

# Some Thoughts on Data Science

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POSTECH

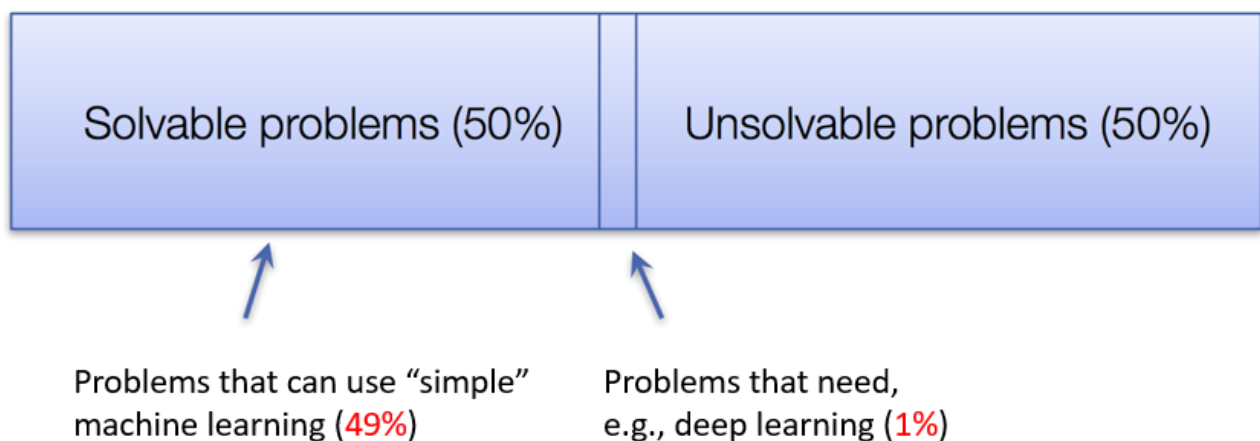
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## 1. Get Involved in Data Science Now

- Most researchers will be interested in how data science and machine learning techniques can be applied to their domains
- but you will need to spend substantial time learning the domain itself

### Data Problems We Would Like to Solve



## **Solving with Deep Learning**

- When you come up against some machine learning problem with “traditional” features (i.e., human-interpretable characteristics of the data),
  - do not try to solve it by applying deep learning methods first
  - Instead, use
    - linear regression/classification,
    - linear regression/classification with non-linear features, or
    - gradient boosting methods
- If you really want to squeeze out a 1-2% improvement in performance, then you can apply deep learning
  - However, it’s also undeniable that deep learning has made remarkable progress for structured data like images, audio, or text

## **What About “Superhuman” Machine Learning**

- It’s a common misconception that machine learning will outperform human experts on most tasks
  - No, it is supervised learning
  - Cannot be better than your training data
- In reality, the benefit from machine learning often doesn’t come from superhuman performance in most cases,
  - it comes from the ability to scale up expert-level performance extremely quickly

## **Dealing with Impossible Problems**

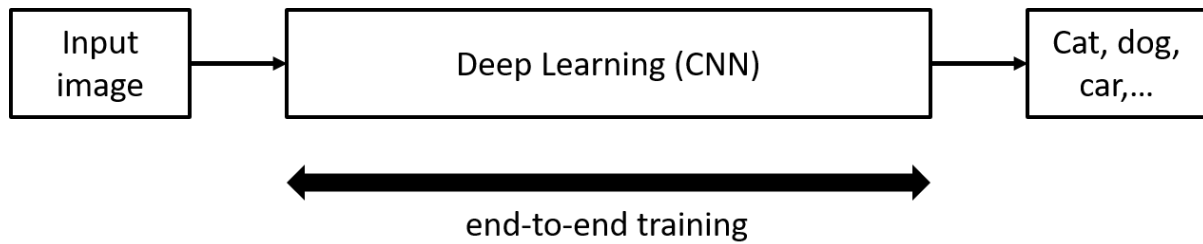
- You’ve built a tool to manually classify examples, run through many cases (or had a domain expert run through them), and you get poor performance
- What do you do?
  - You do not try to throw more, bigger machine learning algorithms at the problem
- Instead you need to change the problem by:
  - 1) changing the input (i.e., the features),
  - 2) changing the output (i.e., decomposing it to smaller sub-problems)

## Machine Learning vs. Deep Learning

- State-of-the-art until 2012



- Deep supervised learning



- Hyperparameters
  - Learning rate
  - # of iterations
  - # of hidden layers
  - # of hidden units
  - Choice of activation functions

## 2. Study Materials

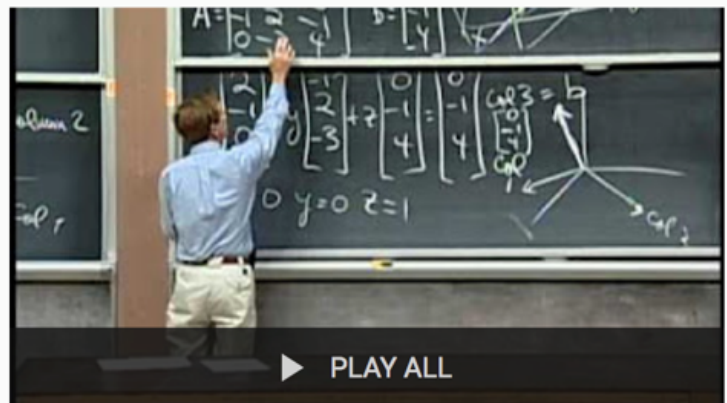
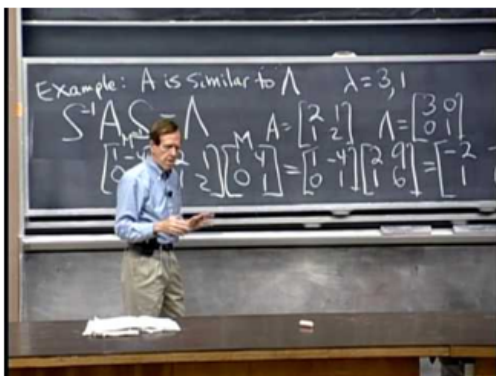
### 인공지능 어떻게 공부할 것인가?

- Deep learning 으로 인공지능을 처음 공부하면 안된다.
- Linear algebra, Optimization, Statistics, Probability, Machine Learning
  - Then deep learning
- (Numerical or Scientific) Computer Programming
  - MATLAB or Python
  - 개념, 수식, 코드

강의 대부분의 내용은 아래 연구자분들의 자료를 선택적으로 취합해서 만들어졌습니다.

#### 1) Linear Algebra

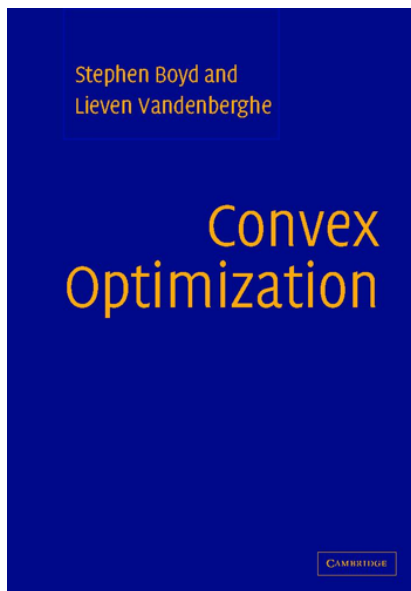
- Gilbert Strang from MIT
- <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/>  
(<https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/>)
- YouTube



Gilbert Strang lectures on Linear Algebra (MIT)

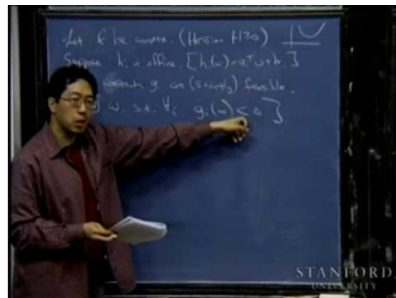
#### 2) Optimization and Linear Systems

- Stephen Boyd and Sanjay Lall from Stanford
  - Linear Dynamical Systems
  - Linear Control Systems
  - Convex optimization
  - Textbook
  - <http://stanford.edu/~boyd/> (<http://stanford.edu/~boyd/>)
  - <https://lagunita.stanford.edu/courses/Engineering/CVX101/Winter2014/about>  
(<https://lagunita.stanford.edu/courses/Engineering/CVX101/Winter2014/about>)



### 3) Machine Learning

- CS229 - Machine Learning
  - Prof. Andrew NG from Stanford
  - Different from coursera
  - YouTube and lecture note
  - <https://see.stanford.edu/Course/CS229> (<https://see.stanford.edu/Course/CS229>)



- Artificial Intelligence
  - Prof. Zico Kolter from CMU
  - YouTube and lecture note
  - <http://zicokolter.com/> (<http://zicokolter.com/>)

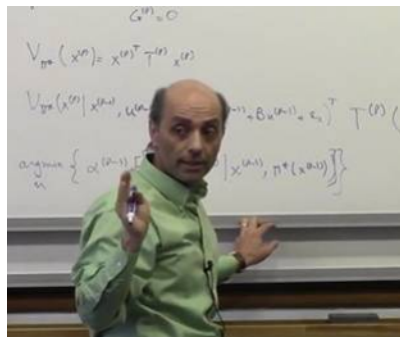


**Zico Kolter**



Lecture 4: Optimization 1

- Learning theory
  - Prof. Reza Shadmehr from Johns Hopkins Univ.
  - YouTube
  - <http://www.shadmehrlab.org/> (<http://www.shadmehrlab.org/>)



- Artificial Intelligence

- Prof. Patrick Henry Winston from MIT
- YouTube
- <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/> (<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/>)



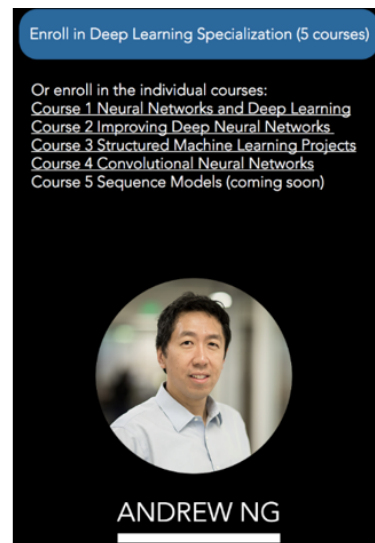
- Learning from data

- Prof. Yaser Abu-Mostafa from Caltech
- <https://work.caltech.edu/telecourse.html> (<https://work.caltech.edu/telecourse.html>)

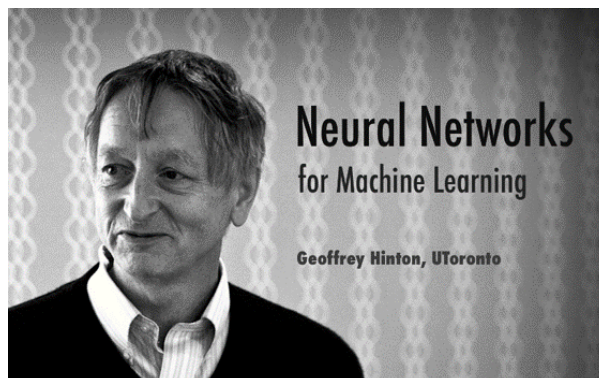


#### 4) Deep Learning

- Prof. Andrew Ng from Stanford
  - Coursera
  - <http://deeplearning.ai/> (<http://deeplearning.ai/>)



- Neural Networks for Machine Learning
  - <https://www.coursera.org/learn/neural-networks#> (<https://www.coursera.org/learn/neural-networks#>)

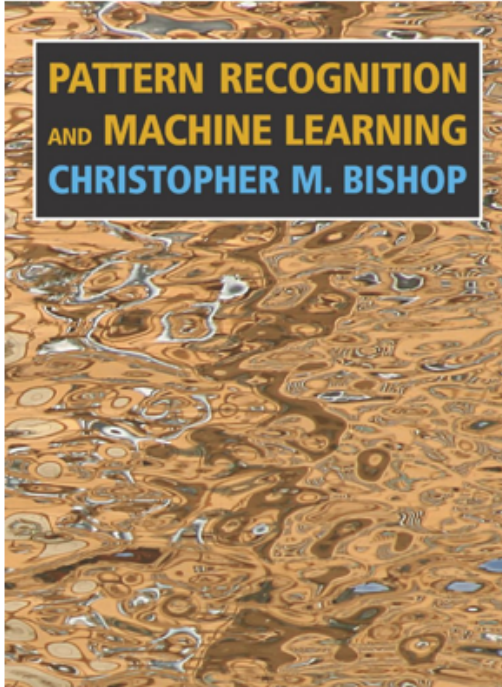


#### University Lectures on Deep Learning

- Stanford
  - CS231n: Convolutional Neural Networks for Visual Recognition
  - <http://deeplearning.stanford.edu/tutorial/> (<http://deeplearning.stanford.edu/tutorial/>)
- CMU
- NYU
- MIT
- Toronto

## Books

- Pattern Recognition and Machine Learning by Christopher Bishop
- <https://www.microsoft.com/en-us/research/people/cmbishop/> (<https://www.microsoft.com/en-us/research/people/cmbishop/>)



Christopher  
Bishop

Laboratory Director, Microsoft  
Research Cambridge



## 한국어 강좌

- 김성훈 교수님, 홍콩과기대 (현재 네이버 AI 팀)
- <https://hunkim.github.io/ml/> (<https://hunkim.github.io/ml/>)



## 모두를 위한 머신러닝/딥러닝 강의

### 모두를 위한 머신러닝과 딥러닝의 강의

알파고와 이세돌의 경기를 보면서 이제 머신 러닝이 인간이 잘 한다고 여겨진 직관과 의사 결정능력에서도 충분한 데이터가 있으면 어느정도 또는 우리보다 더 잘할수도 있다는 생각을 많이 하게 되었습니다. Andrew Ng 교수님이 말씀하신것 처럼 이런 시대에 머신 러닝을 잘 이해하고 잘 다룰수 있다면 그야말로 "Super Power"를 가지게 되는 것이 아닌가 생각합니다.

더 많은 분들이 머신 러닝과 딥러닝에 대해 더 이해하고 본인들의 문제를 이 멋진 도구를 이용해서 풀수 있게 하기위해 비디오 강의를 준비하였습니다. 더 나아가 이론에만 그치지 않고 최근 구글이 공개한 머신러닝을 위한 오픈소스인 TensorFlow를 이용해서 이론을 구현해 볼수 있도록 하였습니다.

수학이나 컴퓨터 공학적인 지식이 없어도 쉽게 볼수 있도록 만들려고 노력하였습니다.

- 문일철 교수님, 카이스트
- [http://kaist.edwith.org/machinelearning1\\_17](http://kaist.edwith.org/machinelearning1_17) ([http://kaist.edwith.org/machinelearning1\\_17](http://kaist.edwith.org/machinelearning1_17))
- <https://www.youtube.com/playlist?list=PLt9QR0WkC4WVszuogbmlIHIIQ2RMI78RC>  
(<https://www.youtube.com/playlist?list=PLt9QR0WkC4WVszuogbmlIHIIQ2RMI78RC>)

## 인공지능 및 기계학습 개론 1

산업 및 시스템 공학과  
문일철 교수

1. Motivations and Basics
2. Fundamentals of Machine Learning
3. Naïve Bayes Classifier
4. Logistic Regression
5. Support Vector Machine
6. Training/Testing and Regularization

In [1]:

```
%%javascript
$.getScript('https://kmahelona.github.io/ipython_notebook_goodies/ipython_notebook_toc.js')
```