IT3011
Machine Learning & Applications

Overview

Stefan Winkler
<dprsw@nus.edu.sg>

NUS National University of Singapore

Credits: Min-Yen Kan

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Agenda

- Motivation
- Course structure, schedule, assessment, rules, etc.
- Machine Learning & applications

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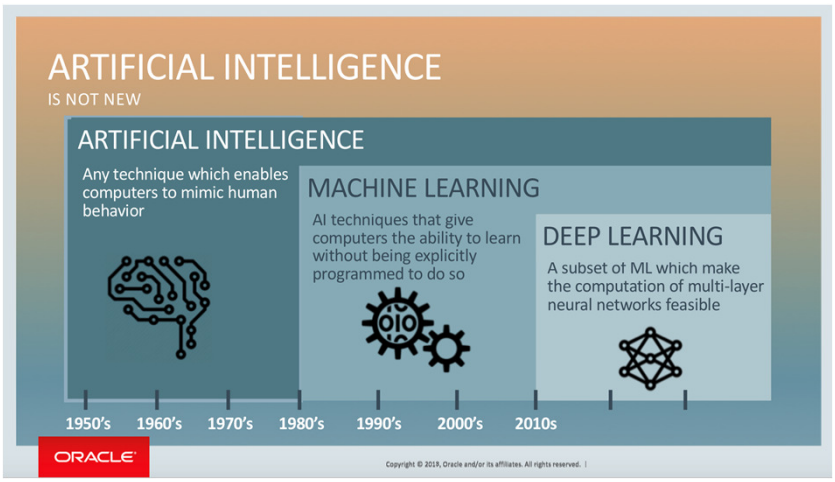
What is Machine Learning (ML)?



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Why should you care about Machine Learning?

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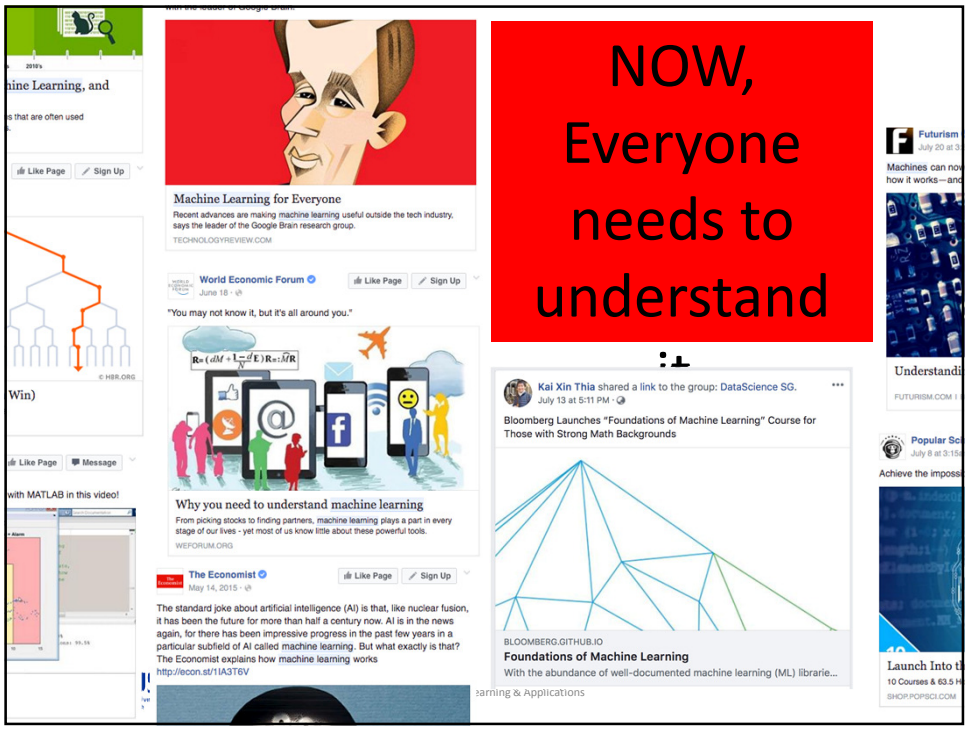
NOW, Everyone needs to understand
Machine Learning for Everyone
Recent advances are making machine learning useful outside the tech industry, says the leader of the Google Brain research group.
TECHNOLOGYREVIEW.COM
World Economic Forum
June 18
"You may not know it, but it's all around you."
Why you need to understand machine learning
From picking stocks to finding partners, machine learning plays a part in every stage of our lives - yet most of us know little about these powerful tools.
WEFORUM.ORG
The Economist
May 14, 2015
The standard joke about artificial intelligence (AI) is that, like nuclear fusion, it has been the future for more than half a century now. AI is in the news again, for there has been impressive progress in the past few years in a particular subfield of AI called machine learning. But what exactly is that? The Economist explains how machine learning works
http://econ.st/1IA3T6V
Kai Xin Thia shared a link to the group: DataScience SG.
July 13 at 5:11 PM
Bloomberg Launches "Foundations of Machine Learning" Course for Those with Strong Math Backgrounds
BLOOMBERG.GITHUB.IO
Foundations of Machine Learning
With the abundance of well-documented machine learning (ML) librarie...
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Win)
with MATLAB in this video!

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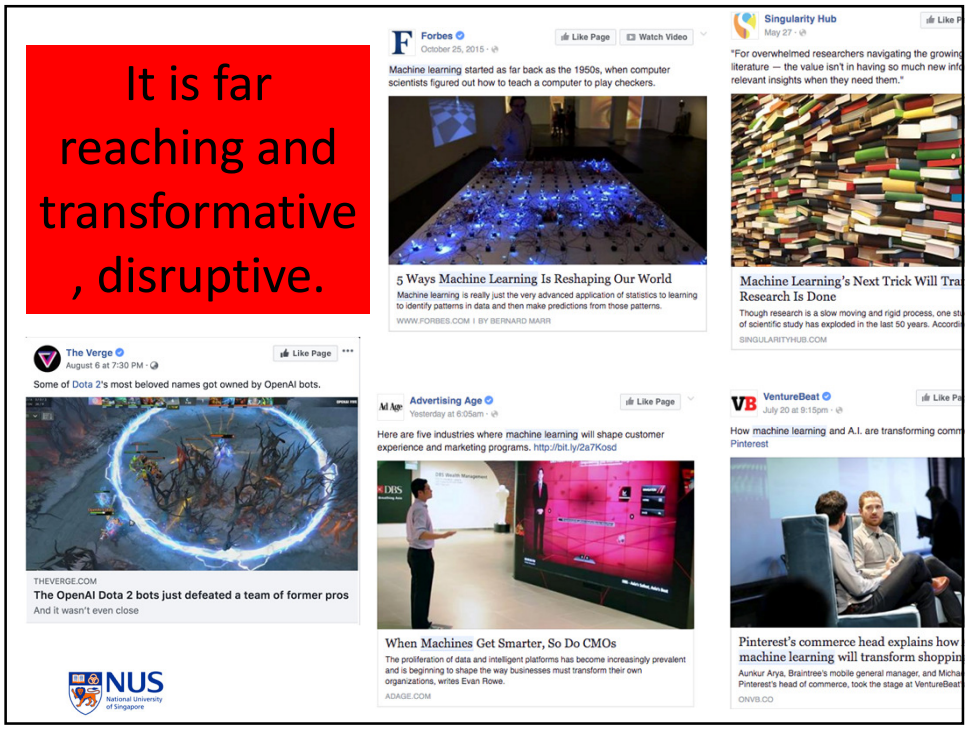
It is far reaching and transformative, disruptive.
Forbes
October 25, 2015
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Watch Video
Machine learning started as far back as the 1950s, when computer scientists figured out how to teach a computer to play checkers.
5 Ways Machine Learning Is Reshaping Our World
Machine learning is really just the very advanced application of statistics to learning to identify patterns in data and then make predictions from those patterns.
WWW.FORBES.COM | BY BERNARD MARR
Singularity Hub
May 27
"For overwhelmed researchers navigating the growing literature — the value isn't in having so much new info relevant insights when they need them."
Machine Learning's Next Trick Will Tra
Research Is Done
Though research is a slow moving and rigid process, one st of scientific study has exploded in the last 50 years. Accordi
SINGULARITYHUB.COM
The Verge
August 6 at 7:30 PM
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Some of Dota 2's most beloved names got owned by OpenAI bots.
THEVERGE.COM
The OpenAI Dota 2 bots just defeated a team of former pros
And it wasn't even close
Advertising Age
Yesterday at 6:05am
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Here are five industries where machine learning will shape customer experience and marketing programs. http://bit.ly/2a7Kosd
When Machines Get Smarter, So Do CMOs
The proliferation of data and intelligent platforms has become increasingly prevalent and is beginning to shape the way businesses must transform their own organizations, writes Evan Rowe.
ADAGE.COM
VentureBeat
July 20 at 9:15pm
How machine learning and A.I. are transforming comm
Pinterest
Pinterest's commerce head explains how machine learning will transform shoppin
Aunkur Arya, Braintree's mobile general manager, and Micha Pinterest's head of commerce, took the stage at VentureBeat
ONVB.CO
NUS
National University of Singapore

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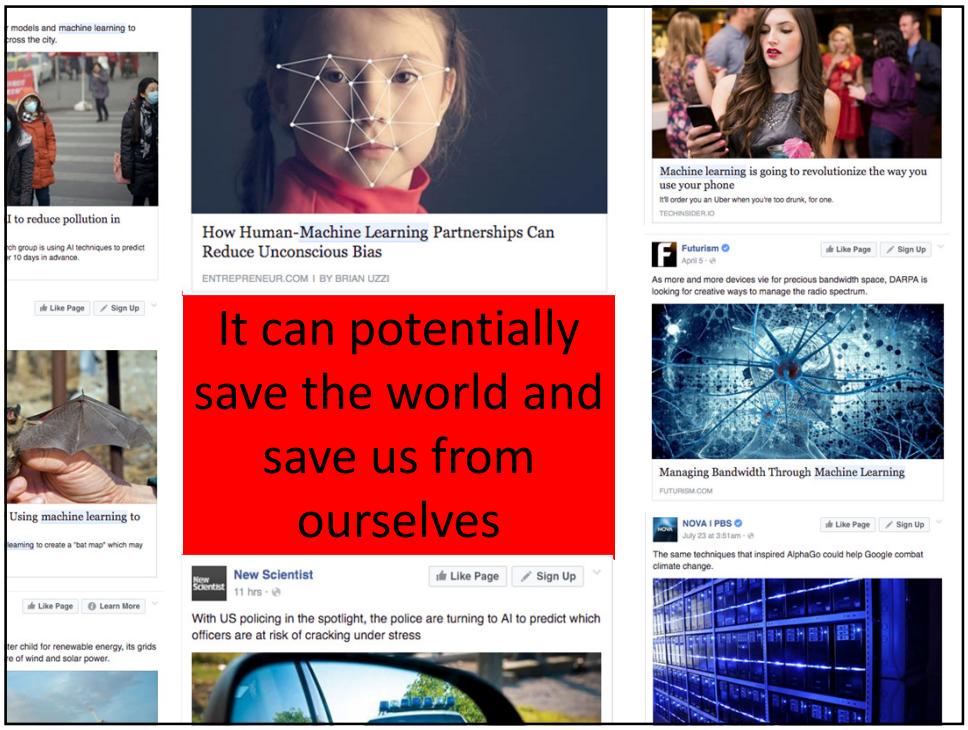

It can potentially save the world and save us from ourselves

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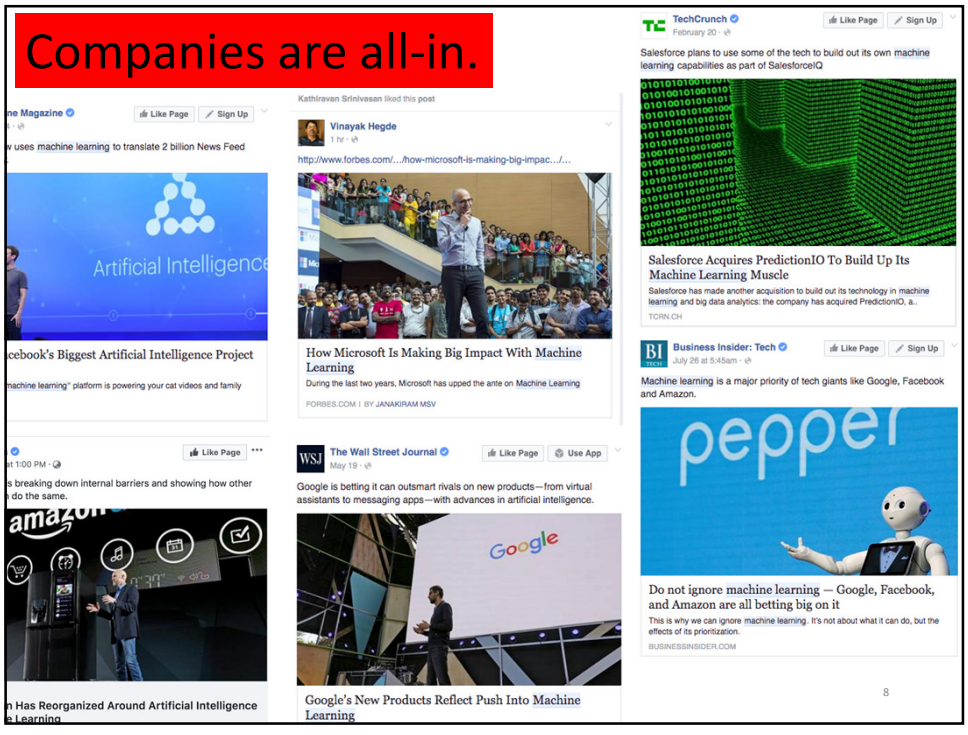

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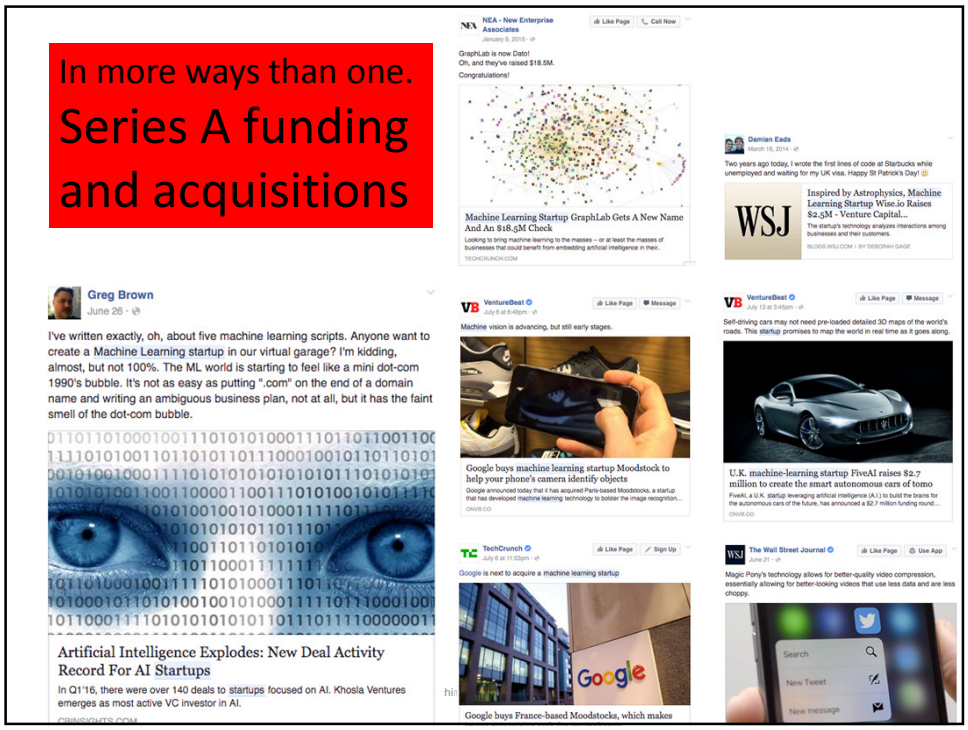
In more ways than one.
Series A funding and acquisitions
NEA - New Enterprise Associates
GraphLab is now Dato!
Oh, and they've raised $18.5M.
Congratulations!
Machine Learning Startup GraphLab Gets A New Name And An $18.5M Check
Damian Eads
Two years ago today, I wrote the first lines of code at Starbucks while unemployed and waiting for my UK visa. Happy St Patrick's Day!
WSJ
Inspired by Astrophysics, Machine Learning Startup Wise.io Raises $2.5M - Venture Capital...
Greg Brown
June 26 ·
I've written exactly, oh, about five machine learning scripts. Anyone want to create a Machine Learning startup in our virtual garage? I'm kidding, almost, but not 100%. The ML world is starting to feel like a mini dot-com 1990's bubble. It's not as easy as putting ".com" on the end of a domain name and writing an ambiguous business plan, not at all, but it has the faint smell of the dot-com bubble.
Artificial Intelligence Explodes: New Deal Activity Record For AI Startups
In Q1'16, there were over 140 deals to startups focused on AI. Khosla Ventures emerges as most active VC investor in AI.
VentureBeat
Machine vision is advancing, but still early stages.
Google buys machine learning startup Moodstock to help your phone's camera identify objects
VentureBeat
Self-driving cars may not need pre-loaded detailed 3D maps of the world's roads. This startup promises to map the world in real time as it goes along.
U.K. machine-learning startup FiveAI raises $2.7 million to create the smart autonomous cars of tomo
TechCrunch
Google is next to acquire a machine learning startup
Google
Google buys France-based Moodstocks, which makes
The Wall Street Journal
Magic Pony's technology allows for better-quality video compression, essentially allowing for better-looking videos that use less data and are less choppy.
Search
New Tweet
New message

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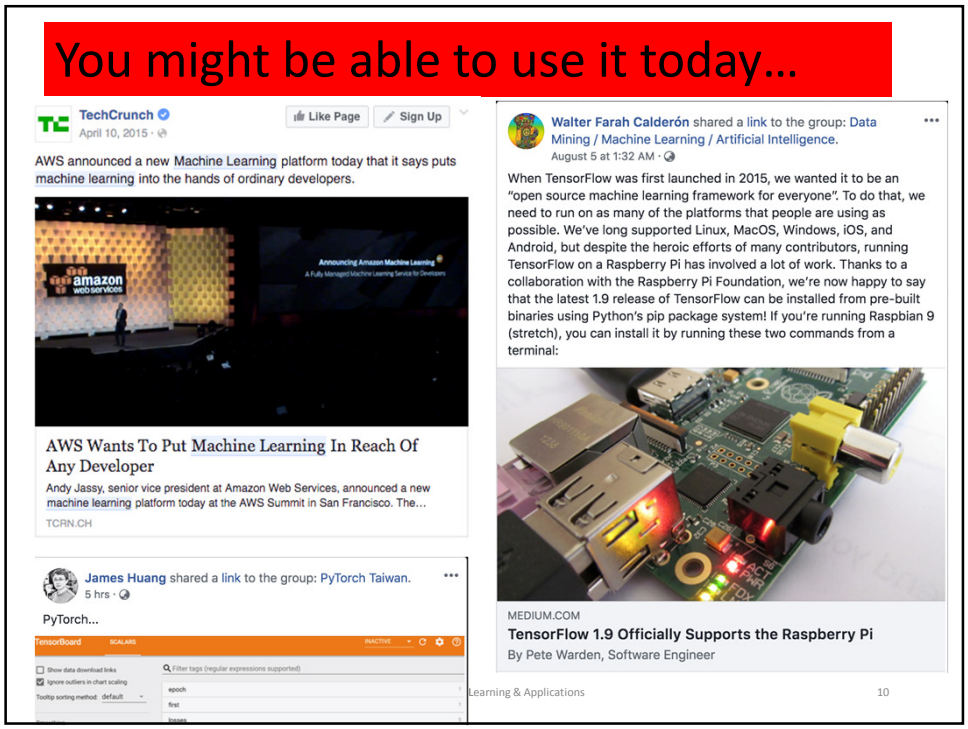
You might be able to use it today…
TechCrunch
April 10, 2015 ·
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AWS announced a new Machine Learning platform today that it says puts machine learning into the hands of ordinary developers.
Announcing Amazon Machine Learning
A Fully Managed Machine Learning Service for Developers
AWS Wants To Put Machine Learning In Reach Of Any Developer
Andy Jassy, senior vice president at Amazon Web Services, announced a new machine learning platform today at the AWS Summit in San Francisco. The…
TCRN.CH
Walter Farah Calderón shared a link to the group: Data Mining / Machine Learning / Artificial Intelligence.
August 5 at 1:32 AM ·
When TensorFlow was first launched in 2015, we wanted it to be an "open source machine learning framework for everyone". To do that, we need to run on as many of the platforms that people are using as possible. We've long supported Linux, MacOS, Windows, iOS, and Android, but despite the heroic efforts of many contributors, running TensorFlow on a Raspberry Pi has involved a lot of work. Thanks to a collaboration with the Raspberry Pi Foundation, we're now happy to say that the latest 1.9 release of TensorFlow can be installed from pre-built binaries using Python's pip package system! If you're running Raspbian 9 (stretch), you can install it by running these two commands from a terminal:
MEDIUM.COM
TensorFlow 1.9 Officially Supports the Raspberry Pi
By Pete Warden, Software Engineer
James Huang shared a link to the group: PyTorch Taiwan.
5 hrs ·
PyTorch...
TensorBoard
SCALARS
Learning & Applications
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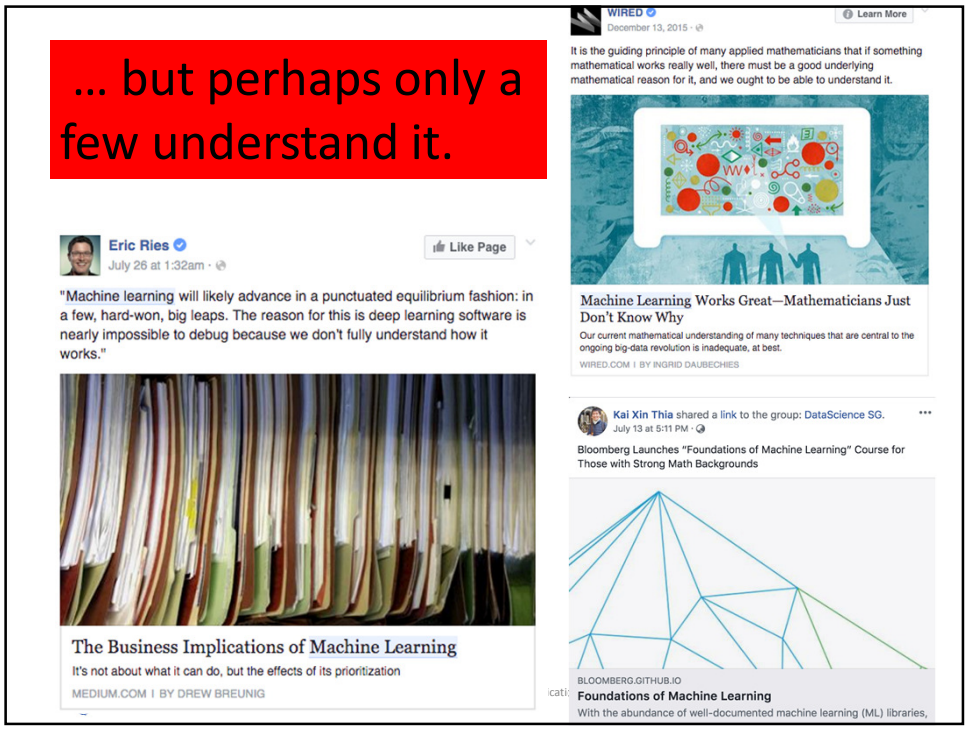

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Barriers to success in this course

- Math
  - Probability and Statistics
  - Linear Algebra
- Programming

Will need your support and understanding as this is a new module being introduced this semester.

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Prerequisites

- CS1010 Programming Methodology or equivalent
- ESP1107 Computing and Statistics or
  ESP2107 Numerical Methods and Statistics or
  ST1232 Statistics for Life Science or
  ST2131 Probability or
  ST2132 Mathematical Statistics or
  ST2334 Probability and Statistics
- MA1102R Calculus or
  MA1505 Mathematics 1 or
  (MA1511 Engineering Calculus and
  MA1512 Differential Equations for Engineering) or
  MA1521 Calculus for Computing
- MA1101R Linear Algebra 1 or
  MA1311 Matrix Algebra or
  MA1506 Mathematics 2 or
  MA1508E Linear Algebra for Engineering

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Learning Outcomes

- Understand the basic concepts of machine learning
- Formulate a given computational problem as a machine learning problem.
- Identify an appropriate machine learning algorithm for a given problem.
- Apply machine learning tools/libraries to solve a given problem.
- Evaluate the performance of a machine learning solution.
- Be aware of pitfalls, limitations, and ethical issues related to using machine learning for solving real-world problems.

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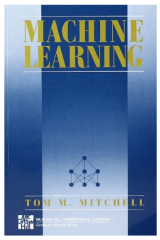
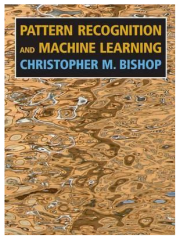
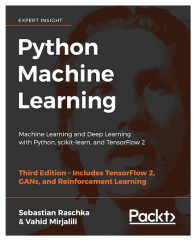
Support Material





- Tom Mitchell:
  Machine Learning.
  McGraw Hill, 1997.
  - http://www.cs.cmu.edu/~tom/mlbook.html
- Christopher M. Bishop:
  Pattern Recognition and Machine Learning.
  Springer, 2006.
- Sebastian Raschka, Vahid Mirjalili:
  Python Machine Learning.
  3rd edition, Packt Publishing, 2019.
  - https://github.com/rasbt/python-machine-learning-book-3rd-edition



- Online resources

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Structure

- Lecture: Friday 10-12pm (LT15)
- Tutorial: Friday 12-1pm, 1-2pm (COM1-02-07), week 4 onwards
- Group project

- TAs:
  - Poh Jie <pohjie@u.nus.edu>
  - Ronak Lakhotia <ronak.lakhotia@u.nus.edu>

- LumiNUS – info, updates, forums, quizzes

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Schedule

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Programming

- We'll be using the Python programming language (version 3) for most of our class work.
- Python is an easy language to transition to for most programmers and it has numerous libraries that work well with machine learning as well as data analysis.

- We'll also be using Jupyter / iPython Notebooks to show and simulate experiments.

- Google has a very nice, convenient Python-in-a-browser experience, Colab, which we'll take advantage of.

- https://www.comp.nus.edu.sg/~winkler/IT3011/01a.colab

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Projects

- Objectives:
  - Applying knowledge to real-world problems
  - Collaborating, communicating
- Form a team (4-5 people) – 31 Jan
- Submit a proposal – 16 Feb

- Templates and guidelines will be available on lumiNUS

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Project Proposal

- Motivation
  - Why is the project interesting/important?
- Problem statement
  - Key questions you want to answer
  - Minimum target: 1-2 questions
  - Stretch target: 1-2 additional questions
- Approach
  - High-level description (ok to change approach later)
  - Deep learning caveats (course, compute, data)
- Evaluation
  - Satisfactory outcome (within X% of project)
  - Excellent outcome (focus on post-ML analyses)
- Resources
  - Compute, data, scale
- Schedule & Roles
  - Budget for periods where you have less time

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Project Ideas & Datasets

- Other class projects:
  - http://cs229.stanford.edu/projects.html
  - https://isteps.comp.nus.edu.sg/event/15th-steps/module/CS3244
- Datasets:
  - https://www.kaggle.com/

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Assessments & Grading

Type	Date	Percentage	Comments
Quizzes		10%	Online
Midterm	5-Mar	20%	Closed book
Project		30%	
Final exam	27-Apr	40%	Open book

- Late submissions policy:
  - 50% reduction in grade
  - No marks after 5 days

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Academic Honesty

- Freedom of information rule
- Pokemon Go rule
- No sponge rule

- Penalties for cheating:
  - No marks for assignment
  - Reduction of final grade by 1

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Freedom of information rule

- Collaboration is acceptable and encouraged.
- To assure that all collaboration is on the level, you must always fill in the name(s) of your collaborators on your assignment.
- You will be assessed for the parts for which you claim is your own contribution.
- Failure to acknowledge your collaborators is a form of plagiarism.

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Pokemon Go rule

- You are free to meet with fellow students(s) and discuss assignments with them.
- Writing on a board or shared piece of paper is acceptable during the meeting; however, you may not take any written (electronic or otherwise) record away from the meeting.
- After the meeting, do something else for at least a half-hour (Pokémon Go, or doing an assignment for a different class), before working on the assignment.
  - This will assure that you are able to reconstruct what you learned from the meeting, by yourself, using your own brain.

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No Sponge rule (group work)

- Each member of the team must actively contribute.
- Group members have the responsibility to:

1. not tolerate anyone who is putting forth no effort (being a sponge)
2. not let anyone who is making a good faith effort "fall through the cracks" (help weaker team members come up to speed).

- We want to know about dysfunctional group situations early on.

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