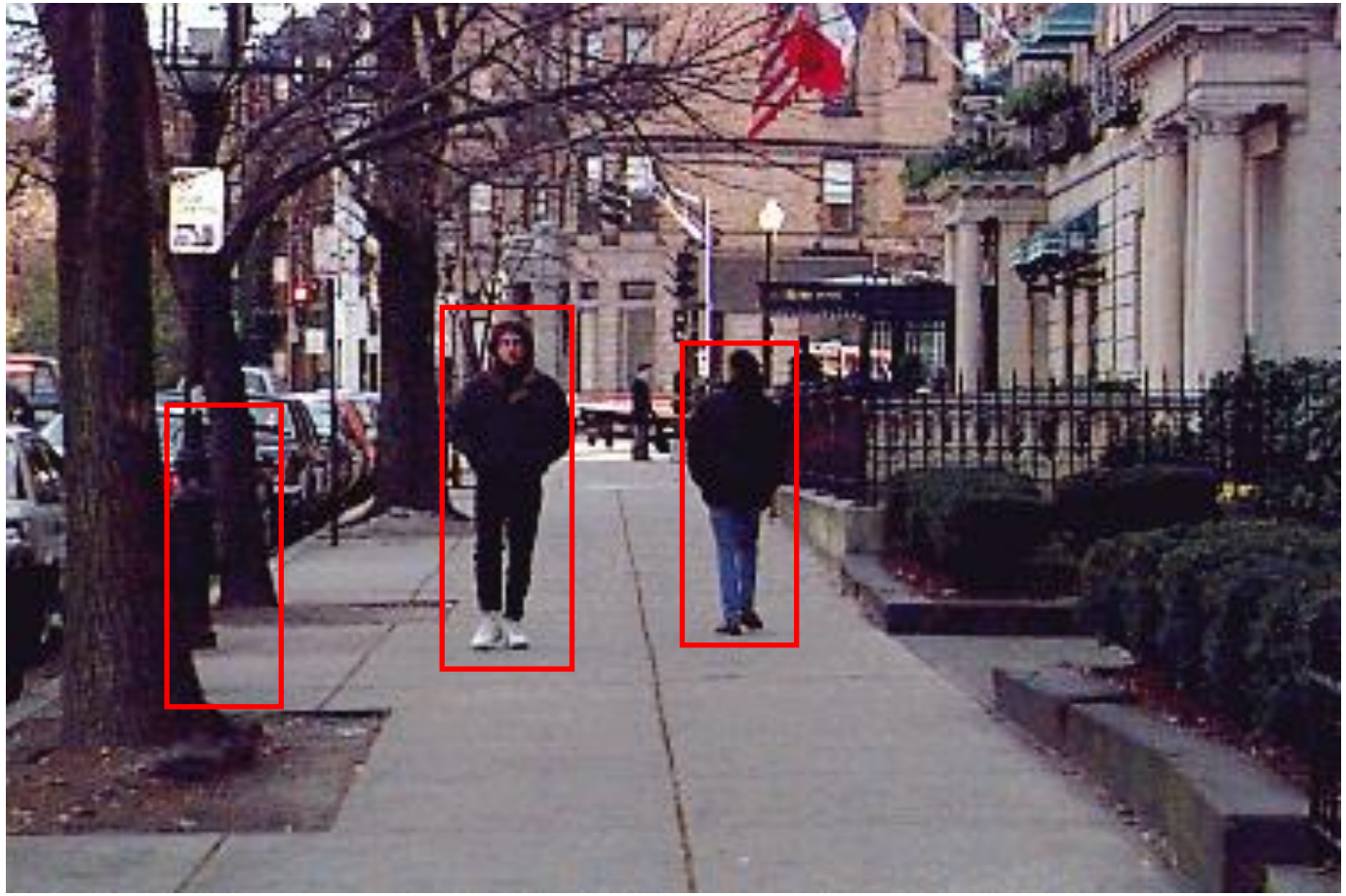
Not scalable, not carefully tested, human based.	Scalable, not carefully tested, humans think, and AI executes.	Scalable, carefully tested, need careful oversight and risk management, but limited usage.	Scalable, carefully tested, wide usage (speech, vision, etc.), oversight and higher risks, typically “black box”.



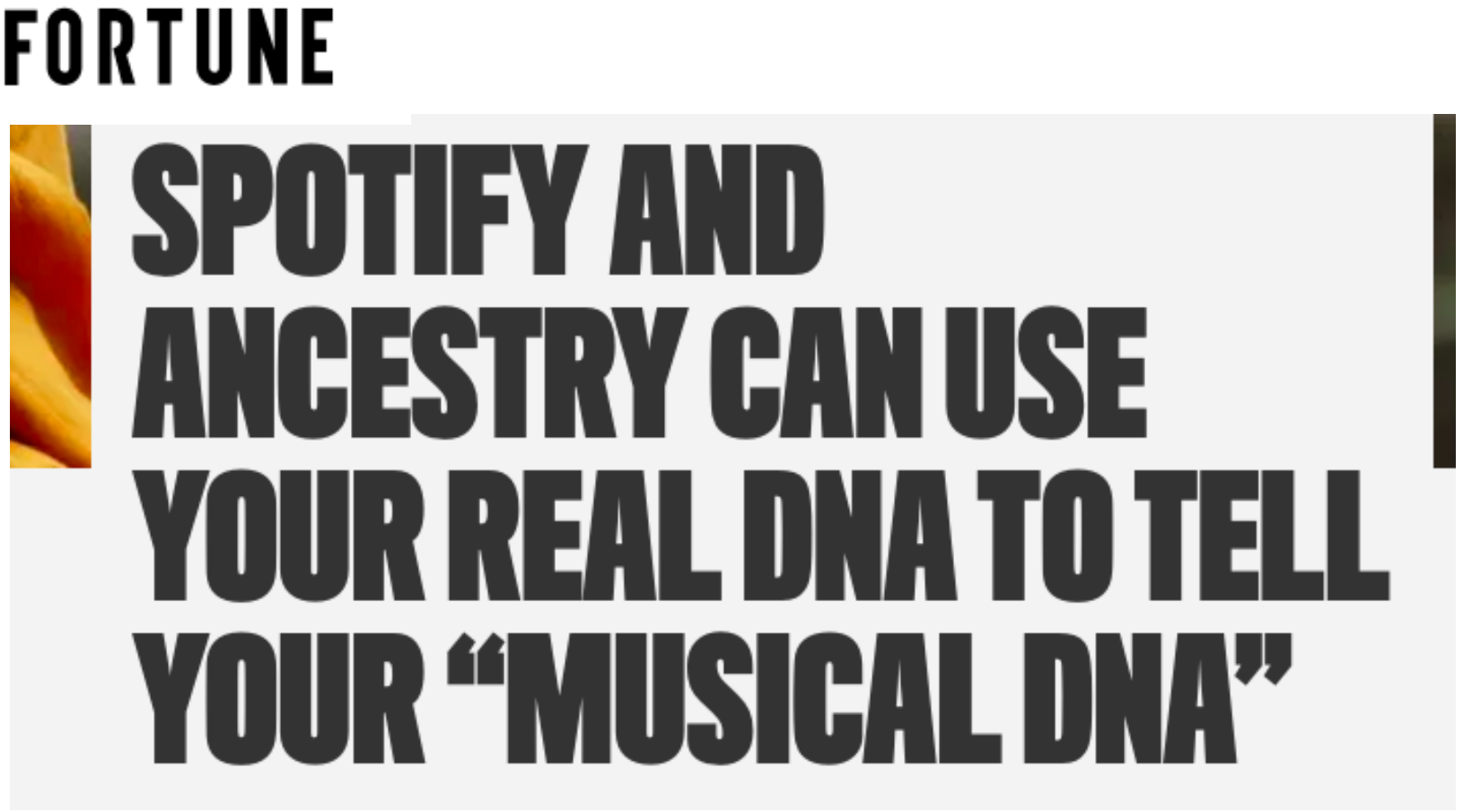
Source: T. Evgeniou, INSEAD

Example: Classify Images

Pixel 1	Pixel 2	…	Pixel 1.000.000	Output
123	13	…	43	1 (Cat)
53	145	…	234	0 (Dog)
134	51	…	31	0 (Dog)
…	…	…	…	…
213	15	…	67	1 (Cat)
86	190	…	118	0 (Dog)

Predict (and Generate) the Next Word

Word 1	Word 2	…	Word 1000	Output
123…	13…	…	43…	Next word
53…	145…	…	234…	Next word
134…	51…	…	31…	Next word
…	…	…	…	…
213…	15…	…	67…	Next word
86…	190…	…	118…	Next word



Source: https://qz.com/quartzy/1399279/spotify-can-use-your-ancestry-dna-test-to-tell-your-musical-dna

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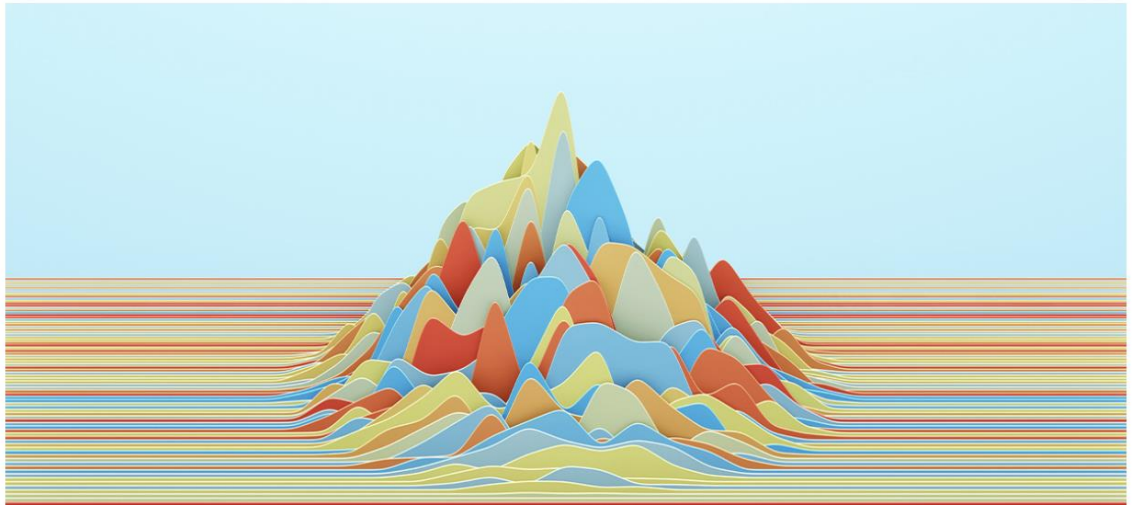
Harvard Business Review

Your Data Supply Chains Are Probably a Mess. Here's How to Fix Them.

by Tom Davenport, Theodoros Evgeniou, and Thomas C. Redman

June 24, 2021



Source: https://hbr.org/2021/06/data-management-is-a-supply-chain-problem

AI Supply Chains

57 Pages • Posted: 16 Apr 2024 • Last revised: 5 May 2024

Sarah Huiyi Cen
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Aleksander Madry
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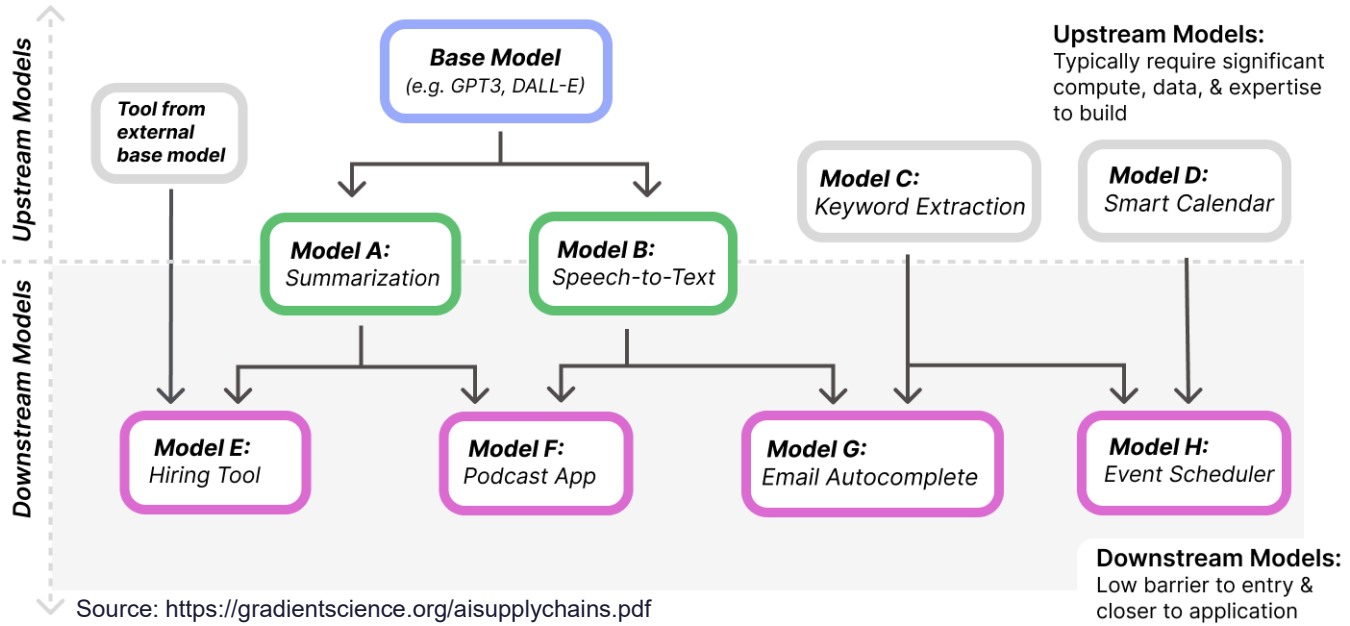
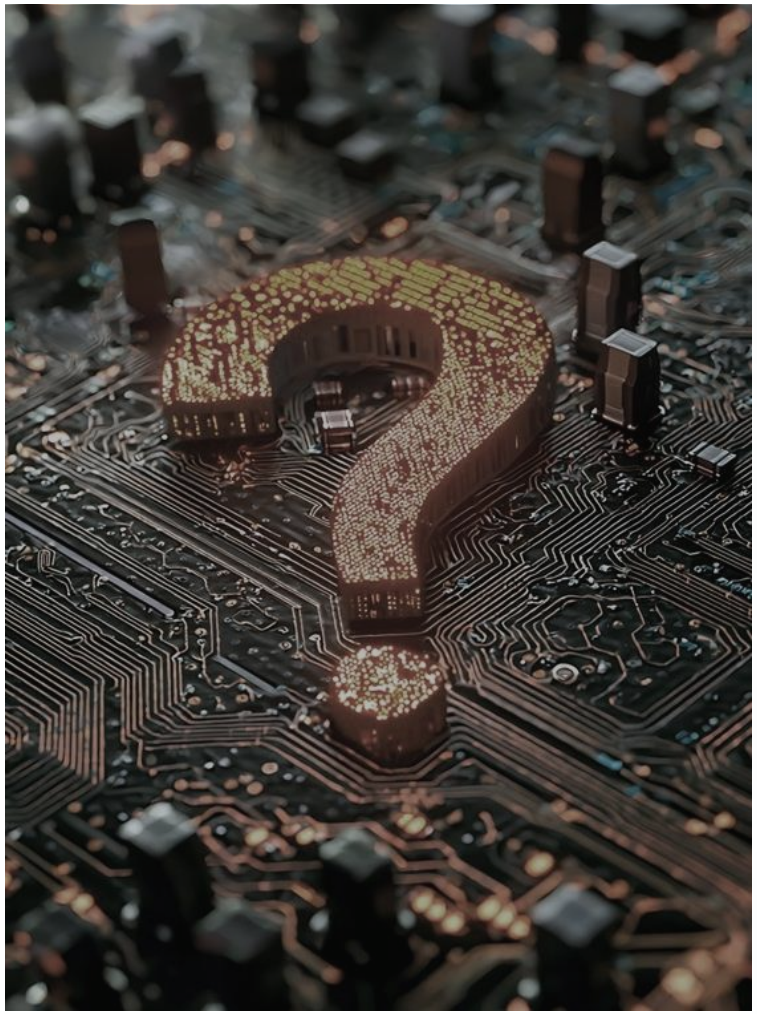
Isabella Struckman
affiliation not provided to SSRN

Luis Videgaray Caso
Protego Investment Associates; Instituto Tecnológico Autónomo de México (ITAM) - Centro de Investigacion Economica



Source: https://gradientscience.org/aisupplychains.pdf

5 Technical Questions



01 Do we deploy **non-Machine** Learning AI? If so, where? If not, where can we do so?

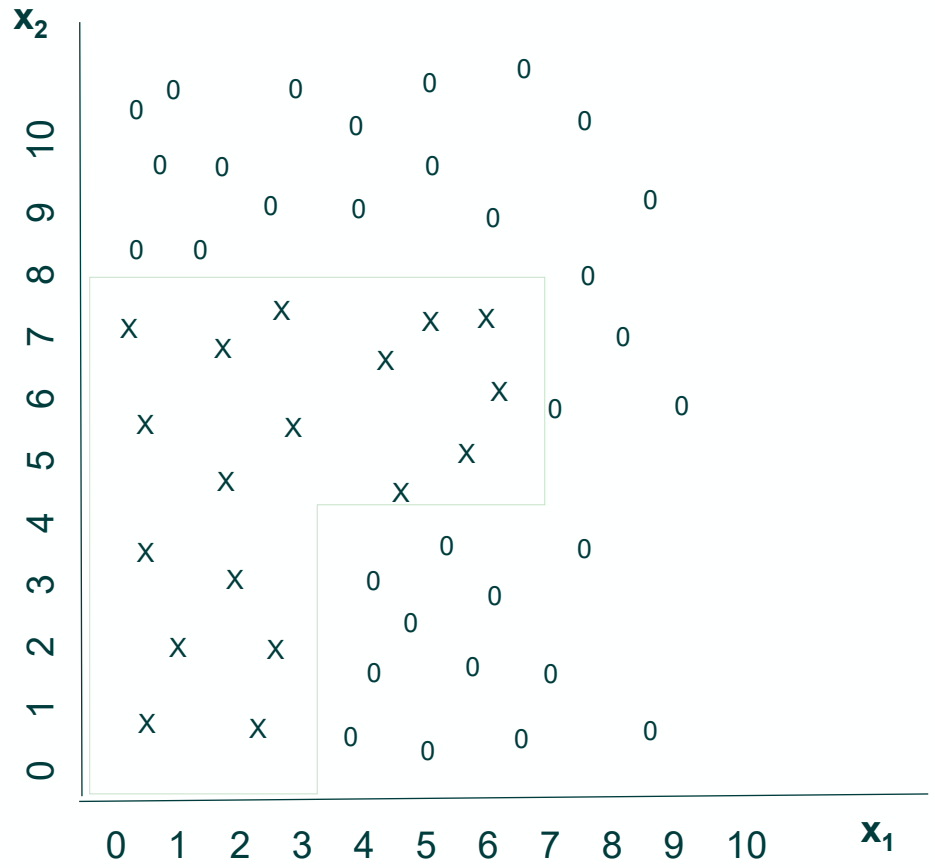
02 Do we manage our **data supply chains** well (e.g., availability, quality control, accountability, traceability, privacy, security, etc.)?

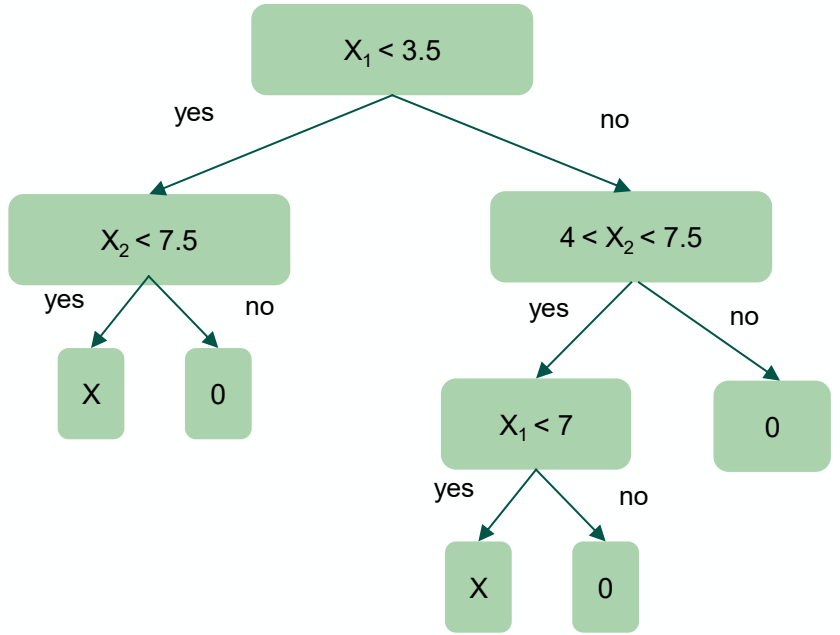
03 Do we manage our **AI models and supply chain** well (e.g., third party models, fine tuning of models, model versions, model monitoring, etc.)?

04 Do we leverage our multimedia data (e.g., text, speech, images, video) using either AI or **GenAI?**

05 Do we leverage **innovative data**, internal or external?

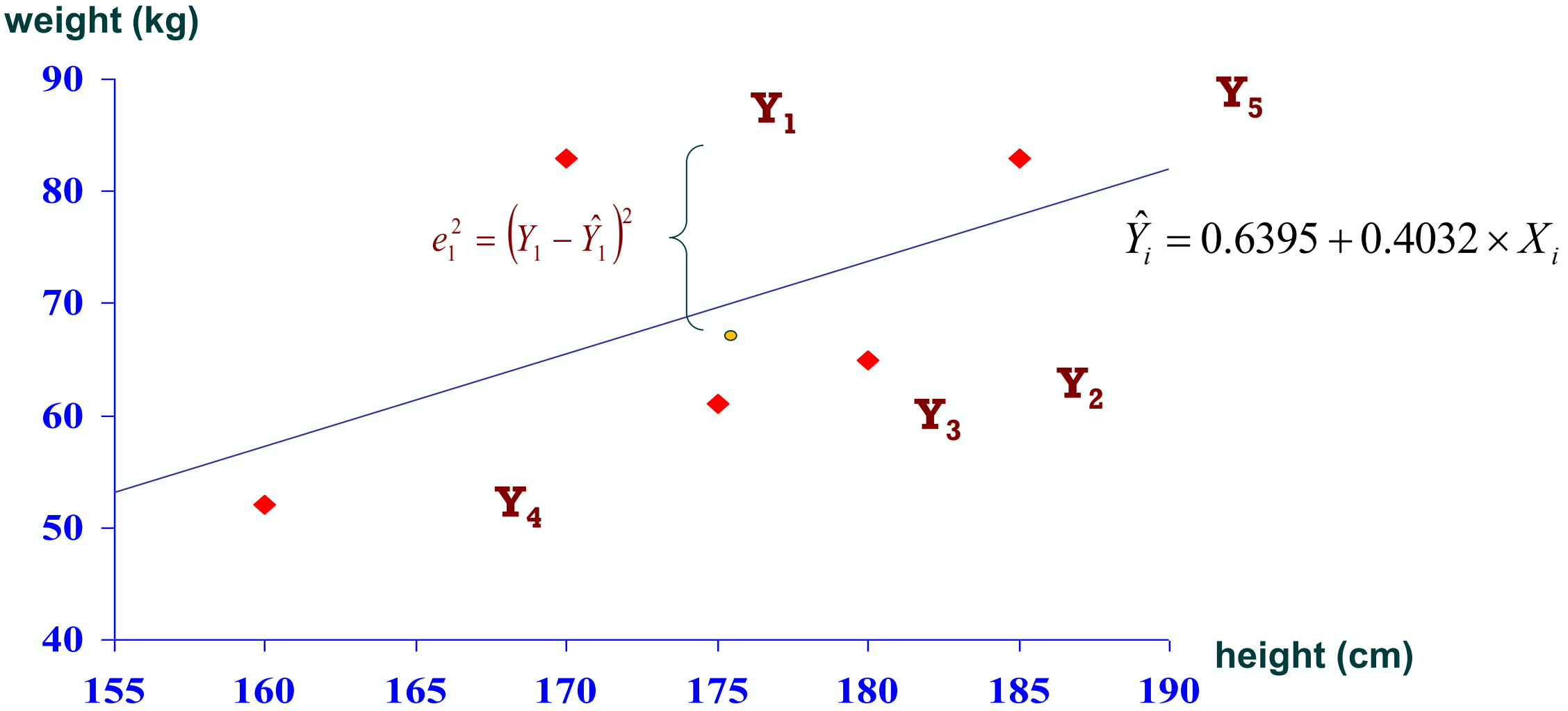
Rules Are Like “Mathematical Functions”





Rules are like Functions

Linear Regression: Example



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Is Linear Regression also Machine Learning?

Syllabus - What you will learn from this course

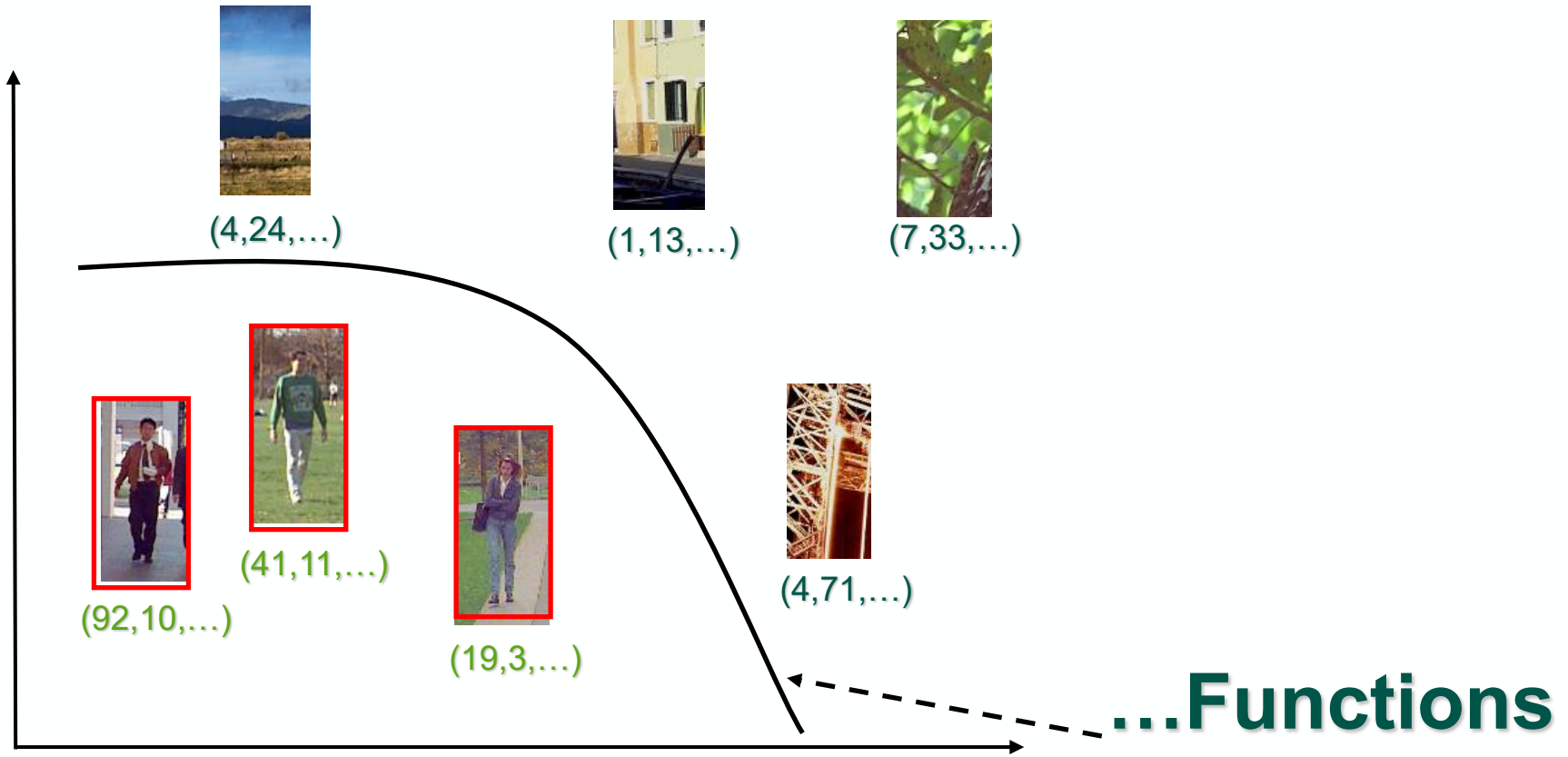
2 hours to complete

Linear Regression with One Variable

Linear regression predicts a real-valued output based on an input value. We discuss the application of linear regression to housing price prediction, present the notion of a cost function, and introduce the gradient descent method for learning.

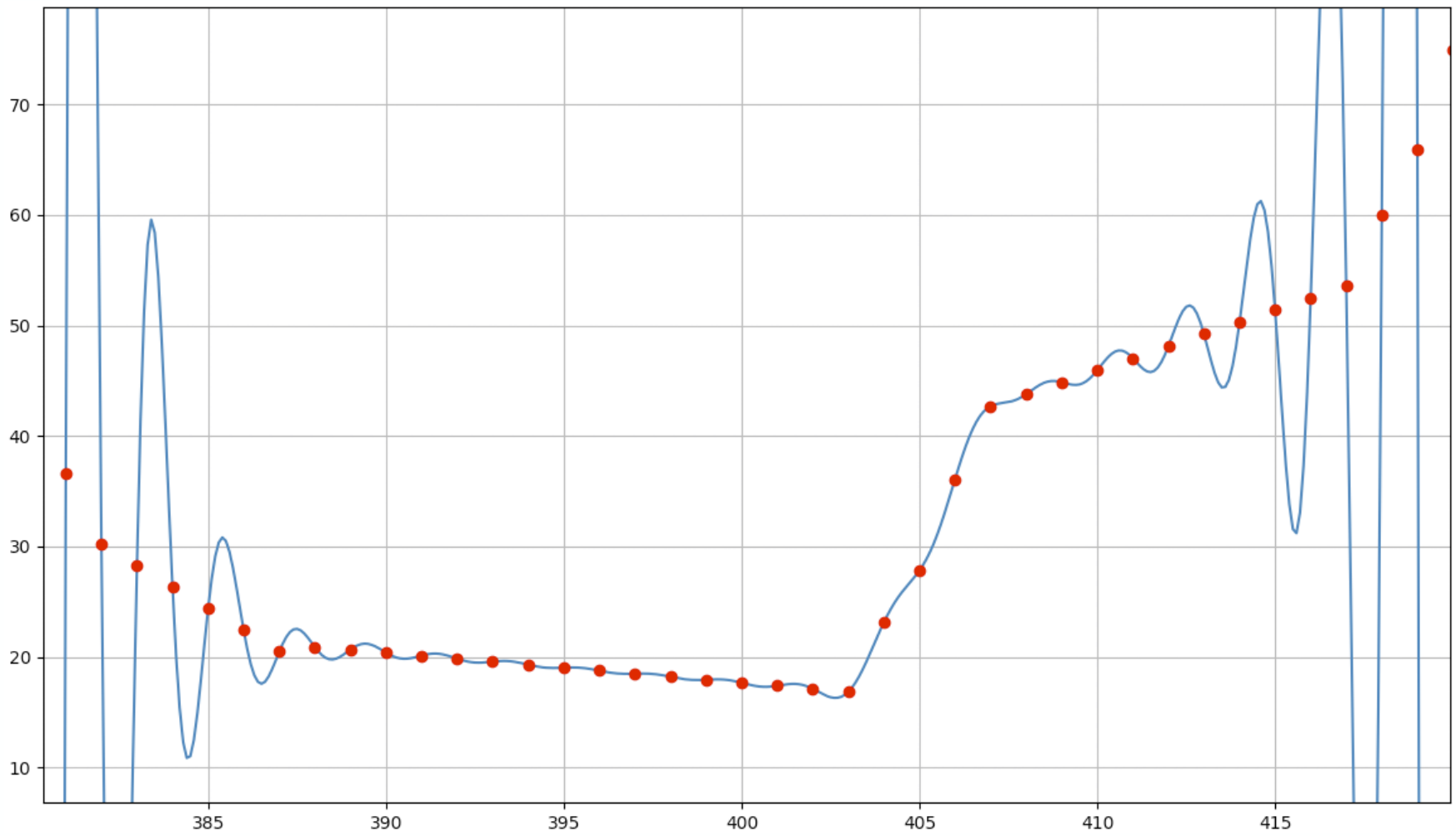
Source: https://www.coursera.org/learn/machine-learning

Everything for a Computer Is Data/Numbers and…

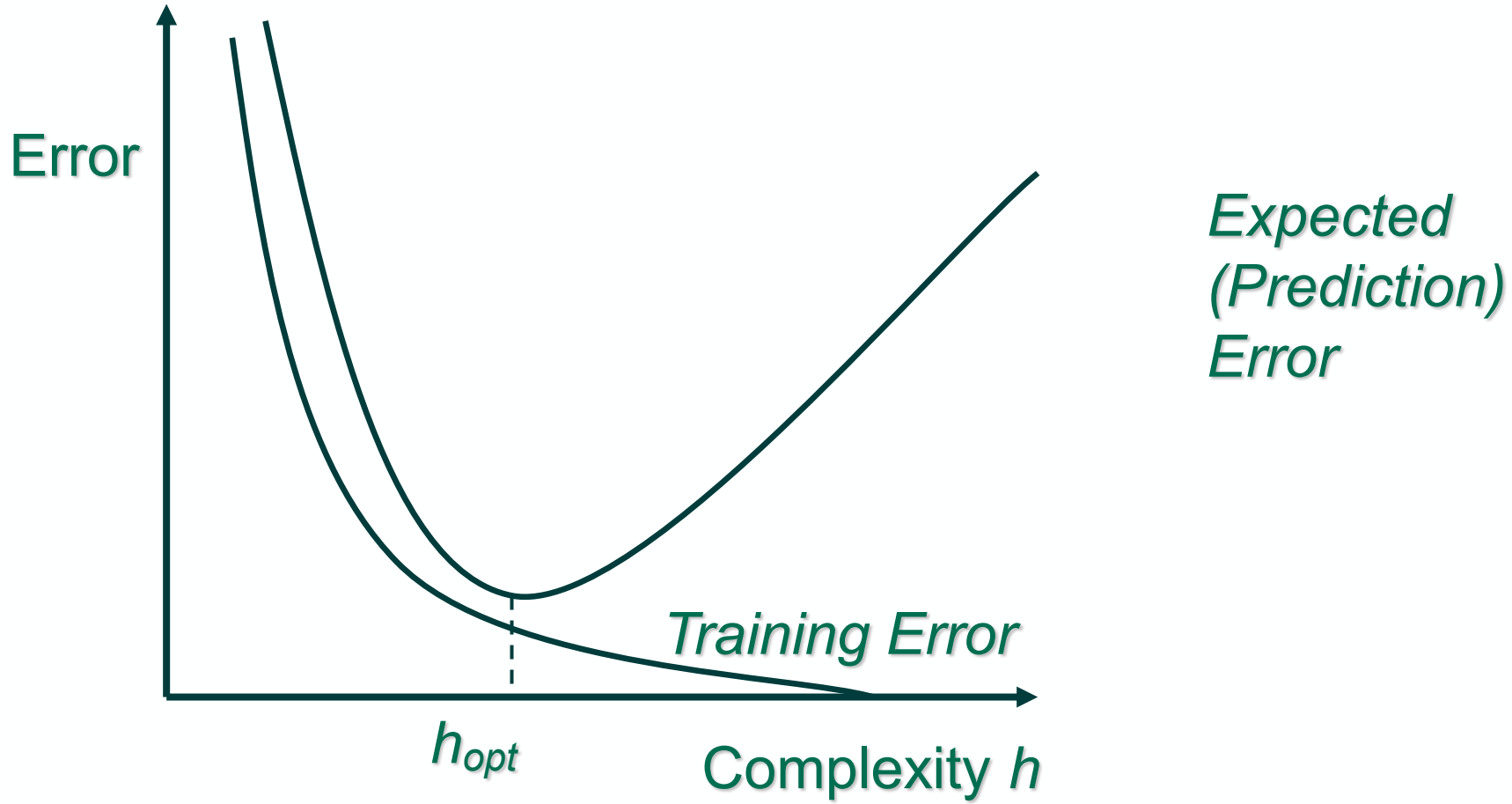


Source: https://www.semanticscholar.org/paper/A-Trainable-Pedestrian-Detection-System-PapgeorgiouEvgeniou/193c7d756e030af8fc0a331857554247d8c75519

A Key Problem: Over-Fitting



A Fundamental Theorem in Machine Learning



AI Strategy Development: Example Approach

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Few days

Initiate and Educate

Training: Develop & deliver presentation on AI key trends, techniques, project approach and key success factors, etc.

Conduct workshop on identifying and prioritising company specific **use cases.**

~ 4 to 8 weeks

Bring clarity

1. Finalise (with CXOs) current AI **ambition, strategy,** value proposition and time horizon.
2. Identify & **prioritise** AI use cases based on value vs feasibility.
3. **Assess** current state of key **capabilities,** develop gap analysis, identify capabilities necessary to deliver use cases (models, data, platform, training, AI culture).
4. Identify potential **risks,** regulatory requirements, and compliance needs.
5. Design comprehensive **operational plan** and pragmatic roadmap.

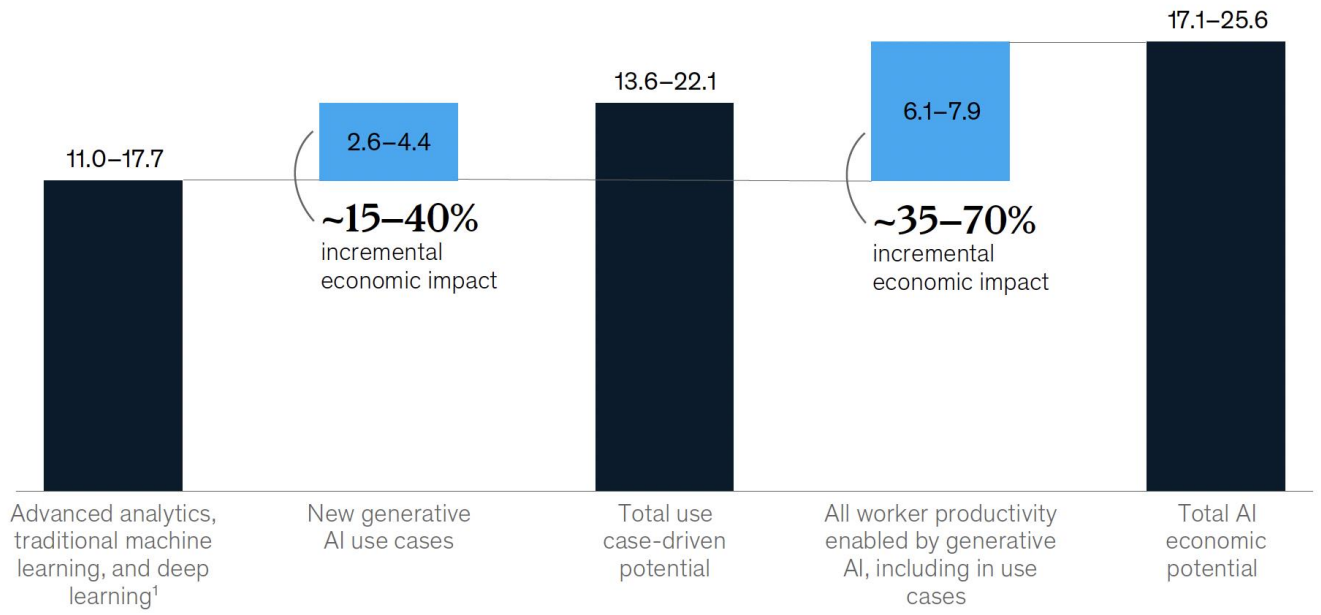
TBC – several months

Build capabilities – Create and Capture Value

- **Deliver AI** & analytics use cases
- **Improve** data foundations
- Develop all elements of AI **operating model**
- Lead **change** management

Generative AI could create additional value potential above what could be unlocked by other AI and analytics.

AI's potential impact on the global economy, $ trillion



McKinsey 2023

Source: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier#business-value

Building an AI Portfolio

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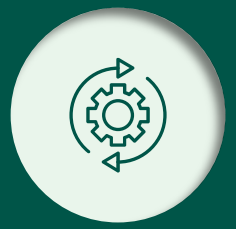
Process vs. Product



Task Transformation: Automation vs. Augmentation

System Redesign and the AI Flywheel

A Portfolio of Experimentation, Quick Wins, Strategic Investments

Building an AI Portfolio

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Process vs. Product

Task Transformation: Automation vs. Augmentation

System Redesign and the AI Flywheel

A Portfolio of Experimentation, Quick Wins, Strategic Investments

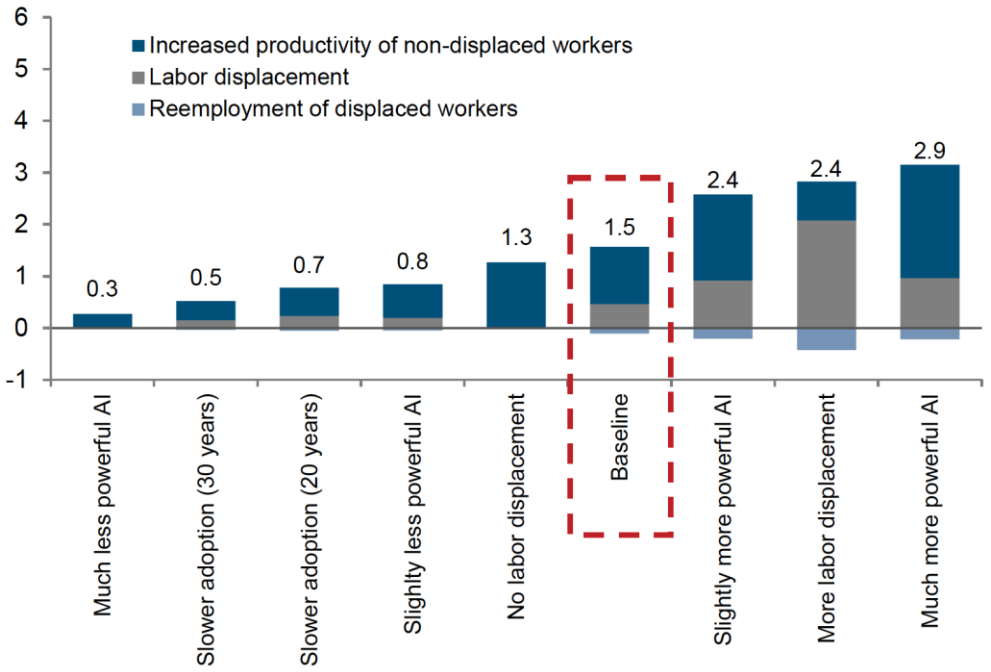
…[AI's] macroeconomic consequences will be given by a version of Hulten's theorem: GDP and aggregate productivity gains can be estimated by what fraction of tasks are impacted and average task-level cost savings.

Acemoglu, May 2024

7% increase in global GDP, equivalent to $7 trillion

A significant boost to US labor productivity from generative AI

Effect of AI adoption on annual US labor productivity growth, 10y adoption period, pp



Source: Goldman Sachs GIR.

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Automating the B2B Salesperson Pricing Decisions: Can Machines Replace Humans and When?

65 Pages • Posted: 6 May 2019

Yael Karlinsky-Shichor
Northeastern University - D'Amore-McKim School of Business

Oded Netzer
Columbia Business School - Marketing

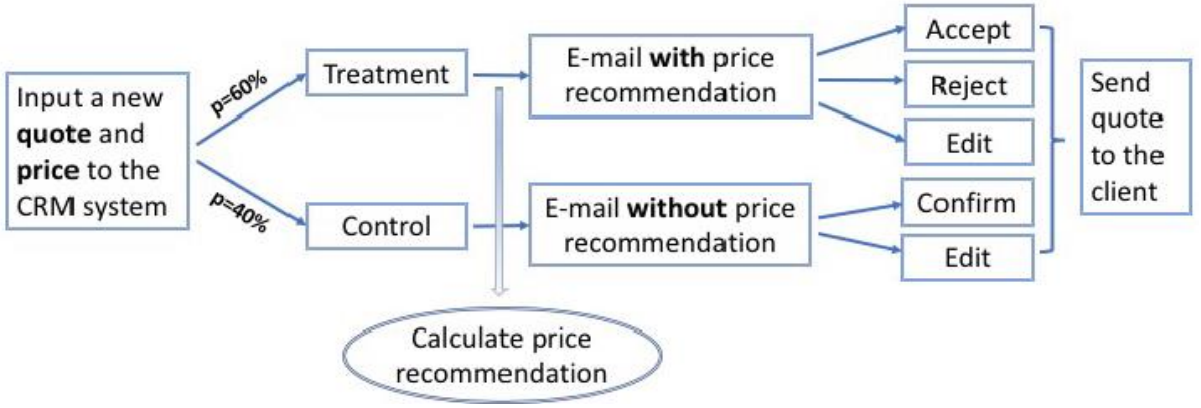

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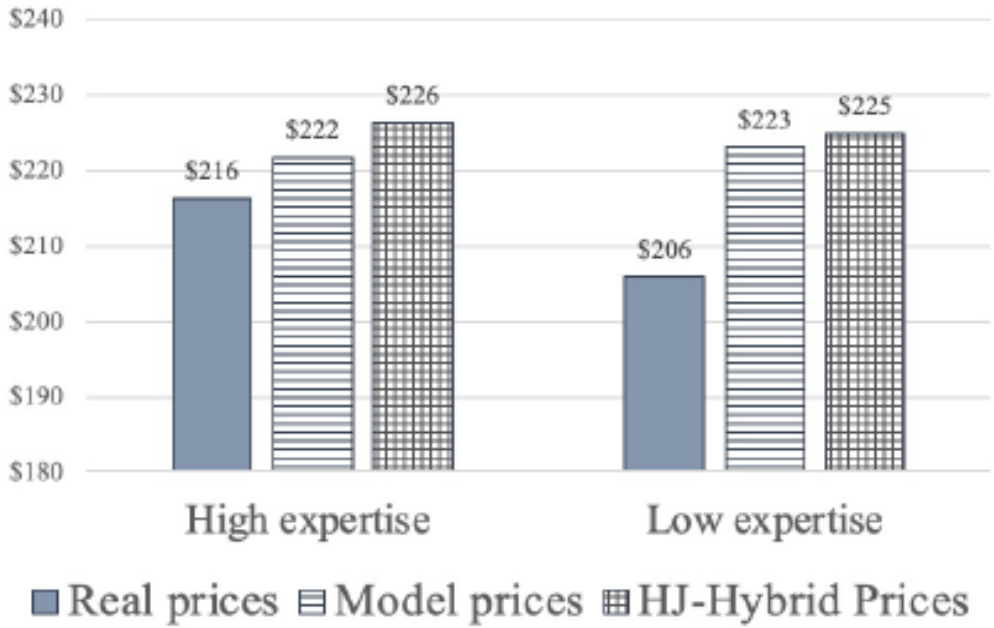
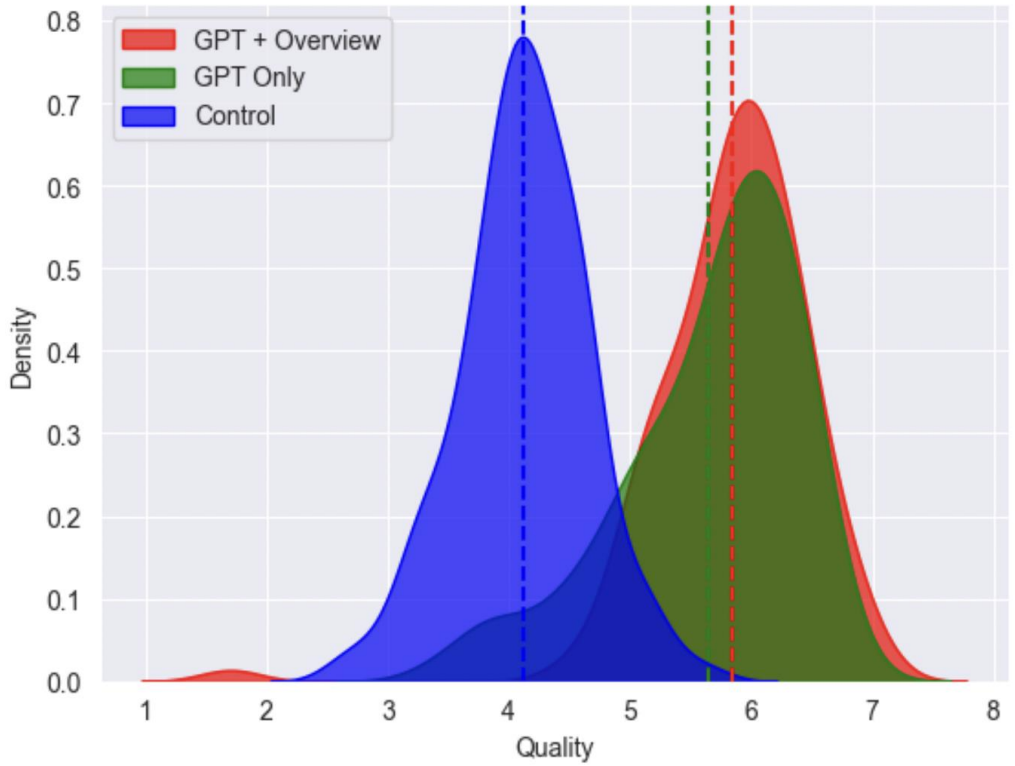
Figure 4: Expected Profits by Salesperson Expertise



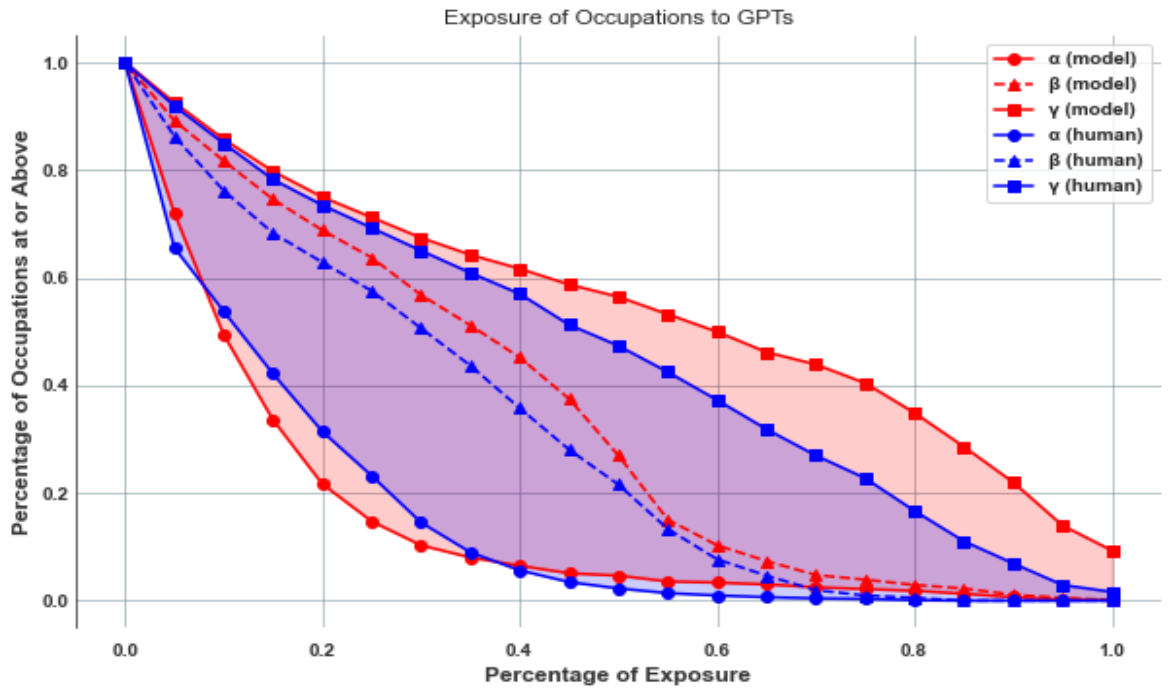
Source: http://www.columbia.edu/~on2110/Papers/Automating_the_B2B_Salesperson.pdf



Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity and Quality – SSRN, September 2023

80% of workers belong to an occupation with at least 10% of its tasks exposed to LLMs.

19% of workers are in an occupation where over half of its tasks are labelled as exposed.



Source: ”GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models”, August 2023

“…[AI’s] macroeconomic consequences will be given by a version of Hulten’s theorem: GDP and aggregate productivity gains can be estimated by what fraction of tasks are impacted and average task-level cost savings.”

Acemoglu, May 2024

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Critical Thinking

Science

Learning

Basic Skill	α (std err)	β (std err)	ζ (std err)
	All skill importance scores are normalized to be between 0 and 1.		
Constant	0.082*** (0.011)	-0.112*** (0.011)	0.300*** (0.057)
Active Listening	0.128** (0.047)	0.214*** (0.043)	0.449*** (0.027)
Mathematics	-0.127*** (0.026)	0.161*** (0.021)	0.787*** (0.049)
Reading Comprehension	0.153*** (0.041)	0.470*** (0.037)	-0.346*** (0.017)
Science	-0.114*** (0.014)	-0.230*** (0.012)	-0.346*** (0.017)
Speaking	-0.028 (0.039)	0.133*** (0.033)	0.294*** (0.042)
Writing	0.368*** (0.042)	0.467*** (0.037)	0.566*** (0.047)
Active Learning	-0.157*** (0.027)	-0.065** (0.024)	0.028 (0.032)
Critical Thinking	-0.264*** (0.036)	-0.196*** (0.033)	-0.129** (0.042)
Learning Strategies	-0.072* (0.028)	-0.209*** (0.025)	-0.346*** (0.034)
Monitoring	-0.067** (0.023)	-0.149*** 0.020)	-0.232*** (0.026)
Programming	0.637*** (0.030)	0.623*** (0.022)	0.609*** (0.024)

Table 5: Regression of occupation-level, human-annotated exposure to GPTs on skill importance for each skill in the O*NET Basic skills category, plus the programming skill. Descriptions of the skills may be found in Appendix B. Task ratings within each occupation for exposure have equal weight.

Source: https://arxiv.org/abs/2303.10130

Task: How Much Can Be Automated?

I will be describing a task to you, and you need to tell me how much it can be automated using AI, both predictive and generative AI such as LLMs, and also argue why and how or else why not. Here is an example:

Task	Direct or coordinate the supportive services department of a business, agency, or organisation.
Automation	High
Argument	Robotics can automate repetitive tasks such as data entry, document scanning, and mail sorting. Image Processing Systems can analyse documents and emails for information extraction and categorisation. LLMs can handle complex tasks like scheduling, coordinating resources, and communicating with team members. Combining these AI technologies can significantly improve the efficiency and accuracy of administrative services, allowing managers to focus on more strategic tasks.

Here is the task for you to now analyse:

Task	Complete car accident reports when necessary.
Follow-up Question	How can AI and LLMs help in all these? Please be specific.

Transforming Tasks with AI

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01

Develop a portfolio of three AI use cases by identifying tasks that AI can transform using the methodology above.

02

For the three selected tasks, explore how exactly AI can transform the tasks.

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Harvard Business Review

A Better Way to Onboard AI

Understand it as a tool to assist rather than replace people. by Boris Babic, Daniel L. Chen, Theodoros Evgeniou, and Anne-Laure Fayard

From the Magazine (July–August 2020)

Step 1

AI - Personal Assistant

AI is introduced without requiring any changes in people's work. It works as an autocomplete or recommender system which helps people go faster about their jobs

Step 2:

AI - Personal Monitor

AI notices if you make a choice that is inconsistent with previous choices and lets you know about the inconsistency so that you can correct your decision if that was not done on purpose - you might be tired or got distracted.

Step 3:

AI - Personal Coach

AI provides training enhancement and a feedback loop that allows users to look at their own performance and reflect on variations and errors. It can also use a case-based training system to help users understanding better their decision patterns and practices.

Step 4:

Human & Machine Collective Intelligence

As the AI becomes better through its interactions with different users and their feedback at each level, and as expert users are analyzed, a community of experts (humans and machines) emerges. Individuals can refer to this community and compare their choices to the choices of different experts.

Source: https://hbr.org/2020/07/a-better-way-to-onboard-ai

Assist – Monitor – Coach – Collect

AI Augmentation: Examples

Source: https://youtu.be/lw5y48yya2U?si=GfyxDnzgaLSora9y

Source https://www.media.mit.edu/groups/fluid-interfaces/projects/

Example: Developing AI Facilitators

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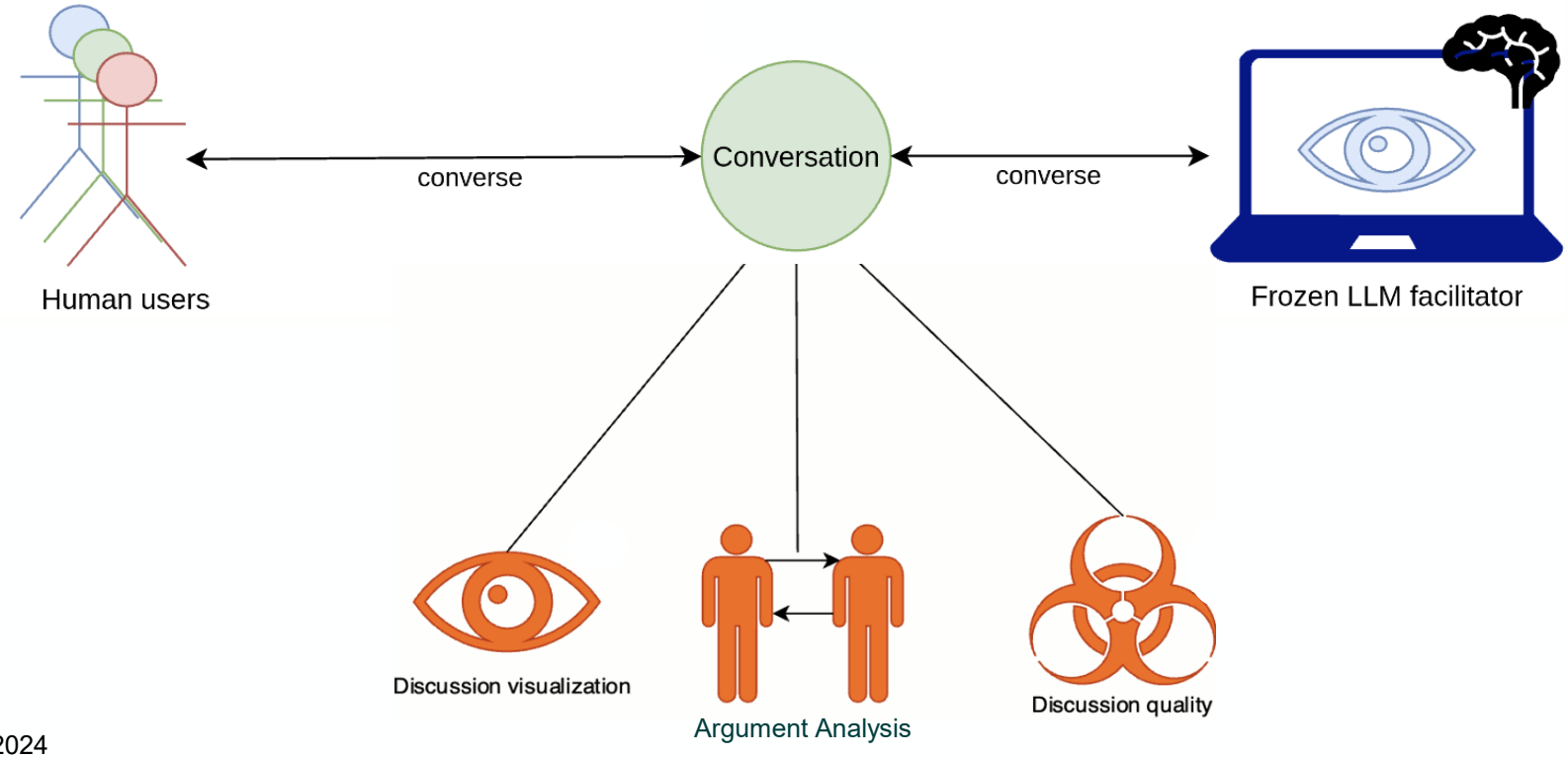
Towards Augmented Collective Intelligence

(work in progress)



Source: D. Tsirmpas et al. 2024

COMMENTARY · A.I.

Humans, machines, and the rise of AI coworkers: How to build the new hybrid organization

BY FRANÇOIS CANDELON, THEODOROS EVGENIOU, LEONID ZHUKOV, MEENAL PORE AND AMARTYA DAS

February 7, 2025 at 12:30 PM GMT+2

AI agents are set to go beyond simply augmenting humans, becoming true co-workers alongside us.

COURTESY OF GETTY IMAGES

Building an AI Portfolio

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Process vs. Product

Task Transformation: Automation vs. Augmentation

System Redesign and the AI Flywheel

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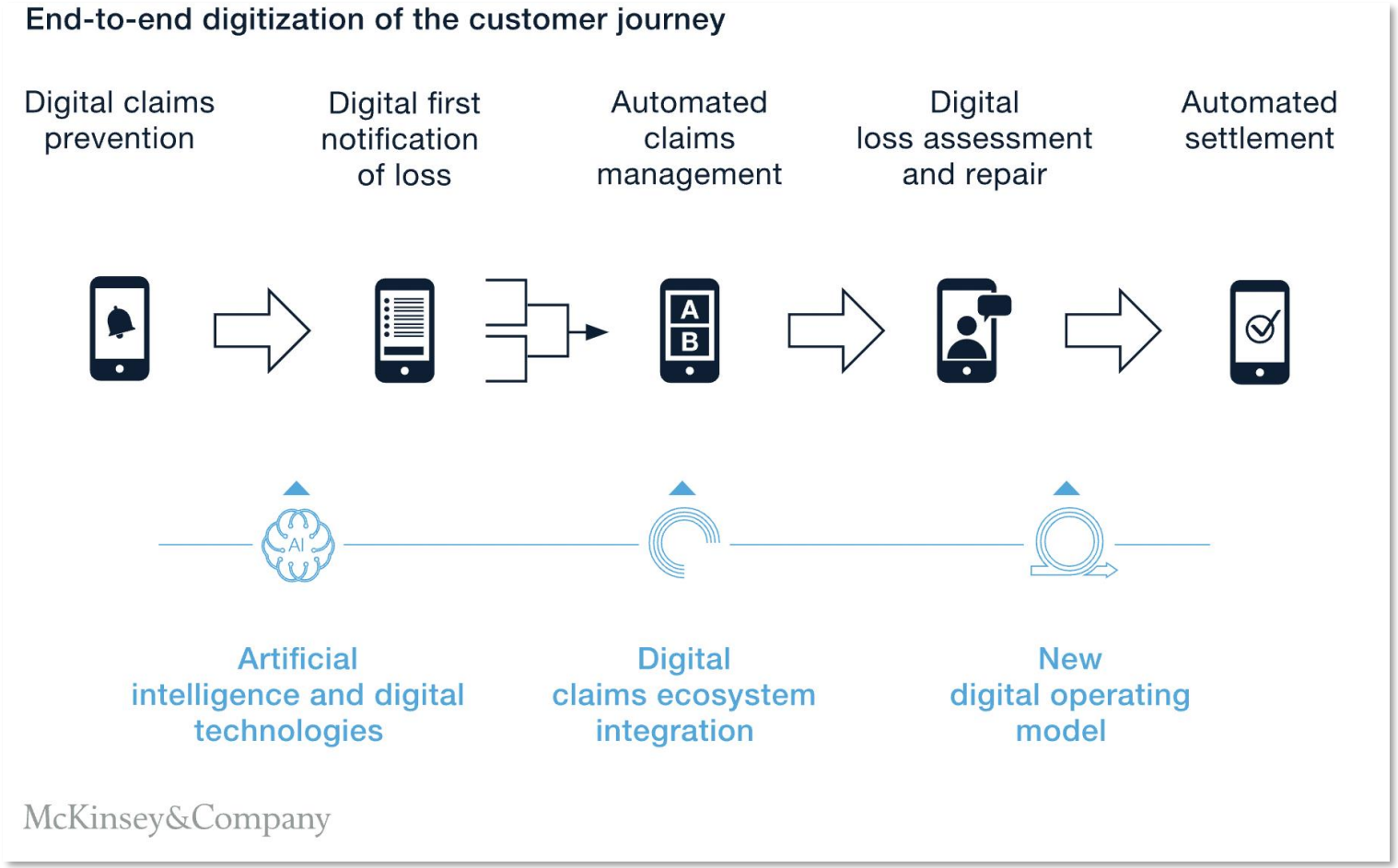
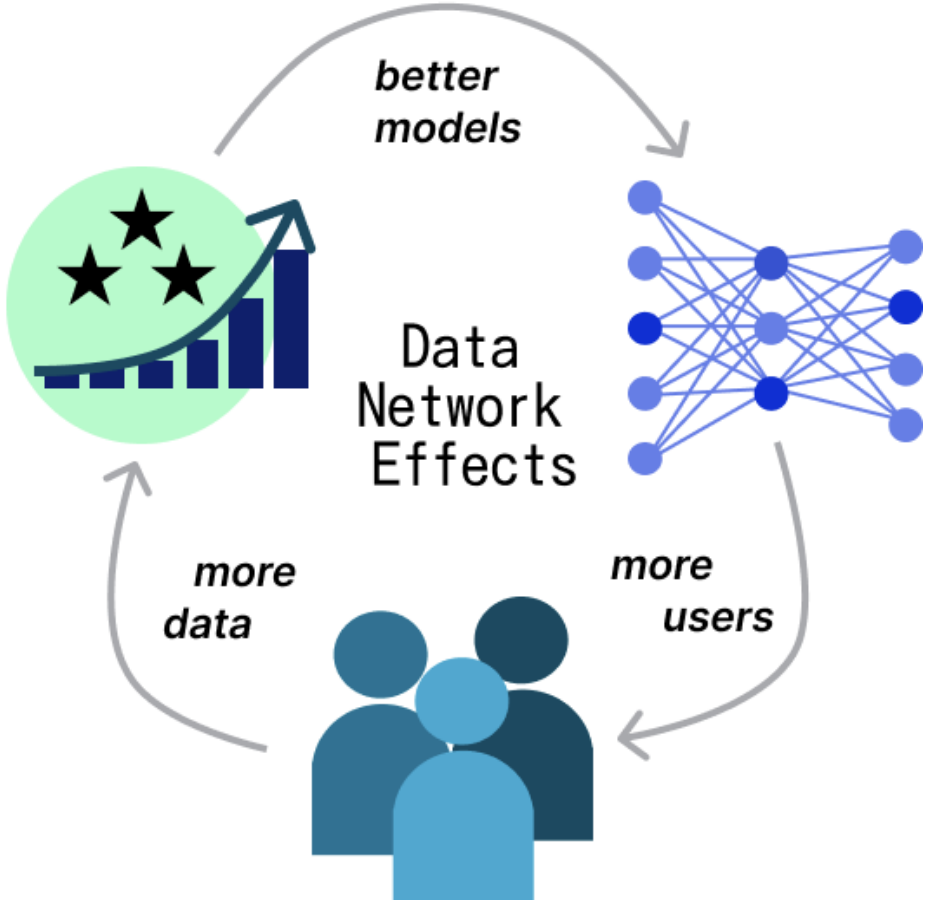
System Redesign: Example

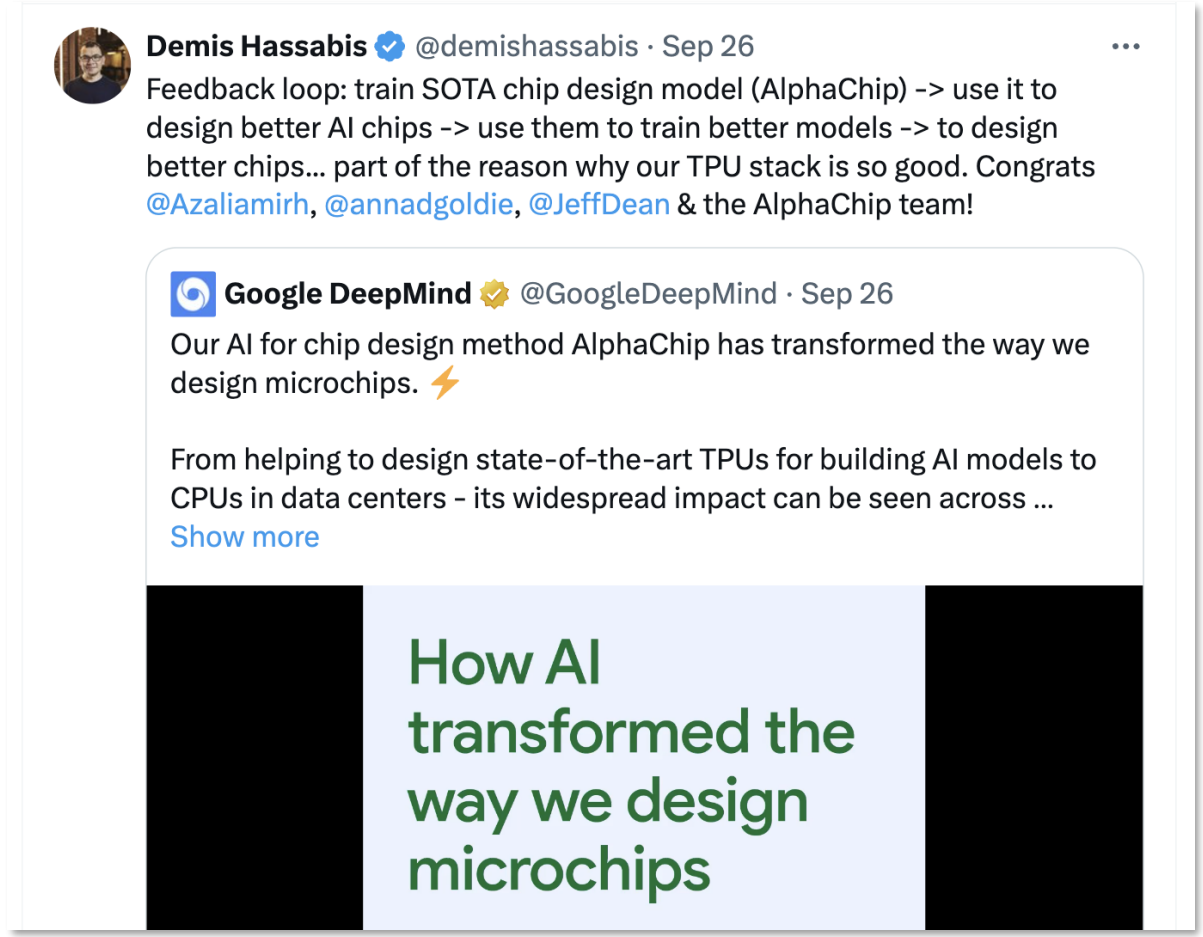


Source: https://www.mckinsey.com/industries/financial-services/our-insights/claims-in-the-digital-age

The AI Flywheel Race: Ready for It?



Source: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4789403



Nobel Prize 2024

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