



AI FOR EVERYONE:

SECOND HALF

WHAT WE HAVE LEARNED SO FAR:

- Terminologies :



- What is ANI and AGI ?
- ML technique – **Supervised Learning**
- Workflow of ML and DS projects
- What makes an AI company
- What ML can do or cannot do



CASE STUDY:

SMART SPEAKER

amazon

OBJECTIVE :

- What does it feels like to work on a complex AI product.
- How you would write AI software to get a smart speaker to respond to a verbal command such as "**Hey device, tell me a joke**" and execute on it ?



STEP 1:

USE A TRIGGER OR WAKE WORD SUCH AS "**HEY DEVICE**".

THE SPEAKER USES A MACHINE LEARNING ALGORITHM TO INPUT THE AUDIO CLIP AND OUTPUT 0 OR 1 .

AUDIO



0/1

STEP 2: SPEECH RECOGNITION

- NOW WHAT THE SOFTWARE HAS TO DO IS :
 - ✓ MAP THE AUDIO CLIP " **TELL ME A JOKE** " TO A TEXT TRANSCRIPT , WHICH IN THIS CASE ARE 4 WORDS .



STEP 3: INTENT RECOGNITION

- THAT MEANS TO TAKE WHAT HAVE YOU SAID AND TO FIGURE OUT WHAT YOU ACTUALLY WANTED TO DO.
 - " TELL ME A JOKE " /
" DO YOU KNOW SOMETHING FUNNY " /
" WANT TO LISTEN A JOKE " .

Intent mapping

MUSIC ?

ALARM ?

NEWS ?

JOKE ?

CALL ?

MANY MORE

STEP 4 - THE LAST : EXECUTE JOKE / COMMAND

A CLASSIC PIECE OF CODE WRITTEN BY A
SOFTWARE ENGINEER THAT EXECUTE A
JOKE .



AT A GLANCE:

OTHER FUNCTIONS :

- ✓ PLAY MUSIC
- ✓ MAKE A CALL
- ✓ CURRENT TIME
- ✓ UNIT CONVERSION
- ✓ GK QUESTIONS
- ✓ NAVIGATION

KEY STEPS :

- TRIGGER WORD DETECTION
- SPEECH RECOGNITION
- INTENT RECOGNITION
- SPECIALIZED PROGRAM TO EXECUTE THE COMMAND



CASE STUDY :

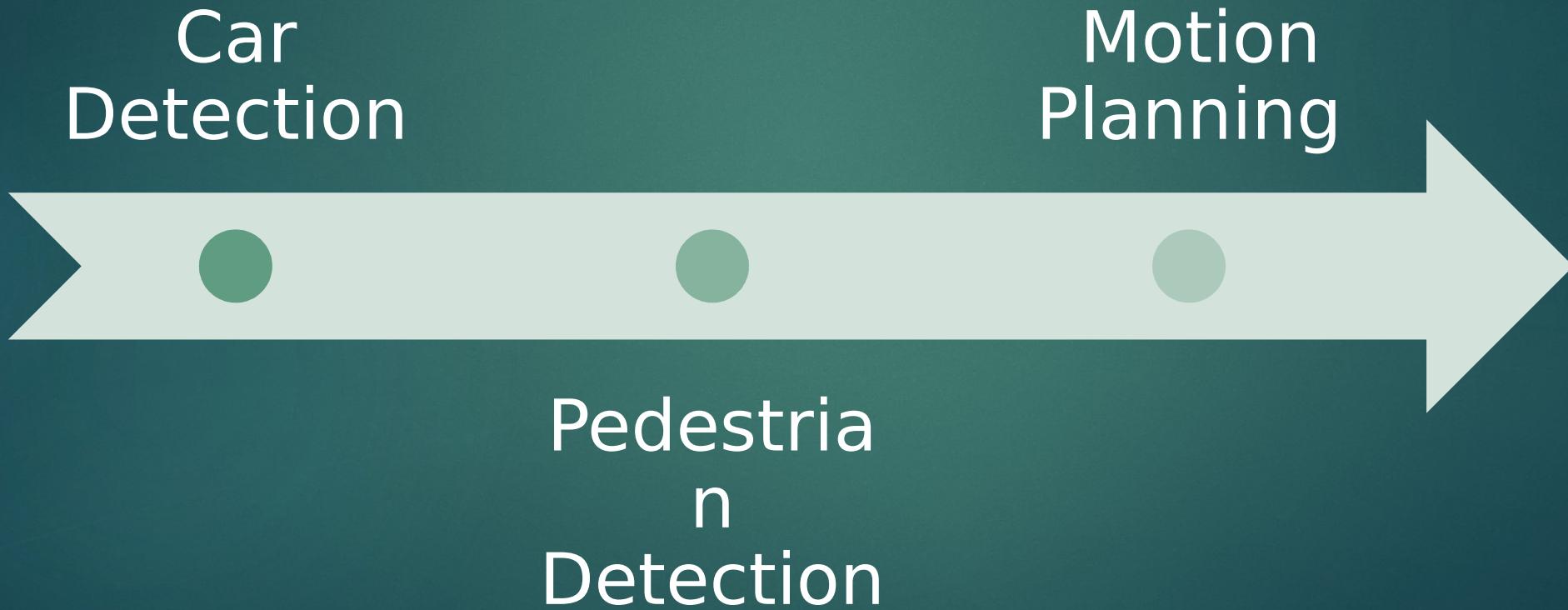
SELF DRIVING CAR

OBJECTIVE :

- ▶ A simplified description of self-driving car.
- ▶ Help you to better understand how you can piece together multiple AI components in order to build these amazing things.

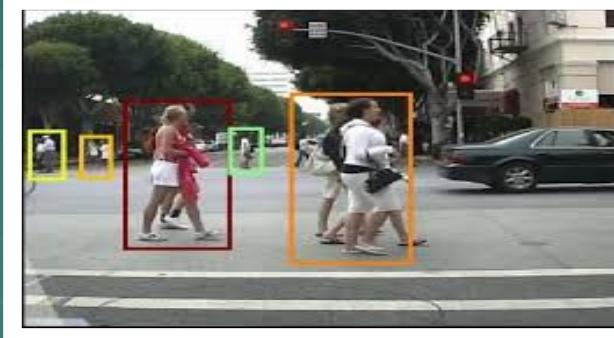
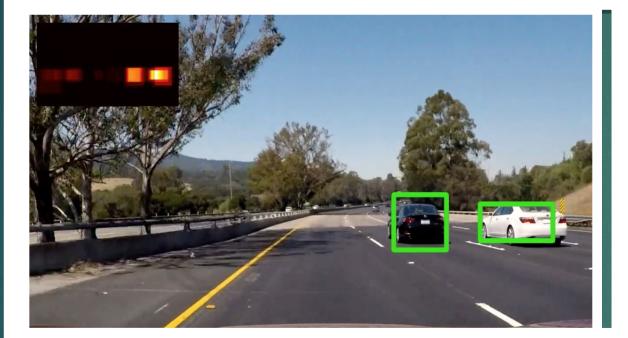


BASIC KEY STEPS FOR DECISION :



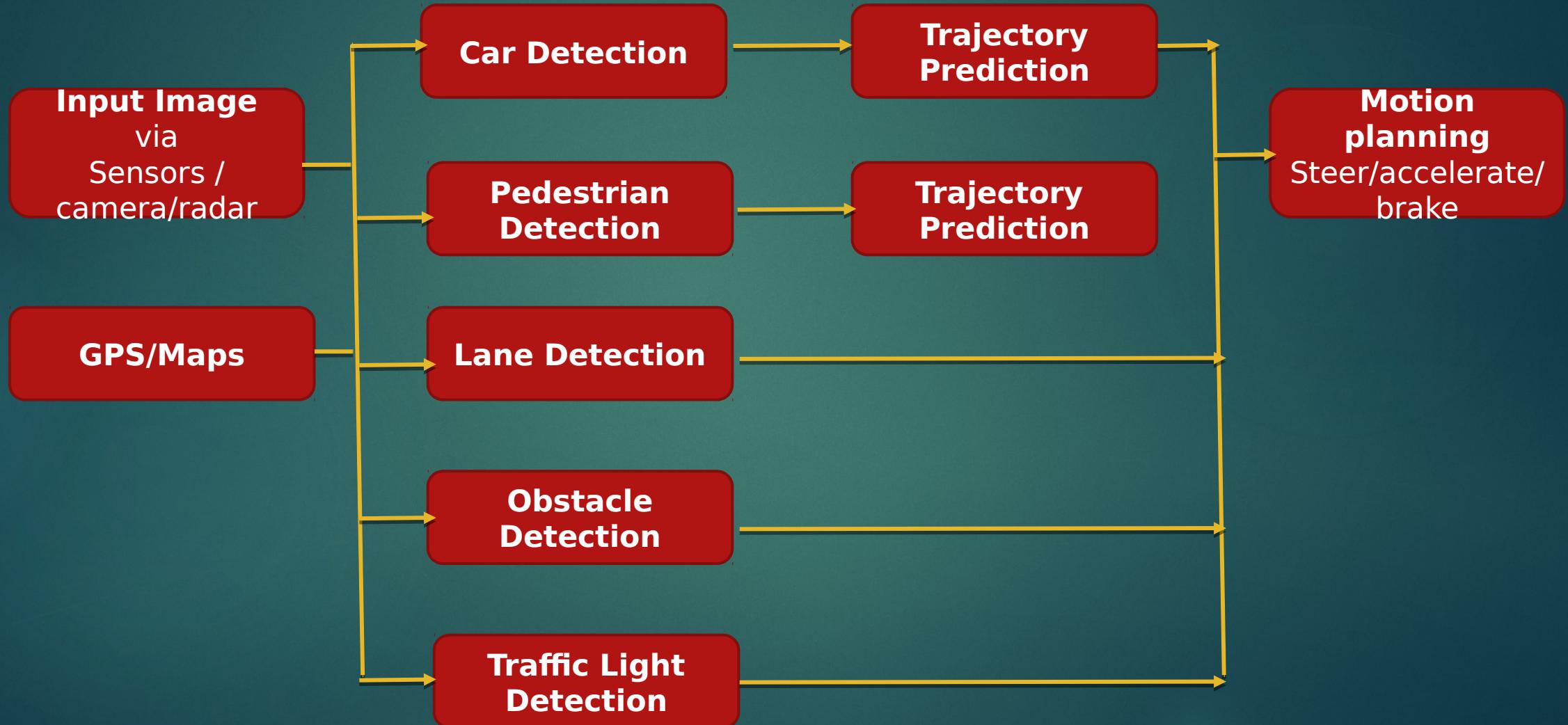
WORKFLOW:

Input Image via
Sensors / camera/radar



Motion planning
Steer/accelerate/brake

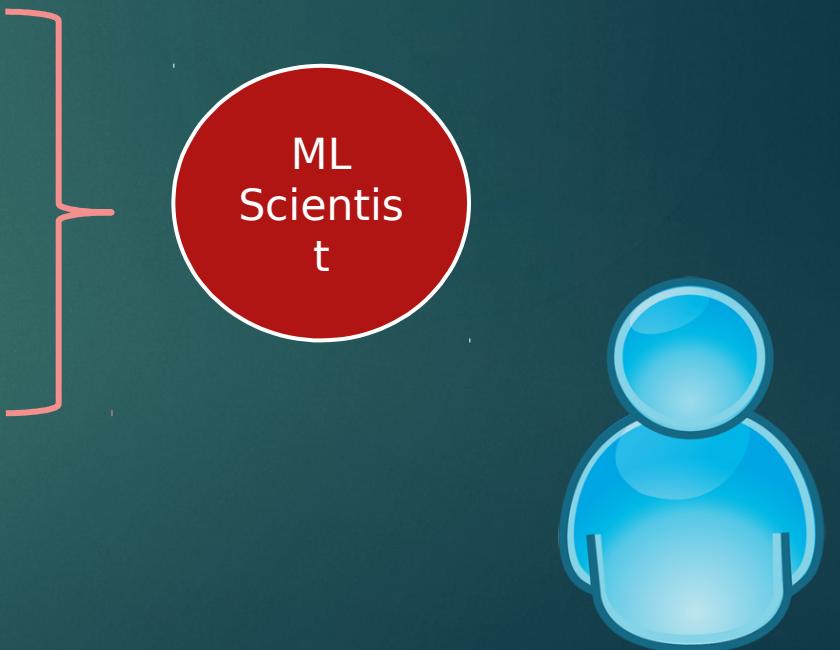
SOME OTHER COMPONENTS :



Company Roles



ROLES
OF AI
TEAM :



State-of-the-art (sometimes **cutting edge**) refers to the highest level of general development, as of a device, technique, or scientific field achieved at a particular time





AI TRANSFORMATION PLAYBOOK



Review :

Execute pilot project to gain momentum.

Build an in-house AI team.

Provide broad AI Training

Develop an AI strategy

Develop internal and external communication

EXECUTE PILOT PROJECT TO GAIN MOMENTUM :

- More important for the initial project is to succeed rather than be the most valuable.
- Show traction within 6 to 12 months.
- First pilot project can be either in-house or out sourced to get expertise and build momentum faster.



BUILD AN IN-HOUSE AI TEAM :

- ✓ Companies should consider hiring an internal team of AI talents.
- ✓ This team is responsible for gaining :
 - AI capabilities
 - Supporting different divisions with AI solutions
 - Developing recruiting and retention standards
 - Building a platform that can be used company-wide

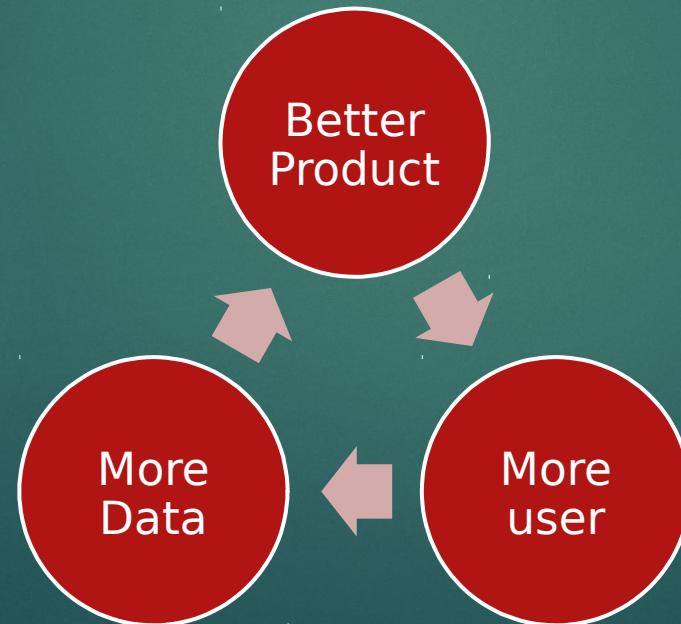
PROVIDE BROAD AI TRAINING :

- Employees should be encouraged to receive an AI education via
 - ✓ A combination of in-person consulting and digital courses on AI and machine learning .

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

DEVELOP AN AI STRATEGY :

- Use the virtuous cycle of AI .
 - ✓ Better product leads to more customers , more customer leads to more data and more data leads to better product
 - ✓ This create an industry-specific advantage that you are uniquely positioned to defend against new entrants on the market.



EXAMPLES :

➤ **Deploying model to different users results in more data , more training and more accuracy .**

- ✓ 1) Smart Speaker - Alexa , Cortana , Siri
- ✓ 2) Facebook - Auto Tagging
- ✓ 3) Online Ad Recommendations



DEVELOP AN INTERNAL AND EXTERNAL COMMUNICATIONS:

Companies should maintain good relationships with investors and governments.

Invest in appropriate marketing

Attract and retain talents.

Promote insightful internal explanations of AI to relieve employee job replacement concerns.



AI PITFALL
TO AVOID :

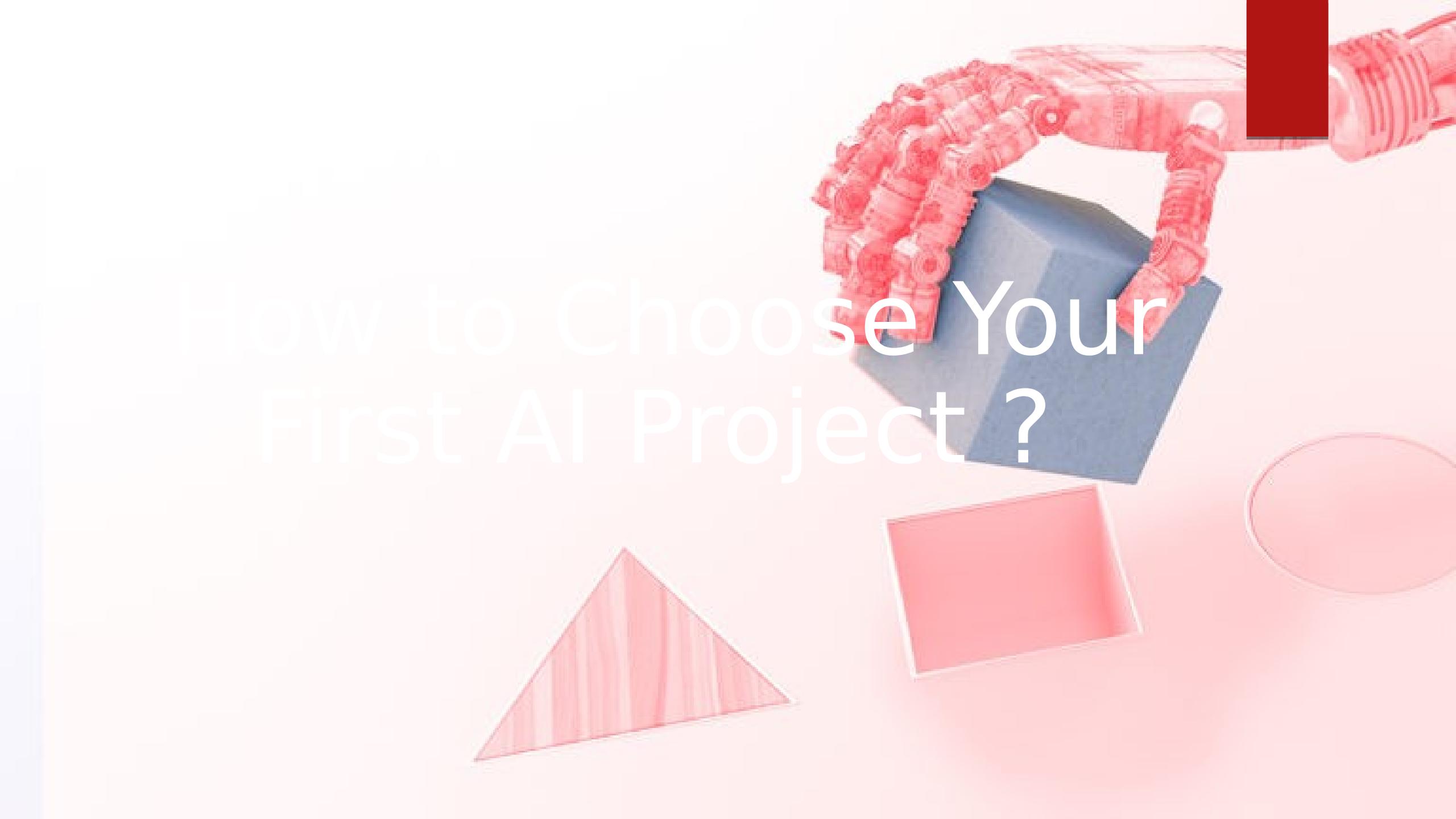
DO

- ▶ Be realistic about the limitations of AI .
- ▶ Include cross functional talent to find feasible and valuable projects .
- ▶ Go through the iterative process .
- ▶ Work with the AI team to establish timelines , milestone , KPI etc.

DONT

- ▶ Expect AI can solve everything .
- Hire ML Engineers and count solely on them to come up with use cases .
- Expect your project to work for the first time.
- Expect Traditional planning process to apply without changes.
- Think you need a super star AI Engineer .

KPI - key performance indicator is a type of performance measurement. KPIs evaluate the success of an organization or of a particular activity in which it engages.



How to Choose Your First AI Project?



Get friends TO LEARN ABOUT AI

START BRAINSTORMING PROJECT

NO PROJECT IS TOO SMALL AND IT'S
BETTER TO START SMALL
AND SUCCEED, THAN TO START TOO BIG
AND NOT SUCCEED

HIRE A FEW ML OR DS PEOPLE TO HELP
YOU (COMPANY/IN-HOUSE)

WHEN YOU GO BIGGER HIRE AI LEADER
(VP OF AI /CAIO)



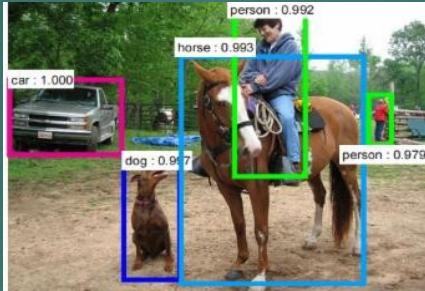
SURVEY OF MAJOR AI APPLICATIONS AREA :

COMPUTER VISION :

- IMAGE CLASSIFICATION / OBJECT RECOGNITION -



- OBJECT DETECTION -



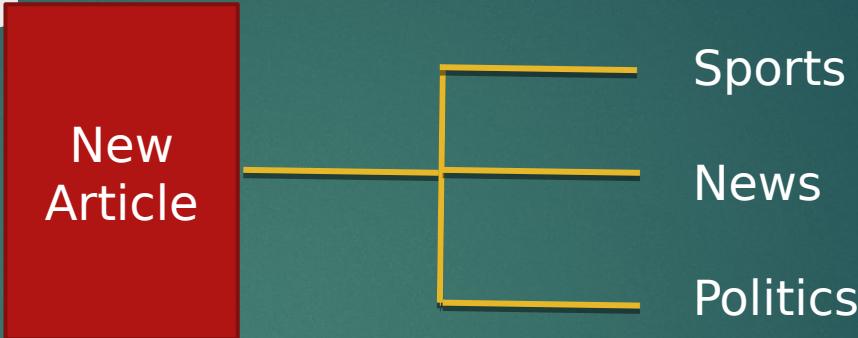
- IMAGE SEGMENTATION -



- TRACKING -



NATURAL LANGUAGE PROCESSING

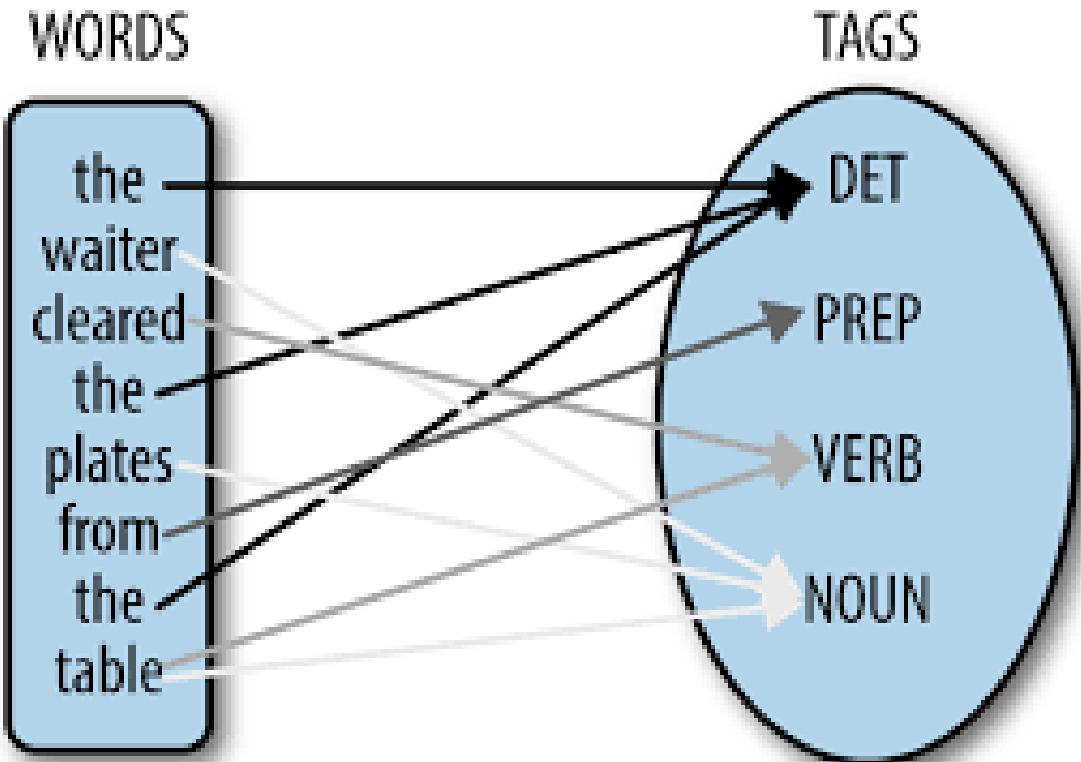
- Text Classification -


```
graph LR; A[New Article] --- B[Sports]; A --- C[News]; A --- D[Politics]
```
- Information Retrieval - web search
- Name Entity Recognition - **Pakistan** has a friendly relationship with **China**
- Machine Translation - اسلامی جمہوریہ پاکستان ----- (input)
Islamic Republic of Pakistan ----- (output)

NLP

Continue :

- Parts of speech tagging



SPEECH :

- ▶
- ▶
- ▶
- ▶

ROBOTICS

:

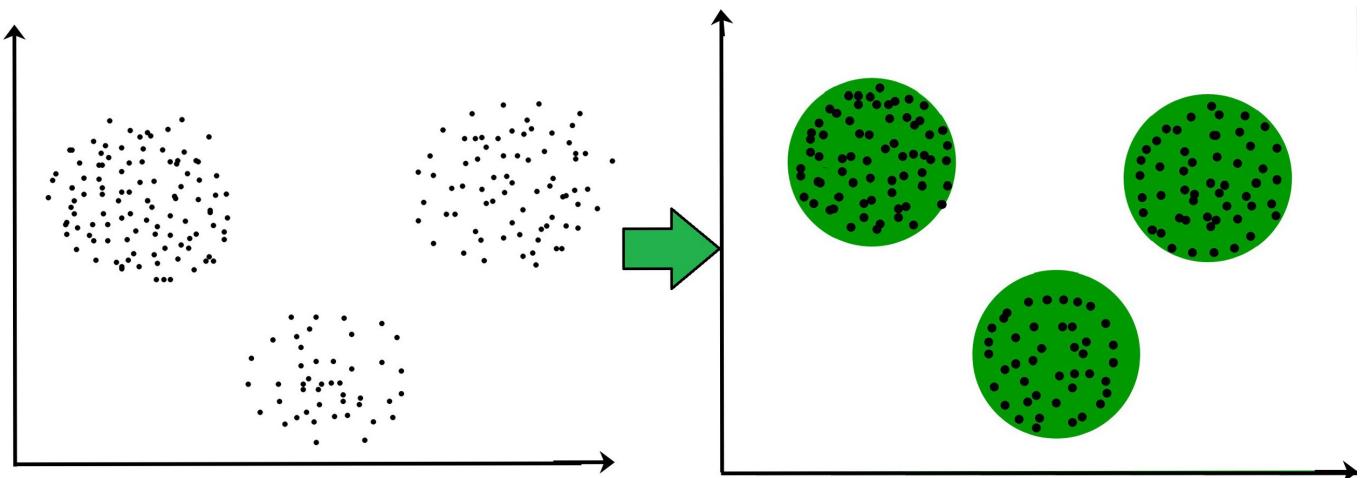
- Perception – Figuring out what's in the world around you
- Motion Planning – Finding a path for the robot to follow
- Control – Sending command to the motors to follow the path



SURVEY OF MAJOR AI TECHNIQUES :

UNSUPERVISED LEARNING :

- Unsupervised learning is where the input data is unlabeled and the system tries to learn structure from that data automatically, without any human guidance
- Unsupervised Learning Technique – **CLUSTERING** :



There are 3 clusters or groups in this image

TRANSFER LEARNING :

- Transfer learning is a research problem in machine learning that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem .



CAR DETECTION
Detection



Truck

REINFORCEMENT LEARNING :

- In reinforcement learning, an **agent** receives information about its environment and **learns to choose actions** that will maximize some **reward** .
- **Example :**

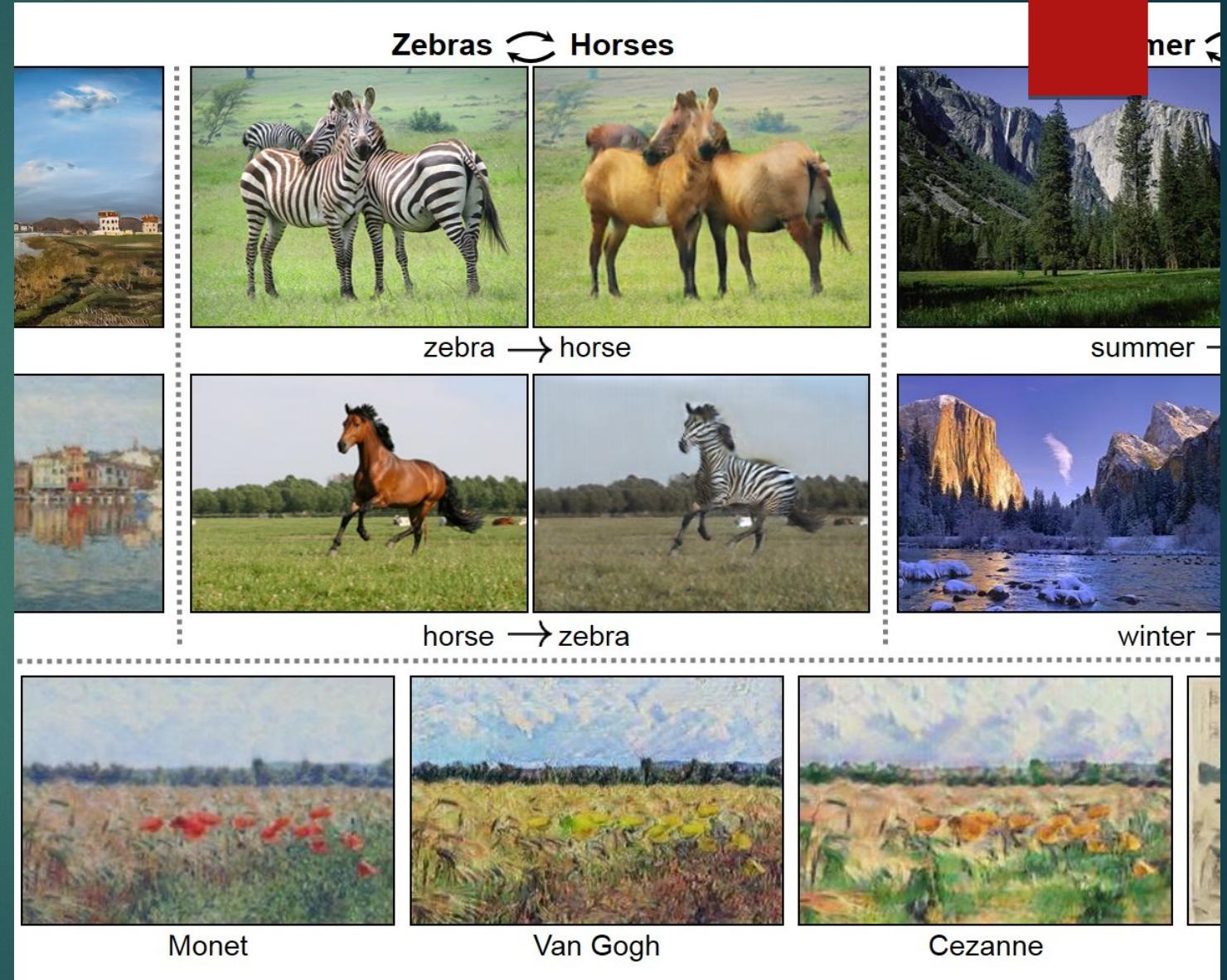
A neural network that **looks** at a videogame screen and outputs game actions in order to maximize its score can be trained via reinforcement learning.



GENERATIVE ADVERSARIAL NETWORK (GAN)

:

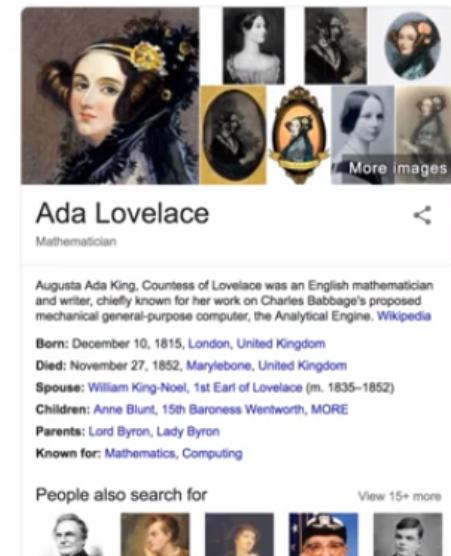
- GAN focuses to generate the data from scratch.
- It means GAN is able to produce or to generate new content .



KNOWLEDGE GRAPH :

- Information that is drawn from a Knowledge Graph means a database that lists people and key information about these people.
- Such as their birthday, when they pass away, their bio, and other properties of these individuals.

Ada Lovelace	
Born	Dec 10, 1815
Died	Nov 27, 1852
Bio	English mathematician and writer...



AI AND SOCIETY

- AI and Hype
- Limitations Of AI
 - ✓ Bias
 - ✓ Adversarial Attacks
- AI developing Economies and Jobs

A REALISTIC VIEW OF AI

- Goldilocks Rule For AI

"Neither Be Too Optimistic Nor Be Too Pessimistic
About What AI Can And Cannot Do"
- Too Optimistic : Sentient / super-intelligent AI killer robots coming soon
- Too Pessimistic : AI cannot do anything so an AI winter is coming
- Just Right : AI can't do everything, but will transform industries

Too Optimistic

we should not be too optimistic about AI technologies and having an unrealistic view of AI technologies may make people think that sentience or super intelligence, artificial, general intelligence is coming soon, and we should invest a lot of resources into defending against AI evil killer robots.



Too Pessimistic

AI cannot do everything.
There are some things AI cannot do and so, another AI winter is coming.

➤ **AI Winter**

The term AI winter refers to a couple of episodes in history when AI had been over-hyped and when people figured out that AI couldn't do everything that they thought it would. It resulted in a loss of faith and a decrease in investment in AI.

Just Right

One difference between AI now and the earlier winters of a few decades ago, is that AI today is creating tremendous economic value.

We also see a surprisingly clear path for it to continue to create even more value in multiple industries.

So, the combination of these two things ensures that AI will continue to grow for the foreseeable future.

Even though, it is also true that AI cannot do everything.

Rather than being too optimistic or too pessimistic the story of Goldilocks learn that something in-between is just right.

LIMITATIONS OF AI

Performance
Limitations

Explain
ability is
hard

Biased AI
through
biased data

Adversarial
attacks on
AI

Performance Limitations

As we have studied in the previous week about the performance limitations of AI as if you want an AI model to differentiate between the types of emails, it is possible but if you are willing from your AI model to write a proper email in reply of the email you have received it is kind of impossible for now may be soon it will be possible.

"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....

Explainability Is Hard

One of the limitations of AI is that explainability is hard and many high-performing AI systems are black boxes. Meaning that it works very well but the AI doesn't know how to explain why it does what it does.

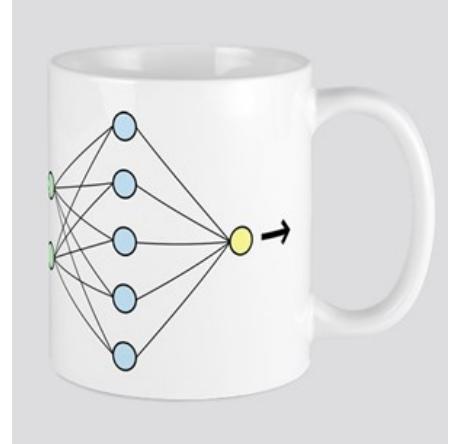
Explainability Is Hard

To be fair, humans are also not very good at explaining how we make decisions ourselves.

For Example

How does a human look at this and say, that's a coffee mug? You know there are some things you can point to like, there's a room for liquid and it has a handle.

But we humans are not very good at explaining, how we can look at this and decide what it is. But because AI is a relatively new thing, the lack of explainability is sometimes a barrier to its acceptance.



Biased AI through biased data

As a society, we do not want to discriminate against individuals based on their gender, based on their ethnicity and we want people to be treated fairly. But when AI systems are fed data that doesn't reflect these values, then an AI can become bias or can learn to discriminate against certain People. AI systems are already making important decisions today, and will continue to do so in the future as well. So, bias matters.

Biased AI through biased data

For Example :

If an AI system is trained primarily on data of lighter skin individuals, then it will be more accurate for that category of individuals to the extent that these systems are used in, for example, criminal investigations, this can create a very biased and unfair effect on dark-skinned individuals

Why Bias Matters

Hiring tool that discriminated against women

Facial recognition working better for light-skinned than dark-skinned individuals

Bank loan approvals

Toxic effect of reinforcing unhealthy stereotypes

How To Reduce Bias

Technical Solutions

- Zero out the bias in words
- Use less biased and/or more inclusive data

Transparency And/Or Auditing Processes

- constantly check what types of bias, if any, these AI systems are exhibiting

Diverse Workforce

- the organizations are becoming more heterogeneous mix of people in terms of gender,age,ethnicity etc

Technical Solutions

Zero out the bias in words

Researchers have found that when an AI system learns a lot of different numbers with which to store words, there are few numbers that correspond to the bias.

If you zero out those numbers, just set them to zero, then the bias diminishes significantly.

Use less biased and/or more inclusive data

Try to use less bias and or more inclusive data.

For example, if you are building a face-recognition system, and make sure to include data from multiple ethnicities, and all genders, then your system will be less biased and more inclusive.

Transparency And/Or Auditing Processes

Many AI teams are subjecting their systems to better transparency and or auditing processes, so that we can constantly check what types of bias, if any, these AI systems are exhibiting, so that we can at least recognize the problem if it exists, and then take steps to address it.

For example, many face recognition teams are systematically checking how accurate their system is on different subsets of the population to check whether, it is more or less accurate on dark-skinned versus light-skinned individuals. Having transparent systems as well as systematic auditing processes increases the odds that will at least quickly spot a problem, in case there is one, so that we can fix it



Adversarial Attacks On AI

ØPicture Perturbation

ØPhysical Attacks



Picture Perturbation

Picture Perturbation means to make minor changes in the pixels of the image, the changes that are almost imperceptible to the human eye. But an AI system sees the world very differently than you and I do.



Hummingbird

Minor perturbation



Hammer

Physical Attacks

Physical Attacks means to add some extra content in a picture which can fool the AI system

For Example :

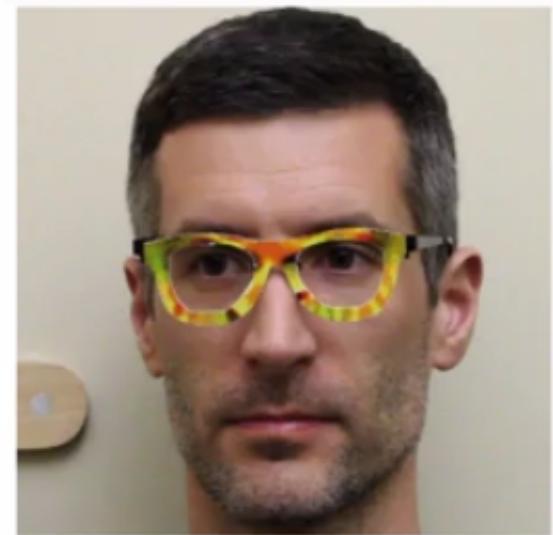
A different group of researchers showed that if you affects stickers like these onto a stop sign, you can fool an AI system into not seeing the stop sign at all. It thinks there's something else there other than a stop sign.



Fails to see stop sign

Physical Attacks

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.



“Milla Jovovich”

Adversarial Defenses

- Ø Defenses do exist, but incur some cost
- Ø Similar to spam vs anti-spam, we may be in an arms race for some applications

Adverse Uses Of AI

- Deep Fakes
 - ✓ 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

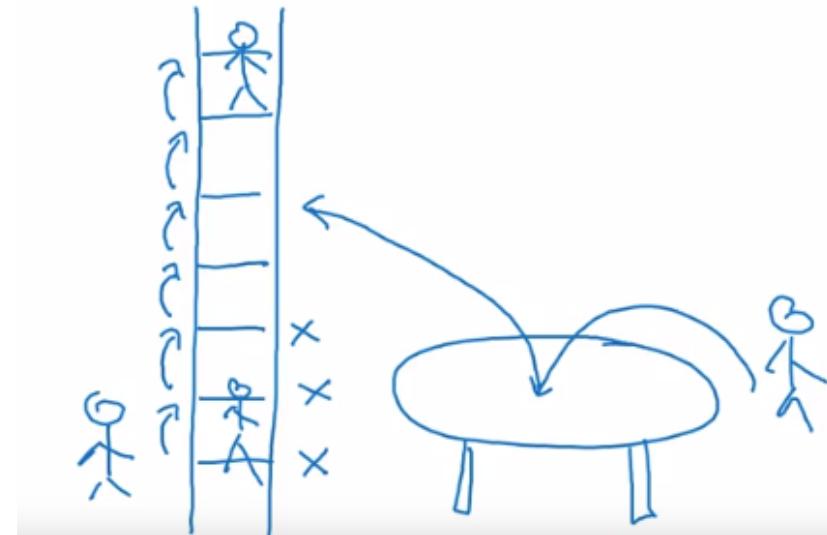
AI and Developing Economies

Leap Frog

Leapfrogging is the notion that areas which have poorly-developed **technology** or economic bases can move themselves forward rapidly through the adoption of modern systems without going through intermediary steps.



leapfrog



Leap Frog

Examples

- Mobile Phones
 - Developing Countries switched directly on mobile phones instead of landlines which were used by developed countries.
- Online Education
 - Developing Countries which do not have much universities and institutes for higher education have directly switched for online education.

How Developing Economies Can Build AI

➤ **Focus on AI to strengthen a country's vertical industries**

Developing countries today should not try to build their own Web search engine. There are already great web search engines and that was last decades competition.

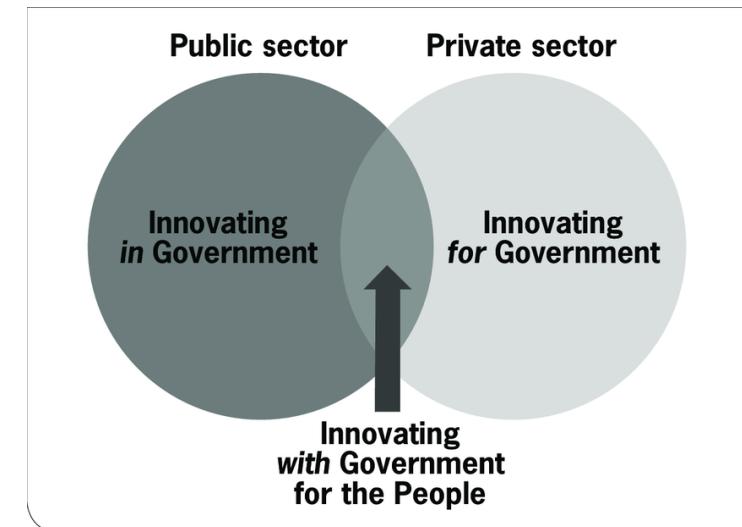
Instead, if a country has a very strong vertical industry then that country should build AI to automate that industry, it will even further Strengthen that industry.

How Developing Economies Can Build AI

▶ **Public Private Partnerships To Accelerate Development**

Public-private partnerships, meaning governments and corporations working together, can really help accelerate a vertical industry's AI developments.

In highly regulated sectors, ranging from healthcare to transportation like self-driving cars to finance, there are certain outcomes that we want and certain outcomes that we don't want.



How Developing Economies Can Build AI

➤ **Invest In Education**

AI is still so immature. There's still plenty of room for every nation

to learn more about AI, maybe even build up its own AI workforce and participate in a significant way in this AI powered world that we're building.

Jobs displaced
by 2030

400-800 mil

Jobs created
by 2030

555-890 mil

[Source: McKinsey Global Institute.]

AI Impact On Jobs World Wide

Conclusion :

What you have learned ?

- What is AI ?
- Building AI Projects
- Building AI in your company
- AI and Society

Best Of Luck For Your Test !