Apprentissage Profond et IA

Yoshua Bengio
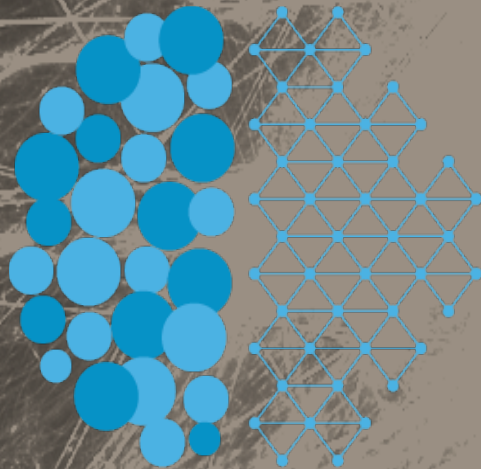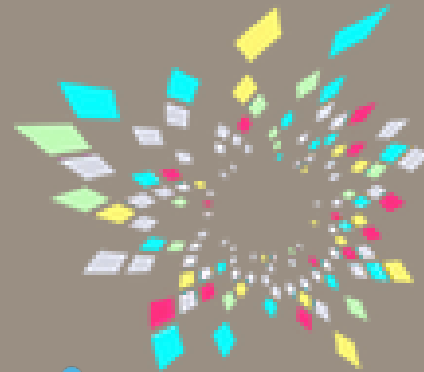
Cars are now driving themselves…

(far from perfectly, yet)
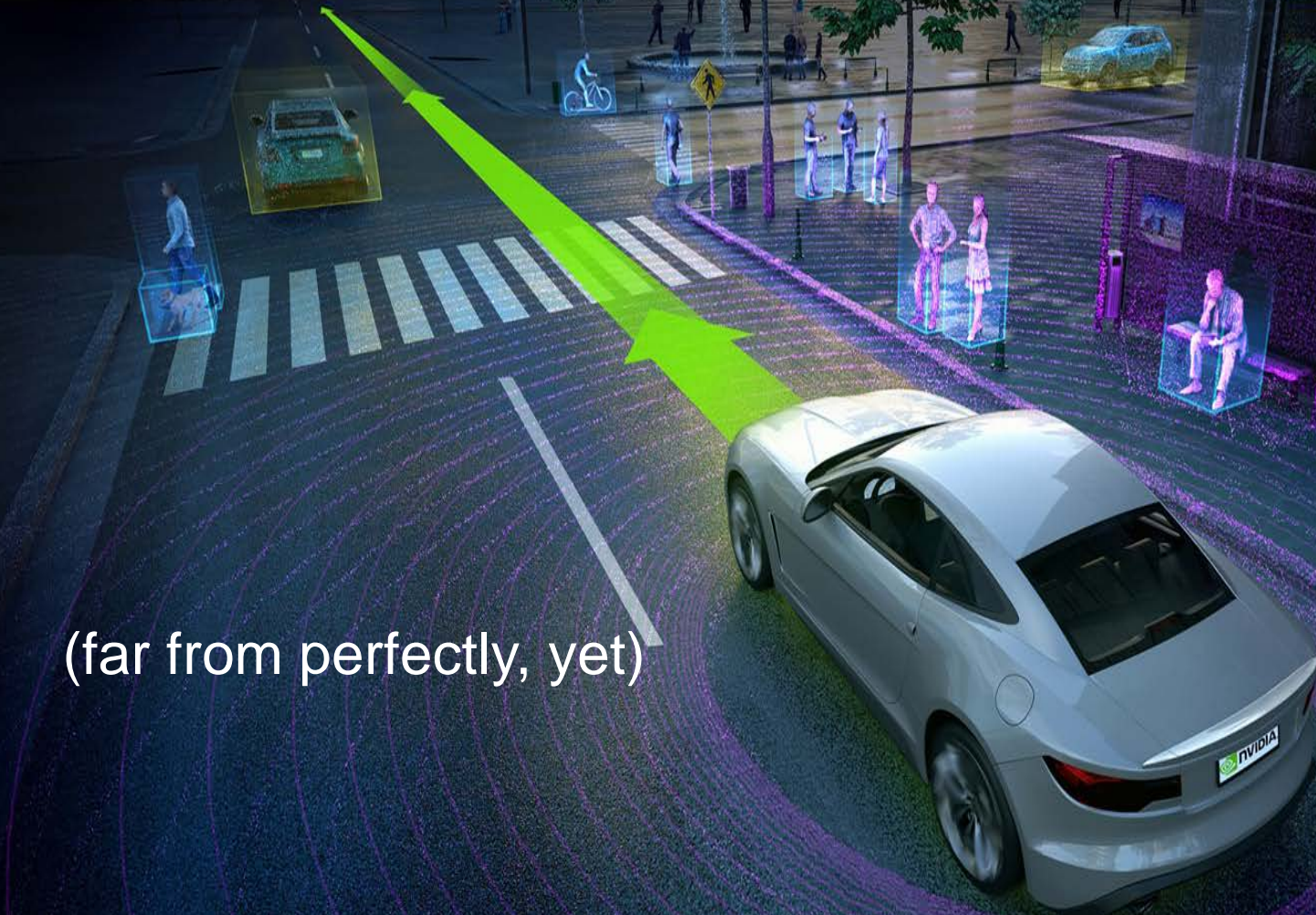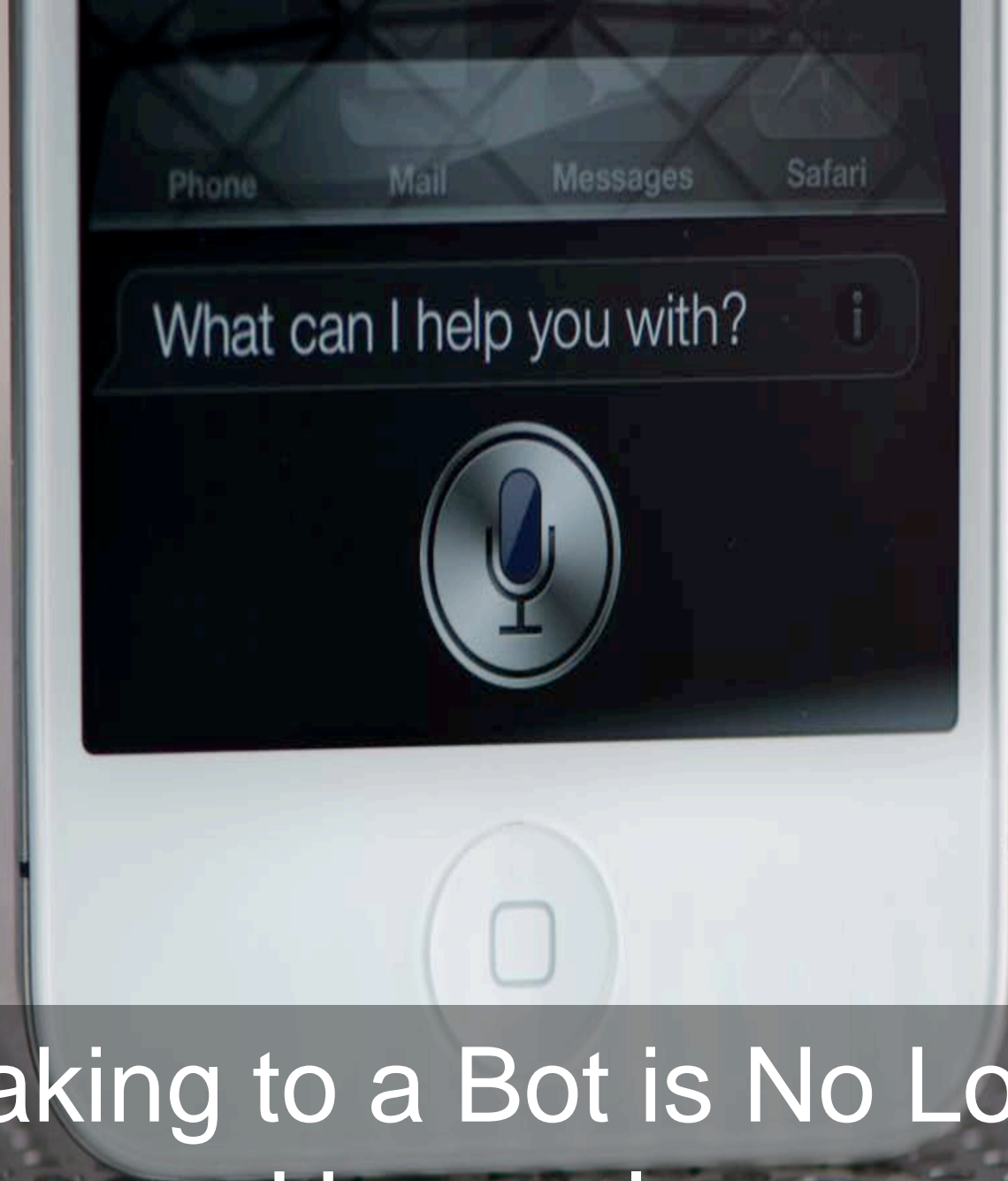
Speaking to a Bot is No Longer Unusual…

# March 2016: World Go Champion Beaten by Machine

AI: The Upcoming Industrial Revolution

First industrial revolution:
- Machines extending humans' **mechanical power**

Upcoming industrial revolution:
- Machines extending humans' **cognitive power**
  - From the digital economy to the AI economy
  - Predicted growth at least 25%/yr
  - All sectors of the economy

A new revolution seems to be in the work after the industrial revolution.
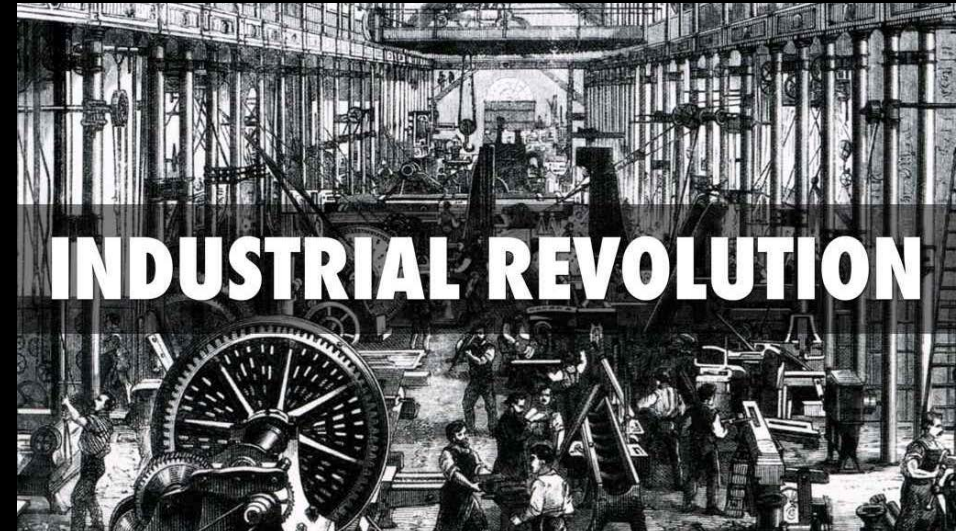
Devices are becoming intelligent.

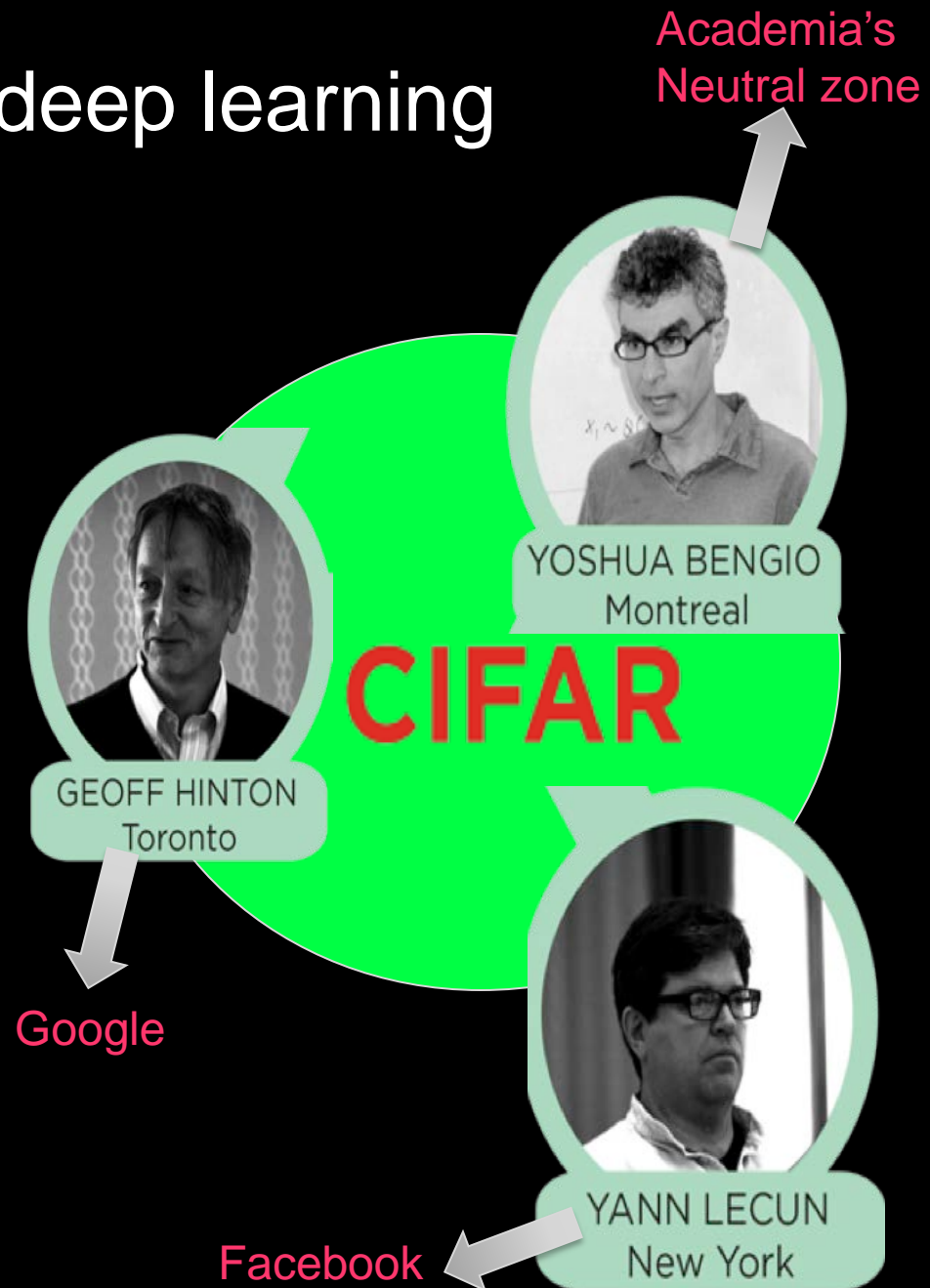And Deep Learning is at the epicenter of this revolution.
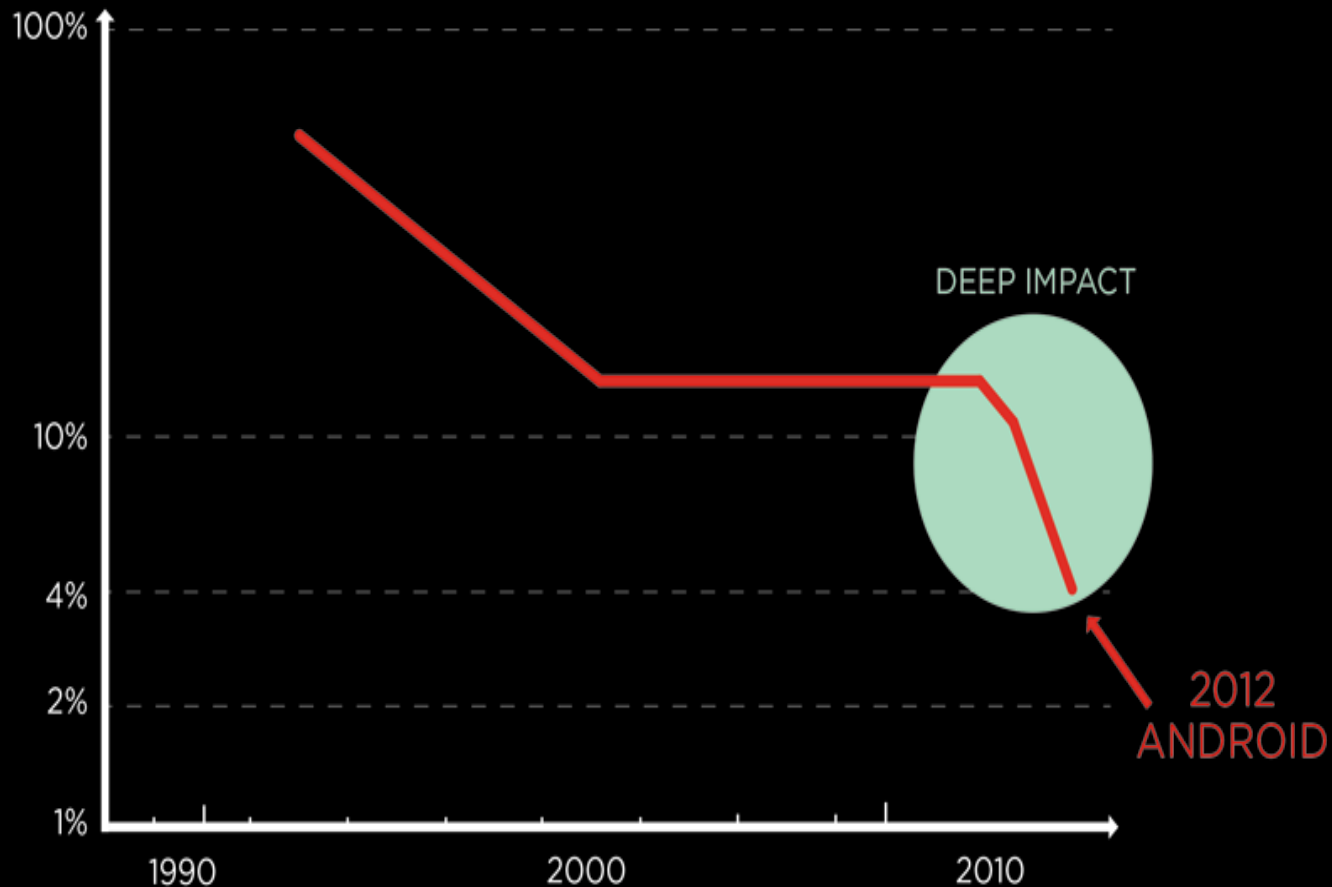
Breakthroughs in deep learning

A Canadian-led trio at CIFAR initiated the deep learning AI revolution

- Fundamental breakthrough in 2006:

first successful recipe for training a deep supervised neural network

- Breakthroughs in applications since then

Academia's Neutral zone

YOSHUA BENGIO
Montreal

GEOFF HINTON
Toronto

CIFAR

Google

YANN LECUN
New York

Facebook

2010-2012: breakthrough in speech recognition

Source: Microsoft

2012-2015: breakthrough in computer vision

- Graphics Processing Units (GPUs) + 10x more data
- 1,000 object categories,
- Facebook: millions of faces
- **2015: *human-level performance***

Person
Dog
Chair

~ level of human accuracy

Use of
Deep Learning
over
Conventional
Computer Vision
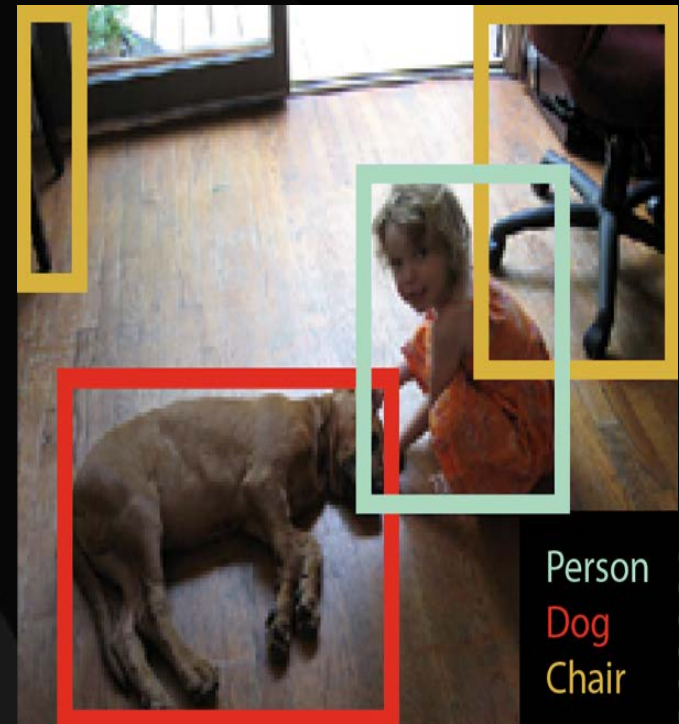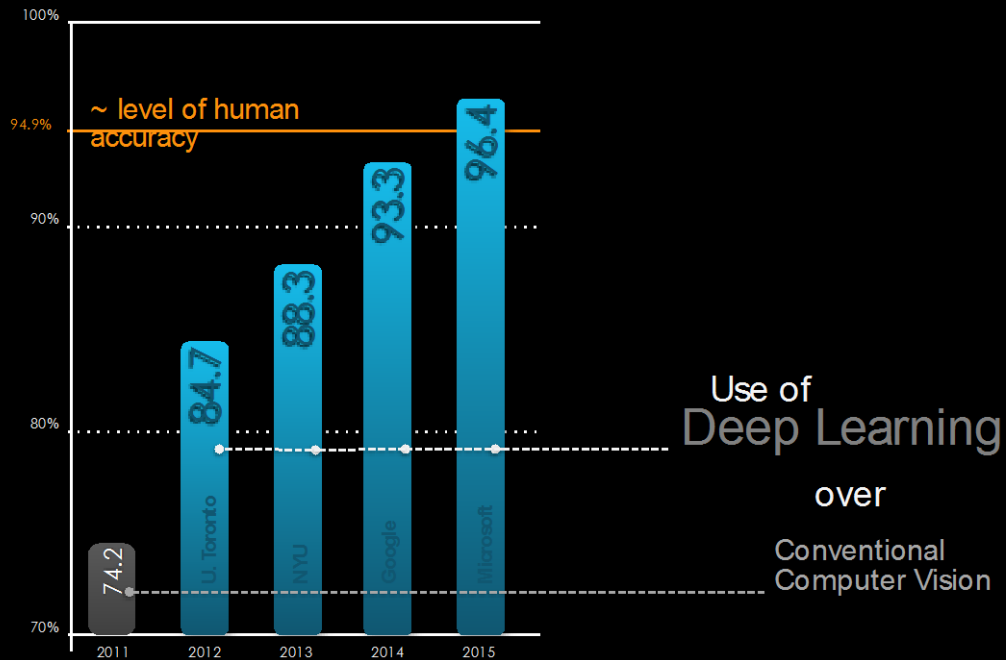
Tens of Billions Invested in DL

Ongoing progress: combining vision and natural language understanding

A woman is throwing a <u>frisbee</u> in a park.

A <u>dog</u> is standing on a hardwood floor

A <u>stop</u> sign is on a road with a mountain in the background

With a lot more data…

visual question answering

Applications en Santé au MILA

- Imagerie médicale, radiologie
  - Imagia (Startup @ Montréal)
  - Collaboration MILA – CHUM, A. Tang
- Cancer
  - Découverte de médicaments, vaccins personalisés
  - Collaboration MILA – IRIC, G. Sauvegeau, C. Perrault
- Cardiologie
  - Collaboration MILA – ICM, J.C. Tardif, M.C. Dubé

MILA

- 100 researchers
  - 7 faculty
  - 7 staff
- Pioneered Deep Learning
- #1 in deep learning publications according to Semantic Scholar
- In DL, ahead of Stanford, Berkeley, NYU, Cambridge, Oxford, CMU
- YB Scientific Director of IVADO, 94 M$ CFREF grant

Questions?