

Your Use Case is Bad and Dumb: What Machine Learning Is and Isn't

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A Brief and Incomplete Outline

1 What is Machine Learning?

- Preliminaries
- Misconceptions Regarding ML

2 The Machine Learning Zeitgeist

- History
- Future

3 An Excellent Use Case!

- The Use Case that Convinced Me to Study ML

4 Additional Resources

- Math is Easy. Math is Fun.
- Programming Resources

Some Definitions

The Canonical Definition

*We have at our command computers with adequate data-handling ability and with sufficient computational speed to make use of machine-learning techniques, but our knowledge of the basic principles of these techniques is still rudimentary. Lacking such knowledge, it is necessary to specify methods of problem solution in minute and exact detail, a time-consuming and costly procedure. Programming computers to **learn from experience** should eventually eliminate the need for much of this detailed programming effort.*

Some Studies in Machine Learning Using the Game of Checkers,
Arthur Samuel, 1959

Some Definitions

A Pithier Definition

“Math at scale.” - Guy Royse, 2017

Jargon!

Not even close to all of it- I deliberately left out the math words.

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- Deep Learning - Business words for “Neural Networks.”

Jargon!

Types of Machine Learning Problems

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 - Dimensionality Reduction - Figuring out which features are not useful.

What Machine Learning Isn't

These are opinions.¹

- Racist - it merely exposes our own biases

¹Please wait until after the talk to tell me that they are dumb and bad.

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- A panacea - it can't solve everything

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A Bad and Dumb Article Title

AI JUST LEARNED HOW TO BOOST THE BRAIN'S
MEMORY², Wired, Feb. 6th, 2018

- Used electrodes implanted in the brains of epilepsy patients to monitor brain activity

This is just one article. There

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- The memory boost came from researchers inducing the memory state by stimulating certain electrodes

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An Incomplete Timeline Pt. 1

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- 1975 - Applications of artificial intelligence for chemical inference. 22. Automatic rule formation in mass spectrometry by means of the meta-DENDRAL program by Buchanan et. al. is published

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- 2016 - AlphaGo beats Lee Sedol, the best Go player in the world, in a 5 game match.

The Knuth Video

Shout out to my Alma Mater!

The Electronic Coach

Where is Machine Learning Going?

Joestradamus.

- Voice recognition and Natural Language Processing

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- Industrial Internet of Things

The Story of Overmind

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- Overmind was UC Berkeley's entry in the 2010 Competition

The Story of Overmind

Defining the Problem Space

Three Main Problems in StarCraft:

- Macromanagement - acquire and manage resources

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Defining the Problem Space

Three Main Problems in StarCraft:

- Macromanagement - acquire and manage resources
- Micromanagement - control ur mans, kill their d00dz
- Managing information - scout the enemy and adjust strategy accordingly

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Macromanagement

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- They tried this, it failed due to unorthodox tactics used by humans.
- Rather than hard coding a macro strategy, they used a build planner - ML!

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Micromanagement

- Building a control unit for a unit is hard, so they focused on one unit

Video: Mutalisks learning to fight High Templars

Video: Hit and Run Emergent Behavior

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- They picked Mutalisks because they are efficient, highly mobile, and can attack air and ground. Hard to control for humans.

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- How do you determine the parameters for attractive and repulsive forces? ML!

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Managing Information

- Scout the early game with Overlords

Video: Building Defenses in Reaction to New Information

Video: Overlords Detecting Cloaked Units

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- Build creep colonies- change to anti-air or anti-ground defense
- It takes time to tech to Mutalisks, zerglings are built if a rush is expected
- Scouting the enemy position also allows for “threat aware path planning” - shortest safest path - ML!

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The Story of Overmind

Epilogue

They won! Read the whole write up here.

Math is Easy. Math is Fun.

You Will Probably Need to Learn Math³

Books

- *The Elements of Statistical Learning* by Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie - TOTALLY LEGAL PDF

³You should anyway. It's useful.

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Machine Learning Packages

Python

- Scikit Learn - There is no reason not to use this. It's great.

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- NumPy - not ML specifically, more numerical linear algebra.

Machine Learning Packages

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- randomForest - A package written by the researchers who invented Random Forests

Machine Learning Packages

Java

■ WEKA

Machine Learning Packages

Java

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- ELKI

Machine Learning Packages

C++

- MLpack - cutting edge algorithms, more technical in nature

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- Armadillo - numerical linear algebra library that mimics MATLAB syntax

Machine Learning APIs

- Data Scientist-centric

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 - AzureML
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- Developer-centric
 - Nexosis API - easiest to use, made in Columbus.

Concluding Remarks

Don't panic.