



AI for Everyone

*Presidential Initiative
for
Artificial Intelligence
and
Computing*



1. What is AI?

4.01 - Objectives of this Course

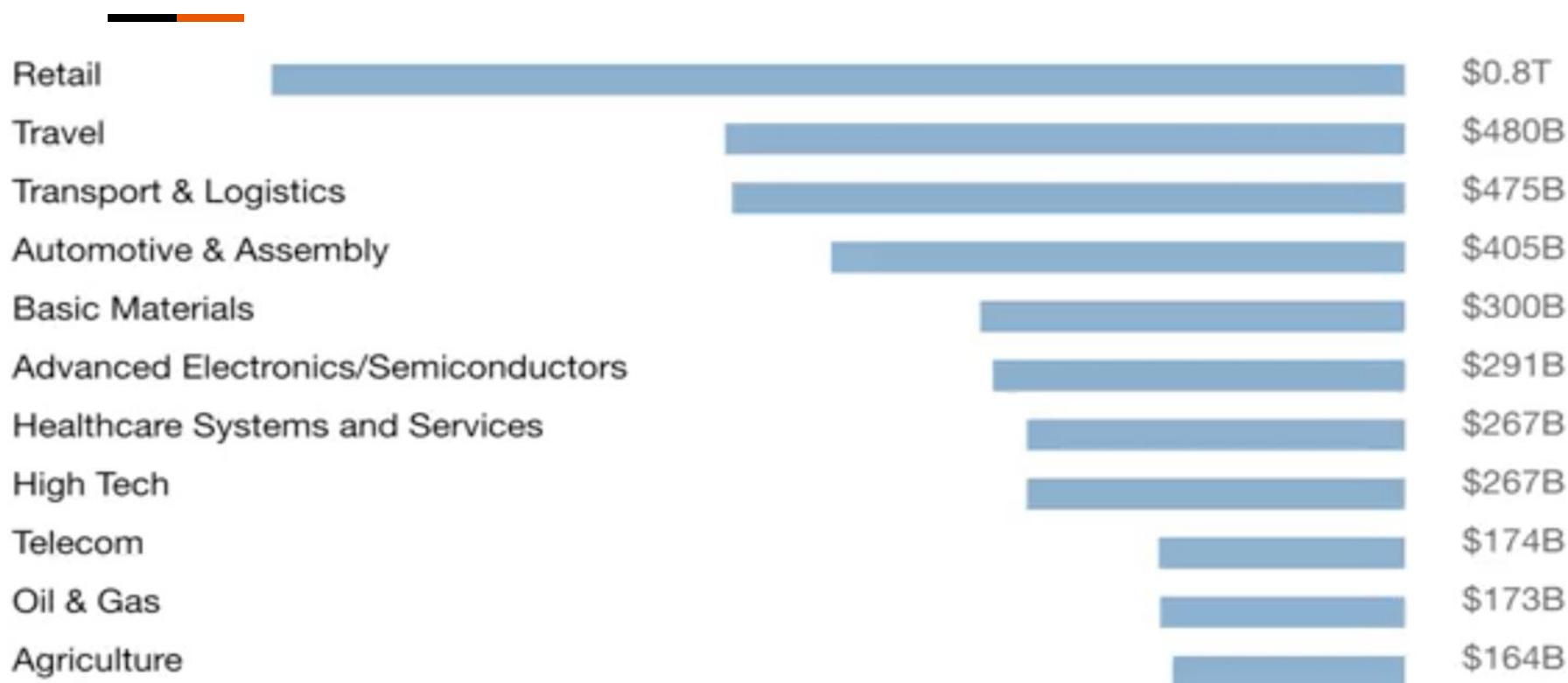
1. The meaning behind common AI terminology, including neural networks, machine learning, deep learning, and data science
2. What AI realistically can--and cannot--do
3. How to spot opportunities to apply AI to problems in your own organization
4. What it feels like to build machine learning and data science projects
5. How to work with an AI team and build an AI strategy in your company
6. How to navigate ethical and societal discussions surrounding AI

4.02 – Impact of AI in Industries

\$13 Trillion

AI value creation by 2030

[Source: McKinsey Global Institute](#)



A lot of the value created by AI will be outside the software industry. AI will have a huge impact on all the major industries.

4.03 – ANI Vs AGI

There are 2 types of AI

ANI

Artificial Narrow Intelligence

LOTS OF PROGRESS

ALMOST NO PROGRESS

AGI

Artificial General Intelligence

Artificial Narrow Intelligence (ANI)

These are AIs that do one thing such as:

- smart speaker
- self-driving car
- AI to do web search
- AI applications in farming or in a factory.



These types of AI are one trick ponies but when you find the appropriate trick, this can be incredibly valuable.

Artificial General Intelligence (AGI)

That is the goal to build AI.

They can do anything a human can do or may be even be super intelligent and do even more things than any human can.

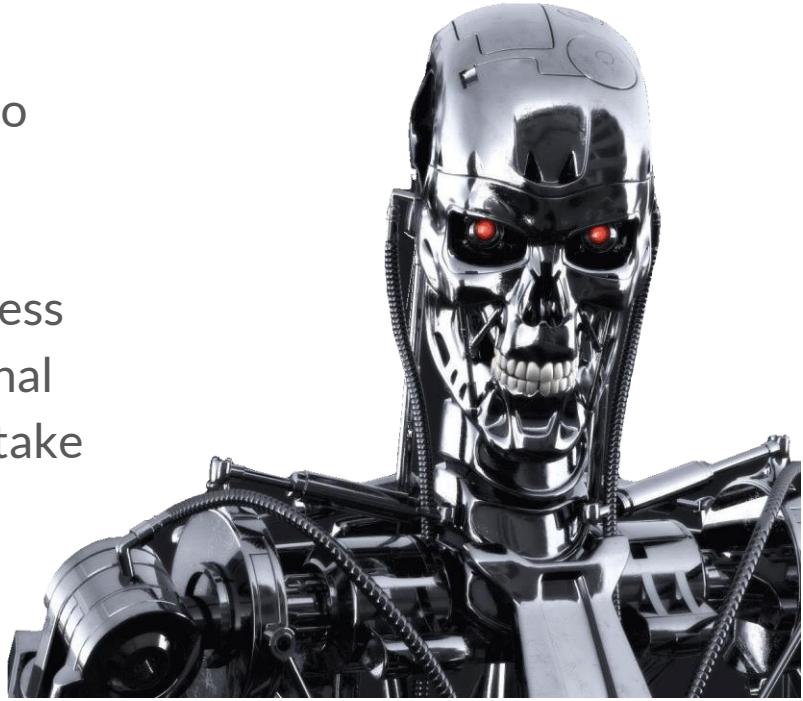


Achieving AGI Will Take Time

AGI is an exciting goal for researchers to work on, but it requires many technological breakthroughs before we get there and it may be decades or hundreds of years or even thousands of years away.

Progress in ANI vs AGI

The rapid progress in ANI has caused people to conclude that there's a lot of progress in AI, which is true. But that has caused people to falsely think that there might be a lot of progress in AGI as well which is leading to some irrational fears about evil clever robots coming over to take over humanity anytime now.



4.04 – Machine Learning

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

Supervised Learning

If the input is an audio clip, and the AI's job is to output the text transcript, then this is speech recognition.



Input (A)
Audio



Output (B)
Text (0/1)



Application
Speech Recognition

Supervised Learning

If you want to input English and have it output a different language, Chinese, Spanish, something else, then this is machine translation.



Input (A)
English



Output (B)
Chinese



Application
Machine Translation

Supervised Learning

All the large online ad platforms have a piece of AI that inputs some information about an ad, and some information about you, and tries to predict, will you click on this ad or not?



Input (A)
Ad + User Info



Output (B)
Click? (0/1)



Application
Machine Translation

Supervised Learning

If you want to build a self-driving car, one of the key pieces of AI is the AI that takes as input an image, and some information from radar, or from other sensors, and outputs the position of other cars, so your self-driving car can avoid the other cars.



Input(A)
Image, radar info



Position of other cars



Self-Driving Car

Supervised Learning

In Manufacturing, we take as input a picture of something you've just manufactured, such as a picture of a cell phone coming off the assembly line., and you want to output, is there a scratch, or is there a dent, or some other defects on this thing you've just manufactured? This is **visual inspection** which is helping manufacturers to reduce or prevent defects in the things that they're making.



Input (A)
Image of a phone



Output (B)
Defects (0/1)



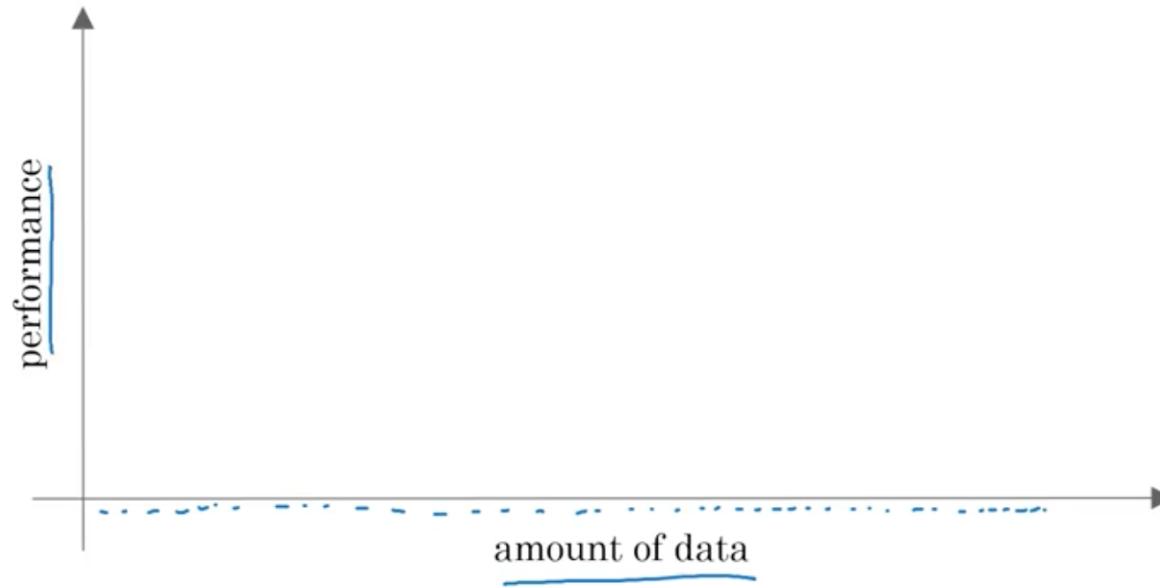
Visual Inspection

Supervised Learning

This set of AI called supervised learning, just learns input to output, or A to B mappings. On one hand, input to output, A to B it seems quite limiting. But when you find a right application scenario, this can be incredibly valuable.

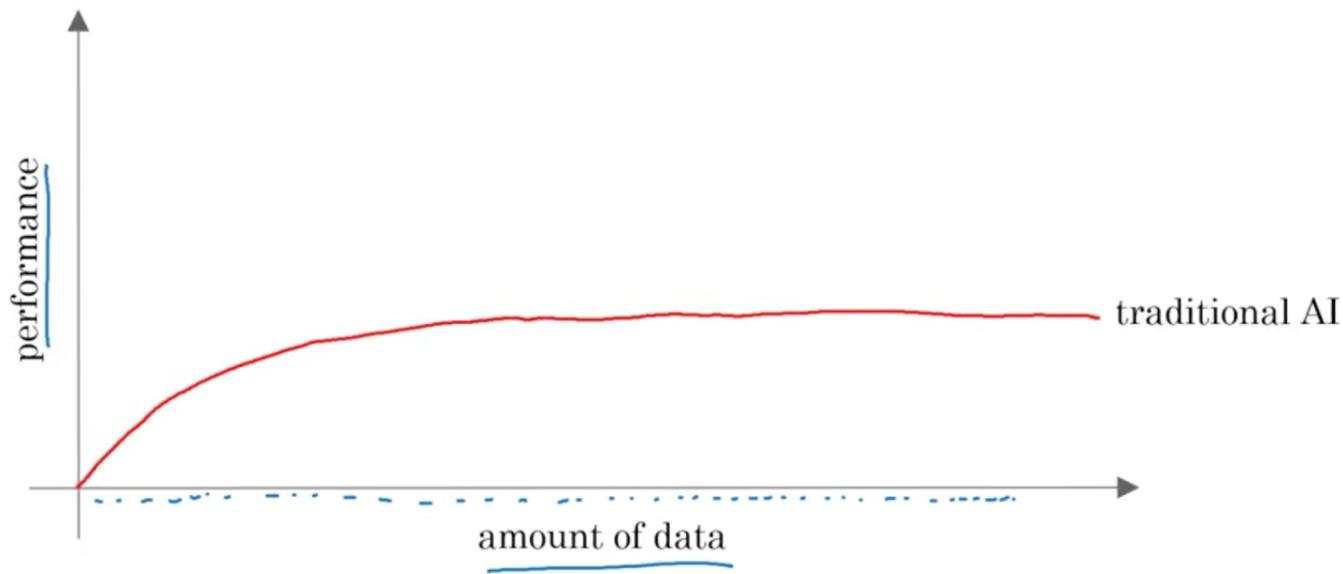


4.05 - Why Now?



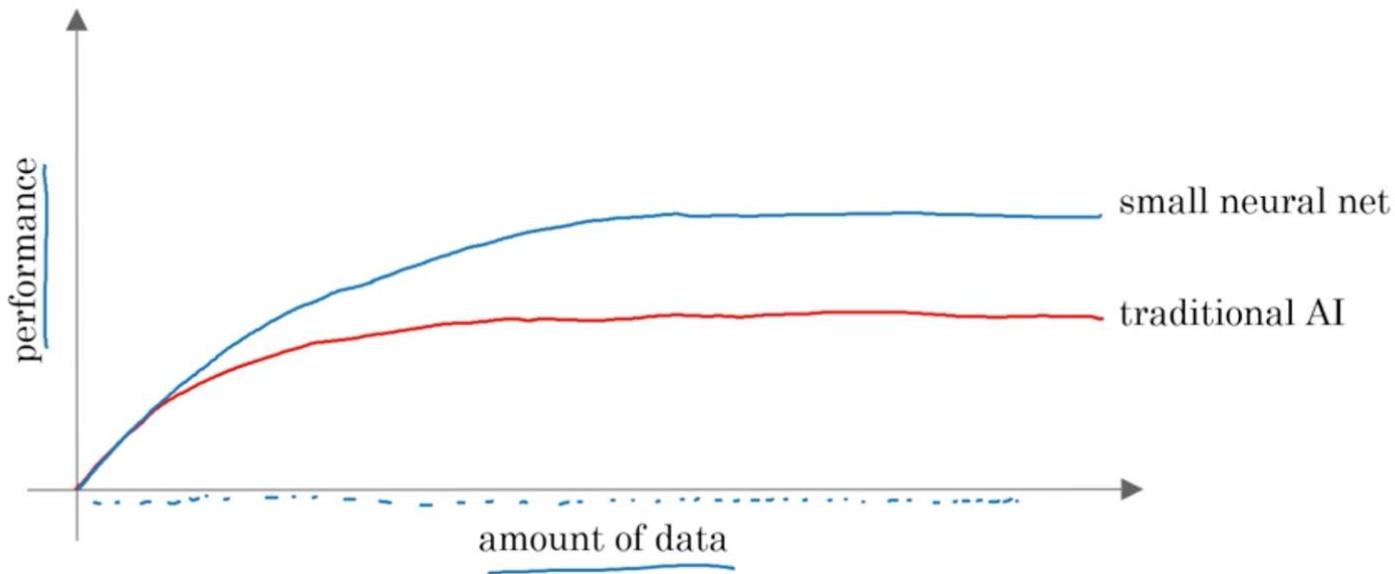


Why Now?



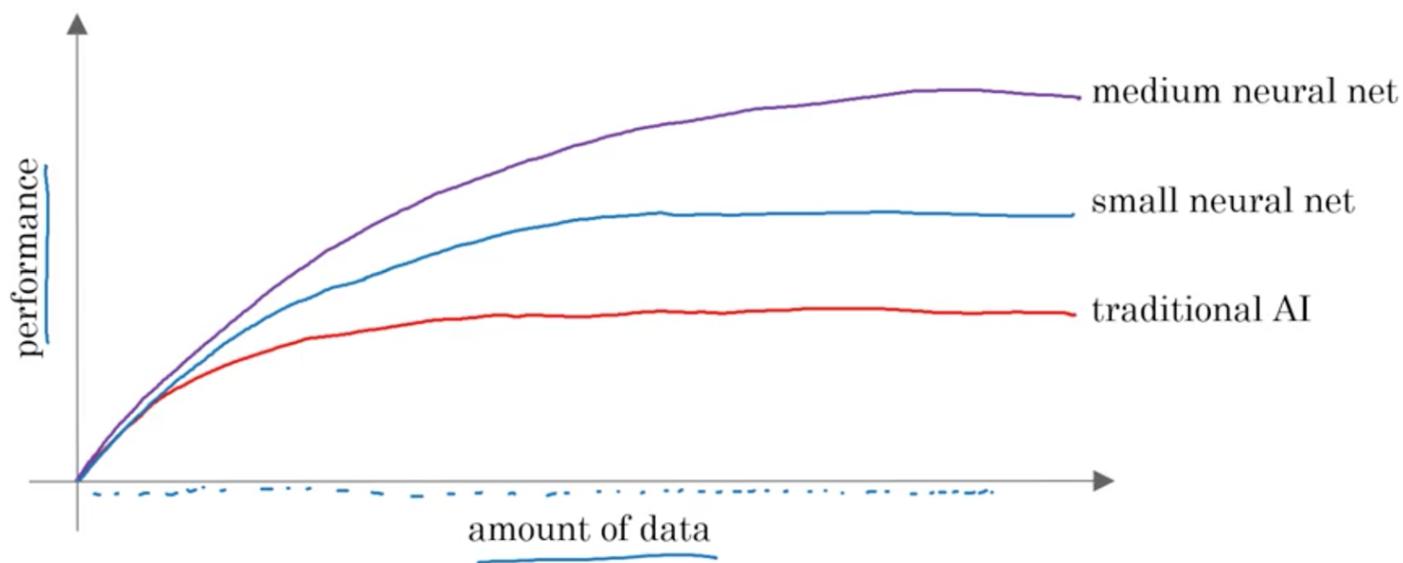


Why Now?



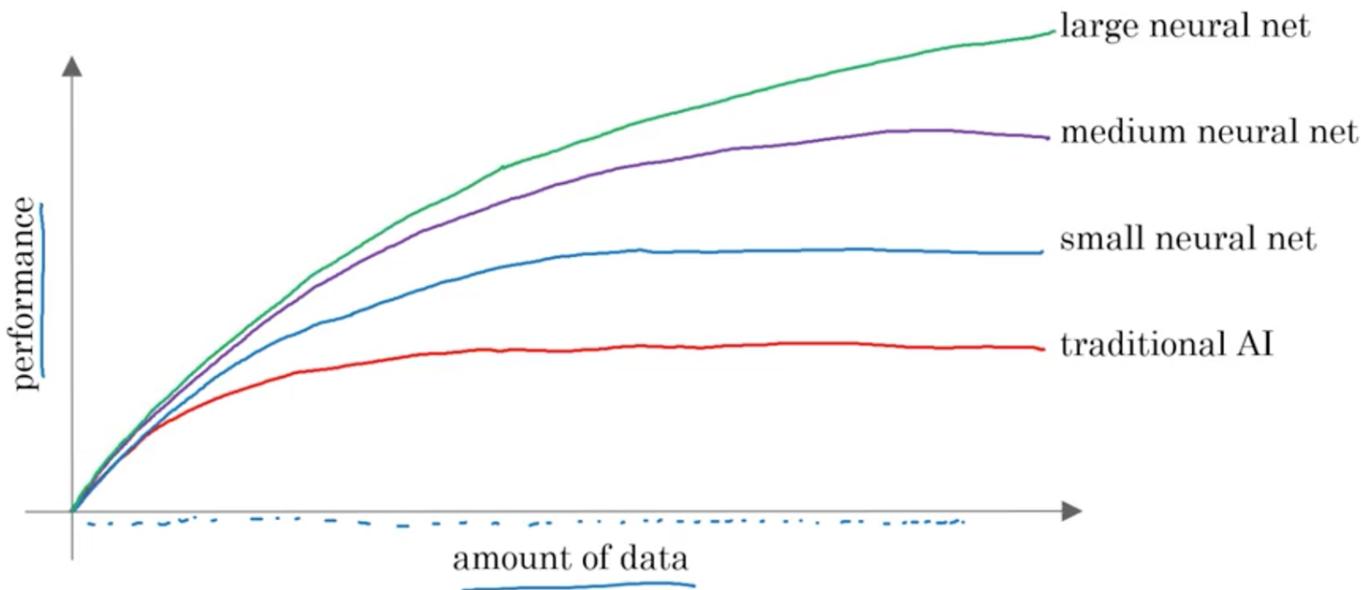


Why Now?

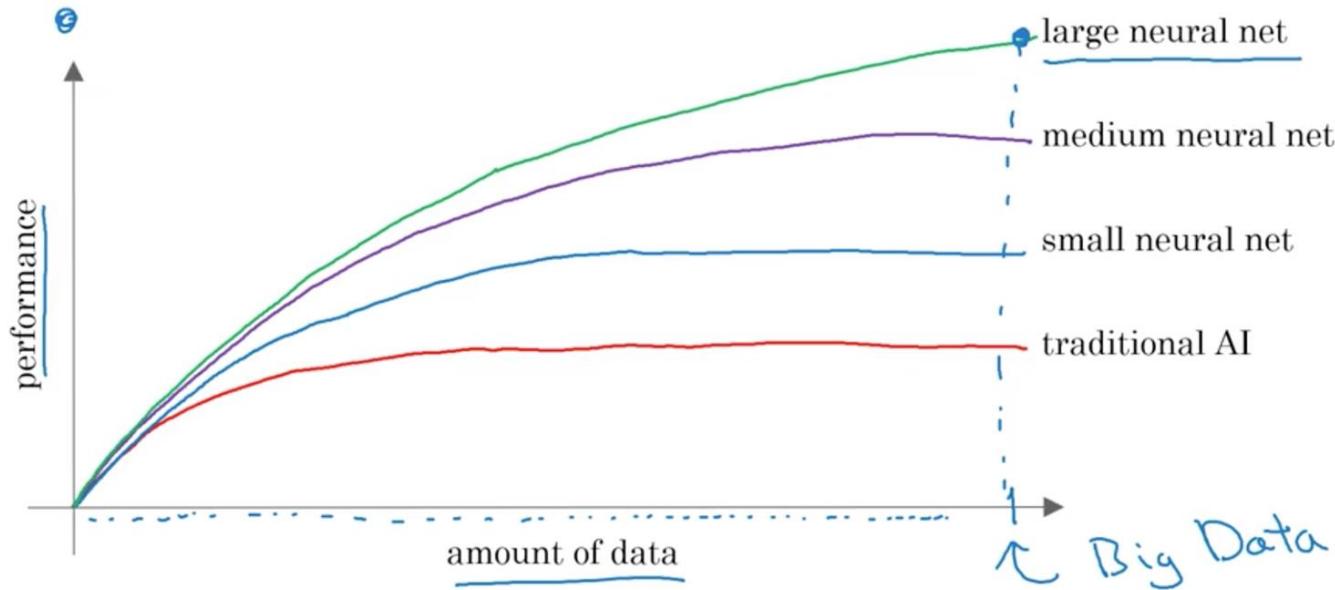




Why Now?



Why Now?



The Rise of Fast Computers

So, the rise of fast computers with specialized processors such as graphics processing units or GPUs has enabled many companies, not just giant tech companies, but many many other companies to be able to train large neural nets on a large enough amount of data in order to get very good performance and drive business value.

4.06 – What is Data?

- What is the most important idea in AI?
- Machine Learning
- What is Supervised Learning?
- A to B mapping or Input to Output mapping
- What enables machine learning to work so well?
- Data
- What is Data?

A Table of Data (Dataset)

Size of House (Square Feet)	Price (\$1000)
523	115
645	150
708	210
1034	280
2290	355
2545	440
A	B

A Table of Data (Dataset)

Size of House (Square Feet)	# of Bedrooms	Price (\$1000)
523	1	115
645	1	150
708	2	210
1034	3	280
2290	4	355
2545	4	440
A		B

Data is often unique to your business

Data is often unique to your business, and this is an example of a dataset that a real estate agency might have that they tried to help price houses.

It's up to you to decide what is A and what is B, and how to choose these definitions of A and B to make it valuable for your business.

Another example

If you have a certain budget and you want to decide what is the size of house you can afford, then you might decide that the input A is how much does someone spend and B is just the size of the house in square feet, and that would be a totally different choice of A and B that tells you, given a certain budget, what's the size of the house you should be maybe looking at.

A Table of Data (Dataset)

Size of House (Square Feet)	# of Bedrooms	Price (\$1000)
523	1	115
645	1	150
708	2	210
1034	3	280
2290	4	355
2545	4	440
B		A

4.07 - Acquiring data

- Manual labeling



cat



not
cat



cat



not
cat

Acquiring data

- From observing behaviors of humans

User ID	Time	Price (\$)	Purchased
4783	Jan 21 08:15.20	7.95	yes
3893	Mar 3 11:30.15	10.00	yes
8384	Jun 11 14:15.05	9.50	no
0931	Aug 2 20:30.55	12.90	yes

Acquiring data

- From observing behaviors of machines

Machine	Temperature	Pressure (psi)	Machine Fault
17987	60	7.65	N
34672	100	25.50	N
08542	140	75.50	Y
98536	165	125	Y
Input A			Input B

Acquiring data

- Download from websites / partnerships
 - Thanks to the open internet you can find so many datasets available for free online
 - Computer vision or image datasets
 - Self driving car datasets
 - Speech recognition datasets
 - Medical imaging datasets
 - Keep in mind licensing and copyright

4.08 - Use and misuse of data



Give me three years to build up my IT team, we're collecting so much data.

Then after three years, I'll have this perfect dataset.

We'll do AI then.

What's wrong with this approach?

Use and misuse of data



It turns out that's a really bad strategy.

Once you've started collecting some data, go ahead and start showing it or feeding it to an AI team.

Then the AI team can give feedback to your IT team on what types of data to collect and what types of IT infrastructure to keep on building.

Example

Maybe an AI team can look at your factory data and say, "Hey. You know what? If you can collect data from this big manufacturing machine, not just once every ten minutes, but instead once every one minute, then we could do a much better job building a preventative maintenance systems for you."

Machine	Temperature	Pressure (psi)	Machine Fault
17987	60	7.65	N
34672	100	25.50	N
08542	140	75.50	Y
98536	165	125	Y
Input A			Input B

Use and misuse of data

"Hey, I have so much data. Surely, an AI team can make it valuable."

What's wrong with this statement?



Use and misuse of data



Unfortunately, this doesn't always work out.

More data is usually better than less data, but I wouldn't take it for granted that just because you have many terabytes or gigabytes of data, that an AI team can actually make that valuable.

Don't throw data at an AI team and assume it will be valuable.

Data is Messy



If you have bad data, then the AI will learn inaccurate things.

Data problems:

- Incorrect labels
- Missing values

Multiple types of data

- Unstructured Data: Images, audio, text

Data is Messy



Not a cat



Cat



Not a cat



Cat

Example

You can have incorrect labels or just incorrect data. For example, this house is probably not going to sell for \$0.1 just for one dollar.

Or, data can also have missing values such as we have here a whole bunch of unknown values.

This is structured data.

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

Machine Learning vs Data Science

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

Running AI System

A software that which automatically returns output B for input A.

If you have an AI system running, serving dozens or hundreds of thousands or millions of users, that's usually a machine-learning system.

4.09 - Data Science

If you want to have a team analyze your dataset in order to gain insights. **The output of a data science project is a set of insights that can help you make business decisions**

So, a team might come up with conclusions like:

- "Hey, did you know if you have two houses of a similar size, they've a similar square footage, if the house has three bedrooms, then they cost a lot more than the house of two bedrooms, even if the square for this is the same."

Data Science

- "Did you know that newly renovated homes have a 15% premium, and this can help you make decisions such as, given a similar square footage, do you want to build a two bedroom or three bedroom size in order to maximize value? "
- "Is it worth an investment to renovate a home in the hope that the renovation increases the price you can sell a house for?"

The output of a data science project is a set of insights that can help you make business decisions, such as what type of house to build or whether to invest in renovation.

Machine Learning vs Data Science

Machine Learning

“Field of study that gives computers the ability to learn without being explicitly programmed.”

- Arthur Samuel (1959)

A machine learning project will often result in a piece of software that runs, that outputs B given A.

Formal Definition of Data Science

Data science is the science of extracting knowledge and insights from data.

So, the output of a data science project is often a slide deck, the presentation summarizes conclusions for executives to take business actions or summarizes conclusions for a product team to decide how to improve a website.

Example of ML vs DS in the online ad industry

Large platforms have AI that quickly tells them what's the ad you're most likely to click on. This is a machine learning system. It inputs information about the user and about the ad and outputs whether the user will click on the ad or not.

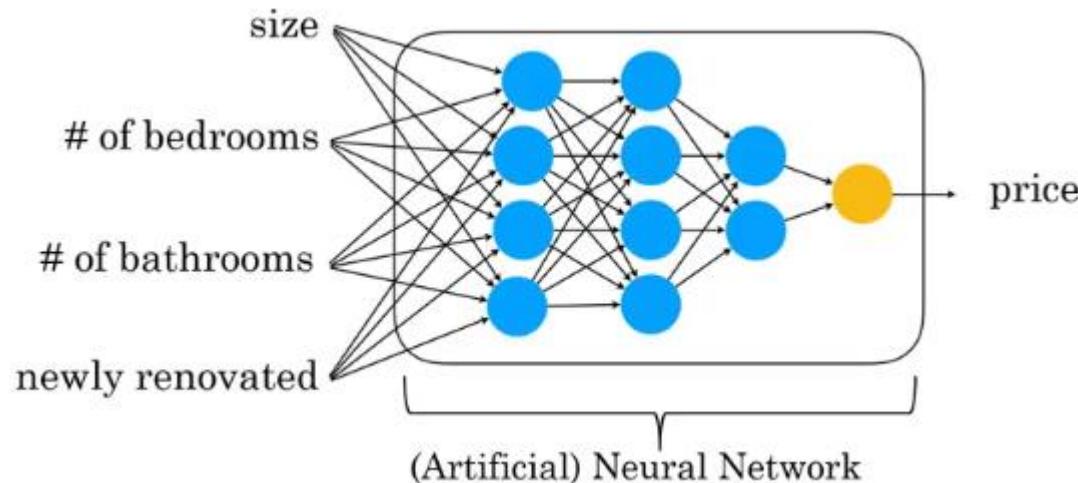
These systems run 24/7 and drive ad revenue for these platforms.

Example of ML vs DS in the online ad industry

If analyzing data tells you, for example, that the travel industry is not buying a lot of ads, but if you send more salespeople to sell ads to travel companies, you could convince them to use more advertising, then that would be an example of a data science project.

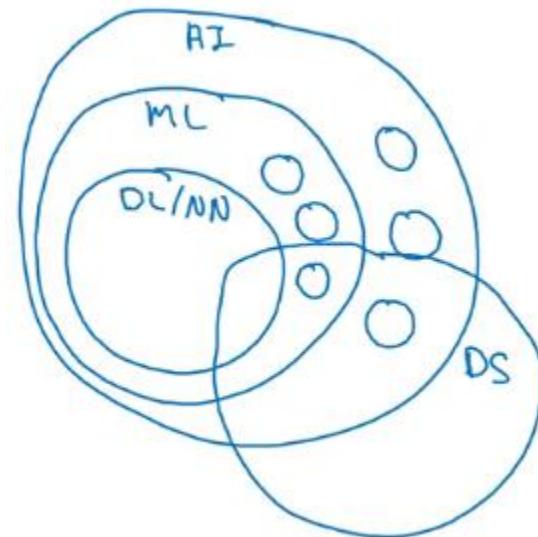
The data science conclusion results in the executives deciding to ask a sales team to spend more time reaching out to the travel industry.

4.10 - Deep Learning



4.11- AI and related disciplines

- Machine Learning
- Data Science
- Deep Learning / Neural Network
- Supervised Learning
- Un supervised learning
- Reinforcement Learning



4.12 - What makes a company AI company?

- Strategic Data Acquisition
- Unified Data Warehouse
- Pervasive Automation
- New Roles such as MLE

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

Deciding about a new project

- Technical diligence
 - Is it feasible project?
 - Can AI do that?
- Pretty much anything you can do with a second of thought can be automated using supervised learning

4.13 - Supervised learning tasks

APPLICATIONS	Input (A)	Output (B)
Spam filtering	email	spam? (0/1)
Speech recognition	audio	text transcripts
Machine translation	English	Urdu
On-line advertising	ads, user info	click? (0/1)
Self-driving car	image, radar info	position of other cars
Visual inspection	image of phone	defect? (0/1)

4.14 What machine learning today 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



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

Examples of what ML can and can't do?

- Identifying the intent of the customer - Possible
- Writing an emphatic response to customer's email – Not possible or difficult

Technical diligence rules

- You are learning a simple concept
- Do you have large training data

More examples

- Self driving car
 - Input is from sensors, camera
 - Output where are the other cars
- Recognizing gesture of traffic police, construction work, people-not possible
 - Critical application requires good accuracy

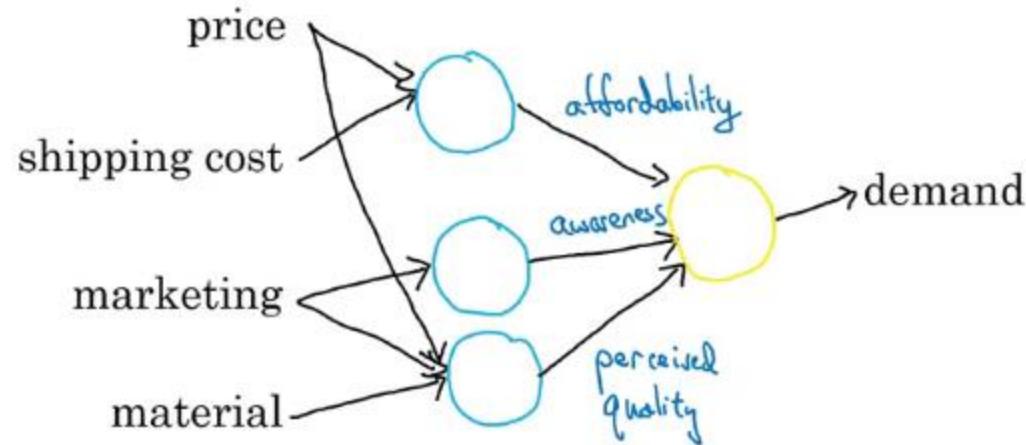
X-ray diagnosis

- Diagnosing a disease from X-ray images – possible
- Diagnosing a disease after reading a book

Strengths and weakness of ML

- Works when,
 - Learning a simple concept
 - Lots of data available
- Doesn't work when,
 - Learning a complex concept
 - Asked to work on new type of data such as X-ray images in different conditions and angles

4.15 – Machine Learning Examples



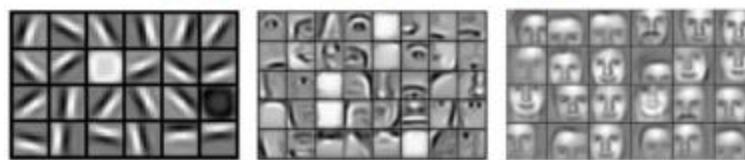
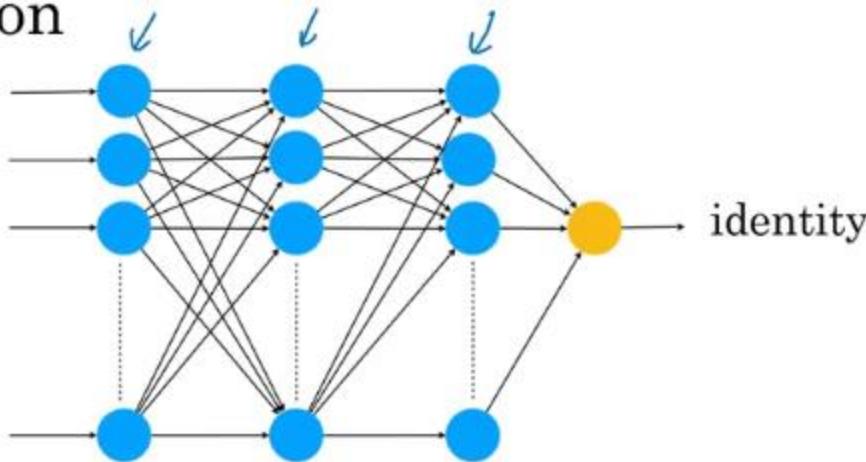
Demand prediction based on price

- Price -> Demand can be modeled using a neural network using a neuron
 - (Perceptron model)
- Network of neurons (ANN)
 - Price
 - Shipping Cost
 - Marketing
 - Material

Face recognition

- Pictures comprise pixels
 - Color images and channels
- A neural network corresponds to pixels
- Earlier layers will detect edges, then lobes and then objects

Face recognition



2. Building AI Projects

- Work flow of a machine learning project
- Workflow of a data Science Project
- Organizing data and the team for the projects

Speech Recognition



Amazon
Echo / Alexa



Google
Home



Apple
Siri



Baidu
DuerOS

Key steps of Echo / Alexa

- Collect data
 - Labelled voice
- Train model
 - Iterate many times
- Deploy the model
 - Get more data and update model

Key steps of a machine learning project

Self-driving car

1. Collect data

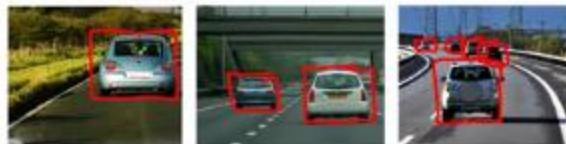


image → position of other cars

2. Train model

Iterate many times until
good enough



3. Deploy model

Get data back
Maintain / update model



4.16 Data Science Example - Workflow of a Project

Unlike a machine learning project, the output of a data science project is often a set of actionable insights, a set of insights that may cause you to do things differently.

Data science projects have a different workflow than machine learning projects.

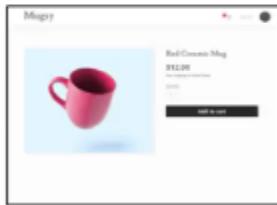


Example: Optimizing a sales funnel

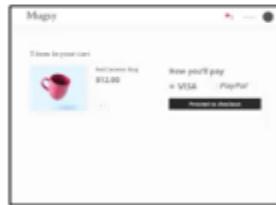
Visit website



Product page



Shopping cart



Checkout



Key steps of a data science project

Optimizing a sales funnel

1. Collect data

User ID	Country	Time	Webpage
2009	Spain	08:34:30 Jan 5	home.html
2897	USA	13:20:22 May 18	redmug.html
4893	Philippines	22:45:16 Jun 11	mug.html

2. Analyze data

Iterate many times to get good insights

3. Suggest hypotheses/actions

Deploy changes

Re-analyze new data periodically

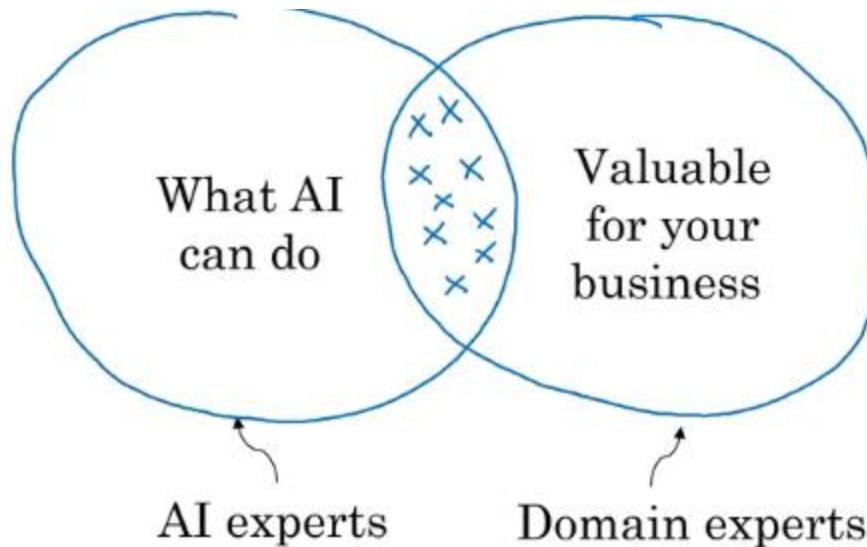
4.17 - Machine Learning changing job functions

- Sales
 - Identifying sales opportunities
 - Prioritizing
- Manufacturing Line Manager
 - Optimize manufacturing
 - Machine learning can spot defects
- Recruiting
 - Identify how people prefer recruitment
 - Spot good candidates



- Marketing
 - Optimize website
 - A/B testing
 - Recommendation system
- Agriculture
 - What to plant?
 - Precision agriculture

4.18 - How to chose an AI project?



Brainstorming framework

- Automate task rather than job
 - Automating call center: picking phone, emails, issue refund, call routing
 - Automating radiologist: X-ray, mentoring other doctors, consulting,
- Main drivers of business value
- What are the main pain points in your business?

Is it always necessary to have big data?

- Having more data is good
- With small datasets you can make progress
- 10, 100 or 1000 data points can be a good start



Technical diligence

- Can AI system meet desired performance
- How much data is needed
- Engineering timeline

Business diligence

- Lower costs
- Increase revenue
- Launch new product or business

Ethical diligence

- Is this going to make society better?

Build Vs Buy

- ML projects can be in-housed or outsourced
- DS projects are generally in-housed
- Buy industry standard, only build specialized products

How to work with AI team

- Specify your acceptance criteria
 - 95% accuracy
 - Training, validation and Test dataset
- Don't expect 100% accuracy
 - Limitations of ML
 - Insufficient data
 - Mislabeled data
 - Ambiguous labels (human perception)

4.19 - Machine Learning frameworks

Machine learning frameworks:

- TensorFlow
- PyTorch
- Keras
- MXNet
- CNTK
- Caffe
- PaddlePaddle
- Scikit-learn
- R
- Weka

Research publications:

- Arxiv

Open source repositories

- GitHub

CPU Vs GPU

CPU: Computer processor (Central Processing Unit)



Edge
Deployment

GPU: Graphics Processing Unit



Cloud vs. On-premises



2. Building Ai in your company

4.20 A – Case Studies

1. Smart Speakers
2. Self-Driving Car

Smart speaker



Amazon
Echo / Alexa



Google
Home



Apple
Siri



Baidu
DuerOS

Different Calls to device:

Hey Device Tell me joke

Hey device tell me something funny

Hey Device do you know some joke

Hey Device what is funny today

Etc etc

But device can recognize the intent easily in all these

"Hey device, tell me a joke"

Steps to process the command:

1. Trigger word/wakeword detection
2. Speech recognition
3. Intent recognition
4. Execute joke

Audio → "Hey device"? (0/1)

A → B

Audio → "tell me a joke"

A → B

"tell me a joke"

A

B

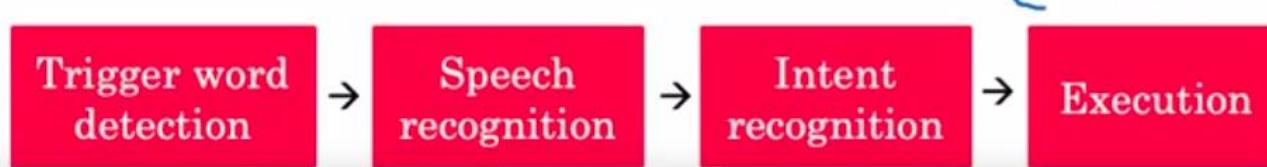
joke?

time?

music?

call?

weather?



AI pipeline

Other functions

- Play music
- Volume up/down
- Make call
- Current time
- Units conversion
- Simple question
- ...

Key steps:

1. Trigger/wakeword detection
2. Speech recognition
3. Intent recognition
4. Specialized program to execute command

These specialized execution routines are written by software engineer

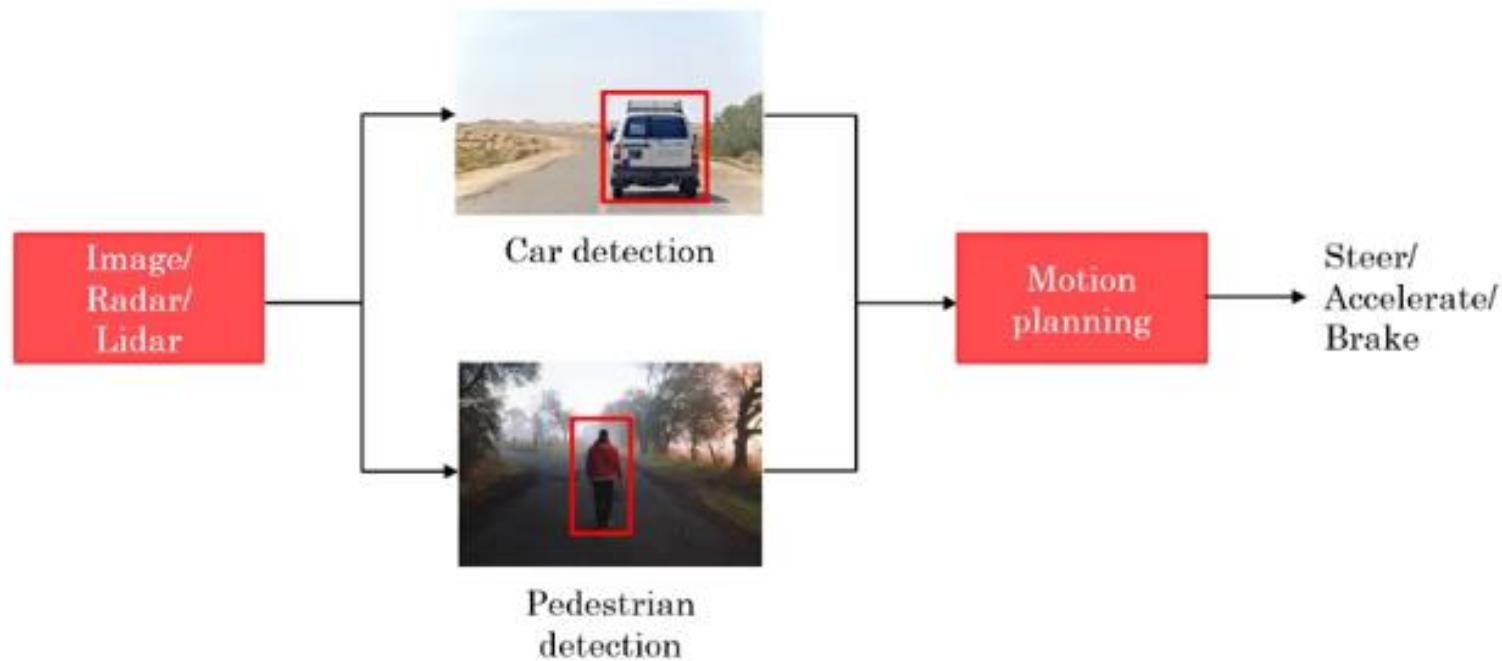
Activity

- Hey device, set timer for 10 minutes
 - What is the intent?
 - Extract duration
 - What command is to execute

Self Deriving Car

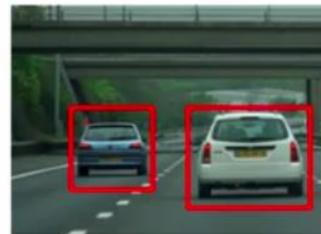


How does it works:



Key steps:

1. Car detection



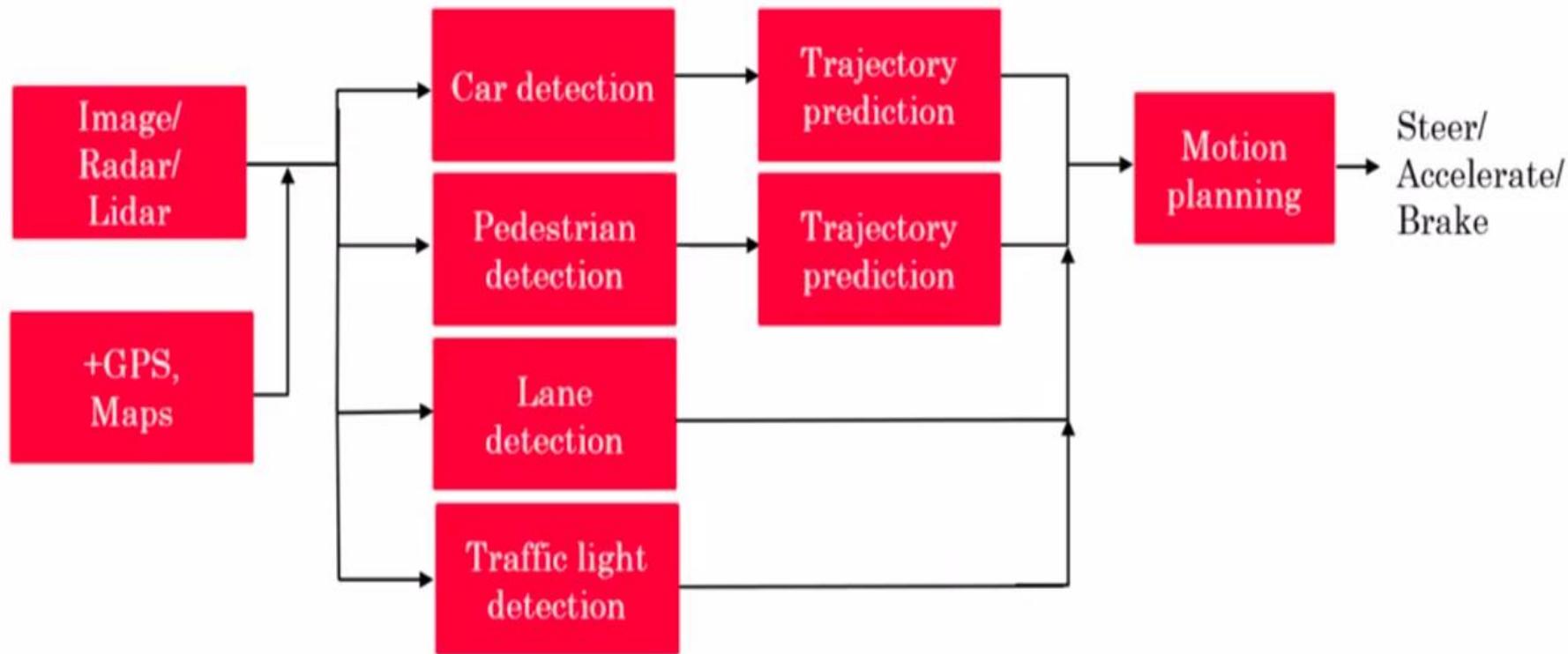
2. Pedestrian
detection



3. Motion planning



Steps for deciding how to drive



4.20 B - Example Roles of large AI Teams:

- AI team may have 100s of engineers
- A small team can have four or five members
- Example roles
 - Software Engineers
 - Execute joke, Set timer
 - Machine Learning Engineer
 - Machine Learning Researcher
 - Extend state-of-the-art
 - Applied ML scientist in between ML researcher and ML Engineer

Example roles

- Data Scientist
 - Examine data and provide insights
 - Make presentation to team/executive
 - Data Engineer
 - Organize data
 - Make sure data is saved in an easily accessible, secure and cost effective way
 - AI Product Manager
 - Help decide what to build; what's feasible and valuable
- 
- 1 MB (megabyte)
 - 1,000 MB = GB (gigabyte)
 - 1,000,000 MB = TB (terabyte)
 - 1,000,000,000 MB = PB (petabyte)

Get started with a small team

- 1 Software engineer
- 1 ML Engineer / Data scientist
- No body but your self

4.21 - AI Transformation Playbook

WHAT IS A PLAYBOOK?

Playbooks are vital to any organization, from businesses to professional sports teams. Simply put, they help organizations plan and strategize tactics that will ultimately bring them success.

It's vital for organizations to stay a step ahead of their industry and create playbooks for aspects that will impact their bottom line, such as recruiting top talent.





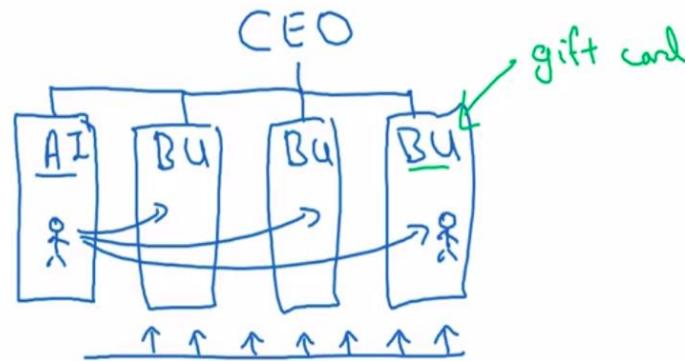
AI Transformation Playbook

1. Execute pilot projects to gain momentum

- More important for the initial project to succeed rather than be the most valuable
- Show traction within 6-12 months
- Can be in-house or outsourced

AI Transformation Playbook

2. Build an in-house AI team



BU= Business Unit

AI function can be under CTO, CIO, CDO, etc. or a new CAIO

AI Transformation Playbook

3. Provide broad AI training

Role	What they should learn
Executives and senior business leaders	<ul style="list-style-type: none">• What AI can do for your enterprise• AI strategy• Resource allocation
Leaders of divisions working on AI projects	<ul style="list-style-type: none">• Set project direction (technical and business diligence)• Resource allocation• Monitor progress
AI engineer trainees	<ul style="list-style-type: none">• Build and ship AI software• Gather data• Execute on specific AI projects

Resources

Online courses

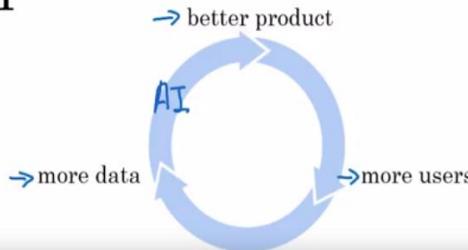
Books

Curate rather than create content

AI Transformation Playbook

4. Develop an AI strategy

- Leverage AI to create an advantage specific to your industry sector
- Design strategy aligned with the “Virtuous Cycle of AI”



- AI needs to be specialized or verticalized to your industry sector
- Don't compete with giants

AI Transformation Playbook

4. Develop an AI strategy

- Consider creating a data strategy
 - Strategic data acquisition
 - Unified data warehouse
- Create network effects and platform advantages
 - In industries with “winner take all” dynamics, AI can be an accelerator

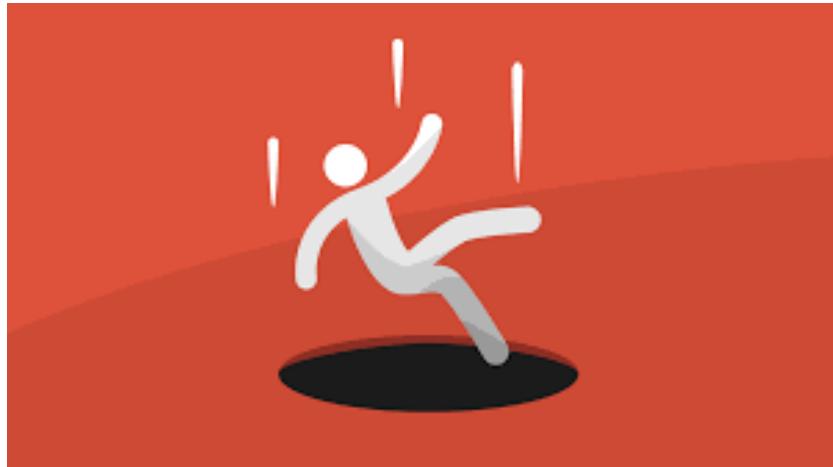
AI Transformation Playbook

5. Develop internal and external communications

- Investor relations
- Government relations
- Consumer/user education
- Talent/recruitment
- Internal communications

Detailed AI Transformation Playbook: <https://landing.ai/ai-transformation-playbook/>

4.22 - Pitfalls of AI



AI Pitfalls

AI pitfalls to avoid

Don't:

- Expect AI to solve everything
- Hire 2-3 ML engineers and count solely on them to come up with use cases

Do:

- Be realistic about what AI can and cannot do given limitations of technology, data, and engineering resources
- Pair engineering talent with business talent and work cross-functionally to find feasible and valuable projects

AI Pitfalls

AI pitfalls to avoid

Don't:

- Expect the AI project to work the first time
- Expect traditional planning processes to apply without changes
- Think you need superstar AI engineers before you can do anything

Do:

- Plan for AI development to be an iterative process, with multiple attempts needed to succeed
- Work with AI team to establish timeline estimates, milestones, KPIs, etc.

4.23 – Taking the First Step

Some initial steps you can take

- Get friends to learn about AI
 - This course
 - Reading group
- Start brainstorming projects
 - No project is too small
- Hire a few ML/DS people to help
- Hire or appoint an AI leader (VP AI, CAIO, etc.)
- Discuss with CEO/Board possibilities of AI Transformation
 - Will your company be much more valuable and/or more effective if it were good at AI?

4.24 – Survey of AI App Areas



Reasoning



Automated Learning & Scheduling



Machine Learning



Natural Language Processing



Computer Vision



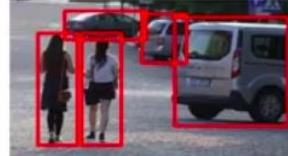
Robotics



General Intelligence

AI Application areas

Computer Vision

- Image classification/Object recognition
 - Face recognition
cat
 - register  new  
- Object detection
- Image segmentation
- Tracking
- Tracking

AI Application areas

Natural Language Processing

- Text classification
 - Sentiment recognition
- Information retrieval
 - E.g., web search
- Name entity recognition
- Machine translation

Email → Spam/Non-Spam

Product description → Product category

“The food was good” → 

“Service was horrible” → 

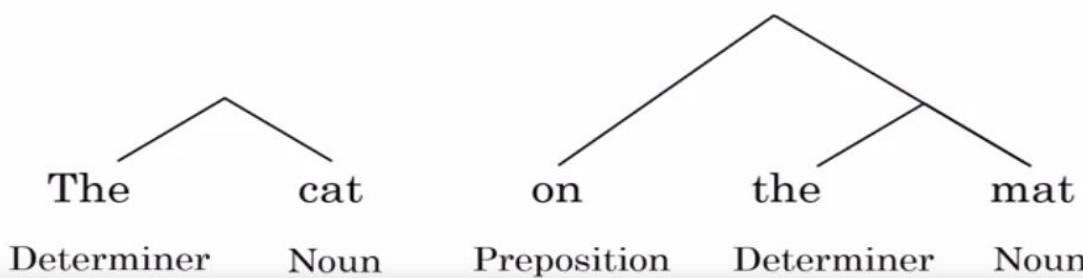
“Queen Elizabeth II knighted
Sir Paul McCartney for his
services to music at the
Buckingham Palace.”

AIは、新たな電気だ
AI is the new electricity

AI Application areas

Natural Language Processing

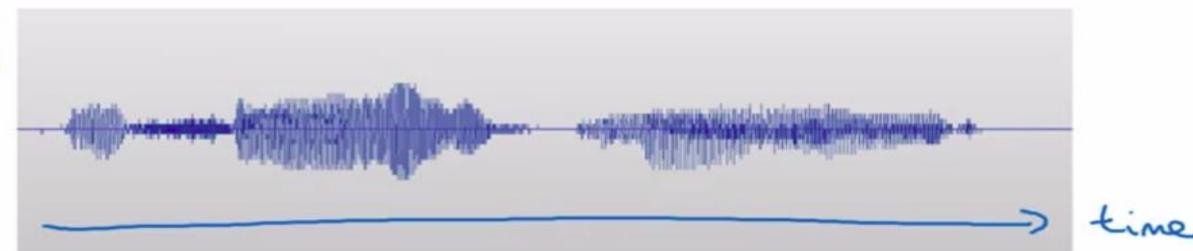
- Others: parsing, part-of-speech tagging



AI Application areas

Natural Language Processing

Speech



- Speech recognition (speech-to-text)
- Trigger word/wakeword detection
- Speaker ID
- Speech synthesis (text-to-speech, TTS)

AI Application areas

Robotics

- Perception: figuring out what's in the world around you
- Motion planning: finding a path for the robot to follow
- Control: sending commands to the motors to follow a path



AI Application areas

General machine learning

- Unstructured data (images, audio, text)



image



audio

AIは、新たな電気だ

AI is the new electricity

text

- Structured data

House size (square feet)	# of bedrooms	Price (1000\$)	Clay batch #	Supplier	Mixing time (minutes)
523	1	100	001	ClayCo	35
645	1	150	034	GooClay	22
708	2	200	109	BrownStuff	28

4.25 - Survey of AI Techniques

Other AI Techniques

Unsupervised Learning

The value today of unsupervised learning is a lot smaller than the value created through supervised learning

Other AI Techniques

Transfer learning

Car detection



100,000 images

Golf cart detection



100 images

Learn from task A, and use knowledge to help on task B

Other AI Techniques

Reinforcement learning



Use a “reward signal” to tell the AI when it is doing well or poorly. It automatically learns to maximize its rewards.

Other AI Techniques

Despite the huge amount of media attention on reinforcement learning, at least today it is creating significantly less economic value than supervised learning.

But there may be breakthroughs in the future that could change that. And AI is advancing so rapidly that all of us certainly hope that there will be breakthroughs in all of these areas that we're talking about.

Other AI Techniques

Generative Adversarial Network (GAN)

GANs (Generative Adversarial Network)

Synthesize new images from scratch



Synthesize new images
from scratch.

Entertainment industry,
Film, Animation



3. AI and Society

Ai & Society

Goldilocks rule for AI

- Too optimistic: Sentient / super-intelligent AI killer robots coming soon
- Too pessimistic: AI cannot do everything, so an AI winter is coming
- Just right: AI can't do everything, but will transform industries

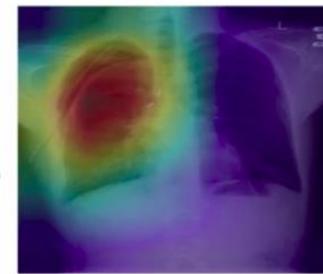
Ai & Society

Limitations of AI

- Performance limitations
- Explainability is hard (but sometimes doable)



Right-sided
Pneumothorax
(collapsed lung)



- Biased through biased data
- Adversarial attacks

Ai & Society

4.27 - Discrimination and Bias

Why bias matters

- Hiring tool that discriminated against women
- Facial recognition working better for light-skinned than dark-skinned individuals
- Bank loan approvals

Ai & Society

Combating bias

- Technical solutions:
 - E.g., “zero out” the bias in words
 - Use less biased and/or more inclusive data
- Transparency and/or auditing processes
- Diverse workforce
 - Creates less biased applications

Ai & Society

4.28 Adversarial attacks on AI



Hummingbird

Minor perturbation



Hammer

There is a minor change in pixel values of the picture
This change is almost imperceptible change to us humans
AI system sees the world very differently.

Ai & Society

Physical attacks



Fails to see stop sign

Researchers from University of Michigan showed that if you affects stickers like these onto a stop sign, you can fool an AI system into not seeing the stop sign at all. It thinks there's something else there other than a stop sign. One interesting thing about this example is that most humans will still see this as a stop sign quite easily. But if you have a computer vision system built into a self-driving car for example, it would be really unfortunate if the car doesn't see the stop sign anymore, because of these stickers applied on top of it.

Ai & Society

Physical attacks



“Milla Jovovich”

A group at Carnegie Mellon University was able to design a funky pair of glasses like this. So, that when does man wears this pair of glasses, he can fool an AI system into thinking that he is actress Milla Jovovich.

Ai & Society

4.29 - Adverse uses of AI

- DeepFakes
 - Synthesize video of people doing things they never did
- Undermining of democracy and privacy
 - Oppressive surveillance
- Generating fake comments
- Spam vs. anti-spam and fraud vs. anti-fraud

Ai & Society

4.30 – AI & Developing Economy

Every time there is a major technological disruption such as of AI, it gives us a chance to remake the world. AI is a very advanced technology, yes affecting both developed economies and developing economies.

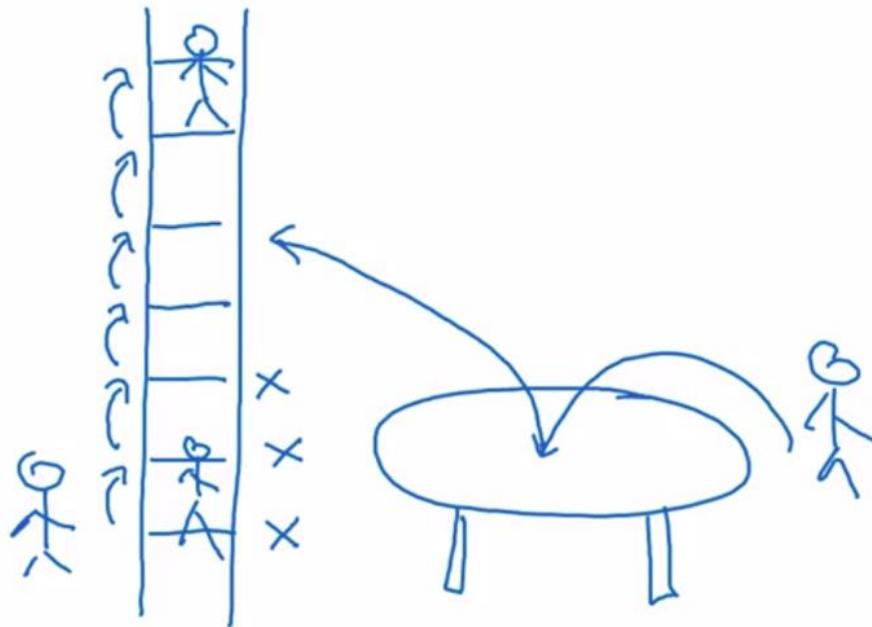
Ai & Society

AI & Developing Economy

- Developing economies gradually moved up the ladder
- Lower end ladder are susceptible to automation such as agriculture
- Trampoline to move higher rungs
 - Leapfrog
 - Example of mobile phone
 - Mobile payments
- Online education

Ai & Society

AI & Developing Economy



“Leapfrog”

-Mobile phones

-Mobile payments

-Online education

Ai & Society

How developing economies can build AI

- US and China are leading, but all AI communities are still immature
- Focus on AI to strengthen a country's vertical industries
- Public-private partnerships to accelerate development
- Invest in education

Ai & Society

4.31 - AI & Jobs

Jobs displaced
by 2030

400-800 mil

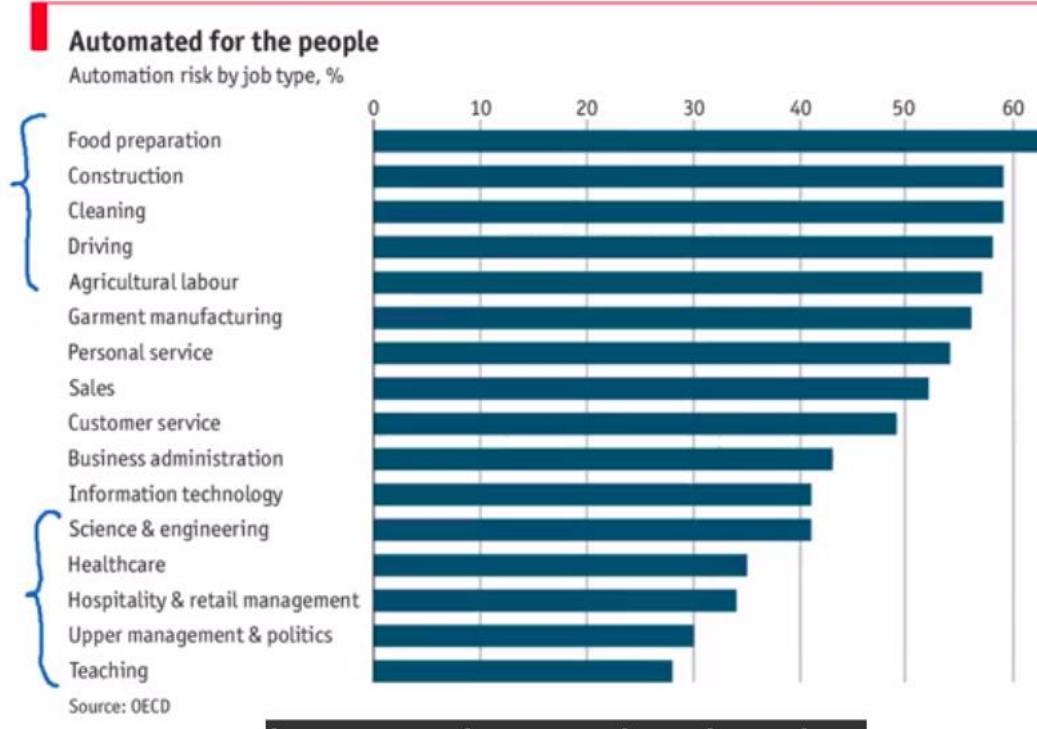
Jobs created
by 2030

555-890 mil

Some solutions to counter AI impact on jobs

- Conditional basic income: provide a safety net but incentivize learning
- Lifelong learning
- Political solutions

AI's impact on jobs worldwide



[Image credit: Economist.com]
[Nedelkoska, L. and G. Quintini. (2018). Automation, skills use and training. *OECD Social, Employment and Migration Working Papers*, No. 202.]

4.32 - Conclusion

What you've learned

- What is AI?
- Building AI projects
- Building AI in your company
- AI and society