SAND2020-8156PE

Artificial Intelligence: Friend or Foe?

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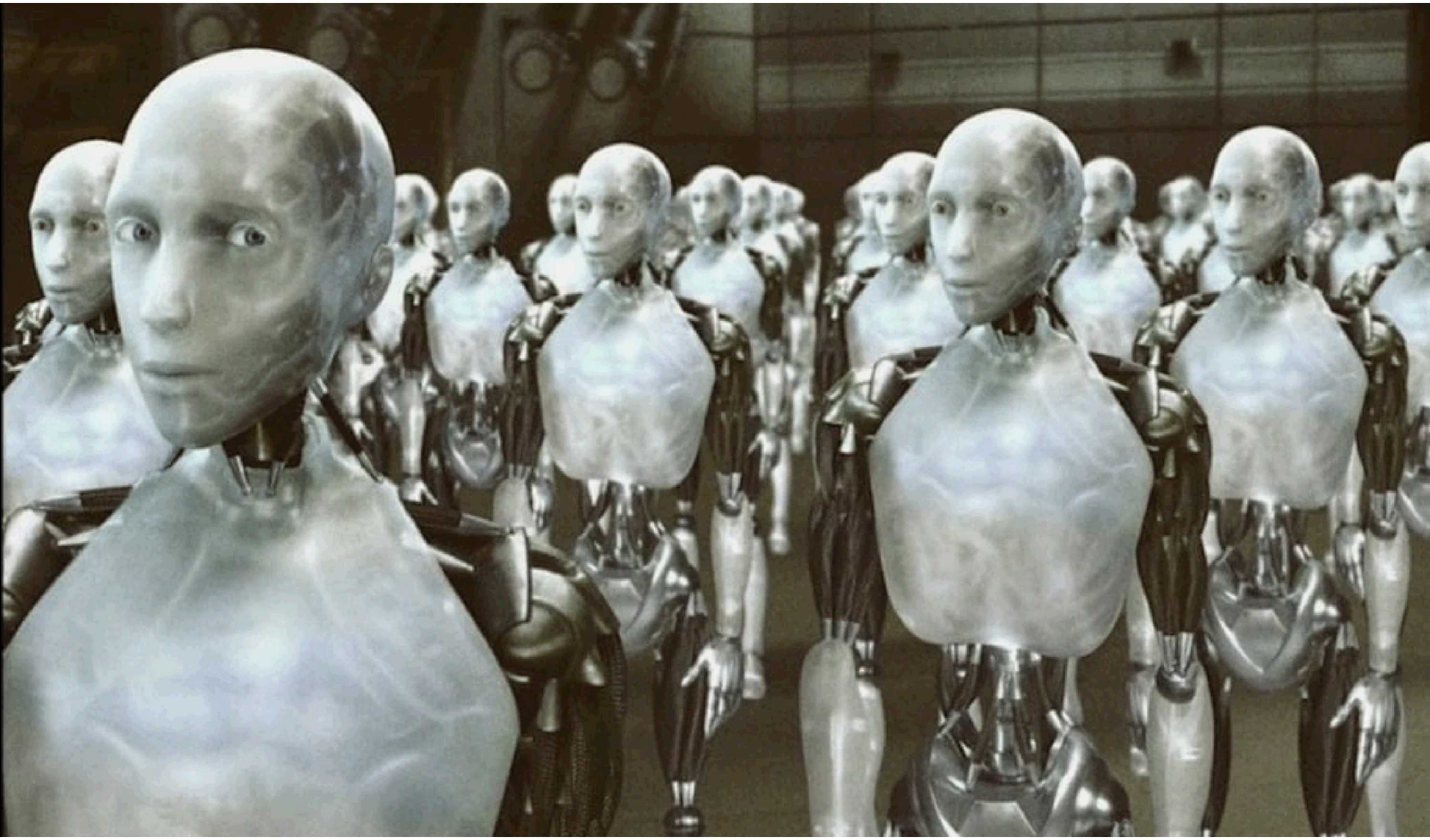
Deep Learning R&D
Sandia National Laboratories

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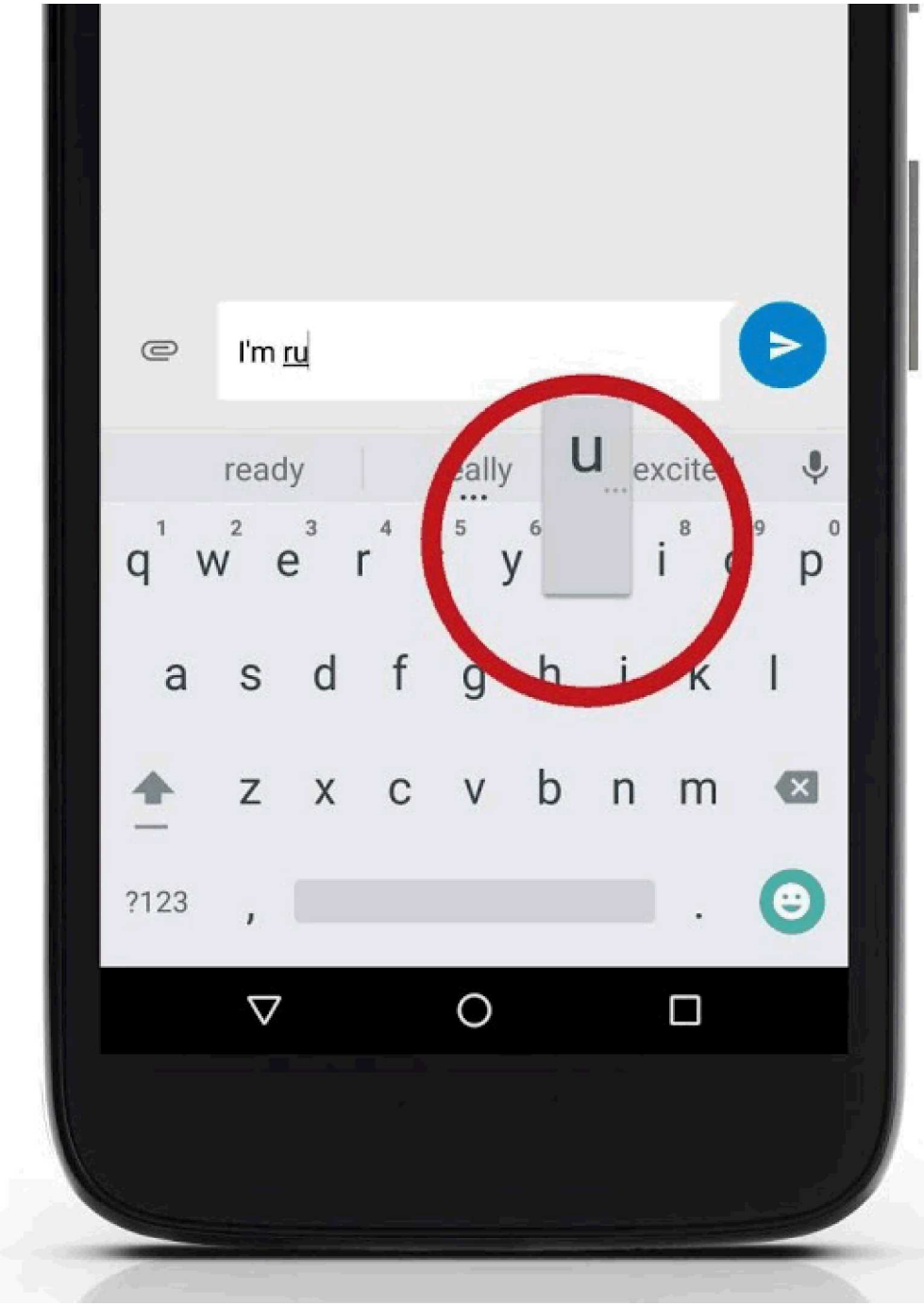
INTRODUCING

amazon echo

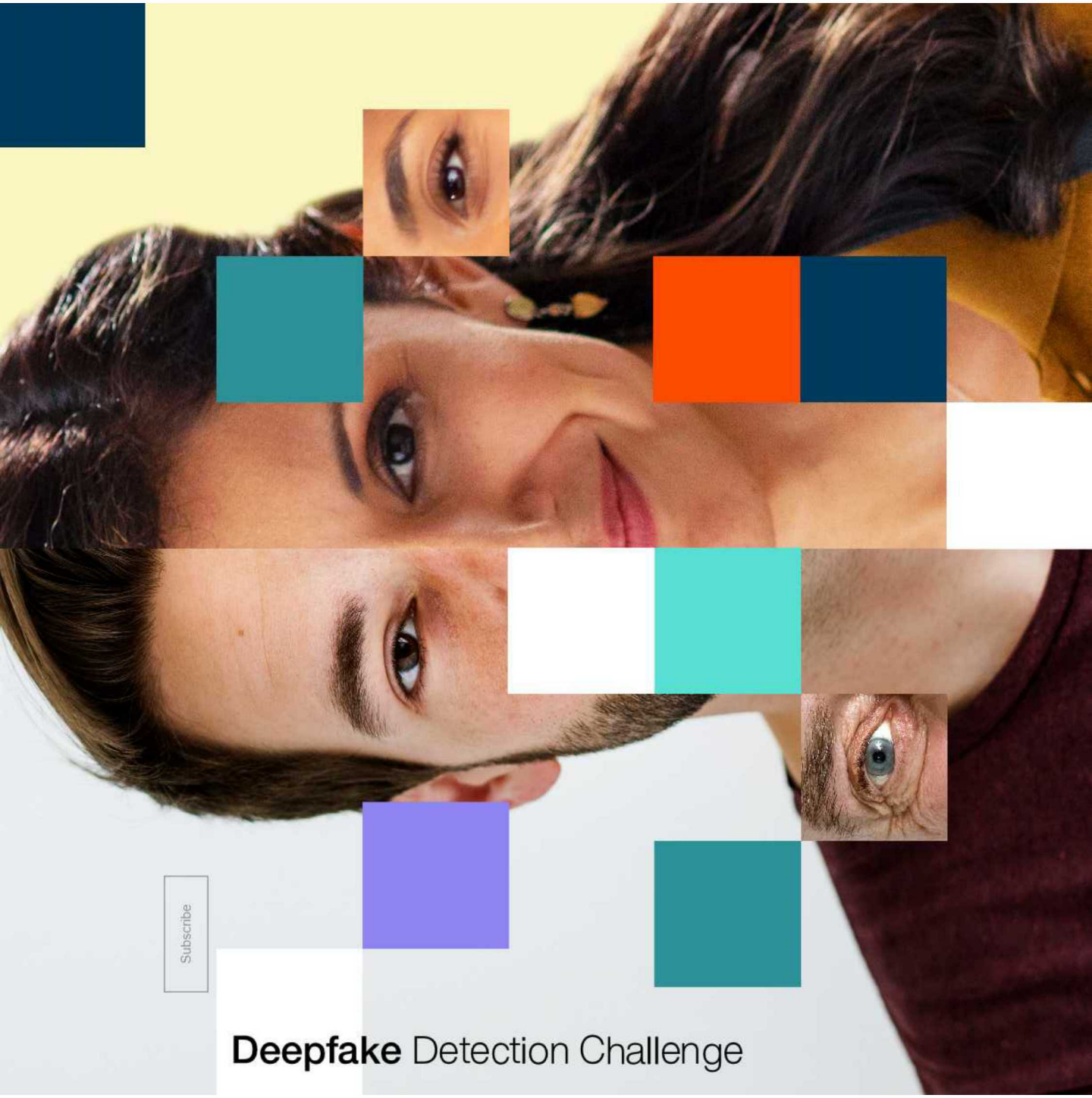
Always ready, connected,
and fast. **Just ask.**



"I'm running late!
I'll be there in 5."


Media Markt


Tesla Motors / MGN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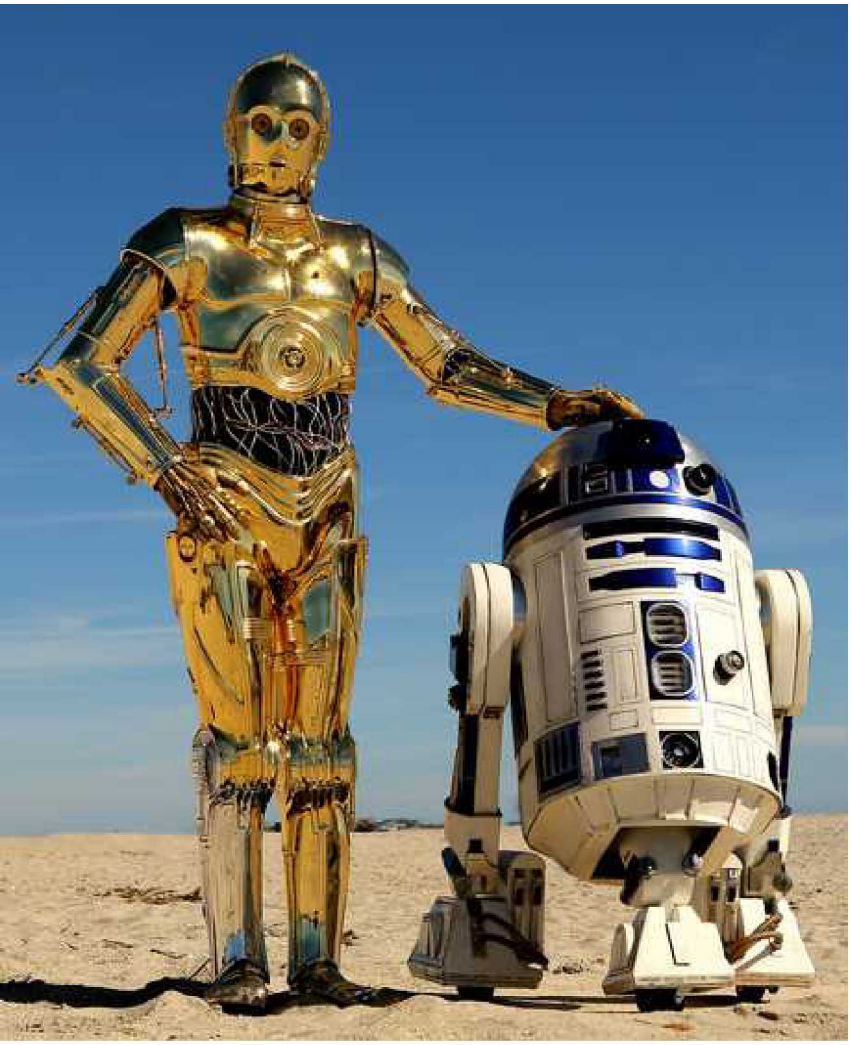
- AI-assisted robotic surgery
- Virtual nursing assistants
- Aid clinical judgment/diagnosis
- Workflow & administrative tasks
- Image analysis

METTLE & METAL

THE DARPA ROBOTICS CHALLENGE



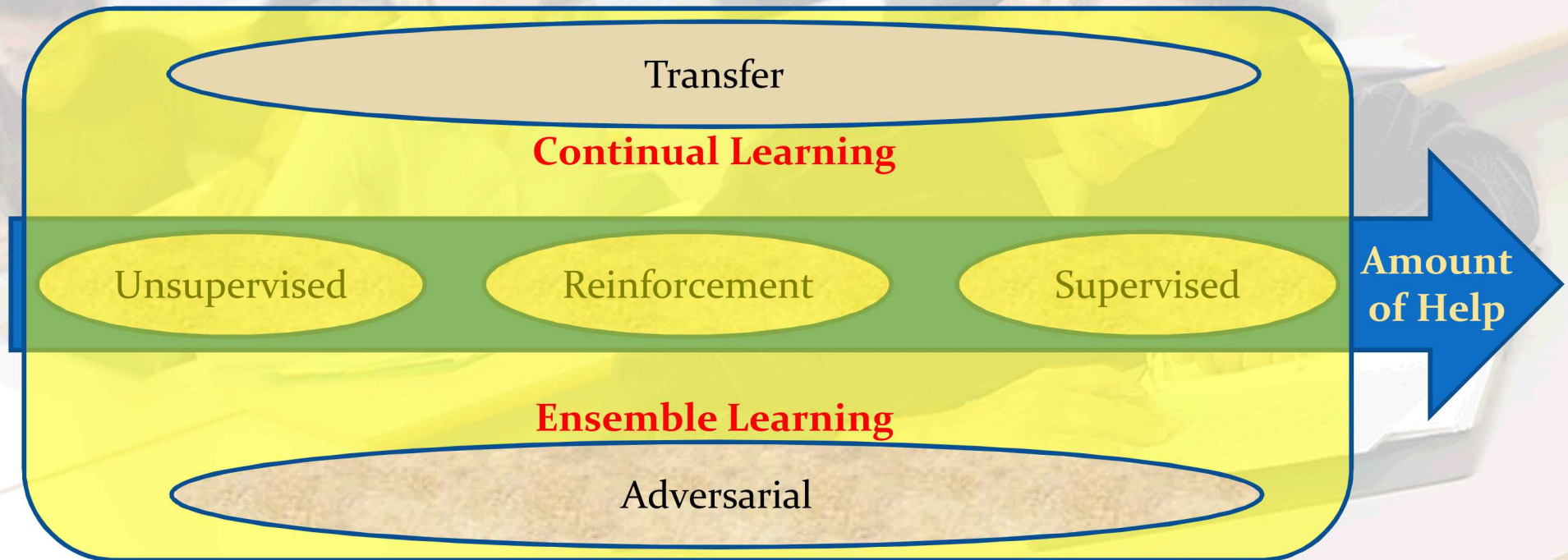
What's under the hood of AI?

Machine Learning (ML) Modalities

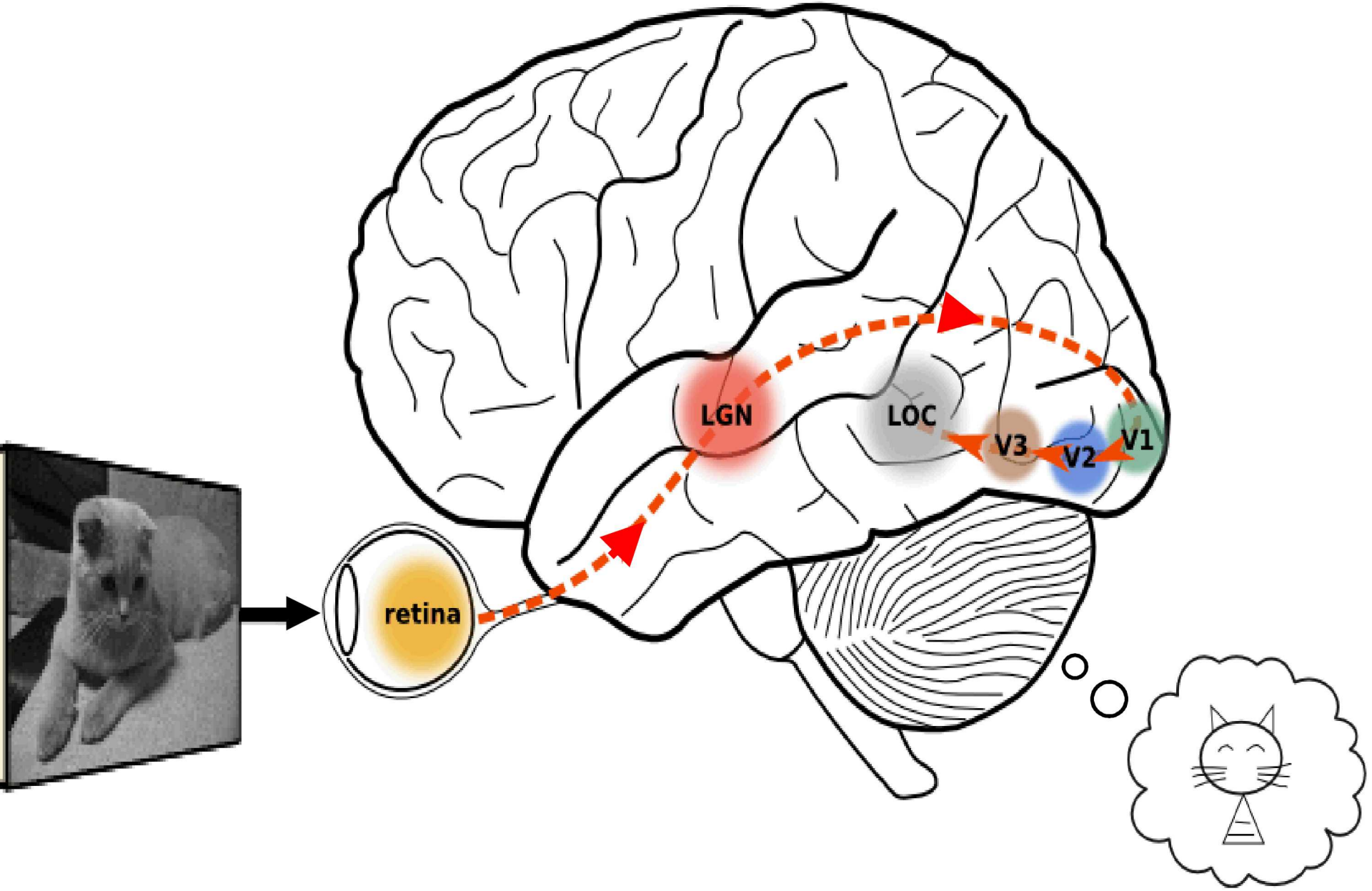
- **Un/Self-supervised** – No teacher, no answers, just data
- **Supervised** – Teacher has right answers to data samples
- **Reinforcement** – Environment teaches with rewards (hints)

ML Extramodalities

- **Un/Self-supervised** – No teacher, no answers, just data
- **Supervised** – Teacher has right answers to data samples
- **Reinforcement** – Environment teaches with rewards (hints)
- **Transfer** – Use previous learning on a new problem
- **Adversarial** – Teacher/data can't be trusted

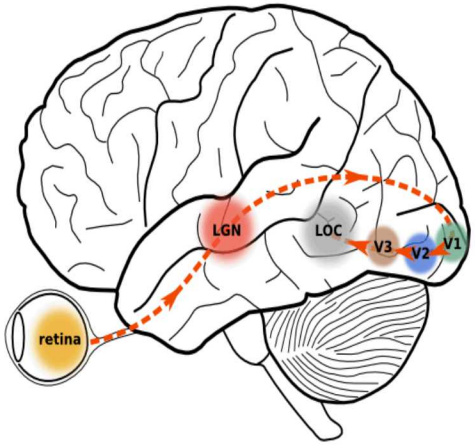


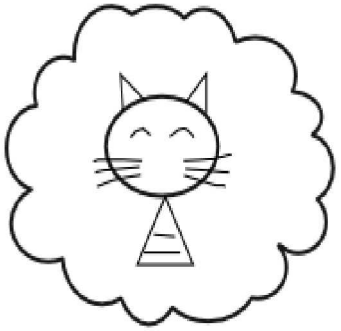

地址：五一路105#

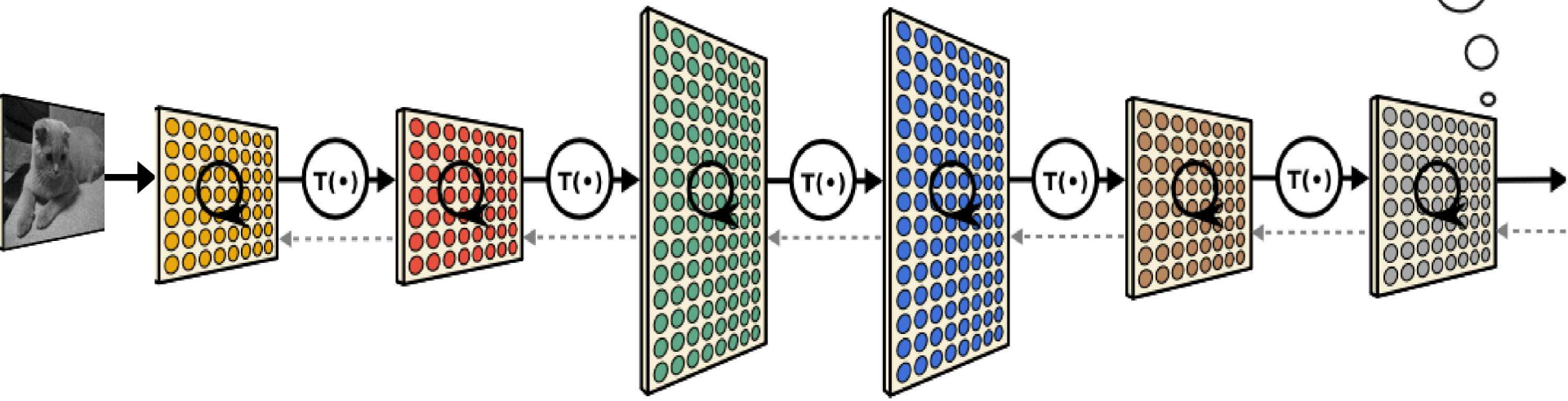

LGN
LOC
V3
V2
V1
retina

Deep Learning: Neural-Inspired AI

- *Data-Driven* Hierarchical Feature Learning

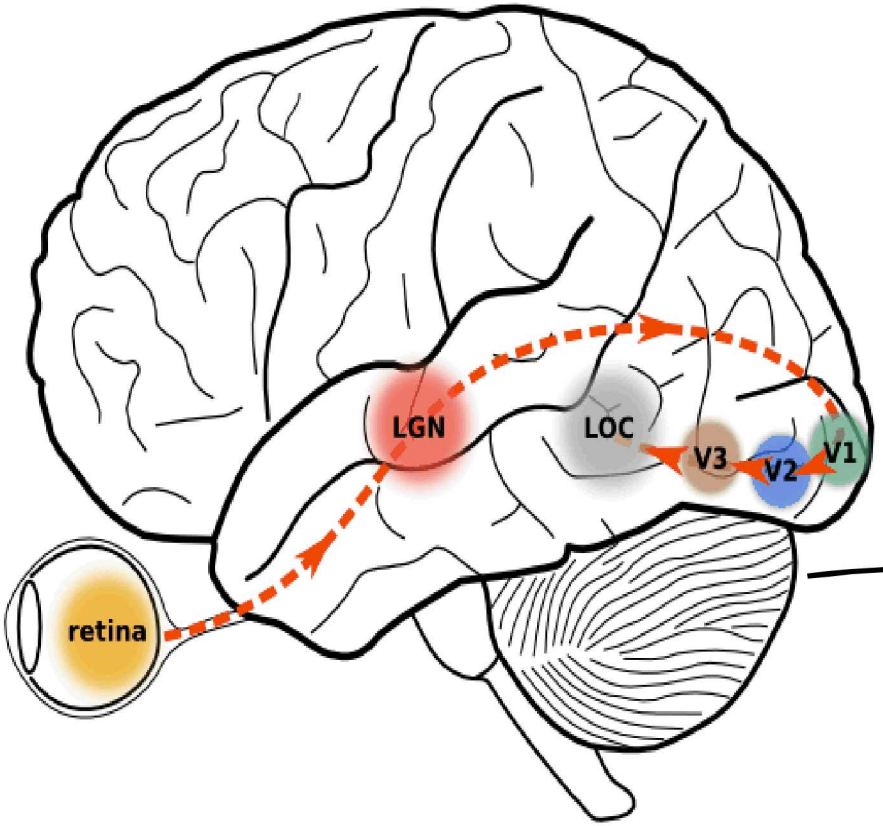




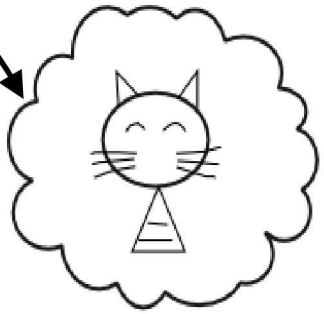


Hierarchical Feature Detection

Deep Learning's Neural Inspiration



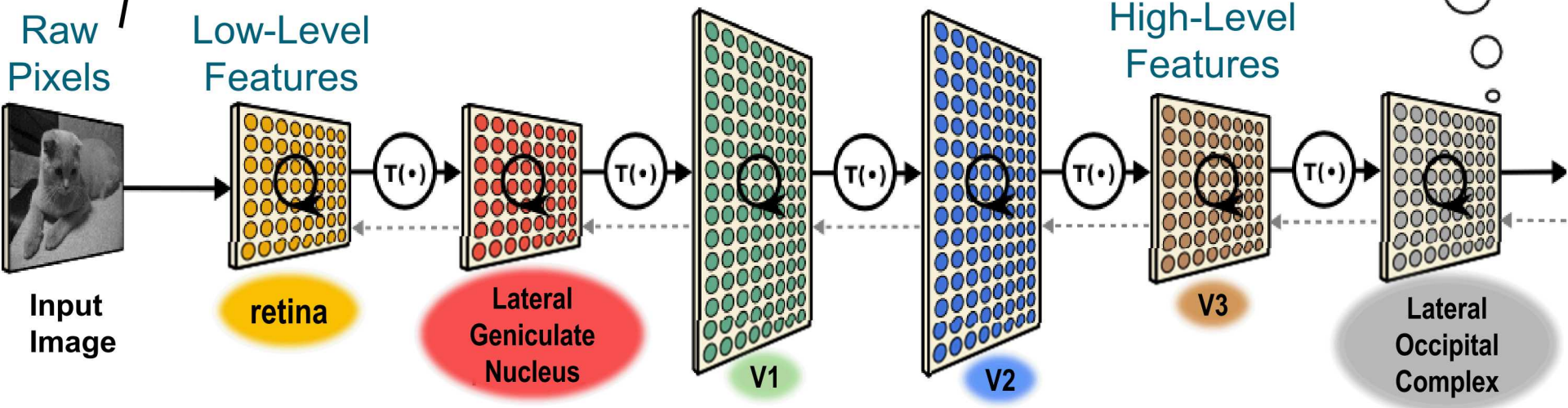
Object Class Label



Raw Pixels

Low-Level Features

High-Level Features



Input Image

retina

Lateral Geniculate Nucleus

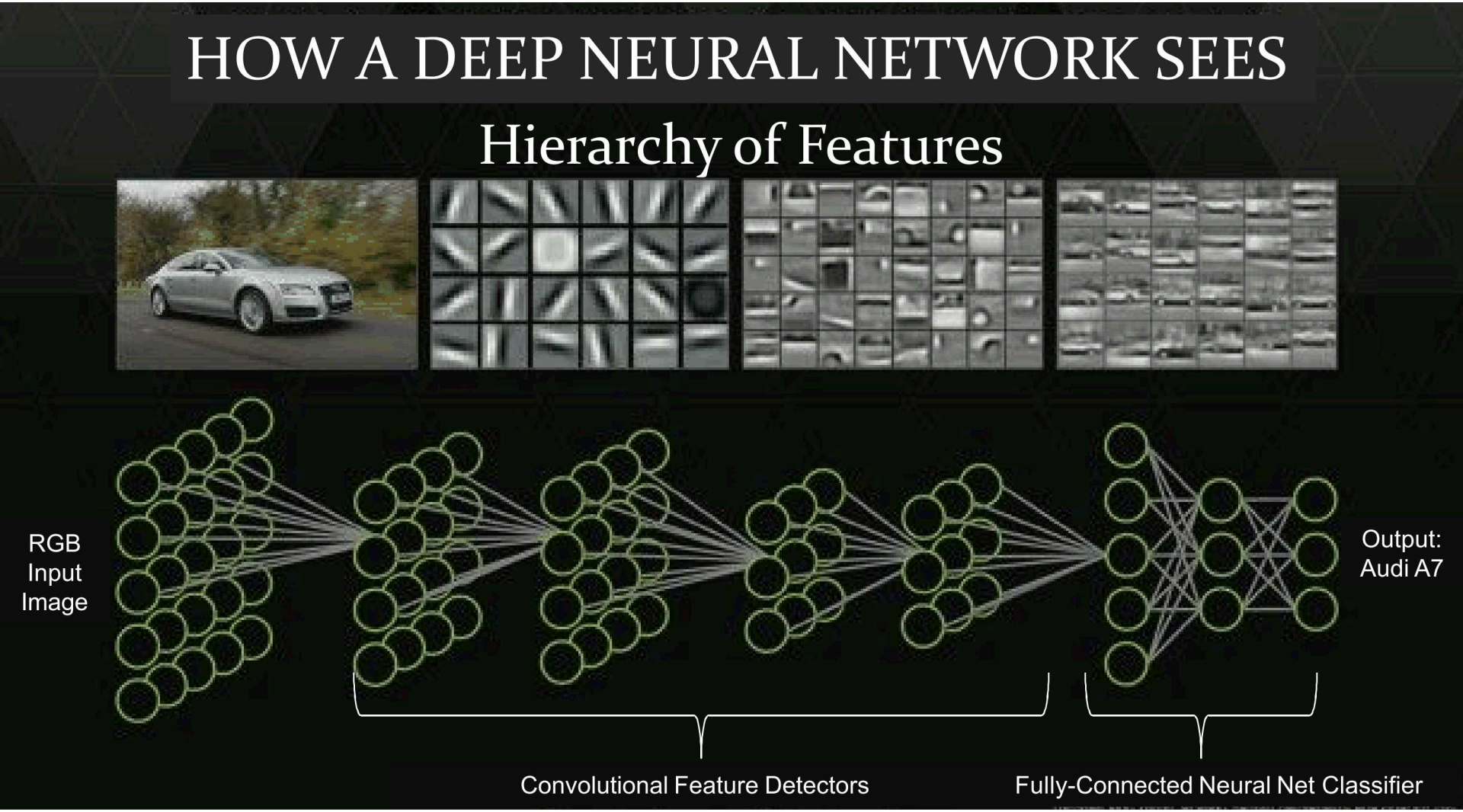
V1

V2

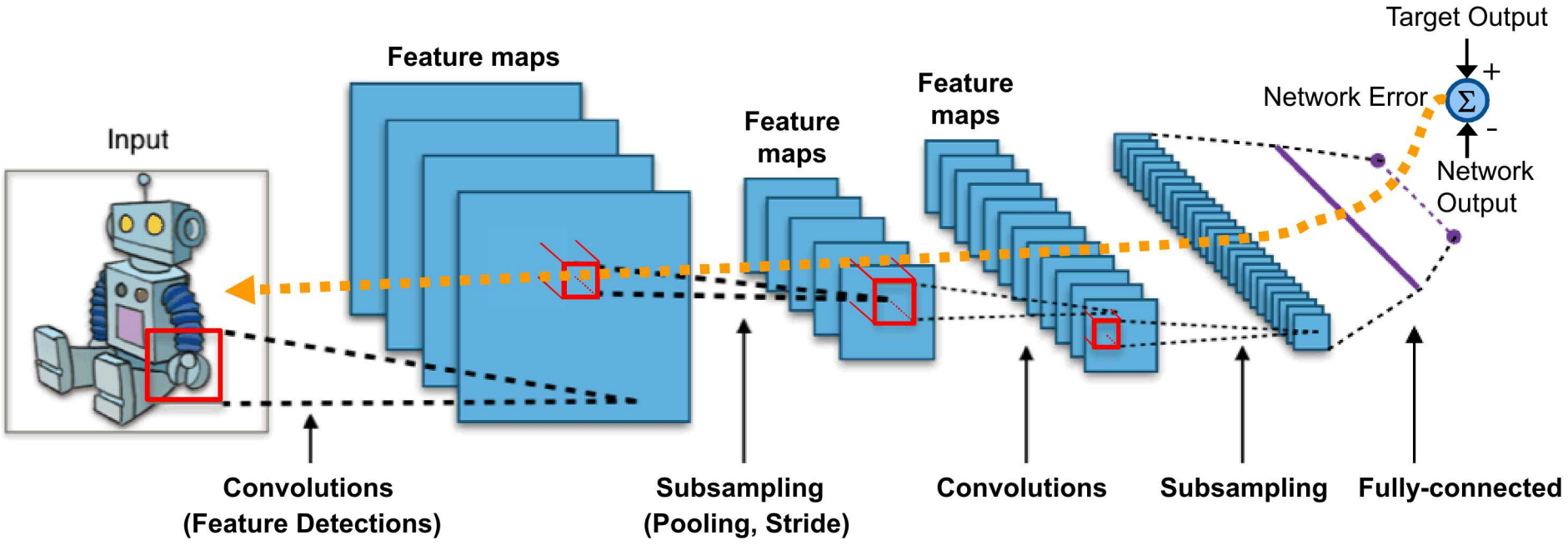
V3

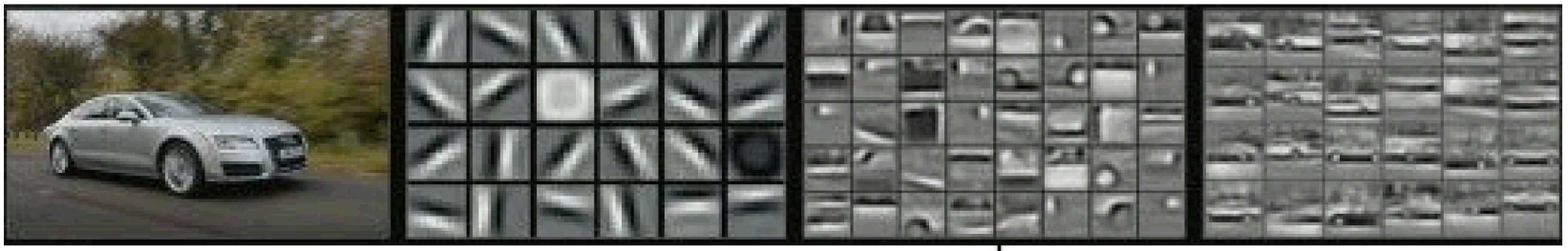
Lateral Occipital Complex

Convolutional Neural Network (CNN)

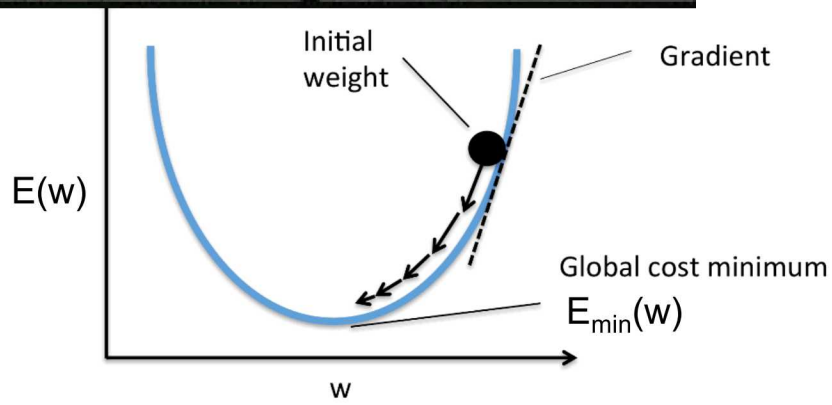


Convolutional Neural Network Training

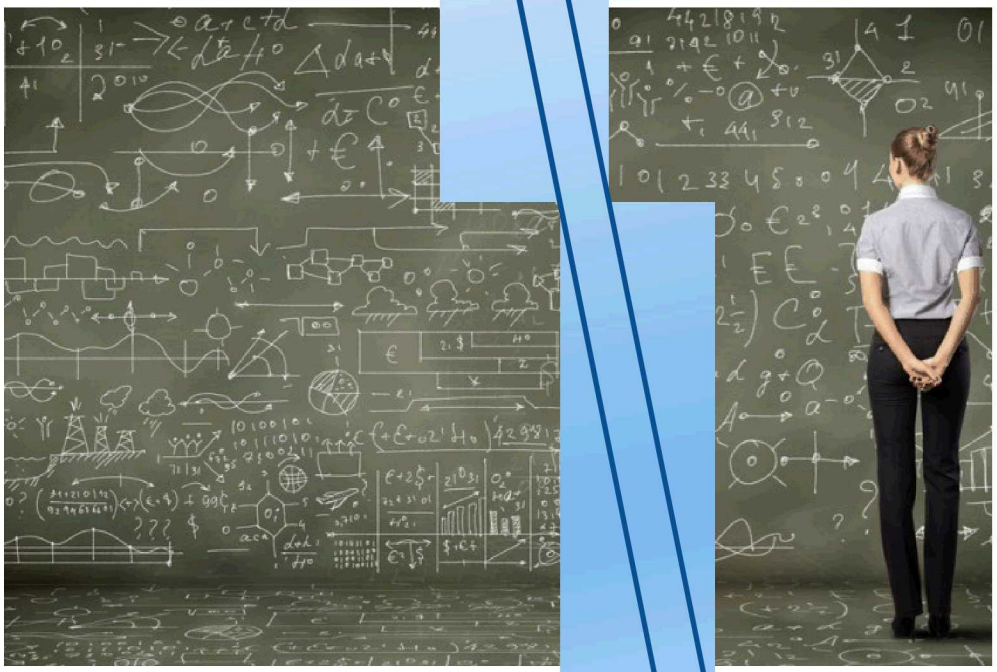




- Convolution filters are the weights in a CNN that can be trained.
- Filter values (weights) are initialized with random values and update via back-propagation of errors.



Deep Learning is a
Human Enginee



- Data collection
- Data pre-processing
- Data labelling
- Data augmentation
- Data for algorithm search
- Data for training
- Data for performance evaluation/interpretation

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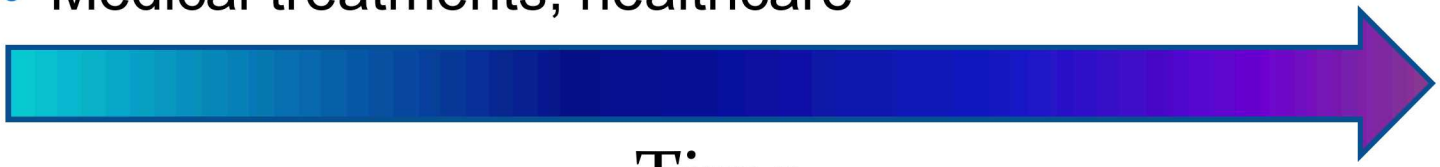
Deep Learning is a Human Engineer

- Data collection
- Data pre-processing
- Data labelling
- Data augmentation
- Data for algorithm search
- Data for training
- Data for performance evaluation/i

Pandemic Prediction

- Impact of a virus is a function of many things, most that change over time.
  - Virus reproductive number, R0
  - Ease/mode of transmission
  - Duration of infection
  - Deadliness (mortality rate)
  - Symptoms
  - Viral load, infectious dose
  - Population density, age, health
  - Social distancing
  - Medical treatments, healthcare



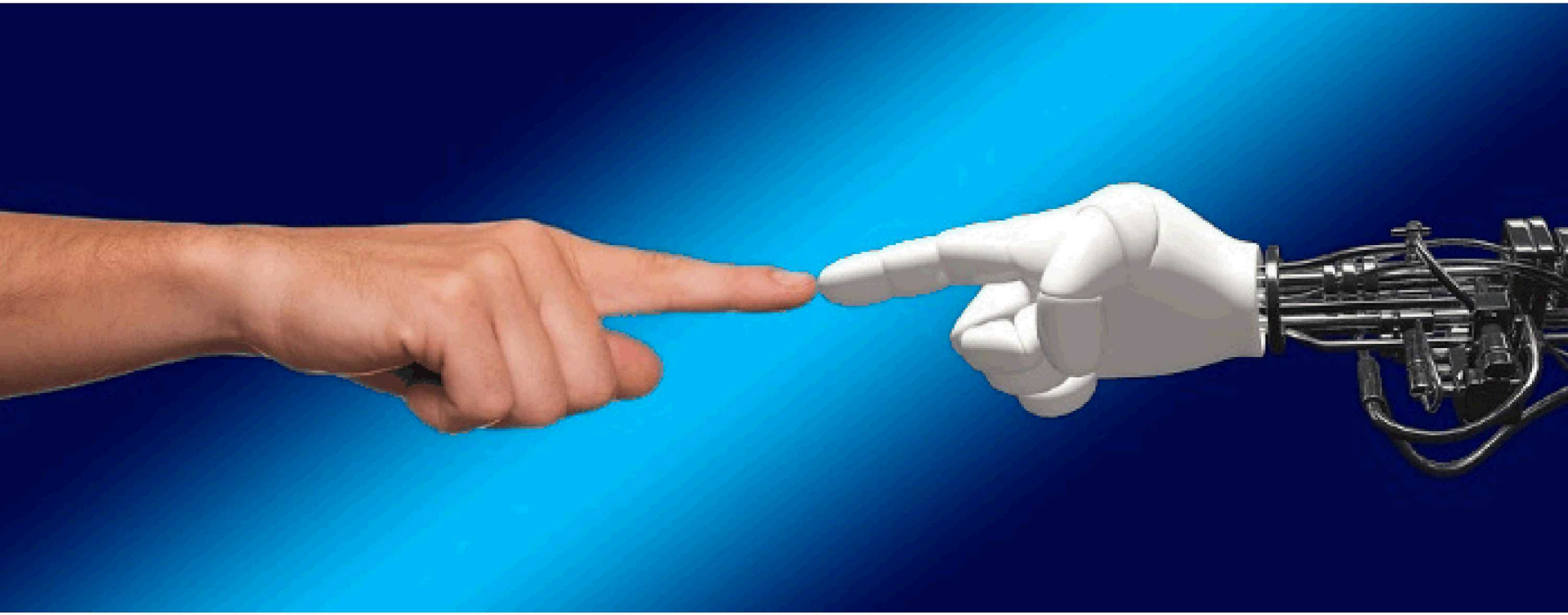
Time

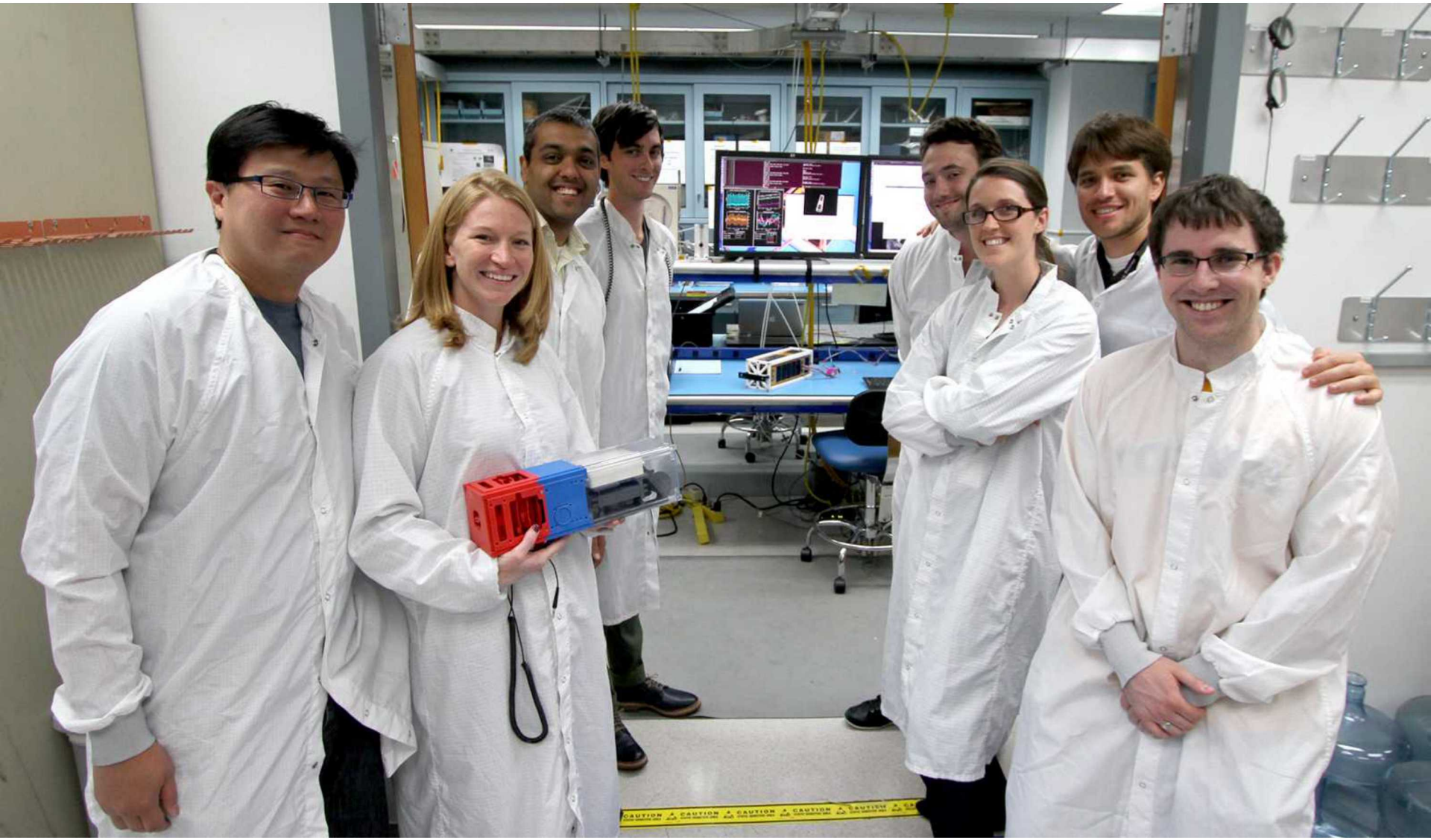
- Easier to use for
  - "What if …" scenarios
  - than for Precise Prediction

Cautionary Quotes

- Big-data boondoggles and brain-inspired chips are just two of the things we're really getting wrong –Michael Jordan
- It would be nice if IBM would tone down the hype and let people know what Watson can actually do and stop making up nonsense about love fading and out thinking cancer. IBM is simply lying now and they need to stop. –Roger Schank
- The Seven Deadly Sins of AI Predictions –Rodney Brooks
  - Any sufficiently advanced technology is indistinguishable from magic.
    - If something is magic, it is hard to know its limitations.
    - Anything one says about it is no longer falsifiable.
  - Today's robots and AI systems are incredibly narrow in what they can do.
    - Human-style generalizations do not apply.
    - Machine learning is very brittle, and it
      - Requires lots of preparation by human researchers or engineers,
      - special-purpose coding, special-purpose sets of training data, and
      - a custom learning structure for each new problem domain.
  - Today's deep-learning success was 30 years in the making.
    - When people hear that a computer can beat the world chess champion (1997) or … best Go players (2016), they tend to think that it is "playing" the game just as a human would.
      - In reality those programs had no idea what a game actually was, or even that they were playing.
- It plays the game for the same reason a calculator adds or a toaster toasts: because it is a machine designed for that purpose –David Gelernter
- It is one thing to say that the brain functions in … like a computer. It is an entirely different thing to say that it is nothing but a computer. Simulation is not duplication. –John Lennox
- AI takes no initiative and is limited by the programmer. –Tim Draelos & Nathan Brannon

AI = Tool in the hands of moral agents




CAUTION
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