Your Future: Machine Learning

CSC103—Last Lecture

Dominique Thiébaut
dthiebaut@smith.edu
ML Around You

- Reading zip code on envelop sent in mail
- Reading digits on a deposited check
- Database mining: spot malicious bank/credit card operations
- Cars learning their driver's style to perform better
- Recognizing faces in your collection of photos
ML Around You

• Snapchat (face recognition + animation)
• Self-driving cars
• Detecting cancerous tumors in X-Rays
• Designing new technologies

ML Around You

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Evolving

Machine learning: The field of study that gives computers the ability to learn without being explicitly programmed.

—Arthur Samuel 1959

Samuel wrote chess program that played against itself, and over time learned patterns that led to winning.

https://en.wikipedia.org/wiki/Arthur_Samuel
Recent Examples
March 2016, Alpha Go beats Lee Sedol in a five-game match: the first time a computer Go program had beaten a 9-dan professional without handicaps.
Example 2: Sound Recognition

Y. Bengio. Learning Deep Architectures for AI

Example 3: Boston Dynamics

Atlas
Example 4: Boston Dynamics
Example 5: Image Classification

https://www.youtube.com/watch?v=mUtW6CHZx0A

5 min 47 sec
How do Neural Nets work?

3Blue1Brown  https://www.youtube.com/watch?v=aircAruvnKk
Video Games?
Geometry in 3D

1. \[
\begin{bmatrix}
 a & b & c \\
 d & e & f \\
 0 & 0 & 1
\end{bmatrix}
\]
   (affine)

2. \[
\begin{bmatrix}
 a & b & c \\
 d & e & f \\
 0 & h & 1
\end{bmatrix}
\]

3. \[
\begin{bmatrix}
 a & b & c \\
 d & e & f \\
 g & 0 & 1
\end{bmatrix}
\]

4. \[
\begin{bmatrix}
 a & b & c \\
 d & e & f \\
 g & h & 1
\end{bmatrix}
\]
"Hockey Stick" Curve

What we can do

2017
"Hockey Stick" Curve

What we can do

2017
"Hockey Stick" Curve

What we can do
THE KURZWEIL CURVE

Moore’s Law is just the beginning: The power of technology will keep growing exponentially, says Kurzweil. By 2050, you’ll be able to buy a device with the computational capacity of all mankind for the price of a nice refrigerator today.

Computer performance
Plotted by number of calculations per second per $1,000

Years by which, according to Kurzweil, $1,000 of computation will equal (or has already equaled) the intelligence of... 

- ... one human brain
- ... one mouse brain
- ... one insect brain
- ... all human brains

Kurzweil's projected trend line

SOURCE: DATA FROM RAY KURZWEIL

https://kraxinlogic.com/2012/06/02/book-review-the-age-of-spiritual-machines-ray-kurzweil/
“Artificial intelligence is the future, not only for Russian, but for all of humankind. It comes with colossal opportunities, but also threats that are difficult to predict. Whoever becomes the leader in this sphere will become the ruler of the world.”

—Vladimir Putin

Forbes Tech, 12 AI quotes everyone should read, Sep 22, 2017
Want to play with Neural Nets? Go to the Tensorflow Playground!

- [http://playground.tensorflow.org/](http://playground.tensorflow.org/)
- A solution to the tensorflow playground