

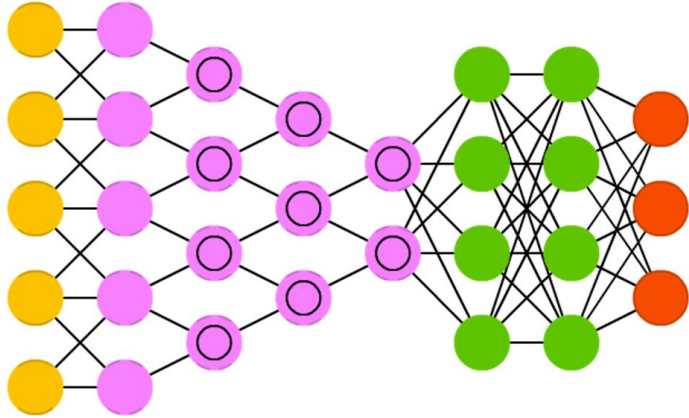
# **Impact of AI Decal:** *A Survey of Modern ML*

Gokul Swamy & Brenton Chu

Quiz: <https://tinyurl.com/impactsp19q2>

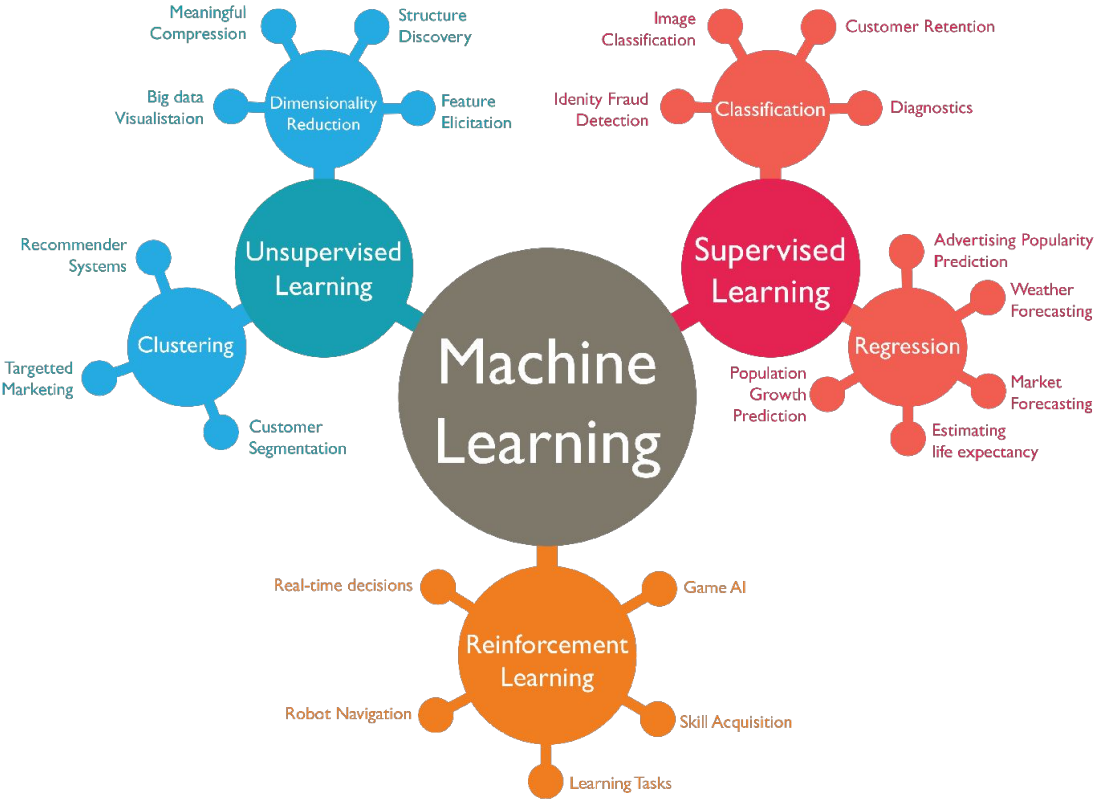


# Approaches to AI: Machine Learning



- Uses data to learn the correct predictions rather than following experts
  - ◆ Each example seen changes internally saved values in a way that helps it find the right answer next time
- Neural networks are the most common form of modern ML algorithm and is inspired by how the neurons in the brain function
- Deep learning stacks many “layers” of neurons
- Currently the best approach for the vast majority of AI tasks

# Organization of subfields



# Subfields within Machine Learning

## → Computer Vision

- ◆ Understanding the visual world

## → Reinforcement Learning

- ◆ Discovering the best actions to get the most rewards

## → Natural Language Processing

- ◆ Communicating using human language

## → Generation

- ◆ Creating brand new content

## → Clustering

- ◆ Seeing data in a different light to gain better insights

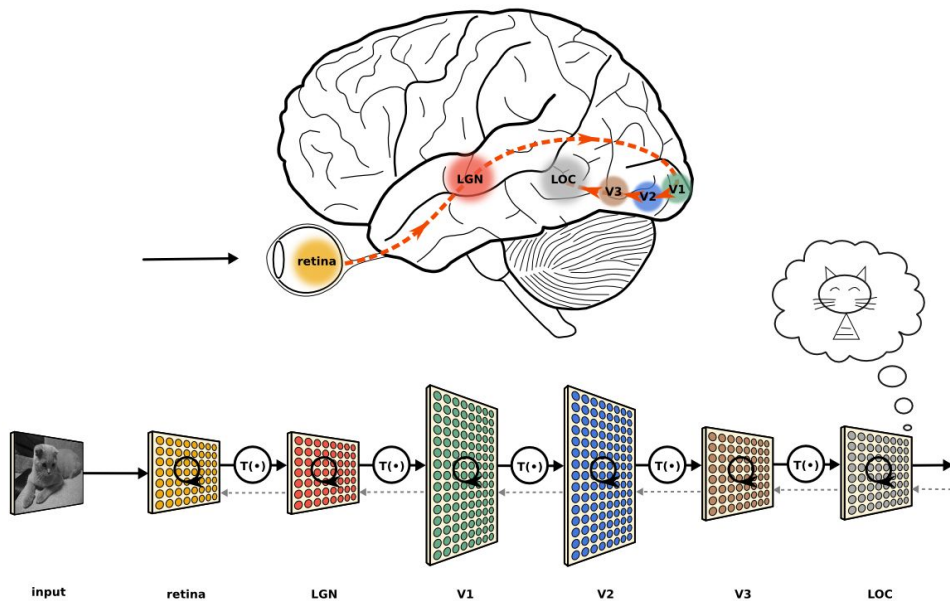
# Computer Vision

- Computer vision tries to give human-like capabilities to computers based on image input
- ◆ Object recognition
  - ◆ 3D Reconstruction



# Computer Vision

- To get human-like capabilities, computer vision uses algorithms that simulate how the visual system of the brain





LEFT REARWARD VEHICLE CAMERA



MEDIUM RANGE VEHICLE CAMERA



RIGHT REARWARD VEHICLE CAMERA



NOISE LOW

LANE LINES

LANE MARKS

ROAD FLOW

OBJECTS

ROAD LIGHTS

ROAD MARKS

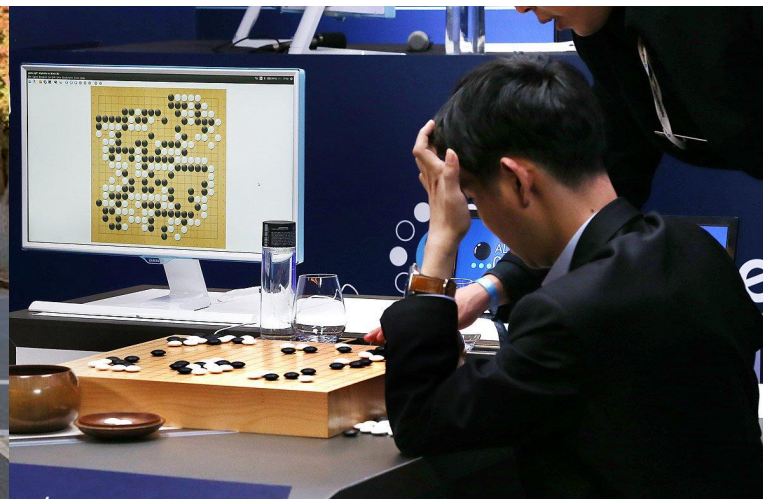
ROAD MARKS





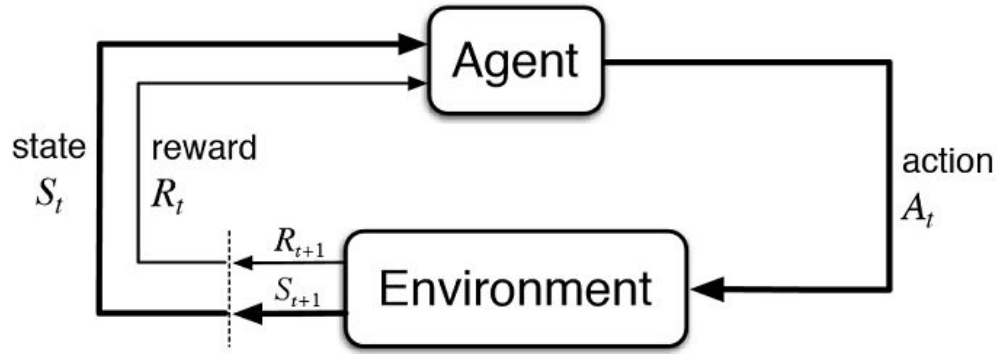
# Reinforcement Learning

- RL is used to design systems that need to make sequential decisions under some kind of uncertainty
- ◆ Self Driving Cars
  - ◆ Game Playing AI



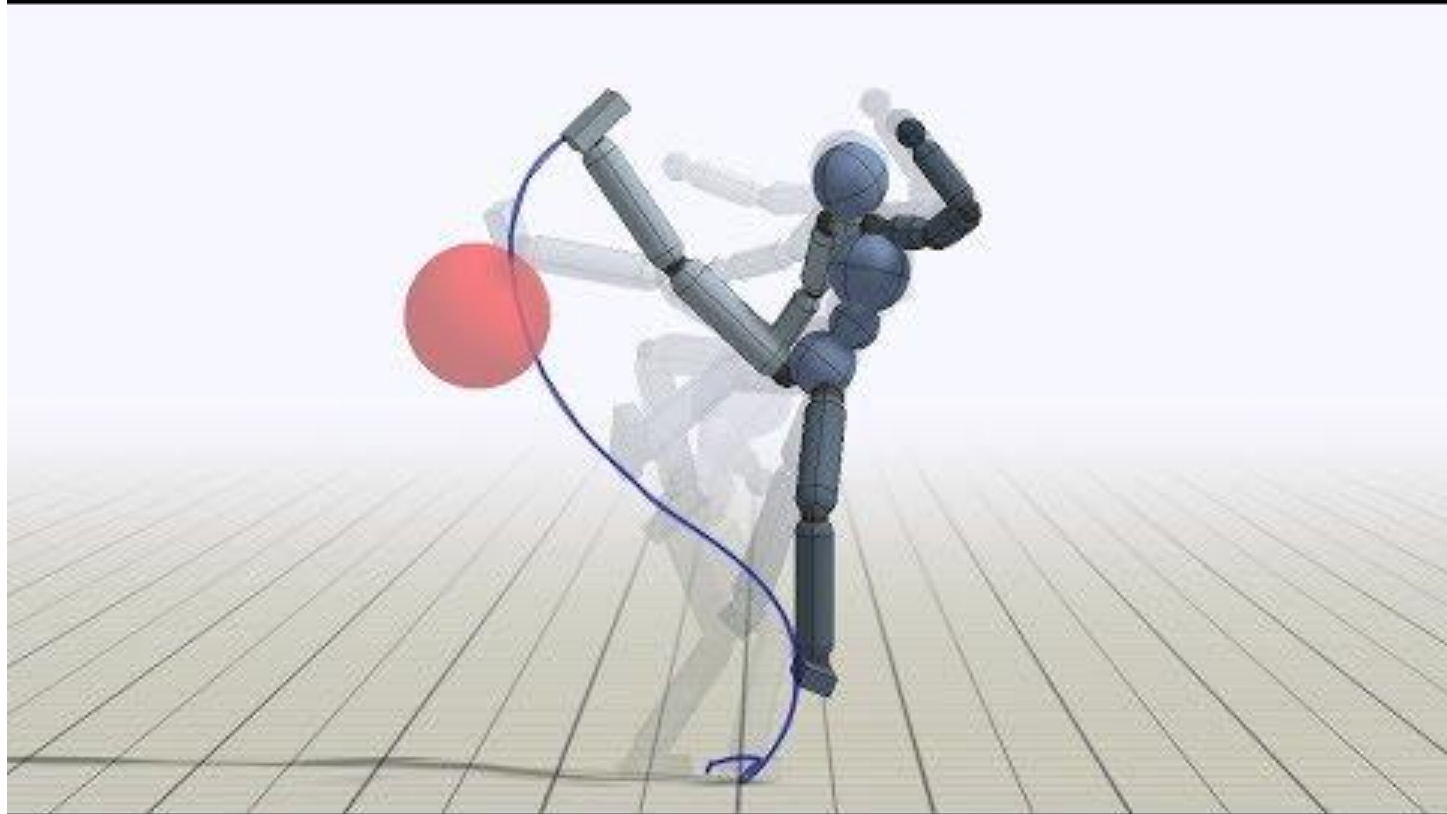
# Reinforcement Learning

- RL assumes you control an agent acting in some sort of environment
- When the agent takes an action, the state of the world moves forward and the agent receives some sort of reward based on how optimal the action it took was



1 8 0 2 1







# Natural Language Processing

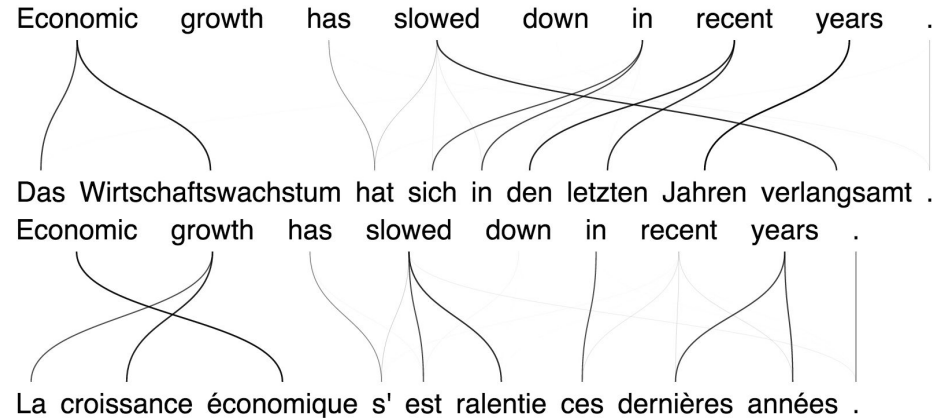
- Natural Language Processing allows computers to understand and communicate with human language
- Difficulty in human language is that there are many idiosyncrasies that is difficult to capture in a single rule set
  - ◆ Plenty of exceptions and exceptions to exceptions
  - ◆ Temporal changes (introduction of new words, phrases, or old vocabulary being retired)
  - ◆ Spatial differences (dialects)
  - ◆ Idioms, puns, sarcasm, etc.

# Natural Language Processing

## Chatbots and Personal Assistants



## Machine Translation





*"Do you have anything between  
10 am and 12 pm?"*

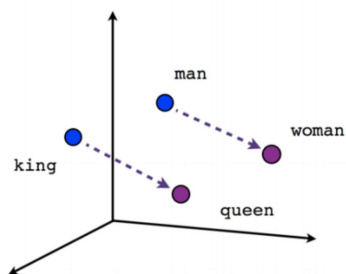


*"Depending on what service she would like.  
What service is she looking for?"*

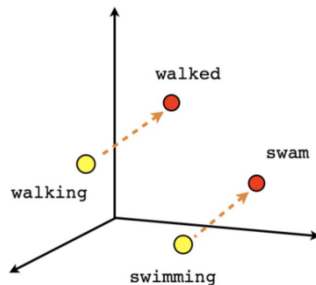


# Word2Vec

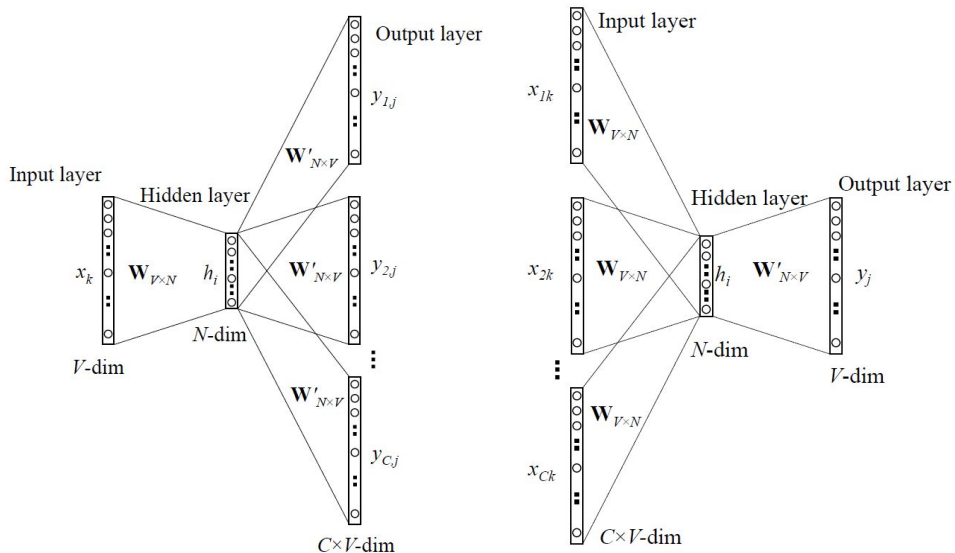
- Word2Vec is an algorithm for semantic dimensionality reduction - turning something as complicated as words into a vector.
- These vectors then encode semantic meaning.



Male-Female



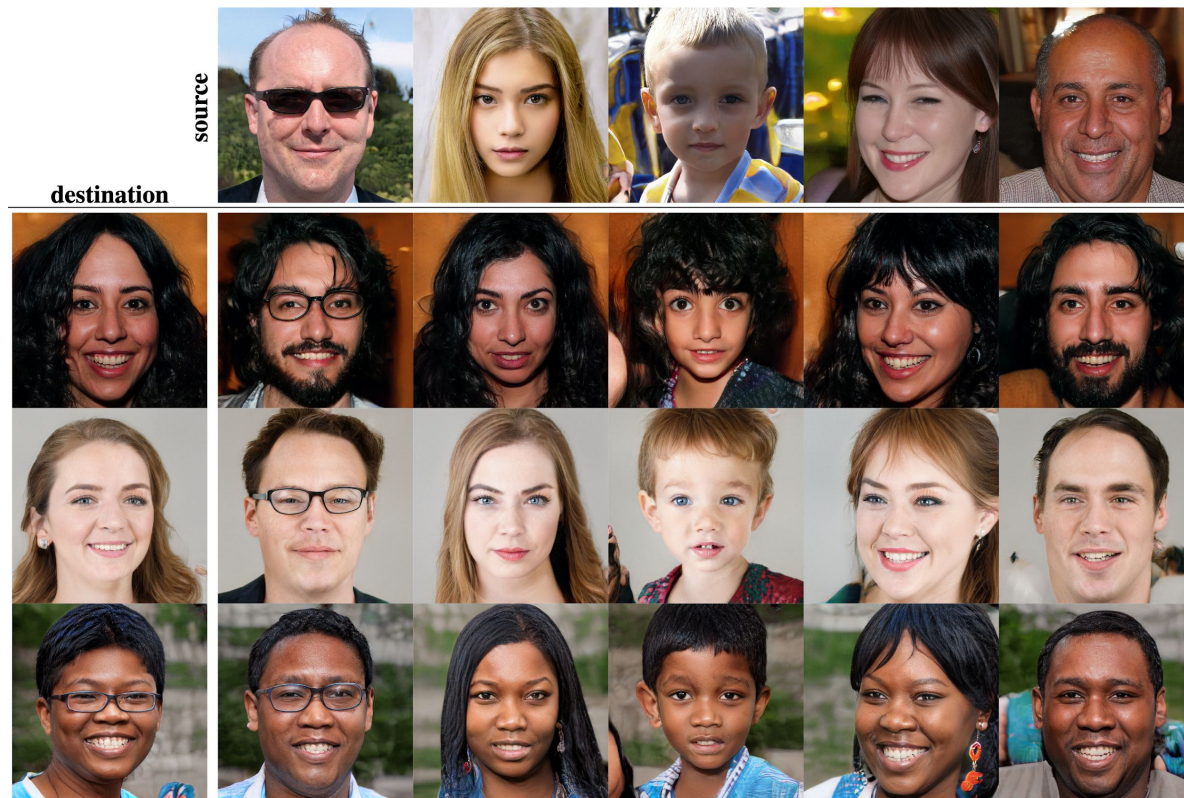
Verb tense



# Generation

- Rather than just analyzing and making predictions from data, generation seeks to create new data
- <https://thispersondoesnotexist.com/>





→ Neural Networks can combine features from one image (age, sex, expression) with different features from another (ethnicity, background, eyewear) to create entirely original faces



# These are not mutually exclusive categories!

- Computer Vision
  - ◆ Understanding what's in the image
- Natural Language Processing
  - ◆ Turning objects from image into human language descriptions
- Generation
  - ◆ Creating new, never-before-seen captions



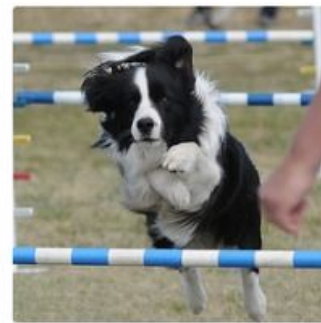
"man in black shirt is playing guitar."



"construction worker in orange safety vest is working on road."



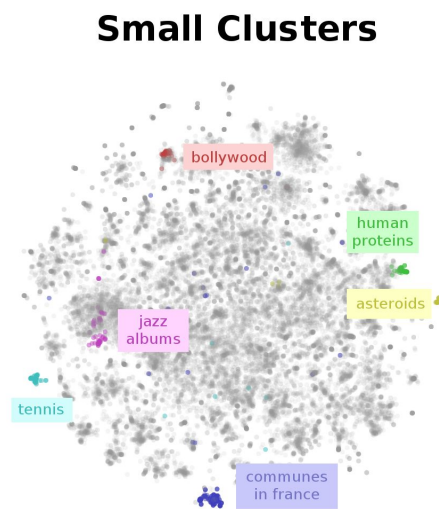
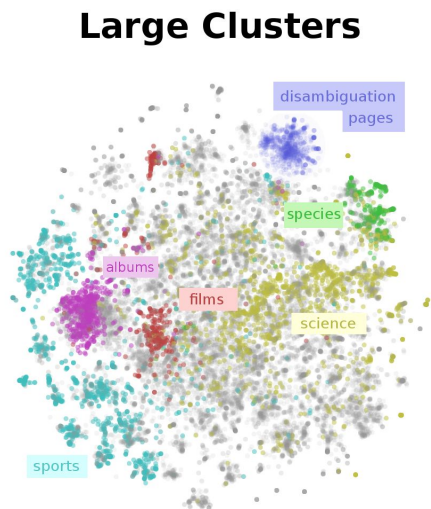
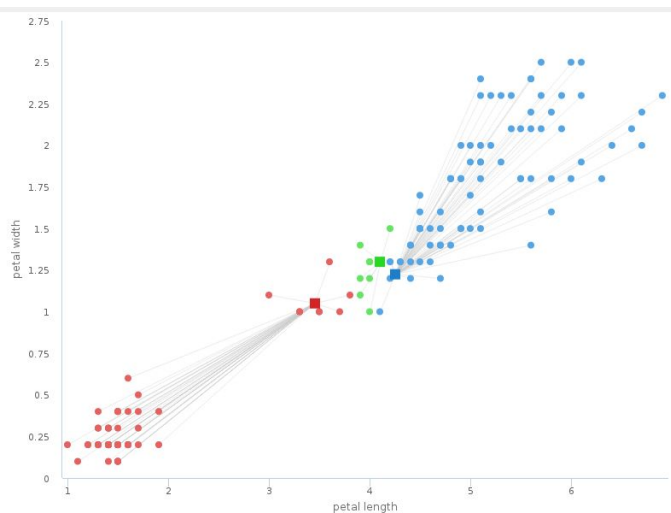
"girl in pink dress is jumping in air."



"black and white dog jumps over bar."

# Clustering

- Used to organize complex data into discrete groups for easier processing or analysis.
- Usually considered an example of unsupervised learning.



# **Impact of AI Decal:** *Activity*

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# What can ML do?

1. Form groups of ~4 and choose a topic from the list below. Take 10 mins to prepare a 3 minute presentation on the applications of ML to the area.
  - 1.1. Drug Discovery
  - 1.2. Product Recommendation
  - 1.3. Video Games
  - 1.4. Fraud Detection
  - 1.5. Physics modeling

Sources of Info: <https://tinyurl.com/whatcanmldo>



# **Impact of AI Decal:** *Next: The Data Revolution*

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