Johnson & Johnson

Artificial Intelligence For TLDP

LEARNING VOYAGE

Who am I?

- Dr. Lee, Faculty, Miami Dade College
- Lead Data Scientist, Miami Dade College
- 26 peer reviewed and well cited research articles on Blockchain, Data Science, and Data Analytics
- 7 Books
- Husband, Father
- Best buddies with Daisy the Wonder Dog

Who are you?

- Let’s get into NEW groups.
- Each person in the group is to be asked as many questions as they can in 2 minutes to get to know them by every other member of the group.
- Document two or three interesting facts about each person in the group.
- Name your group!
- Identify 1 person to introduce your team

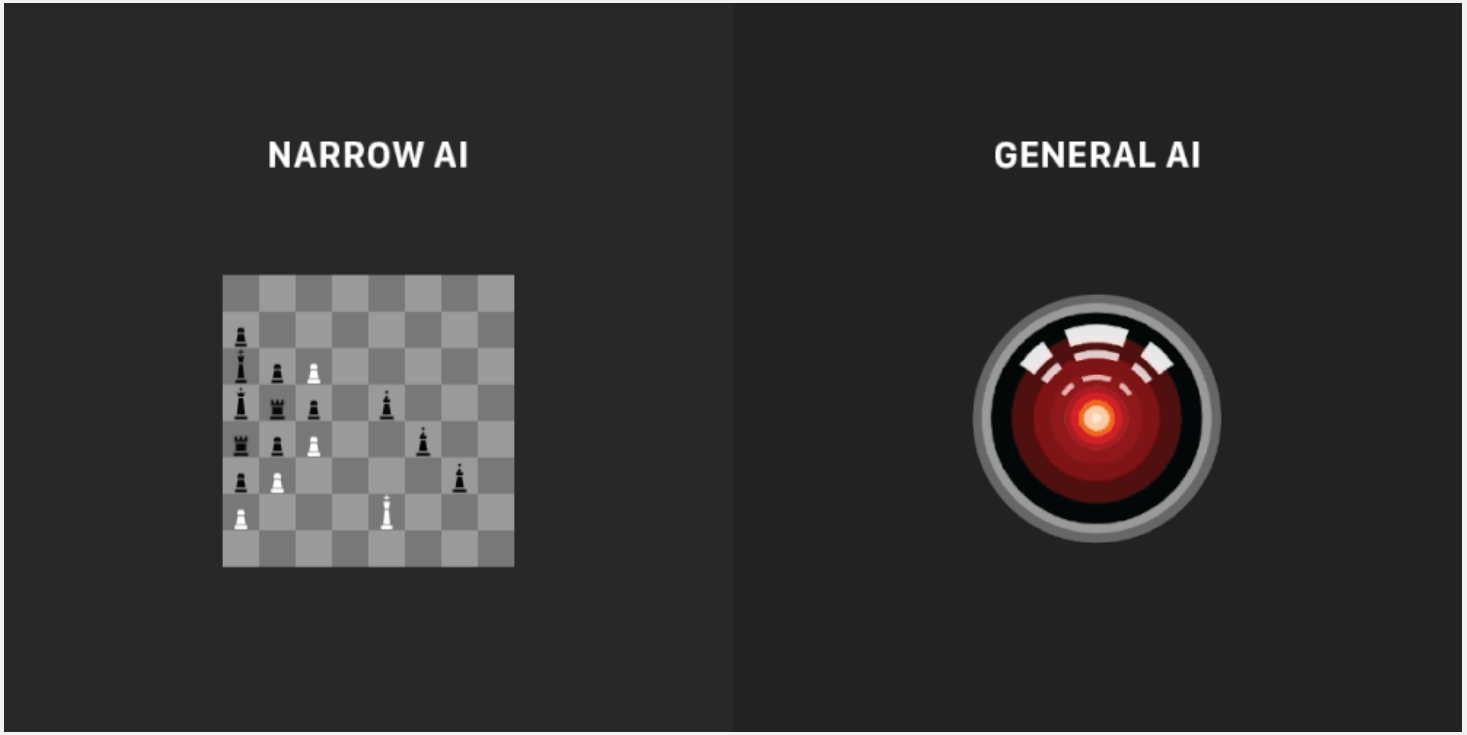
What is AI? Introduction

LEARNING VOYAGE

Introduction

- AI is creating tremendous amounts of value in every industry
- In sectors such as retail, travel, transportation, automotive, materials, manufacturing and so on.

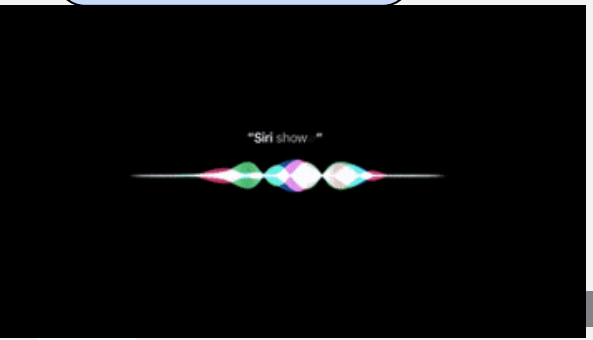
Introduction



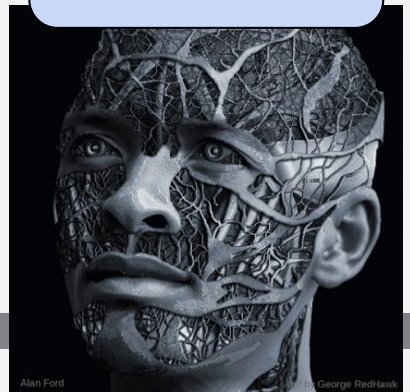
Introduction

AI

ANI



AGI

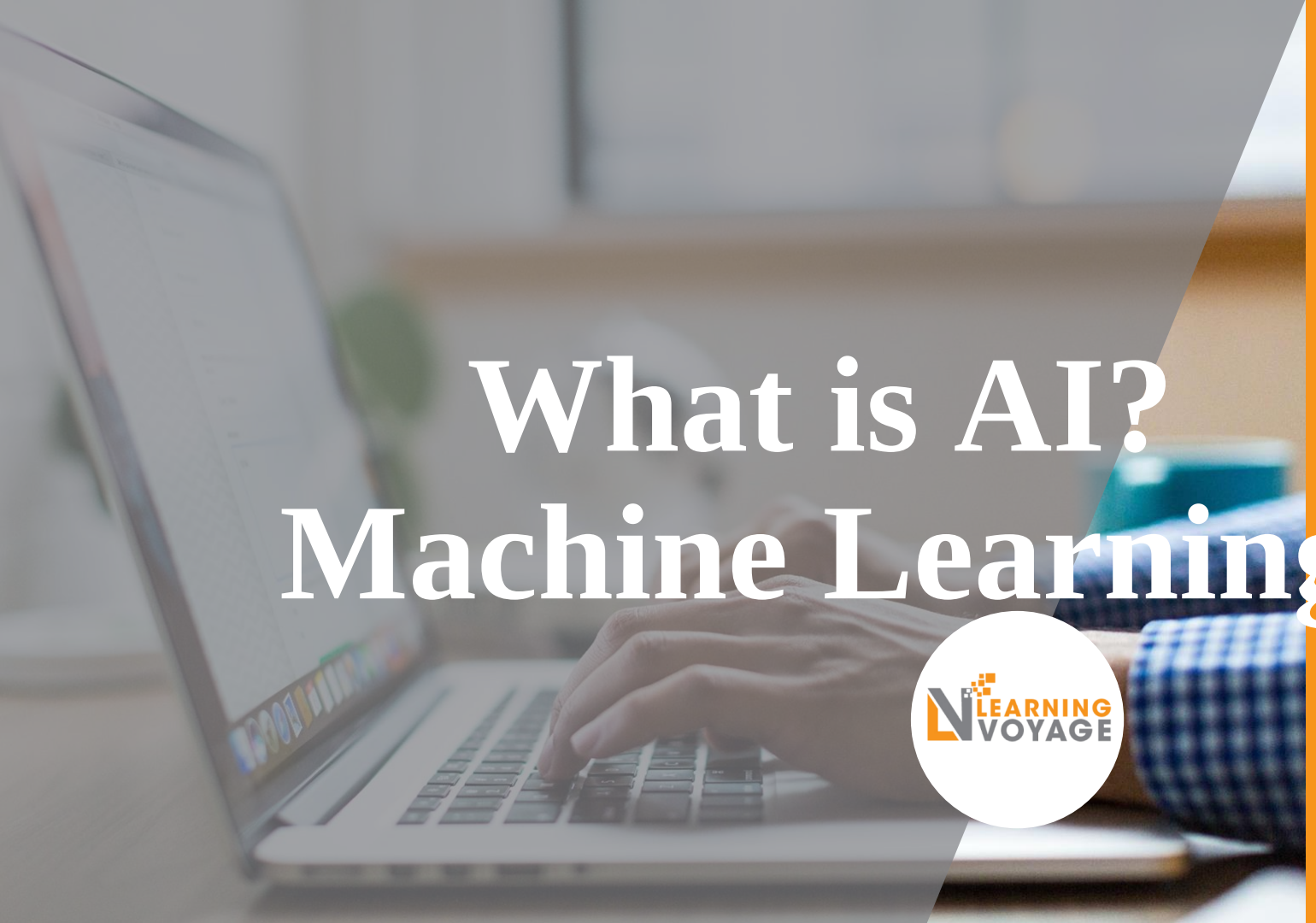


ASI

What you'll learn

What is Data Analytics/Data Science

- **Machine Learning**
- **Data**
- **AI Organizations**
- **What can you really do with this?**
- **Deep Learning**



What is AI?
Machine Learning

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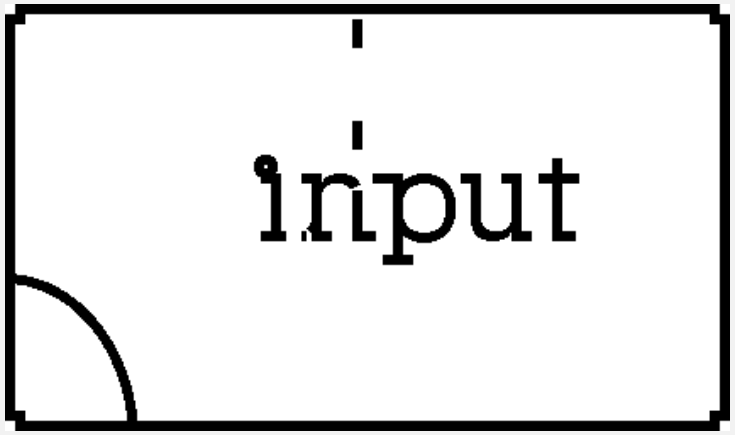
Machine Learning

- The rise of AI has been largely driven by one tool in AI:
  - **machine learning.**
- In this you'll learn what machine learning is, so that by the end, you will start thinking how machine learning might be applied to your role at Johnson and Johnson.

Supervised Learning

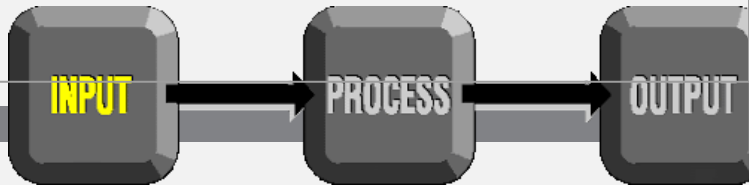
A ⟶ B

Input ⟶ Output

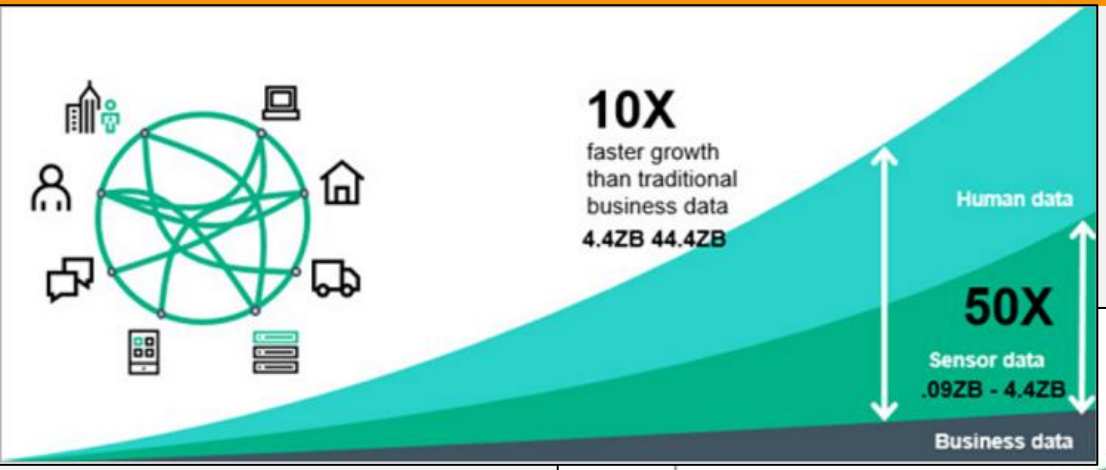


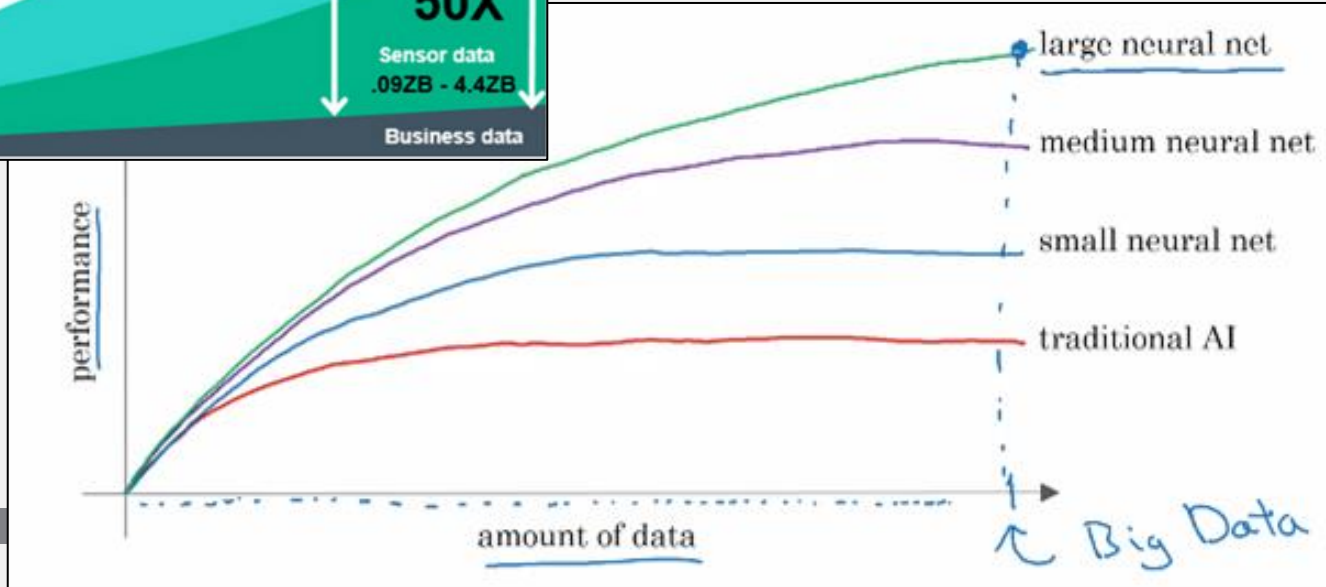
Machine Learning

Input → Process → Output	**Use Cases**
User Information → MODEL → Click?	Social Media. Online Advertising
email → Model → Spam	Spam Filter
Video → Model → Transcript	Speech Recognition
Shopping History → Model → Offers	Recommender Systems
English → Model → Spanish	Speech Translation
Product Image → Model → Defective	QA



Why Now


10X
faster growth
than traditional
business data
4.4ZB 44.4ZB
Human data
50X
Sensor data
.09ZB - 4.4ZB
Business data

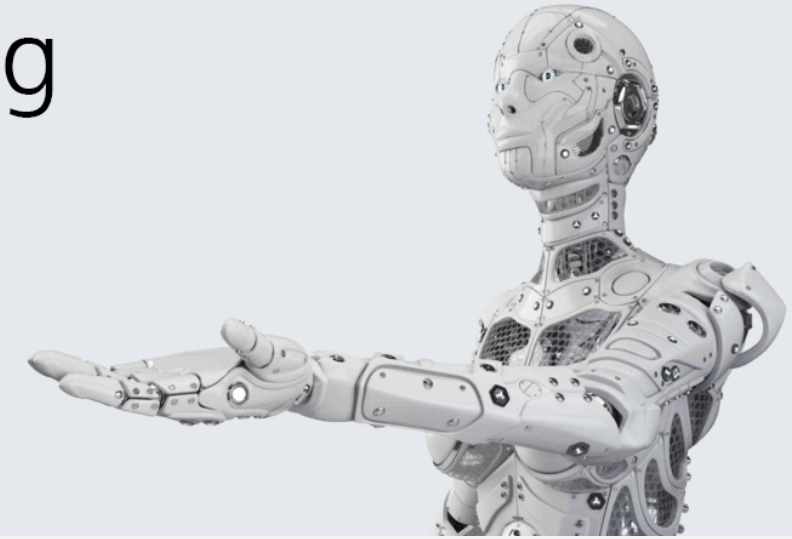

large neural net
medium neural net
small neural net
traditional AI
performance
amount of data
Big Data

Machine Learning

- What enables AI to work really well is data.

AI's coming of age

The progress into the AGI phase and the beginning of true autonomy.



The Zero Principle of AI

What is AI?
What is data?

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Example of Table Of Data (dataset)

Age	Income	Loan Status
21	20000	Rejected
37	55000	Approved
29	35000	Approved
23	17000	Rejected
34	70000	Approved
47	84000	Rejected
25	30000	Approved

Input	Image Label
	Dog
	Dog
	Cat
	Dog
	Cat
	Cat
	Dog

Acquiring Data

- Manual labeling

 cat

 not cat

 cat

 not cat

- From observing behaviors

user ID	time	price ($)	purchased
4783	Jan 21 08:15.20	7.95	yes
3893	March 3 11:30.15	10.00	yes
8384	June 11 14:15.05	9.50	no
0931	Aug 2 20:30.55	12.90	yes

machine	temperature (°C)	pressure (psi)	machine fault
17987	60	7.65	N
34672	100	25.50	N
08542	140	75.50	Y
98536	165	125.00	Y

A B

- Download from websites / partnerships

Data is Messy

- Garbage in, garbage out

- Data problems
  - Incorrect labels
  - Missing values

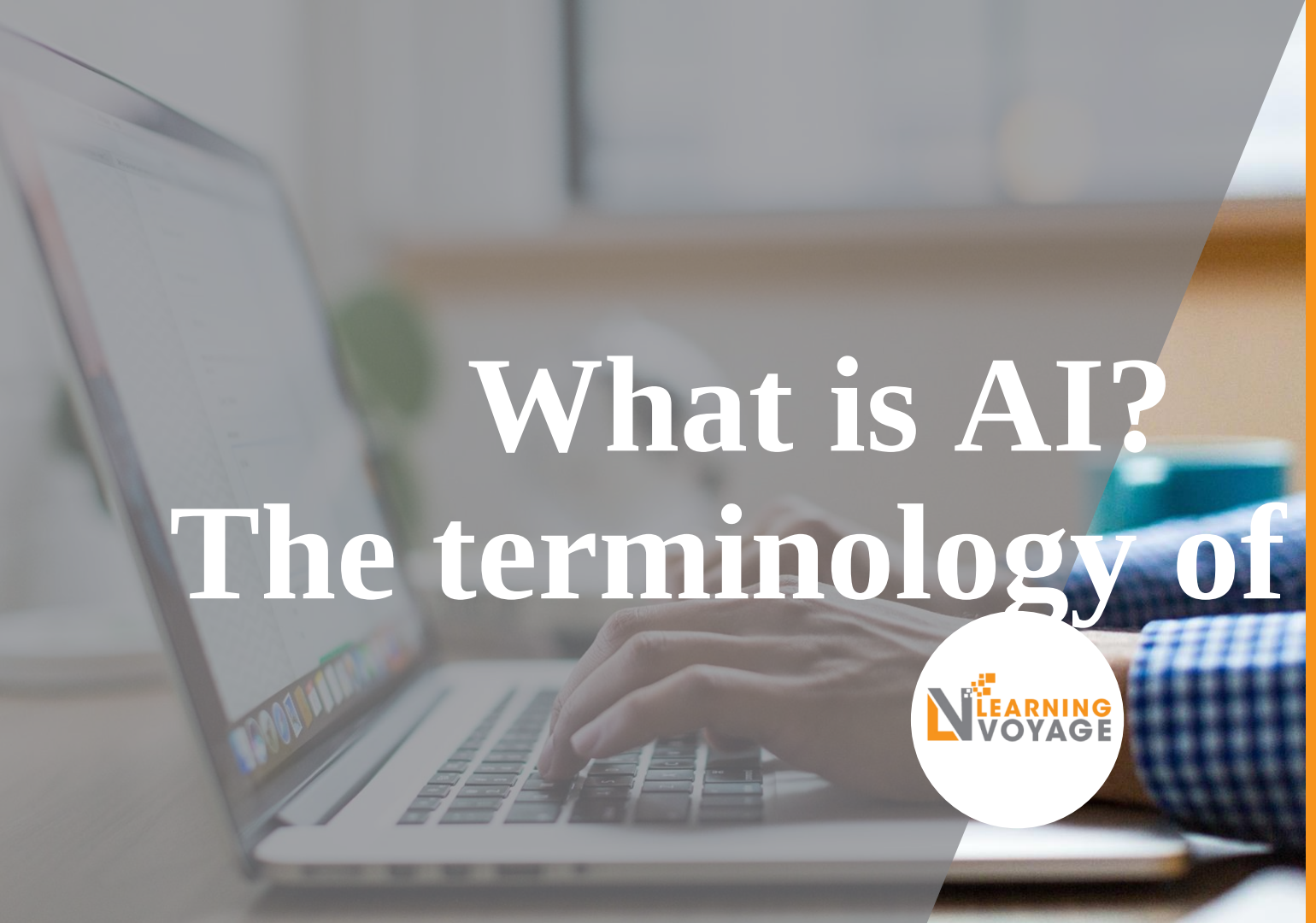
- Multiple types of data

images, audio, text

unstructured

size of house (square feet)	# of bedrooms	price (1000$)
523	1	115
645	1	0.001
708	unknown	210
1034	3	unknown
unknown	4	355
2545	unknown	440

structured



What is AI?
The terminology of AI

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Machine Learning vs. Data Science

Home prices

size of house (square feet)	# of bedrooms	# of bathrooms	newly renovated	price (1000$)
523	1	2	N	115
645	1	3	N	150
708	2	1	N	210
1034	3	3	Y	280
2290	4	4	N	355
2545	4	5	Y	440

A

B

ML. A → B

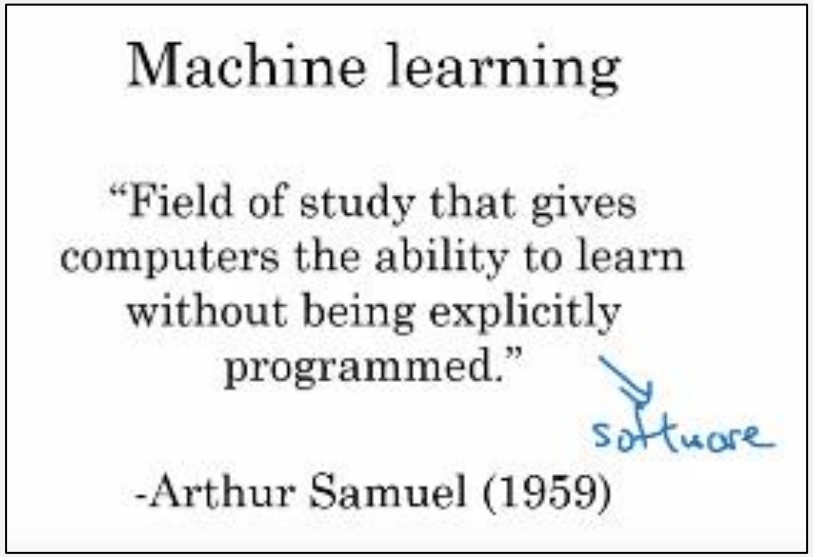
Running AI system
(e.g., websites / mobile app)

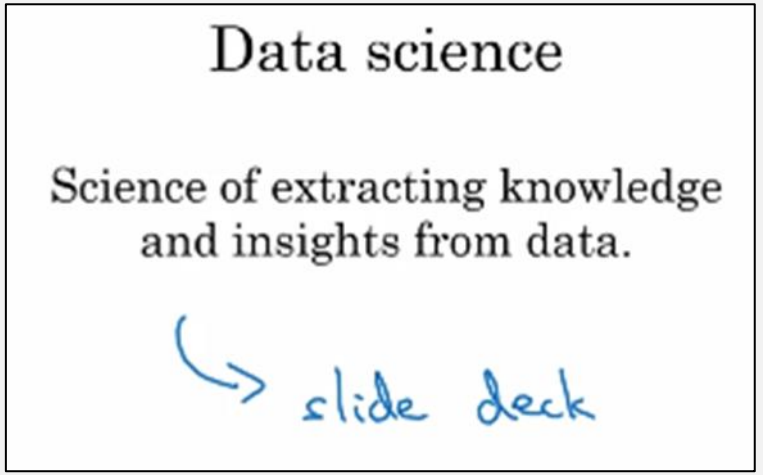
DS

Homes with 3 bedrooms are more expensive than homes with 2 bedrooms of a similar size.

Newly renovated homes have a 15% premium.

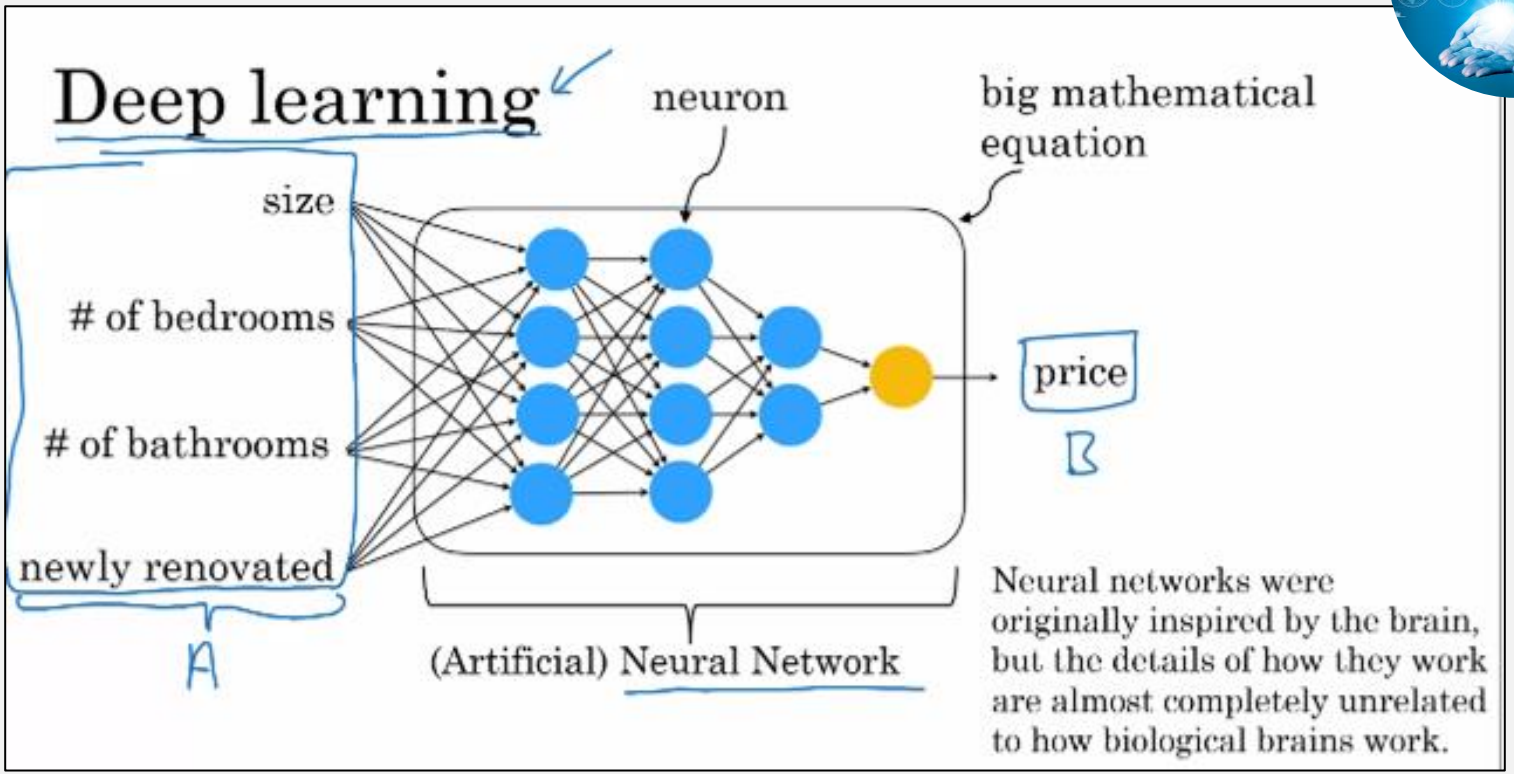
Machine Learning vs.Data Science





The terminology of AI

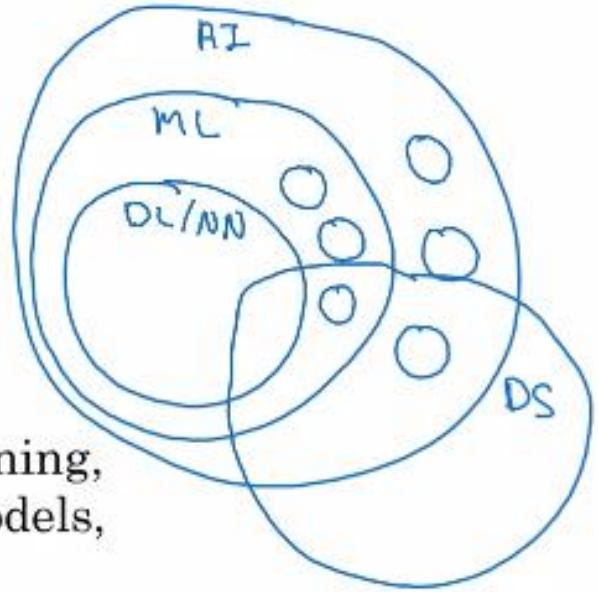
Deep Learning



The terminology of AI

AI has many tools

- Machine learning and data science
- Deep learning / neural network
- Other buzzwords: Unsupervised learning, reinforcement learning, graphical models, planning, knowledge graph, …



The terminology of AI

- In this lesson, you saw what is machine learning, what is data science, and what is deep learning and neural networks.
- I hope this gives you a sense of the most common and important terminology using AI, and you can start thinking about how these things might apply to your company.
- Now, what does it mean for a company to be good at AI? Let's talk about that in the next slides.

Group Activity

- Discuss and Identify 1:
  - Potential Machine Learning project
    - What would you predict?
    - Where would the data come from?
    - What is the value to Johnson and Johnson?
    - What is the value to the customer?
  - Potential Data Science project
    - What would you predict?
    - Where would the data come from?
    - What is the value to Johnson and Johnson?
    - What is the value to the customer?
- Preferably, Johnson and Johnson but don't limit yourself at this point.

What makes Johnson and Johnson an AI company?

What makes an AI company?

- What makes a company good at AI? Perhaps even more importantly, what will it take for your company to become great at using AI?

- So, what can you do for your company?
- This is the lesson I had learned by watching the rise of the Internet that I think will be relevant to how all of us navigate the rise of AI.

What makes an AI company?

A lesson from the rise of the Internet

Internet Era	AI era

What makes an AI company?

A lesson from the rise of the Internet

Internet Era	AI era
Shopping mall + website ≠ Internet company	Any company + deep learning ≠ AI company

What makes an AI company?

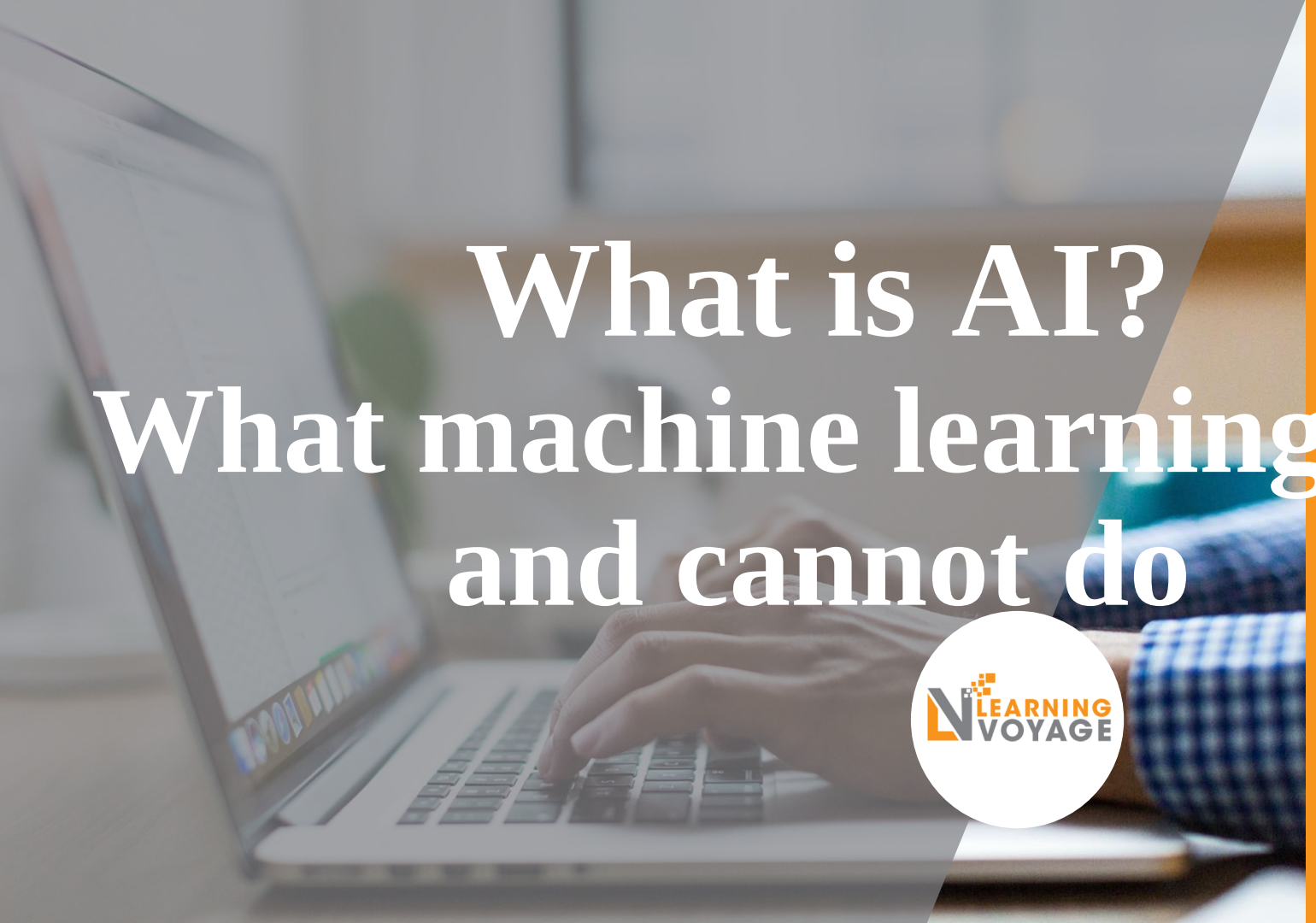
A lesson from the rise of the Internet

Internet Era	AI era
Shopping mall + website ≠ Internet company	Any company + deep learning ≠ AI company
- A/B testing - Short iteration time - Decision making pushed down to engineers and other specialized roles	- Strategic data acquisition - Unified data warehouse - Pervasive automation - New roles (e.g., MLE) and division of labor

What makes an AI company?

AI Transformation

1. Execute pilot projects to gain momentum
2. Build an in-house AI team
3. Provide broad AI training
4. Develop an AI strategy
5. Develop internal and external communications



What is AI?
What machine learning can and cannot do

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What machine learning can and cannot do

- In these slides and the next slides, I hope to help you develop intuition about what AI can and cannot do. In practice, before I commit to a specific AI project, I'll usually have either myself or engineers do technical diligence on the project to make sure that it is feasible.

- This means: looking at the data, look at the input, and output A and B, and just thinking through if this is something AI can really do.

Supervised learning

Input (A)	Output (B)	Application
email	spam? (0/1)	spam filtering
audio	text transcripts	speech recognition
English	Chinese	machine translation
ad, user info	click? (0/1)	online advertising
image, radar info	position of other cars	Self-driving car
image of phone	defect? (0/1)	visual inspection

Anything you can do with 1 second of thought, we can probably now or soon automate.

What machine learning can and cannot do

The toy arrived two days late, so I wasn't able to give it to my niece for her birthday.
Can I return it?

"Refund request"

Input text → Refund/Shipping/Other

A → B

Oh, sorry to hear that.
I hope your niece had a good birthday.
Yes, we can help with....

What Happens If You Try?

Input (A)		Output (B)
User email	→	2-3 paragraph response
1000 examples		
"My box was damaged."	→	Thank you for your email.
"Where do I write a review?"	→	Thank you for your email.
"What's the return policy?"	→	Thank you for your email.
"When is my box arriving?"	→	Thank yes now your….

What makes an ML Problem Easier

1. Learning a "simple" concept

   ≤ 1 sec

2. Lots of data available

   A, B

   A → B

More examples of what machine learning can and cannot do

- One of the challenges of becoming good at recognizing what AI can and cannot do is that it does take seeing a few examples of concrete successes and failures of AI.

- If you work on an average of say, one new AI project a year, then to see three examples would take you three years of work experience and that's just a long time.

Self Driving Car

Can do

A → B

10,000

Cannot do

stop

hitchhiker

10,000

bike turn
left signal

1. Data
2. Need high accuracy

A → B

More examples of what machine learning can and cannot do

- Say you want to build an AI system to look at X-ray images and diagnose pneumonia. So, all of these are chest X-rays.
  - So, the input A could be the X-ray image and the output B can be the diagnosis.
- Does this patient have pneumonia or not?
  - So, that's something that AI can do.
- Something that AI cannot do would be to diagnose pneumonia from 10 images of a medical textbook chapter explaining pneumonia.

X Ray Diagnosis





Can do	Cannot do
Diagnose pneumonia from ~10,000 labeled images	Diagnose pneumonia from 10 images of a medical textbook chapter explaining pneumonia
A → B	A → B

Strengths and Weaknesses Of ML

ML tends to work well when:

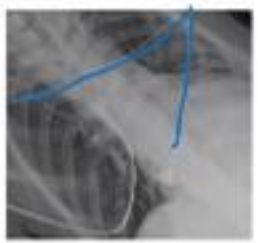
1. Learning a "simple" concept
2. There is lots of data available

ML tends to work poorly when:

1. Learning complex concepts from small amounts of data
2. It is asked to perform on new types of data

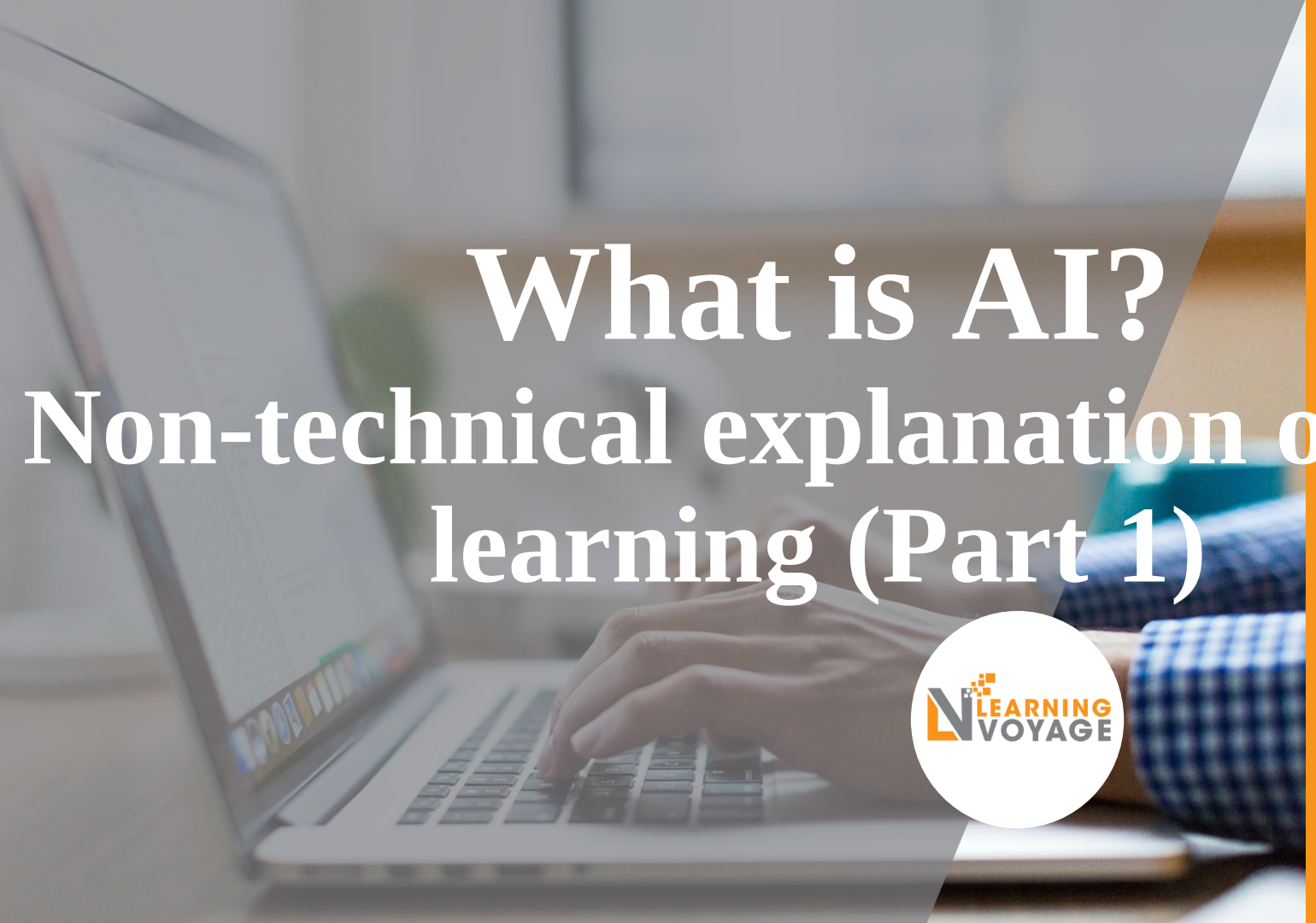
A→B



More examples of what machine learning can and cannot do

- I hope these examples are helping you hone your intuitions about what AI can and cannot do. In case the boundary between what it can or cannot do still seems fuzzy to you, don't worry.
- It is completely normal, completely okay. In fact even today, I still can't look at a project and immediately tell is something that's feasible or not.
- I often still need weeks or small numbers of weeks of technical diligence before forming strong conviction about whether something is feasible or not.



What is AI?
Non-technical explanation of deep learning (Part 1)

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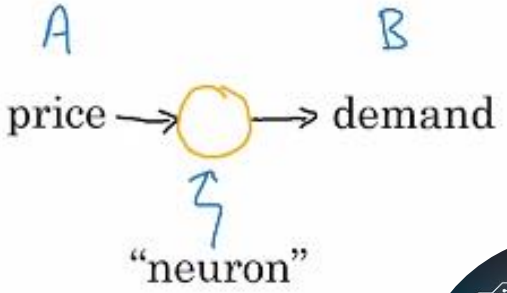
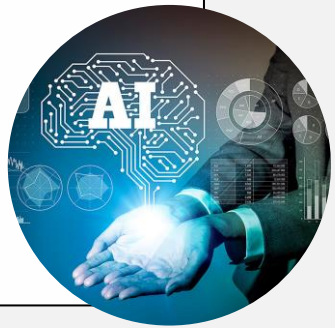
Non-technical explanation of deep learning (Part 1, optional)

Demand prediction



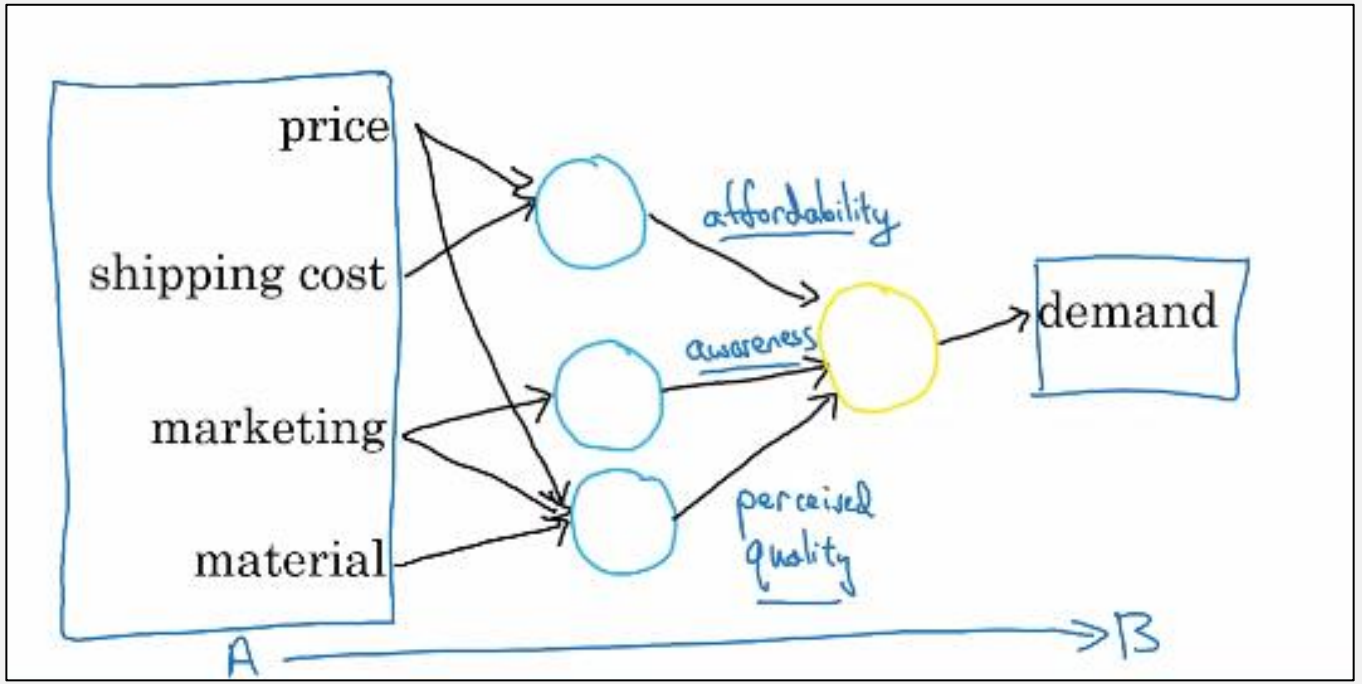


Demand Prediction

- Suppose that instead of knowing only the price of the product, you also have the shipping costs that the customers will have to pay to get the product.

- May be you spend more or less on marketing in a given week, and you can also make the product out of high quality material.

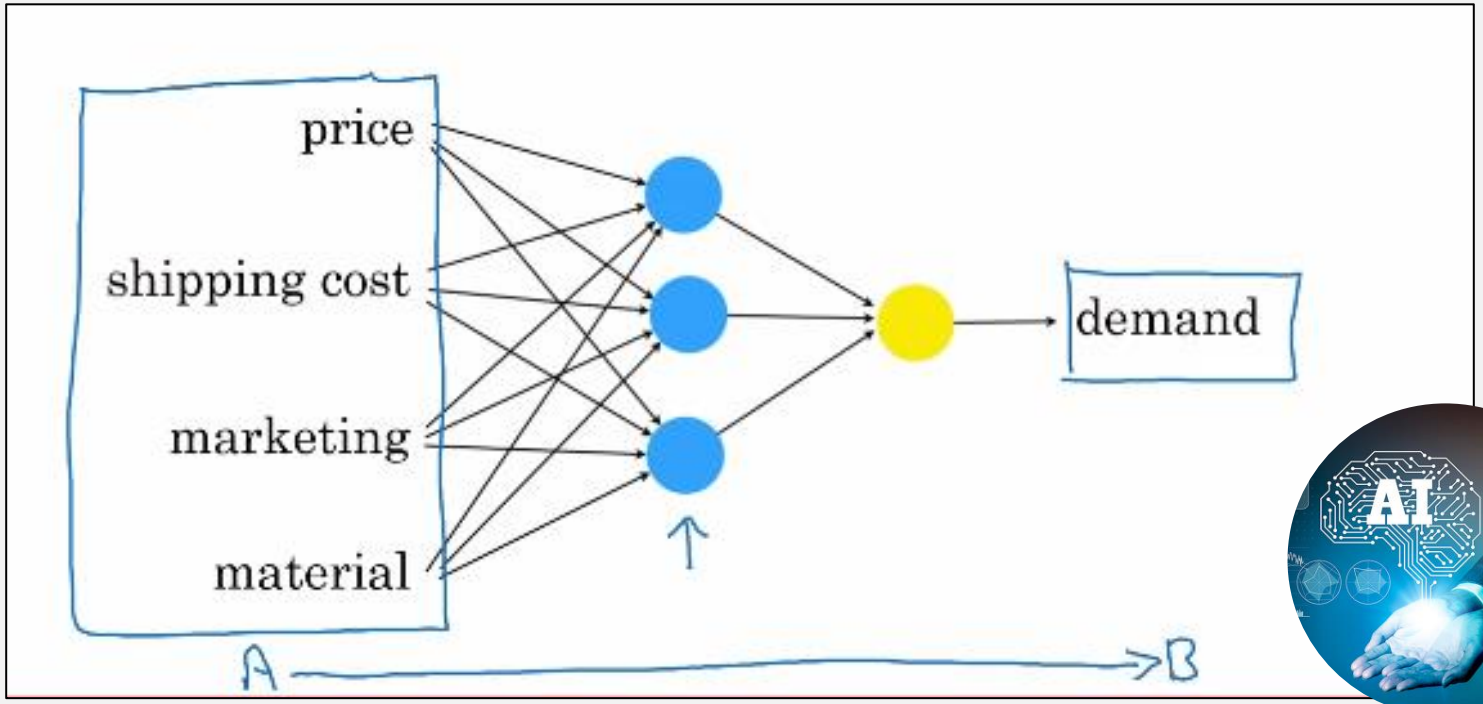
Demand Prediction



Non-technical explanation of deep learning (Part 1, optional)

- So It learns this input output or A to B mapping.
- This is a fairly small neural network with just four artificial neurons.
- In practice, neural networks used today are much larger, with easily thousands, tens of thousands or even much larger than that numbers of neurons.

Demand Prediction



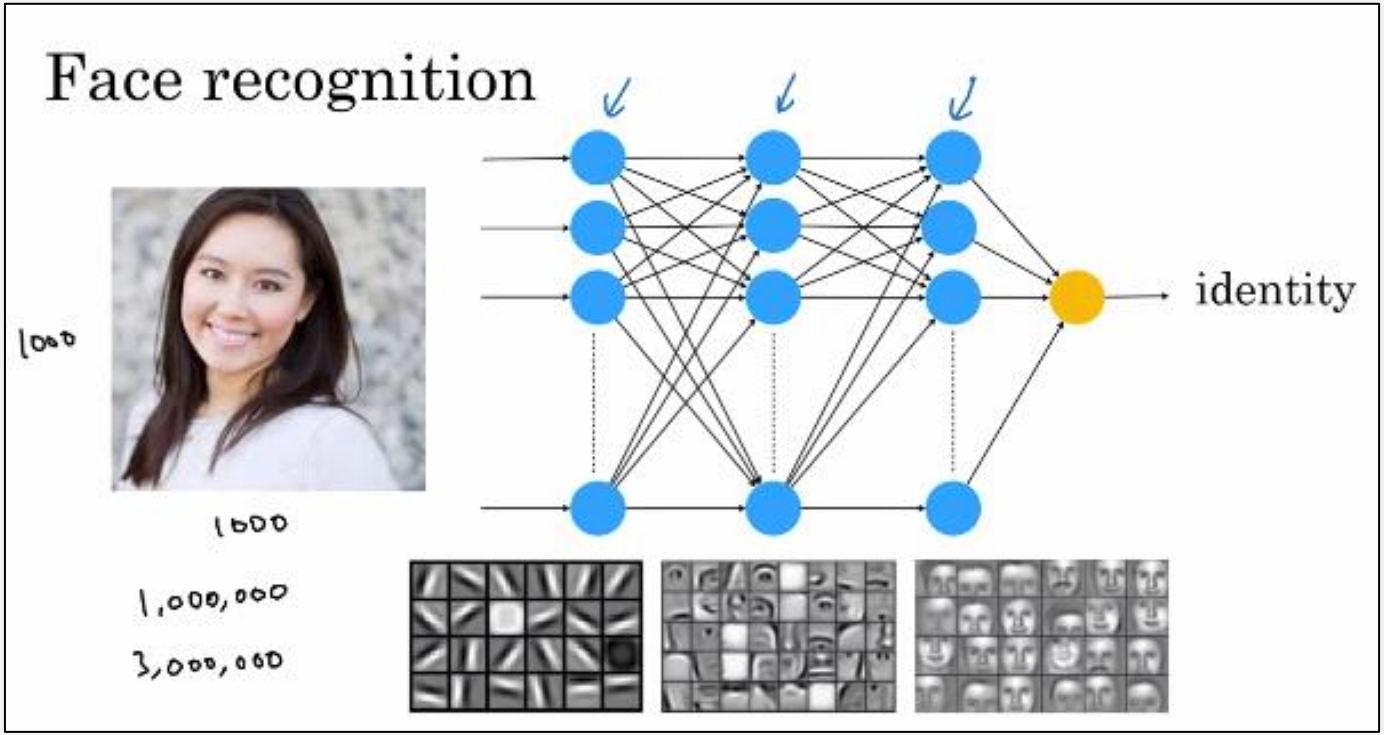
Non-technical explanation of deep learning (Part 1, optional)

- So that's a neural network, is a group of artificial neurons each of which computes a relatively simple function.
- But when you stack enough of them together like Lego bricks, they can compute incredibly complicated functions that give you very accurate mappings from the input A to the output B.
- Now, in this you saw an example of neural networks applied to demand prediction.

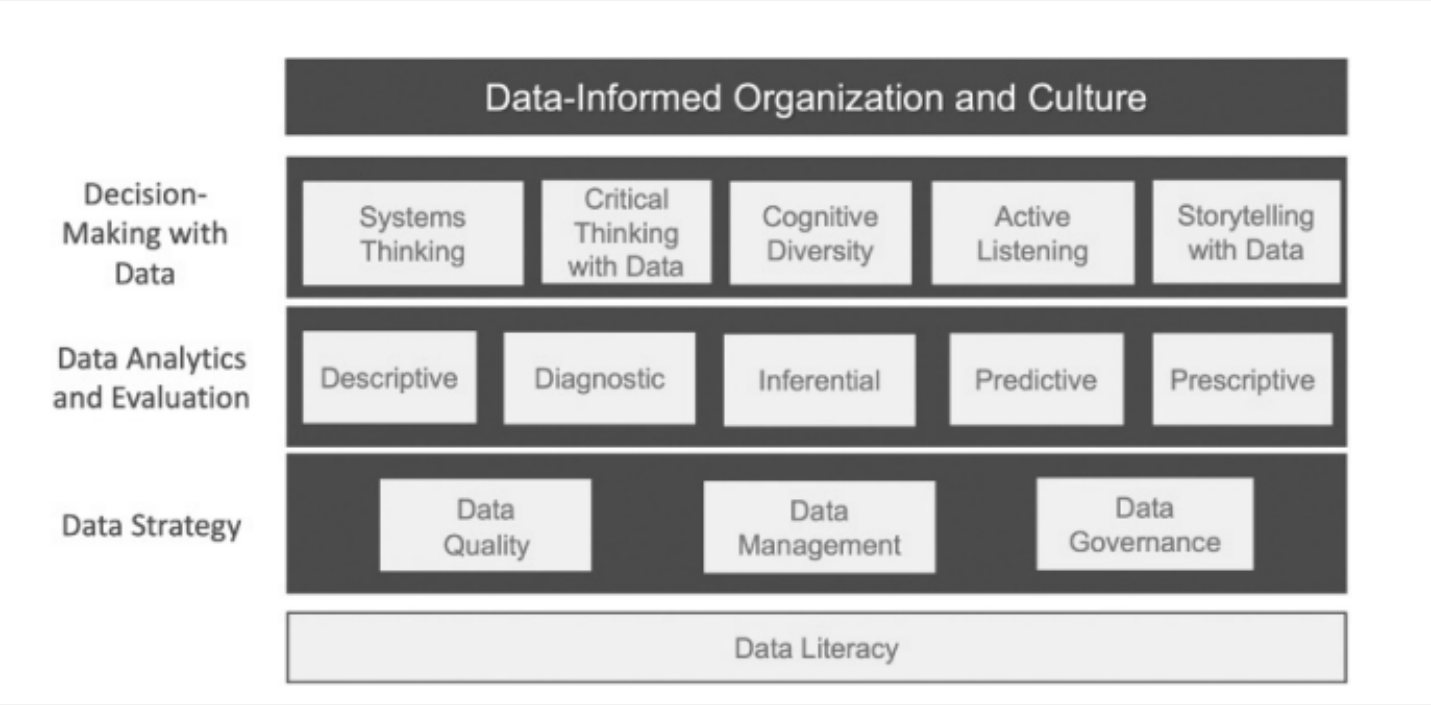
Face Recognition

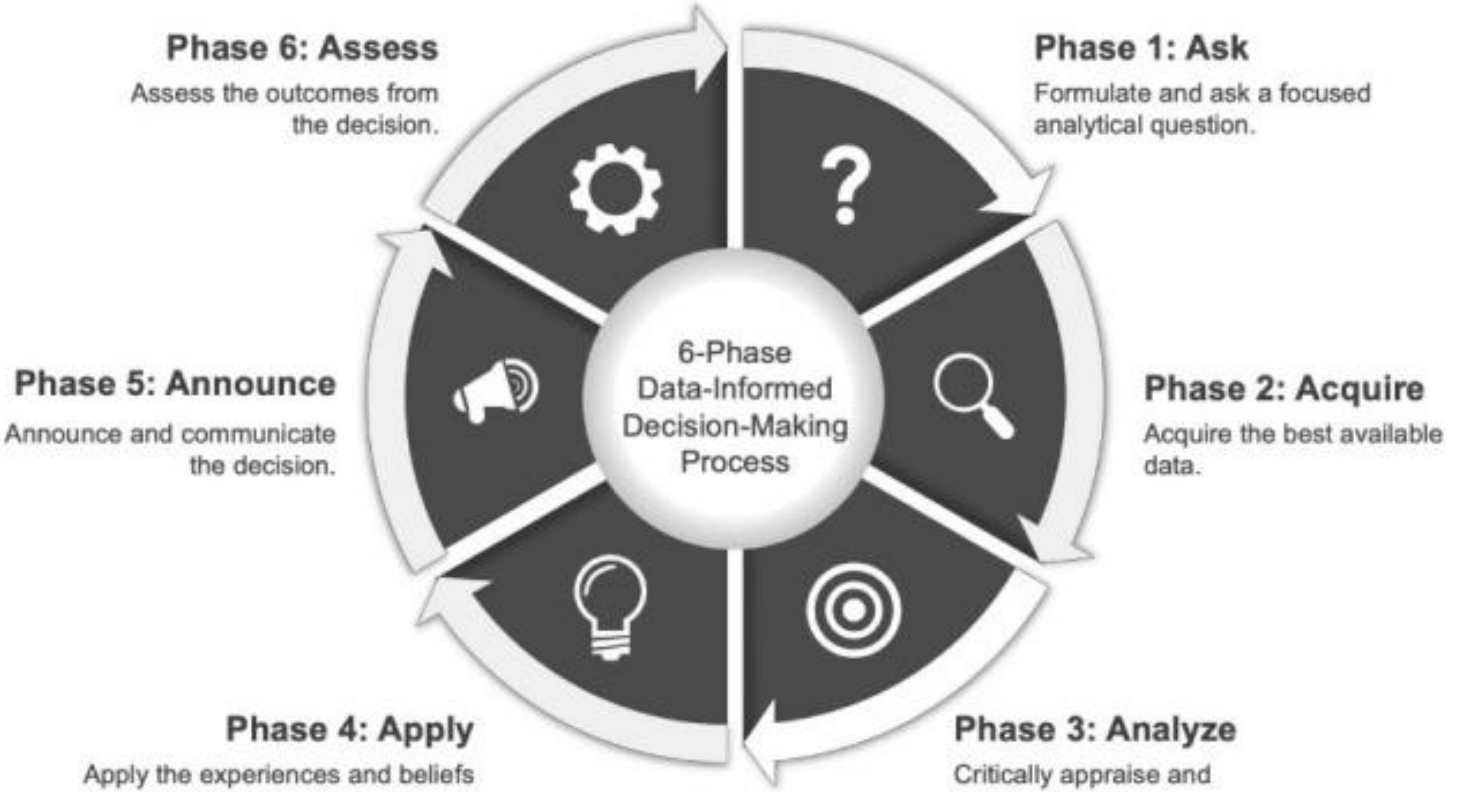
30	32	22	12	10	10	12	33	35	30
12	11	12	234	170	176	13	15	12	12
234	222	220	230	200	222	230	234	56	78
190	220	186	112	110	110	112	180	30	32
49	250	250	250	4	2	254	200	44	6
55	250	250	250	3	1	250	245	25	3
189	195	199	150	110	110	182	190	199	55
200	202	218	222	203	200	200	208	215	222
219	215	220	220	222	214	215	210	220	220
220	220	220	220	221	220	221	220	220	222

Non-technical explanation of deep learning (Part 2, optional)



Data Informed Decision Making




Phase 6: Assess
Assess the outcomes from the decision.
Phase 1: Ask
Formulate and ask a focused analytical question.
Phase 5: Announce
Announce and communicate the decision.
6-Phase Data-Informed Decision-Making Process
Phase 2: Acquire
Acquire the best available data.
Phase 4: Apply
Apply the experiences and beliefs of yourself and others to the data to make a decision, being aware of any bias you or others may hold.
Phase 3: Analyze
Critically appraise and analyze the data.

STEP	PHASE	DESCRIPTION
1	Ask	Turn business questions into analytical questions.
2	Ask	Classify the decision needed.
3	Acquire	Find and source all relevant data. Remember to think about the analytical questions systemically and to include any interrelated data that could be relevant. This means not only internal data but external data and information as well.
4	Acquire	Ensure the sourced data is trusted.
5	Analyze	Create a measurement framework to describe your data with key performance indicators (KPIs) and descriptive analytics.
6	Analyze	Use diagnostic analytics to find patterns, trends, and relationships that may exist but not be obvious to start to drill into root cause. If applicable, leverage inferential statistics to take a sample of data and make generalizations about the entire population, predictive analytics to run simulations or to test potential decisions/solutions, and prescriptive analytics to act on situations as they happen.
7	Apply	Review and orient yourself to the data and information so far, apply your personal experiences to it, and create a hypothesis.
8	Apply	Challenge the data, and actively look for information to see if you can disprove your hypothesis.
9	Apply	Leverage strategies to become aware of and to mitigate bias, and then make a decision.
10	Announce	Announce your decision at the right level to ALL stakeholders (direct, indirect, upstream, and downstream) by leveraging tools like reframing, the Pyramid principle, and the Rule of Three in your storytelling.
11	Announce	Provide adequate time for stakeholders to unlearn any outdated mental models and to learn new ones.
12	Assess	Set up a review mechanism to monitor the impacts of the decision after it is made and acted upon. Leverage that review mechanism, and fail/fix/learn fast, making improvements to data, measurement frameworks, accountability, decisions, and anything else relevant.

Take away

- Data-informed decision-making in AI for leaders should follow a systemic and systematic process, such as the one that will be discussed.
- Data-informed decision-making requires a combination of hard and soft skills.

Group Activity

Which two cards would you turn over to test the rule?

A) A, 4

C) Q, 4

B) A, 7

D) Q, 7

Ask the right question

- 1. “Can we increase profits by securing forward contracts from a region with less-expensive grapes?”
- 2. “What expense categories account for the greatest budget variance by region? Is there seasonality in the variance?”
- 3. “Are there any patterns or trends?”

How was my campaign?

- Compared to what? Q1? Q2? Previous year?
- What is important to your decision? Your strategy?
- How important is the question to the business?
- PUT QUESTIONS IN THE RIGHT LANGUAGE.
- Answer need to be quantifiable. QBQ
- Understand the DATA needed to answer these questions.

What is a good DATA question?

1. Clear.
2. Specific
3. Scoped
4. Data oriented
5. Answerable

Turn Business ?'s into Data ?'s

- How was my campaign?
  - What qualifies as successful?
  - What period are you looking at and comparing to?
  - Are there various dimensions you want to compare?

Good Data Questions

- What was the overall positive response rate for the Q3 marketing campaign?
- What were the differences in positive response rate (if any) among the various marketing channels?
- What were the differences in positive response rate (if any) across different demographics?

Analytical Framework for AI Leaders

- Univariate
- Bivariate
- Multivariate
- (DEMO)

Group Activity

- Identify a dataset from Kaggle.com
- Create 3 DATA questions from this dataset
- Perform a univariate, bivariate, multivariate analysis on your data and identify as many insights as you can (especially those that relate back to the data questions).

Recommenders

Any Questions?