

# Introduction to Machine Learning

by Eka Antonius Kurniawan

# Outline

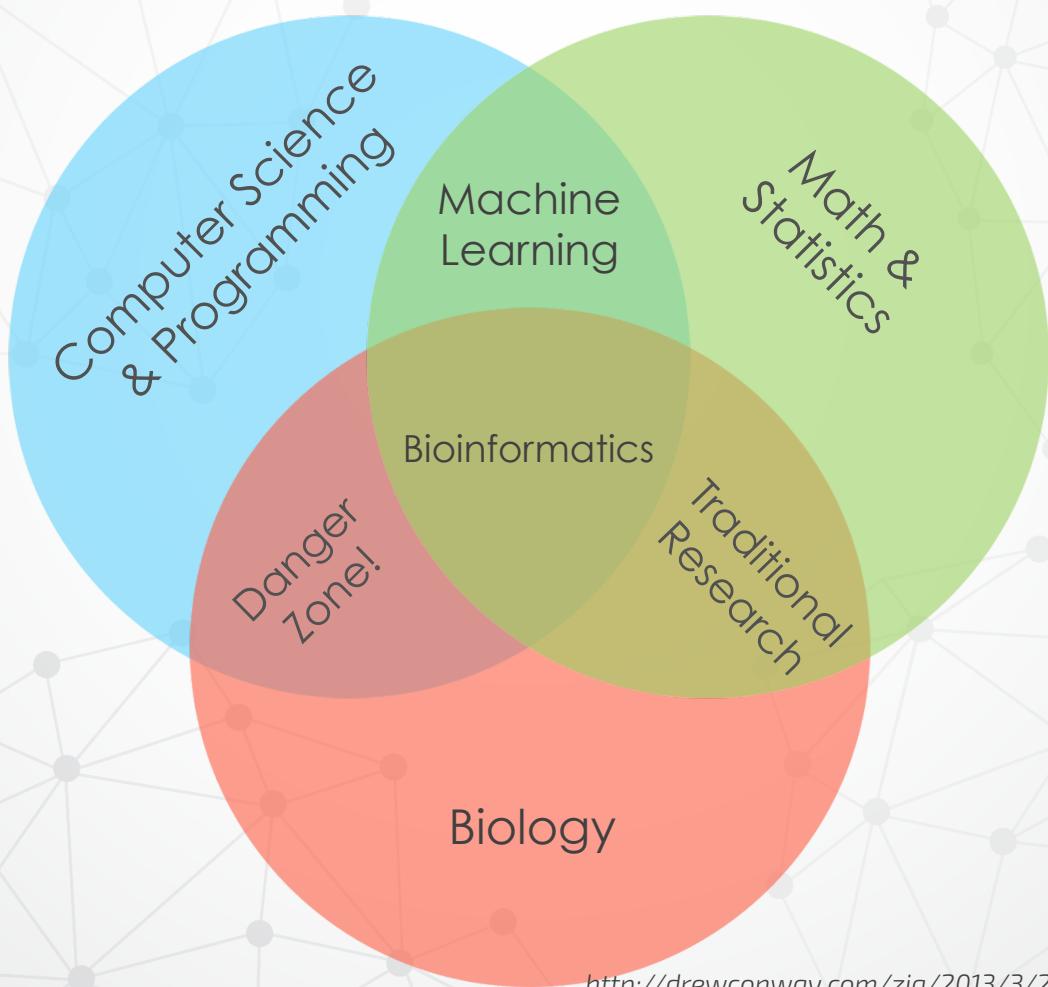
- ❑ What is Machine Learning?
- ❑ Impacts on Daily Life
- ❑ Tasks in Machine Learning
- ❑ Deep Learning
- ❑ Jobs in Machine Learning
- ❑ Machine Learning Workshop

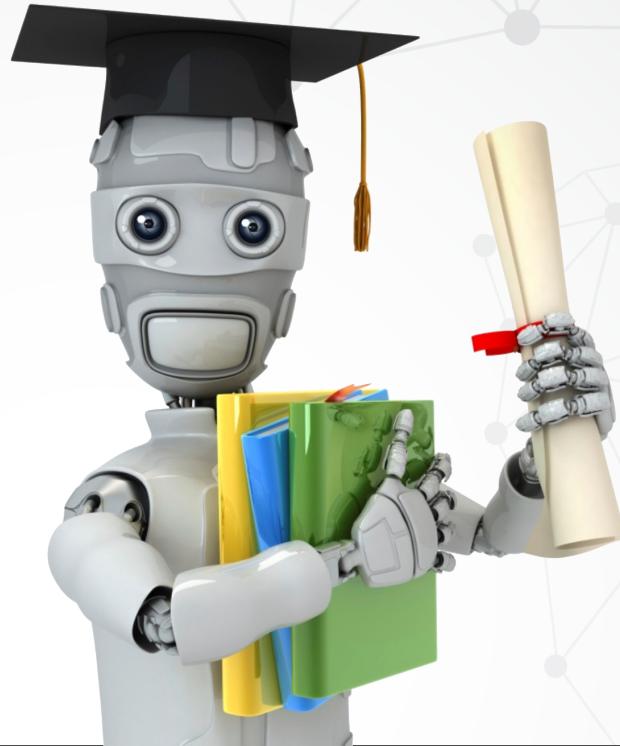
# What is Machine Learning?

# What is Machine Learning?

Machine learning is a subfield of **computer science** that evolved from the study of pattern recognition and computational learning theory in **artificial intelligence**. Machine learning explores the construction and study of **algorithms** that can **learn** from and **make predictions** on **data**. Such algorithms operate by **building a model** from example inputs in order to make **data-driven predictions or decisions**, rather than following strictly static program instructions.

# Adjusted Data Science Venn Diagram





## Machine Learning at Stanford offered by Coursera

“

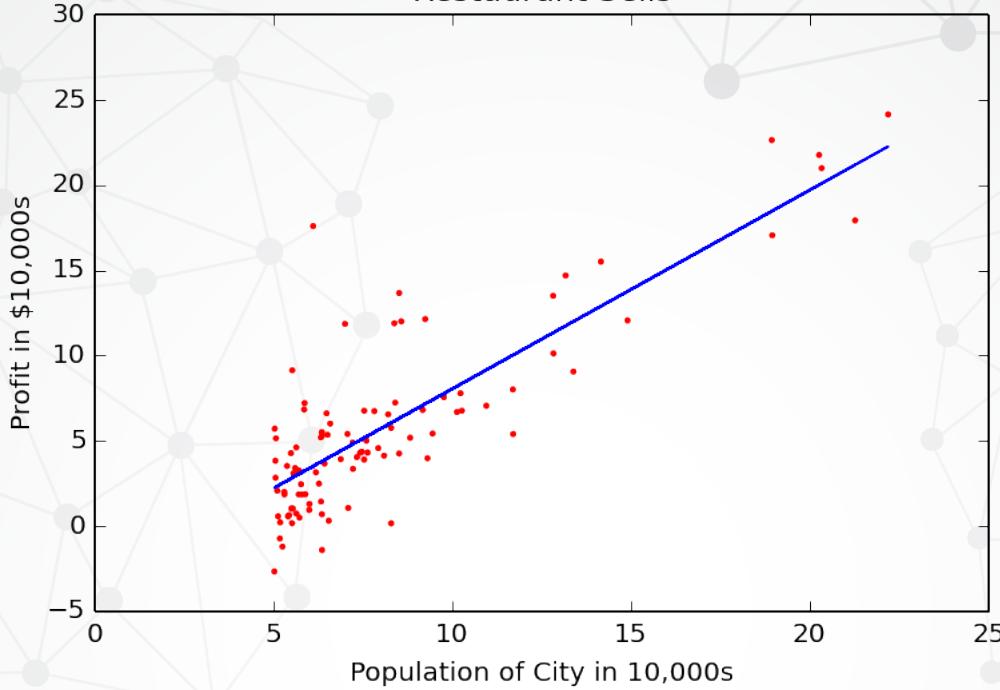
Machine learning is the science of getting computers to **act without being explicitly programmed**. In the past decade, machine learning has given us self-driving cars, practical speech recognition, **effective web search**, and a vastly improved **understanding of the human genome**.

# Impacts on Daily Life

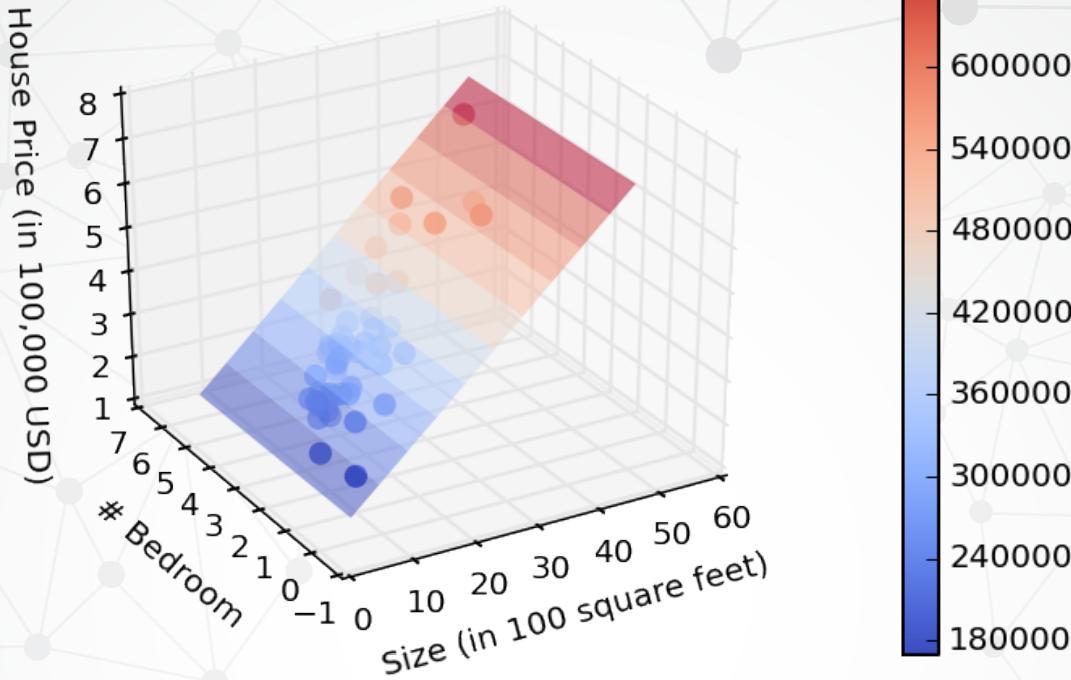


## Self-driving Car

### Restaurant Sells



## Predicting Sells Revenue



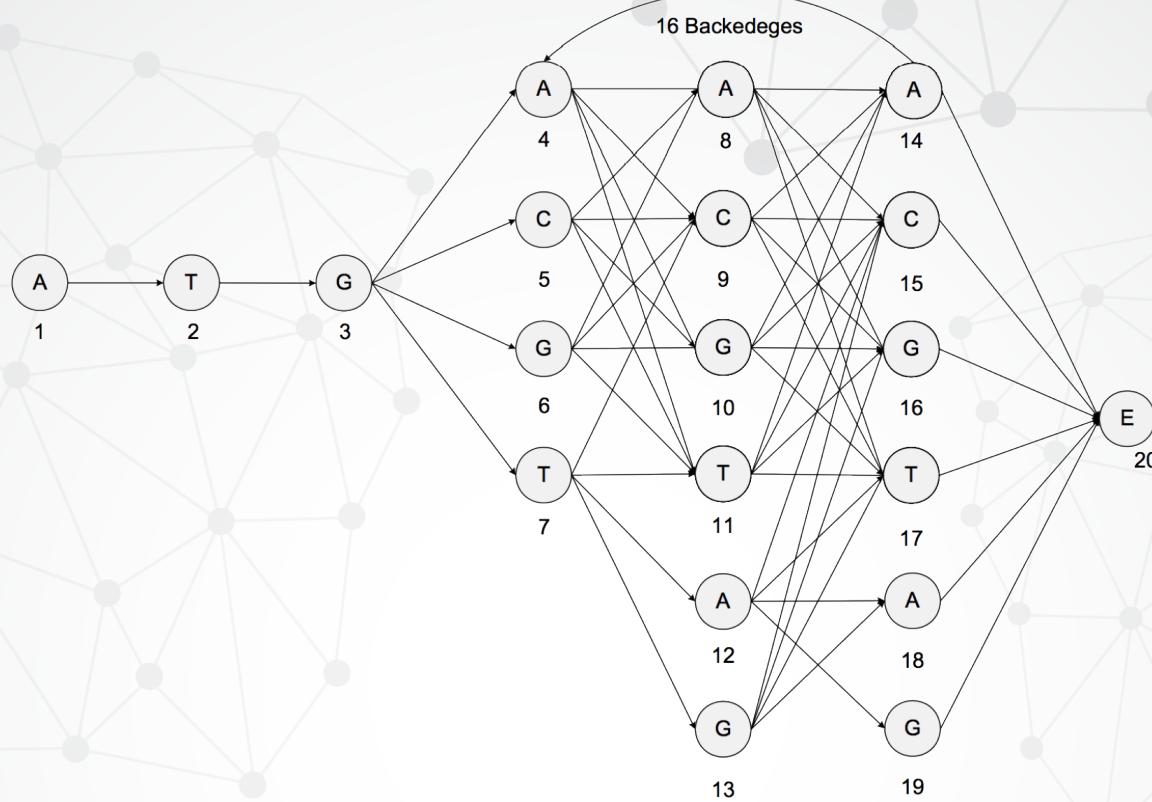
## Predicting Housing Price

7	9	6	5	8	7	4	4	1	8
0	7	3	3	2	4	8	4	5	1
6	6	3	2	9	1	3	3	2	6
1	3	7	1	5	6	5	2	4	4
7	0	9	8	7	5	8	9	5	4
4	6	6	5	0	2	1	3	6	9
8	5	1	8	9	3	8	7	3	6
1	0	2	8	2	3	0	5	1	5
6	7	8	2	5	3	9	7	0	0
7	9	3	9	8	5	7	2	9	8

## Character Recognition

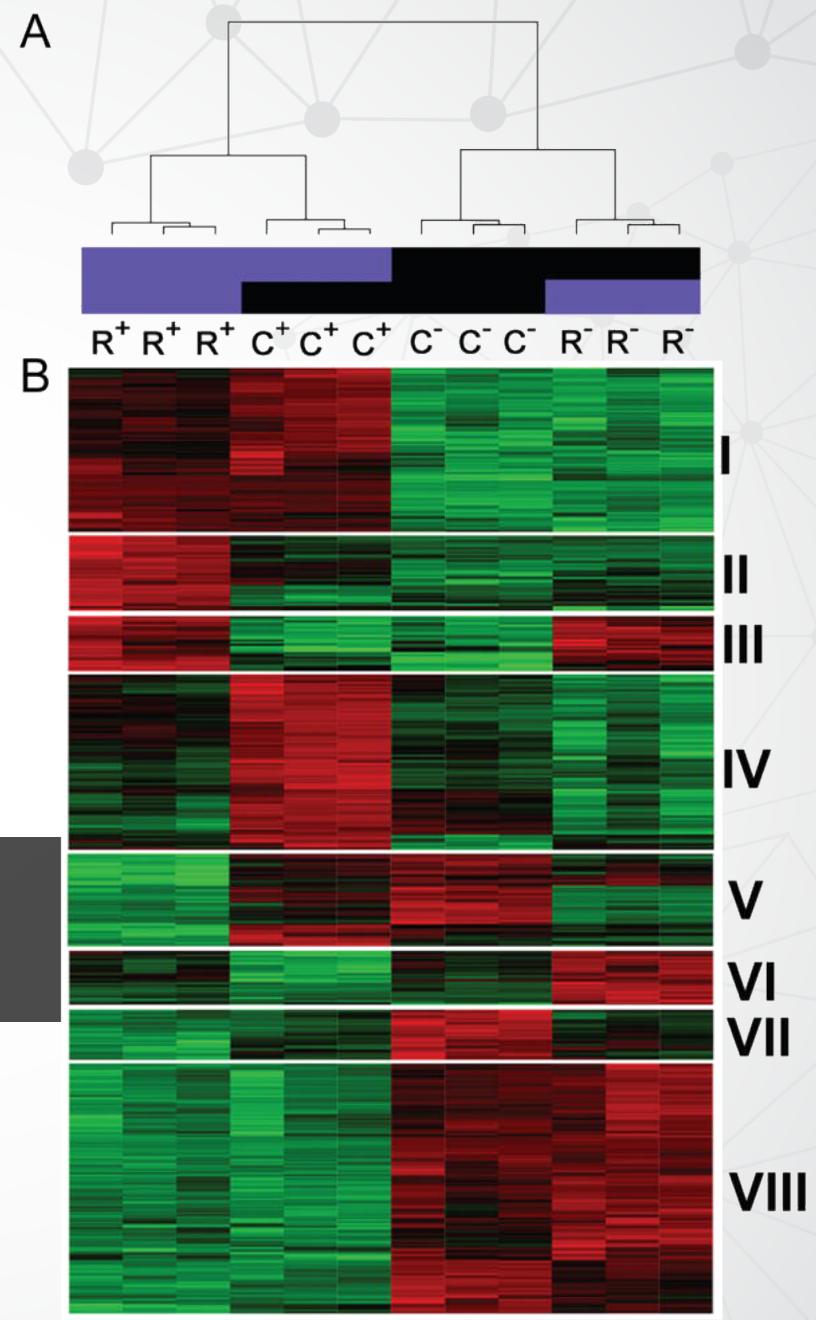
# Impacts on Daily Life

- ❑ Classifying email into spam and non-spam
- ❑ Image compression
- ❑ Movie recommendation



## Gene Exon Detection

## Gene Expression Clustering



# Tasks in Machine Learning

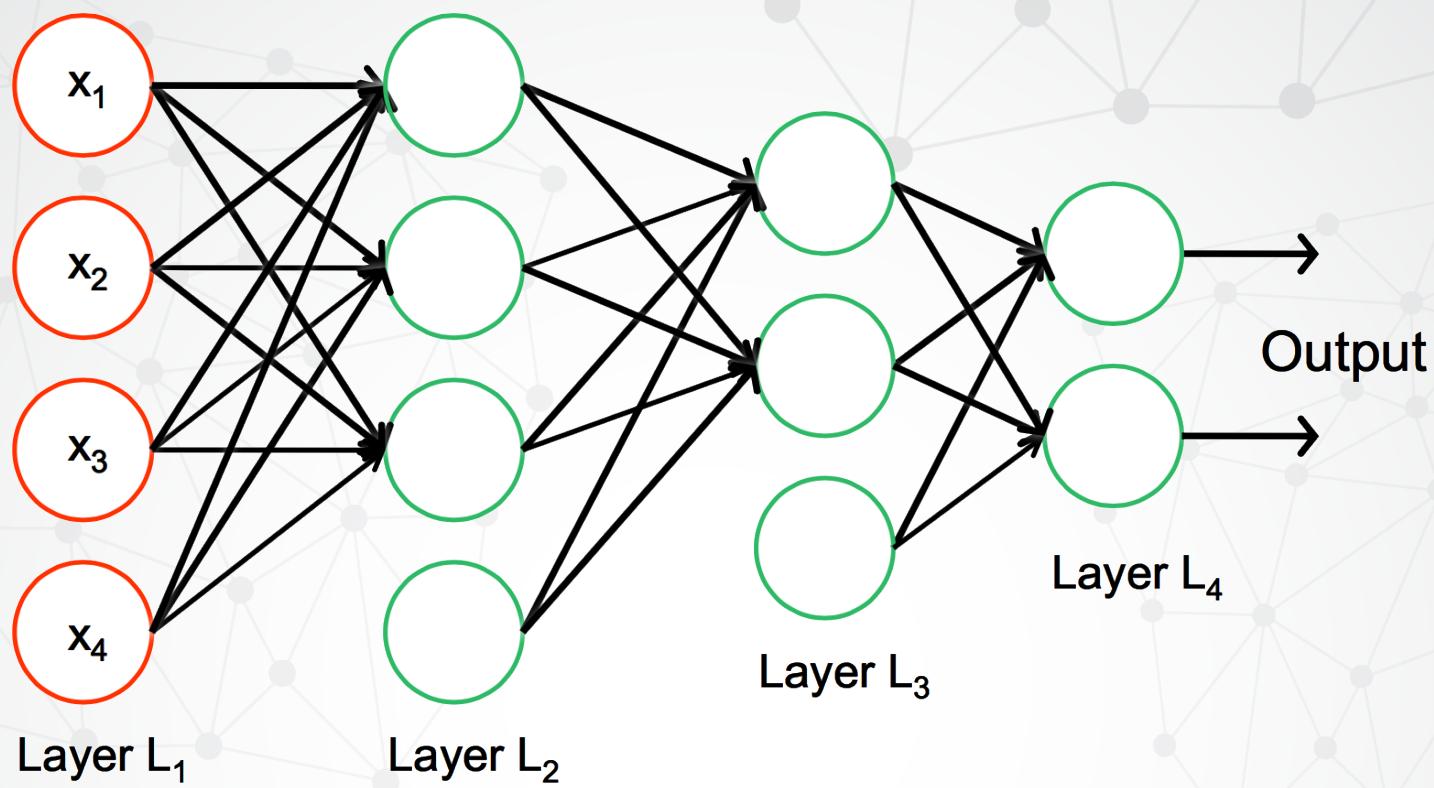
# Tasks in Machine Learning

- ❑ Supervised Learning
- ❑ Unsupervised Learning
- ❑ Reinforcement Learning

# Deep Learning

# Inspired by Brain

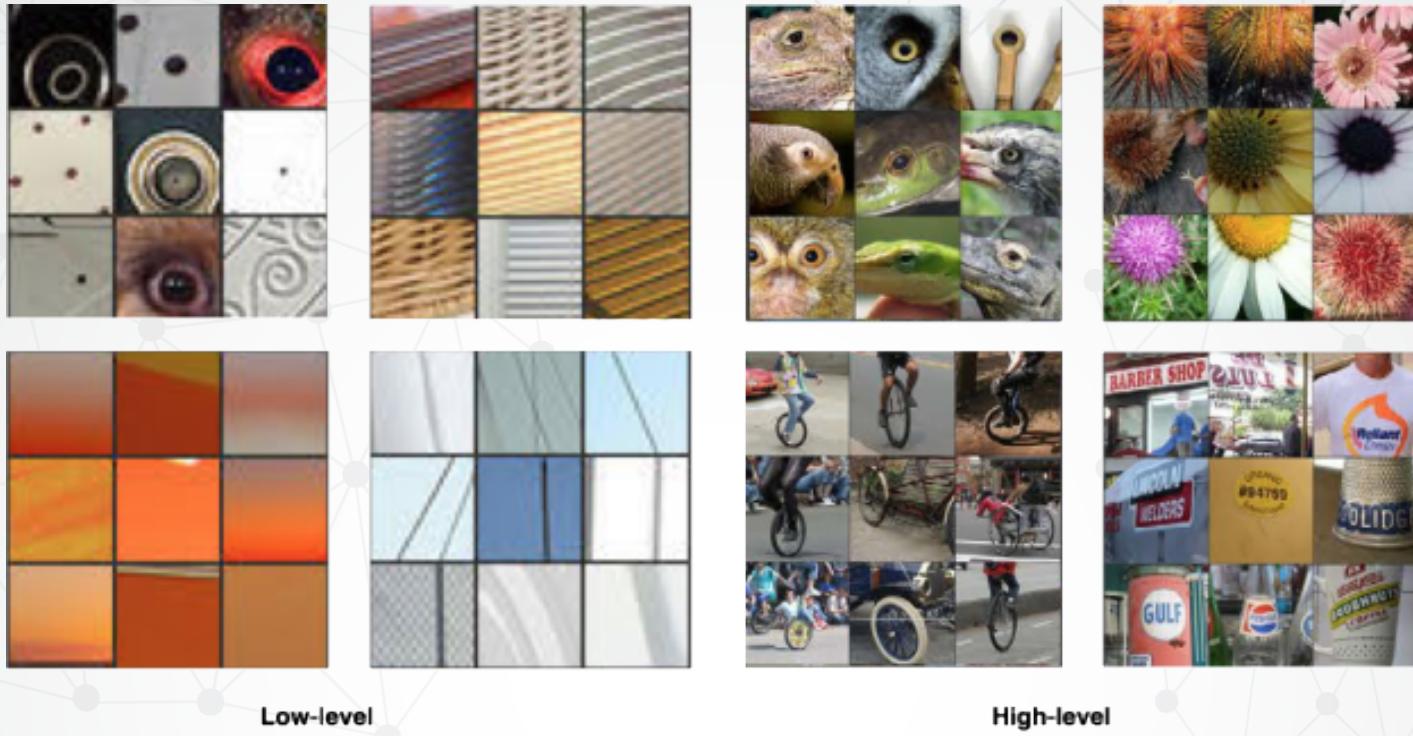
Some of the representations are inspired by advances in **neuroscience** and are loosely based on interpretation of **information processing and communication patterns** in a **nervous system**, such as neural coding which attempts to define a relationship between the stimulus and the neuronal responses and the relationship among the electrical activity of the neurons in the brain.



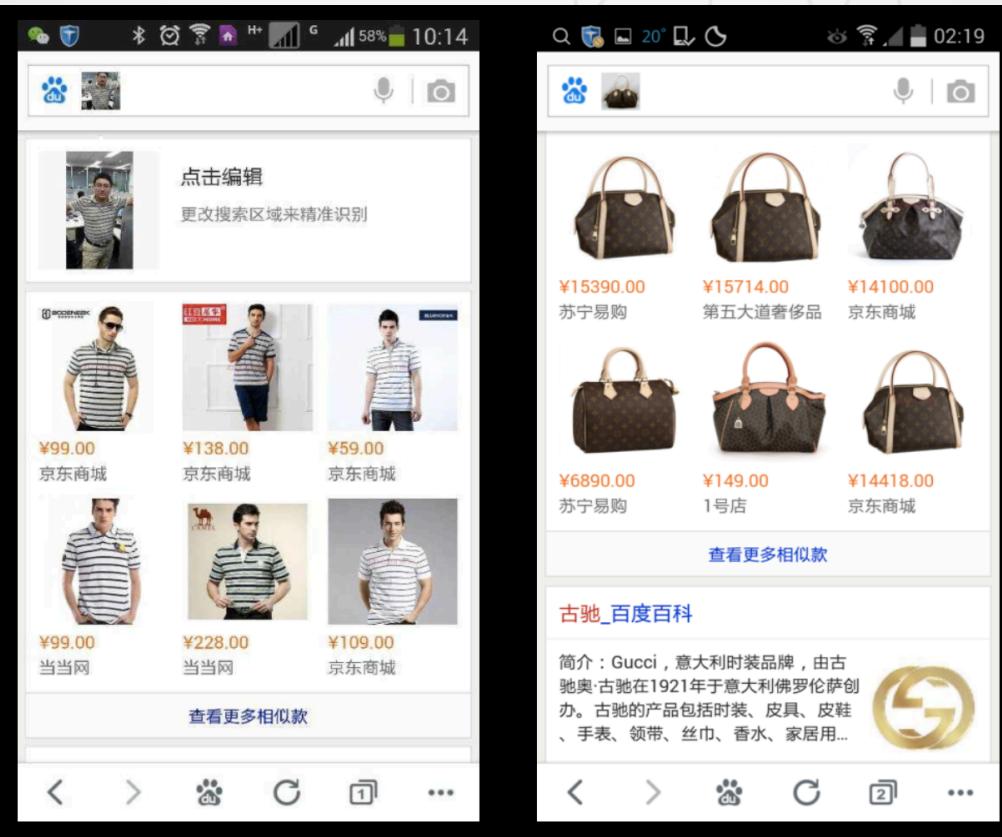
## Neural Network

# Three Main Areas

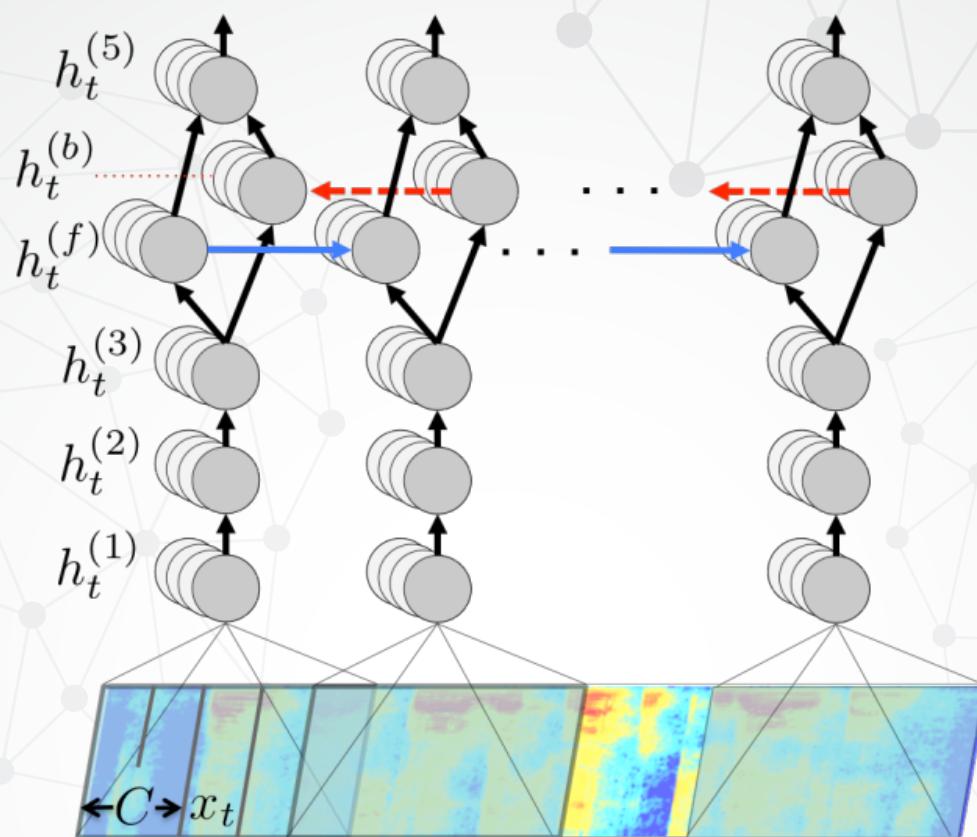
- ❑ Image Processing
- ❑ Speech Processing
- ❑ Natural Language Processing



# Image Processing

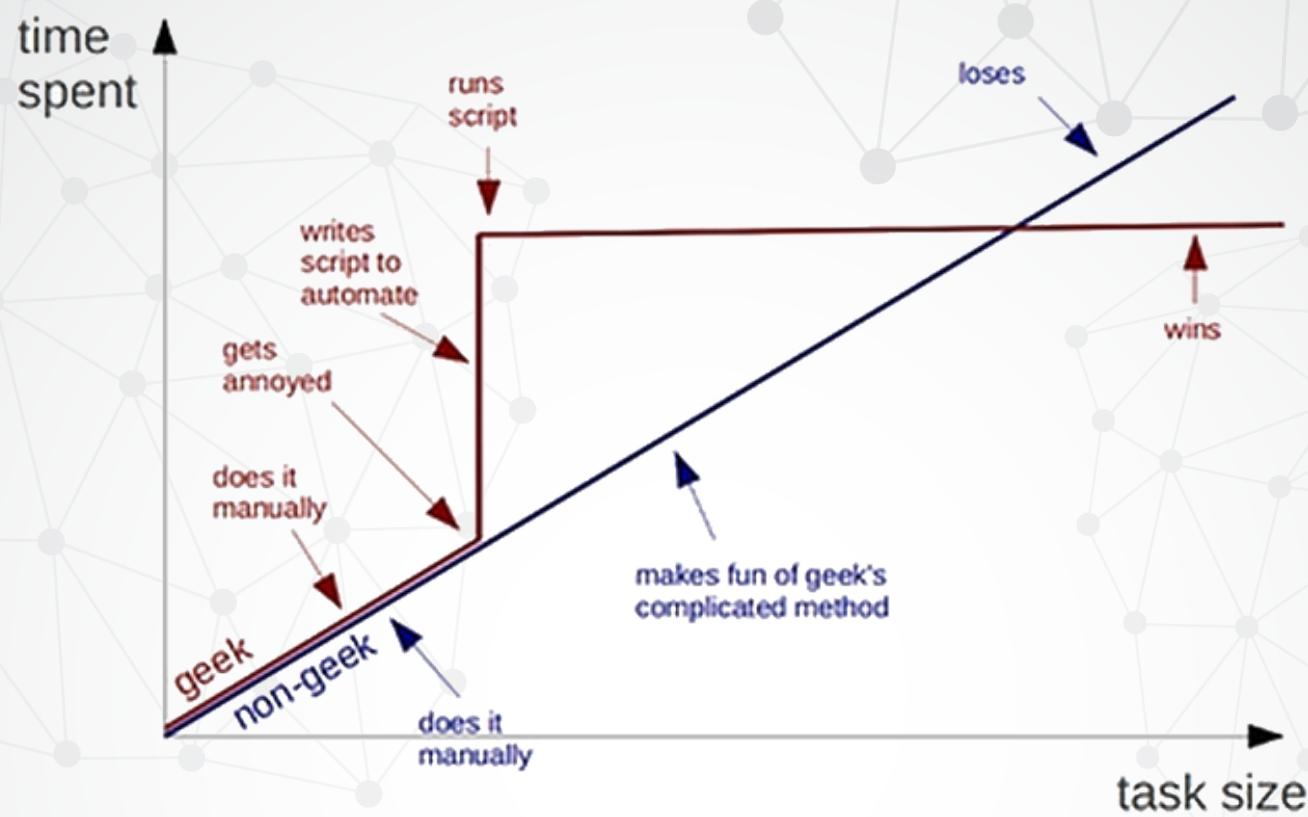


# Image Processing



## Speech Processing

# Jobs in Machine Learning



## Geeks vs Non-Geeks when Doing Repetitive Tasks

## [Software Engineer, Machine Learning & Artificial Intelligence](#)

Mountain View, CA, USA [Share](#)

Participate in cutting edge research in artificial intelligence and **machine learning** applications. Develop solutions for real world, large scale problems.

Software Engineering

## [Machine Learning Software Engineer, YouTube](#)

San Bruno, CA, USA

Participate in cutting edge research in **machine learning** applications. Develop solutions for real world, large scale problems. Come up with novel, user-facing applications in the v...

Software Engineering

## [Microfabrication Engineer, Quantum Machine Learning](#)

Los Angeles, CA, USA

Work in a cleanroom environment. Develop and maintain fabrication processes for superconducting integrated circuits. Stabilize existing standard processes and develo...

Hardware Engineering

## [Software Engineer, Research and Machine Intelligence](#)

Mountain View, CA, USA

Participate in cutting edge research in artificial intelligence and **machine learning** applications. Develop solutions for real world, large scale problems.

Software Engineering

## [Research Scientist](#)

London Borough of Islington, London, UK

Design, implement and evaluate models, agents and software prototypes of perceptual processing. Report and present research findings and developments including status ...

Technical Solutions

## [Imaging Algorithms and Software Engineer](#)

Mountain View, CA, USA

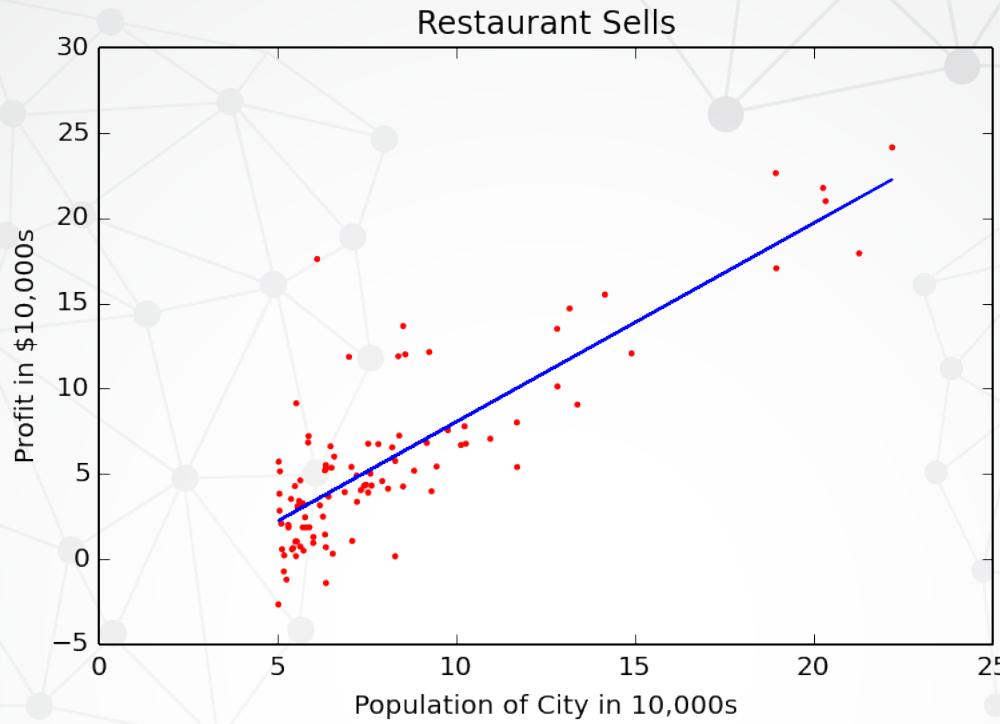
Develop and improve image enhancement and analysis algorithms. Write software for mobile imaging applications. Develop multi-frame fusing methods to generate good qu...

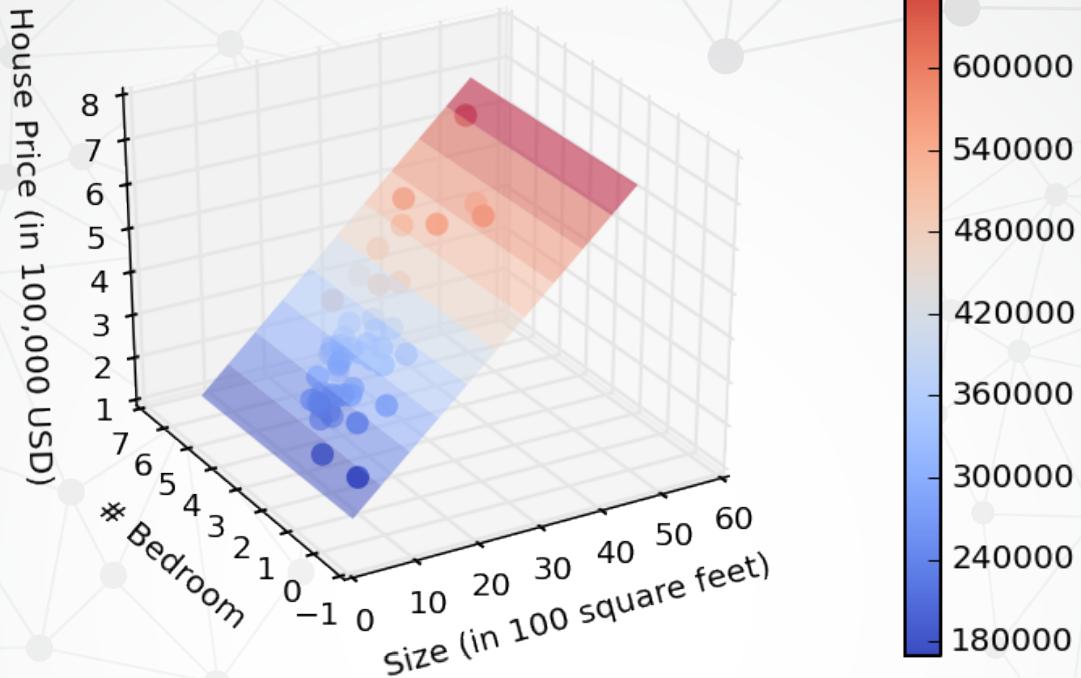
Software Engineering

# Jobs in Machine Learning

- Bioinformatician
- Data Scientist
- Researcher, Lecturer

# Machine Learning Algorithms





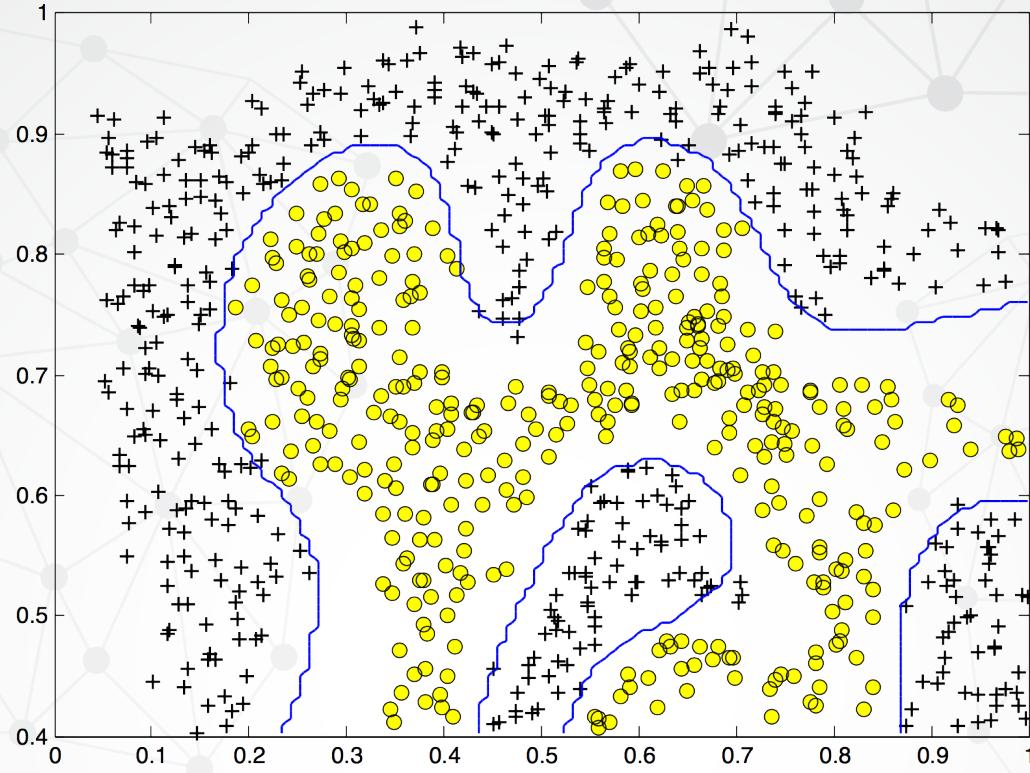
## Linear Regression with Multiple Variables

To predict housing price

7	9	6	5	8	7	4	4	1	8
0	7	3	3	2	4	8	4	5	1
6	6	3	2	9	1	3	3	2	6
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4	6	6	5	0	2	1	3	6	9
8	5	1	8	9	3	8	7	3	6
1	0	2	8	2	3	0	5	1	5
6	7	8	2	5	3	9	7	0	0
7	9	3	9	8	5	7	2	9	8

# Neural Network

To recognize handwriting



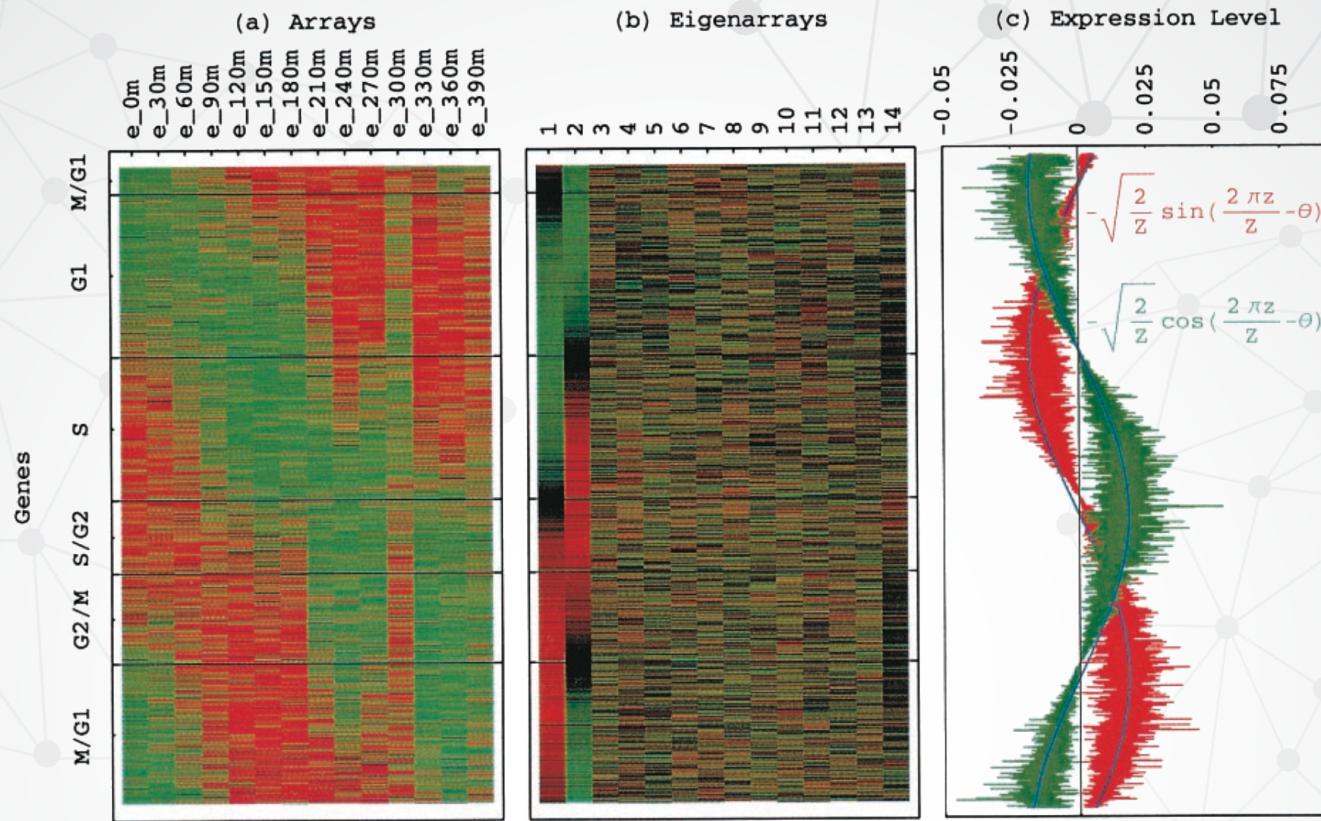
## Support Vector Machine

To classify emails into spam and non-spam



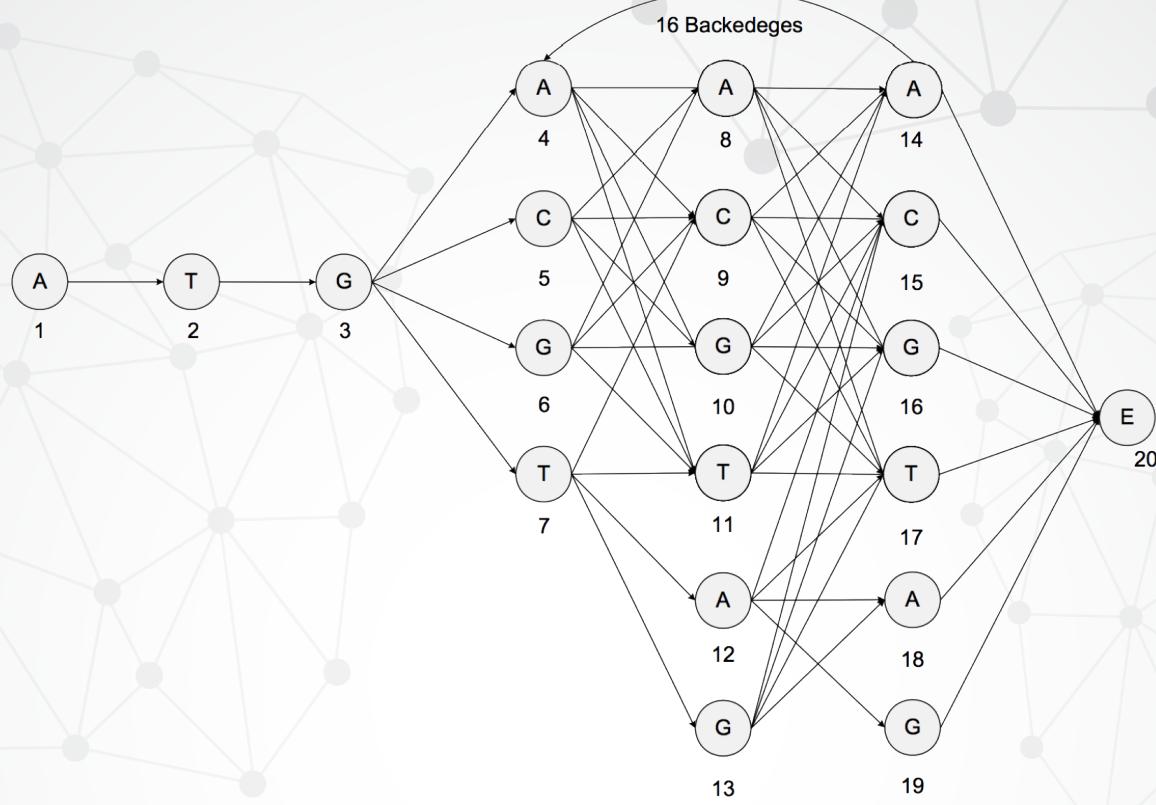
## Principal Component Analysis

To speed up learning algorithm by dimensionality reduction



## Singular Value Decomposition

To find genes involved in certain phase of cell cycle



## Markov Model

To detect gene exon

Original ratings provided:

Rated 4 for Toy Story (1995)

Rated 3 for Twelve Monkeys (1995)

Rated 5 for Usual Suspects, The (1995)

Rated 4 for Outbreak (1995)

Rated 5 for Shawshank Redemption, The (1994)

Rated 3 for While You Were Sleeping (1995)

Rated 5 for Forrest Gump (1994)

Rated 2 for Silence of the Lambs, The (1991)

Rated 4 for Alien (1979)

Rated 5 for Die Hard 2 (1990)

Rated 5 for Sphere (1998)

Top recommendations for you:

Predicting rating 9.0 for movie Titanic (1997)

Predicting rating 8.9 for movie Star Wars (1977)

Predicting rating 8.8 for movie Shawshank Redemption, The (1994)

Predicting rating 8.5 for movie As Good As It Gets (1997)

Predicting rating 8.5 for movie Good Will Hunting (1997)

Predicting rating 8.5 for movie Usual Suspects, The (1995)

Predicting rating 8.5 for movie Schindler's List (1993)

Predicting rating 8.4 for movie Raiders of the Lost Ark (1981)

Predicting rating 8.4 for movie Empire Strikes Back, The (1980)

Predicting rating 8.4 for movie Braveheart (1995)

## Collaborative Filtering

To recommend movie



Q&A