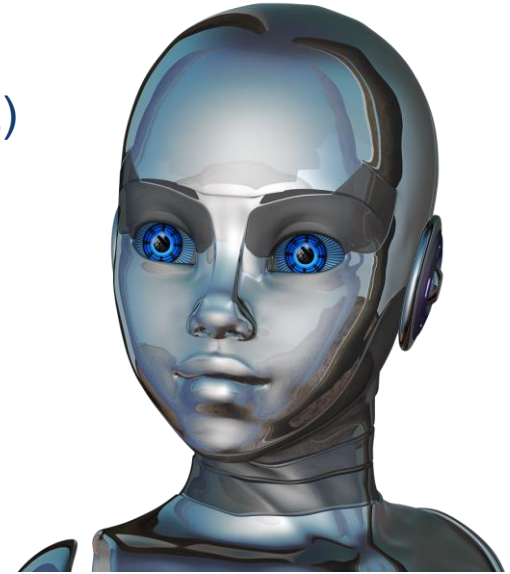
Learning Objectives

You will be able to:

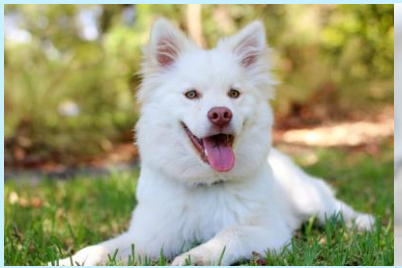
- Define “Artificial Intelligence” (AI),

  “Machine Learning” (ML), and “Deep Learning” (DL)
- Explain how DL helps solve classical ML limitations.
- Differentiate modern AI from prior AI.
- Relate sample applications of AI.



AI Breakthroughs

Image classification



“Dog” *“Cat”*

As of *2015*, computers can be trained to perform better on this task than humans.

Machine translation

“I am a student” →  → *“Je suis étudiant”*

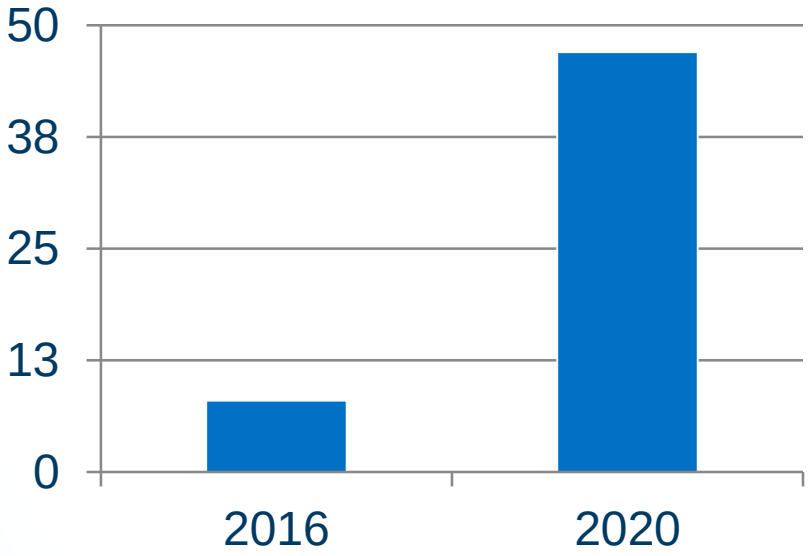
As of *2016*, we have achieved near-human performance using the latest AI techniques.

AI Is The New Electricity

"About 100 years ago, electricity transformed every major industry. AI has advanced to the point where it has the power to transform…every major sector in coming years."

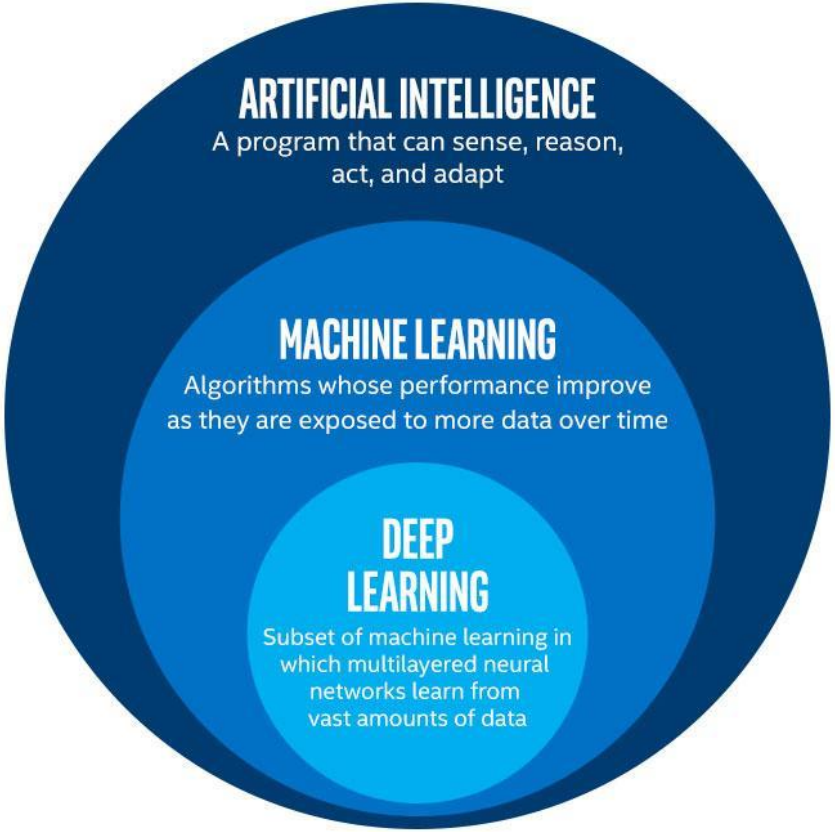
-Andrew Ng, Stanford University

Projected Revenue (in billions USD) Generated from AI, 2016-2020 (IDC)



Definitions

- Artificial Intelligence
- Machine Learning
- Deep Learning



Artificial Intelligence

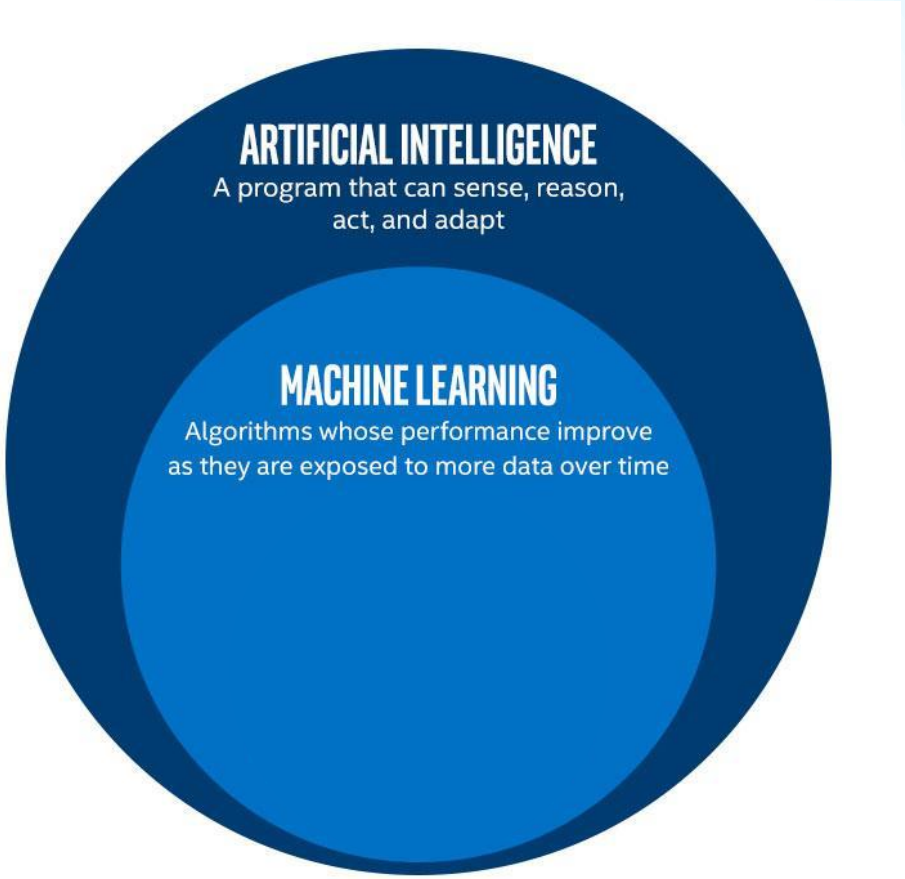
“A branch of computer science dealing with the simulation of intelligent behavior in computers.” (Merriam-Webster)

“A program that can sense, reason, act, and adapt.” (Intel)

“Colloquially, the term ‘artificial intelligence’ is applied when a machine mimics ‘cognitive’ functions that humans associate with other human minds, such as ‘learning' and ‘problem solving’.” (Wikipedia)

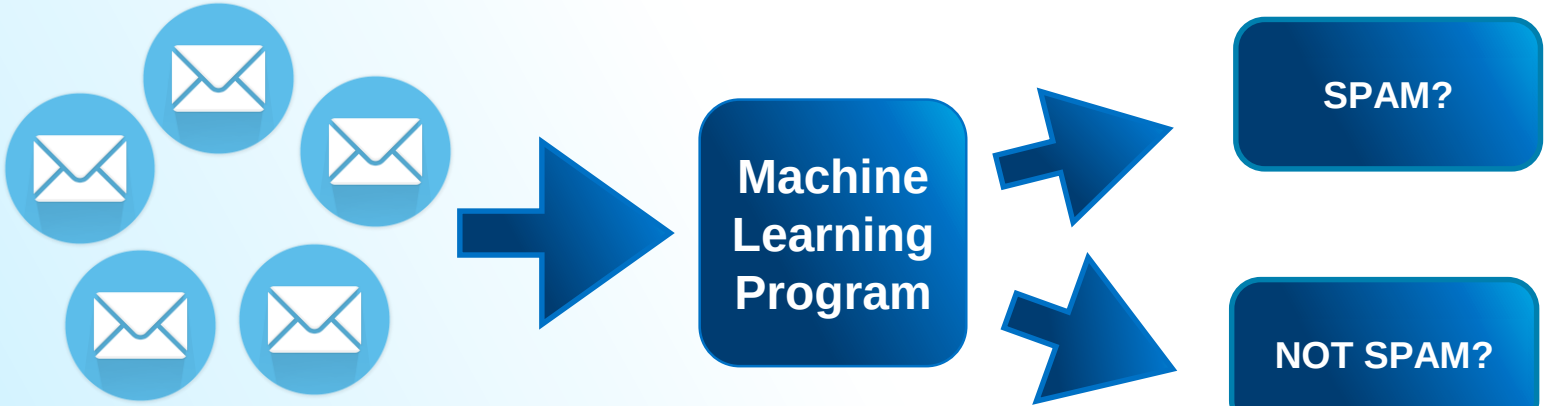
Machine Learning

"The study and construction of programs that are *not explicitly programmed*, but learn patterns as they are exposed to more data over time." (Intel)



Machine Learning

These programs learn from repeatedly seeing data, rather than being explicitly programmed by humans.



Emails are labeled as spam vs. not

The more emails the program sees…

…the better it gets at classification

Machine Learning Terminology

This example is learning to classify a species from a set of measurement features.

Features:
Attributes of the data.

Target:
Column to be predicted.

sepal length	sepal width	petal length	petal width	species
6.7	3.0	[illegible]	2.3	virginica
6.4	2.8	5.6	2.1	virginica
4.6	3.4	1.4	0.3	setosa
6.9	3.1	4.9	1.5	versicolor
4.4	2.9	1.4	0.2	setosa
4.8	3.0	1.4	0.1	setosa
5.9	3.0	5.1	1.8	virginica
5.4	3.9	1.3	0.4	setosa
4.9	3.0	1.4	0.2	setosa
5.4	3.4	1.7	0.2	setosa

Two Main Types of Machine Learning

	Dataset	Goal	Example
Supervised Learning	Has a target column	Make predictions	Fraud detection
Unsupervised Learning	Does not have a target column	Find structure in the data	Customer segmentation

Machine Learning Example

- Suppose you wanted to identify fraudulent credit card transactions.
- You could define features to be:
  - Transaction time
  - Transaction amount
  - Transaction location
  - Category of purchase
- The algorithm could learn what feature combinations suggest unusual activity.

Machine Learning Limitations

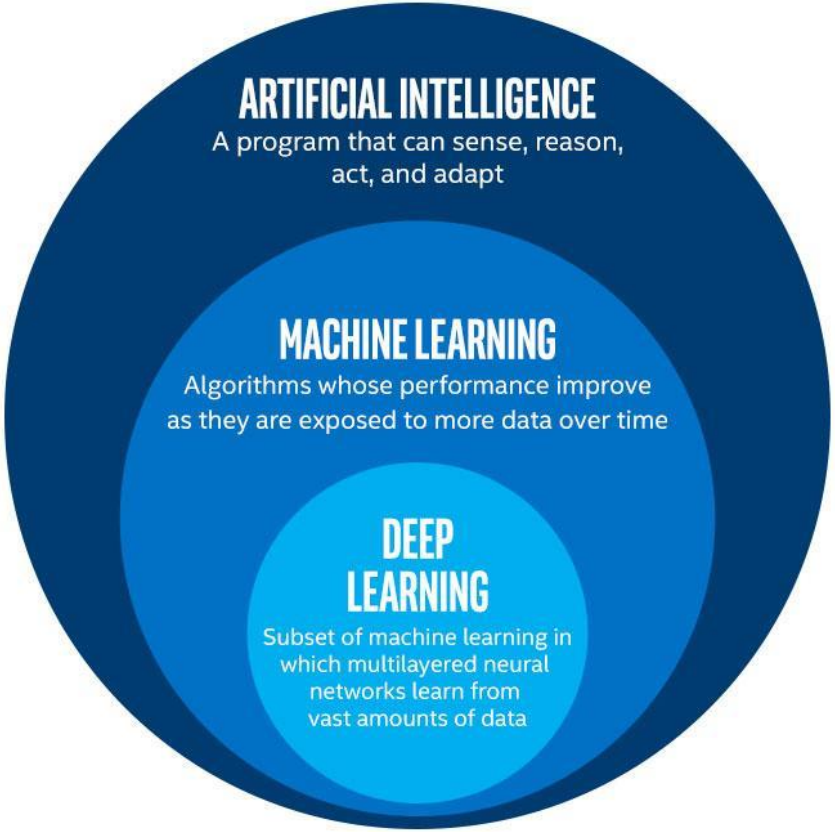
- Suppose you wanted to determine if an image is of a cat or a dog.
- What features would you use?
- This is where **Deep Learning** can come in.

Dog and cat recognition

Deep Learning

“Machine learning that involves using very complicated models called “deep neural networks”." (Intel)

Models determine best representation of original data; in classic machine learning, humans must do this.



Deep Learning Example

Classic Machine Learning

Step 1: Determine features.

Step 2: Feed them through model.

Feature Detection

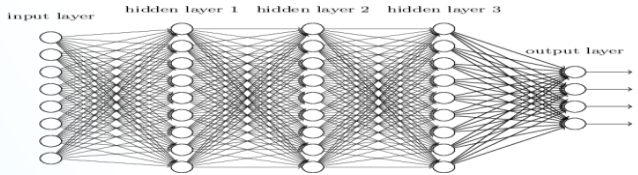
Machine Learning Classifier Algorithm

“Arjun"

Deep Learning

Steps 1 and 2 are combined into 1 step.

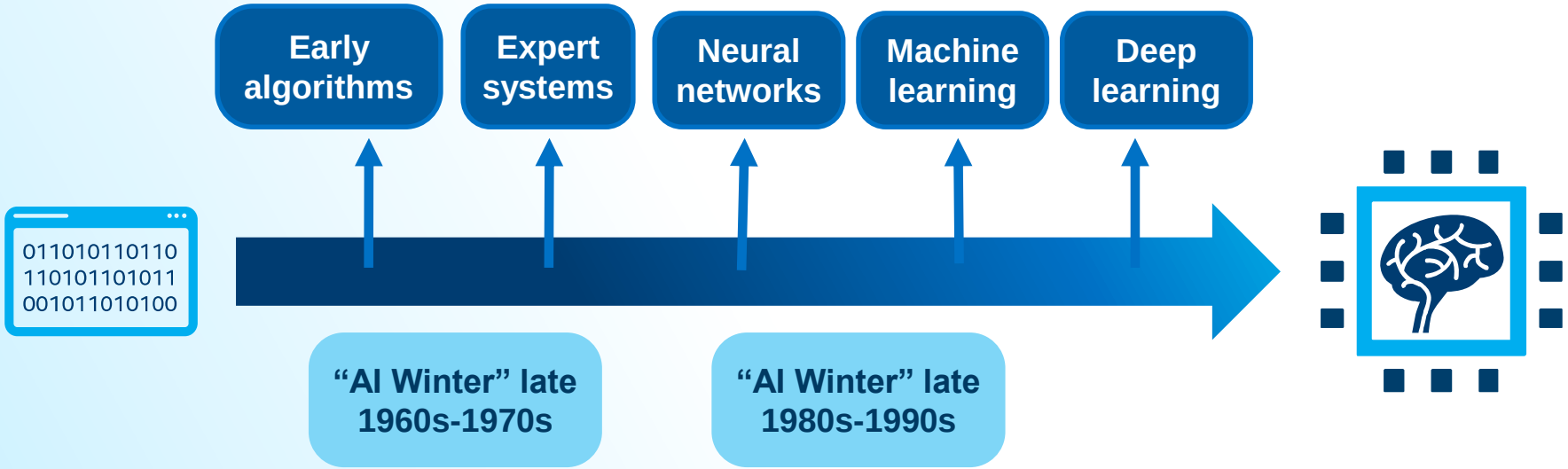
Neural Network



“Arjun"

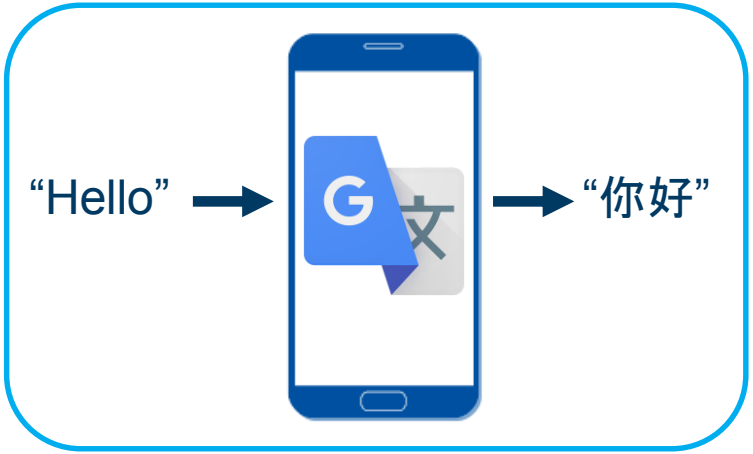
History of AI

AI has experienced several hype cycles, where it has oscillated between periods of excitement and disappointment.



Deep Learning Breakthroughs (2012 – Present)

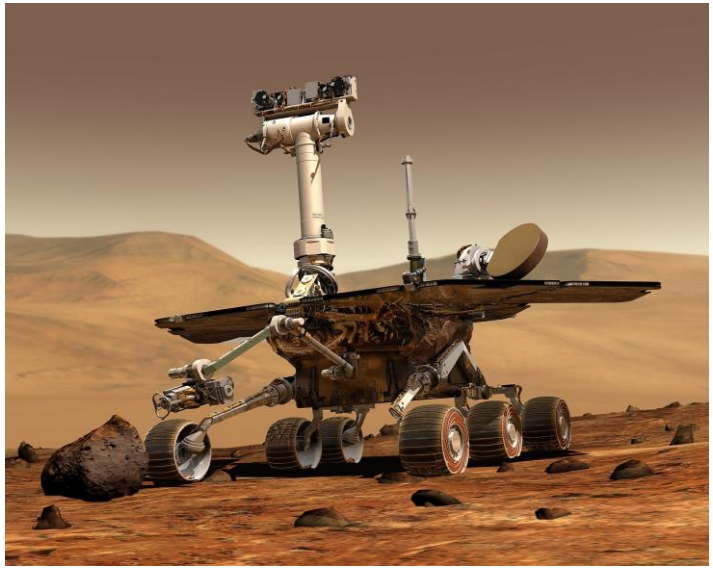
- In 2012, deep learning beats previous benchmark on the ImageNet competition.
- In 2013, deep learning is used to understand "conceptual meaning" of words.
- In 2014, similar breakthroughs appeared in language translation.
- These have led to advancements in Web Search, Document Search, Document Summarization, and Machine Translation.



Google Translate

Deep Learning Breakthroughs (2012 – Present)

- In 2014, computer vision algorithm can describe photos.
- In 2015, Deep learning platform TensorFlow* is developed.
- In 2016, DeepMind* AlphaGo, developed by Aja Huang, beats Go master Lee Se-dol.



Modern AI (2012 – Present): Deep Learning Impact

Computer vision

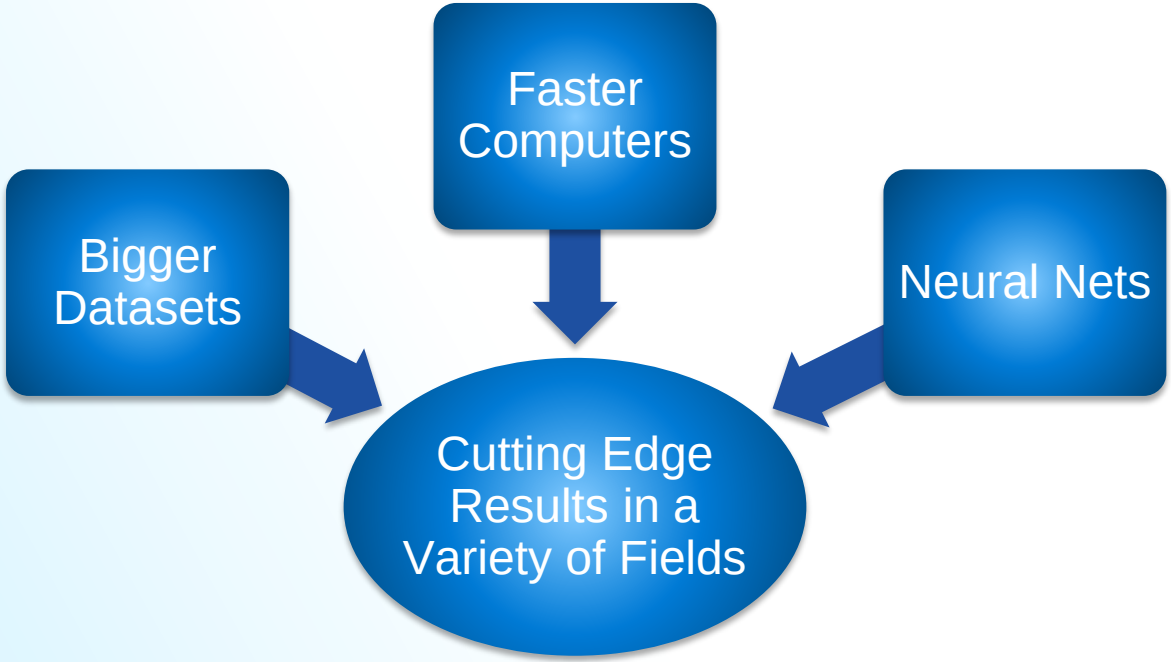
Self-driving cars:
object detection

Healthcare:
improved diagnosis

Natural language

Communication:
language translation

How Is This Era of AI Different?



Other Modern AI Factors

- Continued expansion of open source AI, especially in Python*, aiding machine learning and big data ecosystems.
- Leading deep learning libraries *open sourced*, allowing further adoption by industry.
- Open sourcing of large datasets of millions of labeled images, text datasets such as Wikipedia has also driven breakthroughs.

Transformative Changes

Health

Enhanced Diagnostics

Drug Discovery

Patient Care

Research

Sensory Aids

Industrial

Factory Automation

Predictive Maintenance

Precision Agriculture

Field Automation

Source: Intel forecast

Transformative Changes

Finance

Algorithmic Trading

Fraud Detection

Research

Personal Finance

Risk Mitigation

Energy

Oil & Gas Exploration

Smart Grid

Operational Improvement

Conservation

Source: Intel forecast

Transformative Changes

Government

Defense

Data Insights

Safety & Security

Engagement

Smarter Cities

Transport

Autonomous Cars

Automated Trucking

Aerospace

Shipping

Search & Rescue

Source: Intel forecast

Transformative Changes

Other

Advertising

Education

Gaming

Professional & IT Services

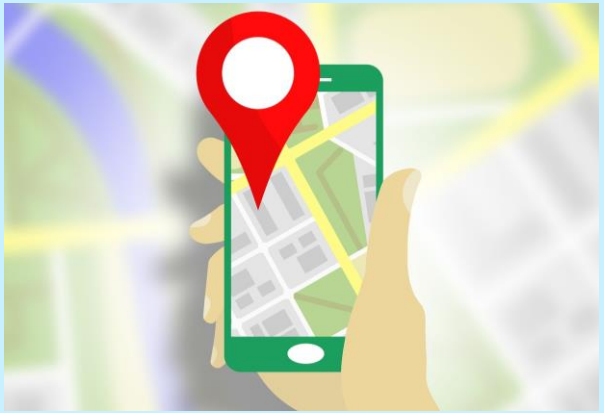
Telco/Media

Sports

Source: Intel forecast

AI Omnipresence In Transportation

Navigation



Google & Waze find the fastest route, by processing traffic data.

Ride sharing

Uber & Lyft predict real-time demand using AI techniques, machine learning, deep learning.

AI Omnipresence In Social Media

Audience

Facebook & Twitter use AI to decide what content to present in their feeds to different audiences.

Content

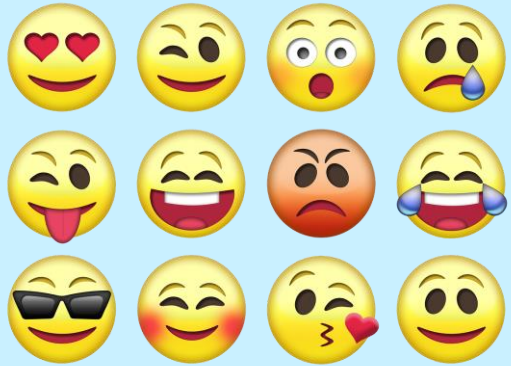


Image recognition and sentiment analysis to ensure that content of the appropriate “mood” is being served.

AI Omnipresence In Daily Life

Natural language

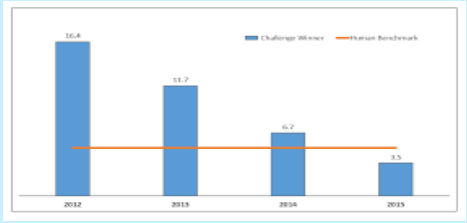
We carry around powerful natural language processing algorithms in our phones/computers.

Object detection

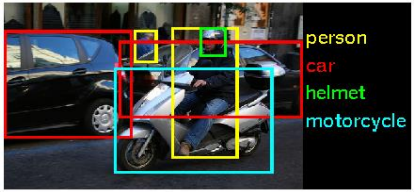
Cameras like Amazon DeepLens* or Google Clips* use object detection to determine when to take a photo.

Latest Developments: Computer Vision

Deep Learning “proven” to work for image classification.



Models outperform humans on image classification.



Object detection models beat previous benchmarks.

2012 2015 2016

Application Area: Abandoned Baggage Detection

- We can automatically detect when baggage has been left unattended, potentially saving lives.
- This system relies on the breakthroughs we discussed:
    - Cutting edge object detection.
    - Fast hardware on which to train the model (Intel® Xeon® processors in this case).

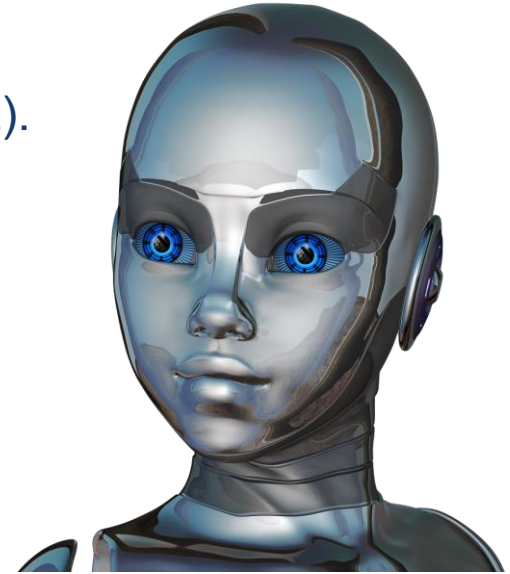
Abandoned baggage

Learning Objectives Recap

In this session, we worked to:

- Define “Artificial Intelligence” (AI),

  “Machine Learning” (ML), and “Deep Learning” (DL).
- Explain how DL helps solve classical ML limitations.
- Explain key historical developments
- Relate sample applications of AI.



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