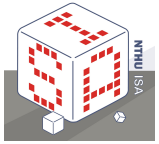


Data Mining Lab

Fall 2017

Elvis Saravia

About me

Where you can find me:

- **Email:** ellfae@gmail.com
- **Website:** elvissaravia.com
- **Github:** @omarsar
- **Twitter:** @omarsar0
- **Communities:** Medium / CS-X (slack group -- invite only)

Housekeeping

- **Join Slack group for more information on Data Mining**
  - Link: https://datamining2017nthu.slack.com
  - Invite only
  - Please introduce yourselves
  - State what you expect to learn in Data Mining
- **Mini Lab meeting (learn Git)**
  - Hangout / Skype Video Chat
  - In-person lab session

Objectives

Table of Contents

1. Data Source
2. Data Preparation
3. So What's Next
    - 3.1 Converting Dictionary into Pandas dataframe
    - 3.2 Familiarizing yourself with the Data
4. Data Mining using Pandas
    - 4.1 Dealing with Missing Values
    - 4.2 Dealing with Duplicate Data
5. Data Preprocessing
    - 5.1 Sampling
    - 5.2 Feature Creation
    - 5.3 Feature Subset Selection
    - 5.4 Dimensionality Reduction
    - 5.5 Atrribute Transformation / Aggregation
    - 5.6 Discretization and Binarization
6. Conclusion
7. References

Requirements

Jupyter notebook:

- Create Github account
- Find the working repository here: https://goo.gl/Fh8R9j
- Fork it (*Complete the exercises and upload changes*) (How-to)

Assignment:

- Published on Github as a Jupyter Notebook (*Please learn Git*)
- **Due date: October 16, 2017**
- More details provided later

Data in a bygone era

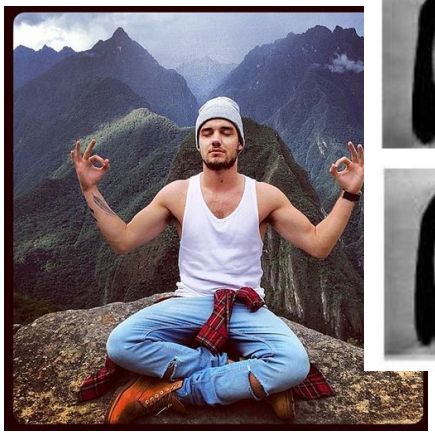
We used to share data through carvings and peculiar symbols

Observation: Very difficult to interpret any meaning; Any other observations?

Data Now

Now we share text messages, photos, and videos -- also known as Big Data era

Observation: Very difficult to interpret and gather knowledge from it; any other observations?



Data: Past vs Present

We all want to share and analyze data, even from ancient times.

Problem: Very difficult to mine knowledge from it

Reasons: Data format / Data Scarcity / ?

Solutions: Advanced Computing / Fast Algorithms / Big Data / Dynamic Visualization Tools

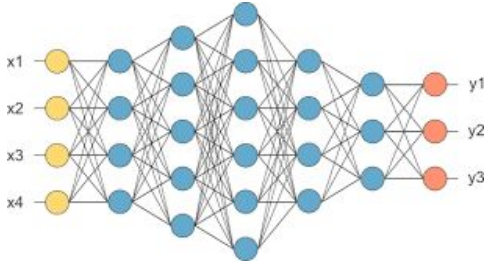
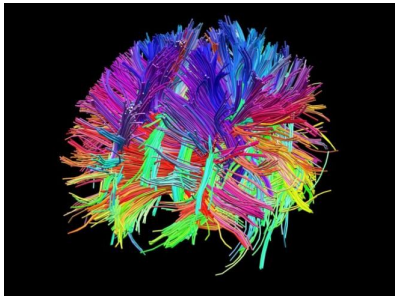


Diagram of Neural Network

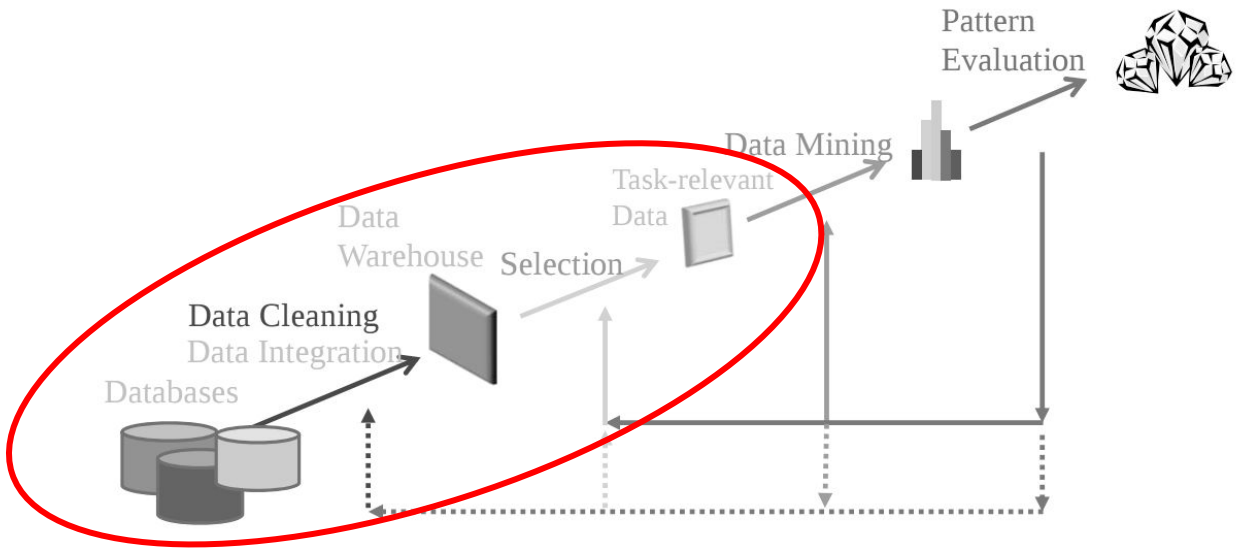
Google's Tensor Processing Unit



The Human Connectome Project

KDD (Knowledge Discovery) Process Overview

Our main focus in this lab session



Data Sources

Worst Case: Web crawling data / Graph data / API data / Surveys

Best case: Already processed and formatted for us

Data usually comes in one of three kinds: *data matrix, document data, transaction data.*

Some popular site for open data:

- UCI Machine Learning Repository
- Kaggle

kaggle

Our Dataset

Name: 20 Newsgroups

Type: Text (*unstructured*)

Characteristics:

- 20 news categories (1000 articles for each)
- Initially collected from multiple sources and compiled into one

```
alt.atheism
comp.graphics
comp.os.ms-windows.misc
comp.sys.ibm.pc.hardware
comp.sys.mac.hardware
comp.windows.x
misc.forsale
rec.autos
rec.motorcycles
rec.sport.baseball
rec.sport.hockey
sci.crypt
sci.electronics
sci.med
sci.space
soc.religion.christian
talk.politics.guns
talk.politics.mideast
talk.politics.misc
talk.religion.misc
```

Document Data

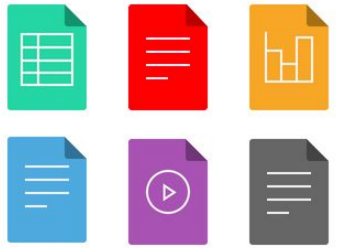
Our main focus is on *document data*

Why:

- We get to work with both ***structured*** and ***unstructured*** data
- Our ***final project*** will heavily focus on this type of dataset

	team	coach	play	ball	score	game	win	lost	timeout	season
Document 1	3	0	5	0	2	6	0	2	0	2
Document 2	0	7	0	2	1	0	0	3	0	0
Document 3	0	1	0	0	1	2	2	0	3	0

Where to store data?



Options for storing data:

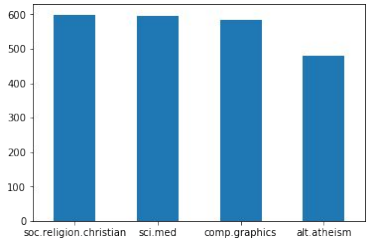
- Raw files (csv, txt, xml, json, etc.)
- Database
    - SQL / NoSQL / Document-based / Distributed
- Warehouse
- Elasticsearch (*fast for search*)
- Pandas Dataframes - fast in-memory data processing (*we will use this*)
- etc.

Data Operations

Snapshots of what we will do with the dataset

	text	category	category_name	unigrams	bin_category
0	From: sd345@city.ac.uk (Michael Collier) Subje...	1	comp.graphics	[From, :, sd345, @, city.ac.uk, (, Michael, Co...	[0, 1, 0, 0]
1	From: ani@ms.uky.edu (Aniruddha B. Deglurkar) ...	1	comp.graphics	[From, :, ani, @, ms.uky.edu, (, Aniruddha, B....	[0, 1, 0, 0]
2	From: djohnson@cs.ucsd.edu (Darin Johnson) Sub...	3	soc.religion.christian	[From, :, djohnson, @, cs.ucsd.edu, (, Darin, ...	[0, 0, 0, 1]
3	From: s0612596@let.rug.nl (M.M. Zwart) Subject...	3	soc.religion.christian	[From, :, s0612596, @, let.rug.nl, (, M.M, ., ...	[0, 0, 0, 1]
4	From: stanly@grok11.columbiasc.ncr.com (stanly...	3	soc.religion.christian	[From, :, stanly, @, grok11.columbiasc.ncr.com...	[0, 0, 0, 1]
5	From: vbv@lor.eeap.cwru.edu (Virgilio (Dean) B...	3	soc.religion.christian	[From, :, vbv, @, lor.eeap.cwru.edu, (, Virgil...	[0, 0, 0, 1]
6	From: jodfishe@silver.ucs.indiana.edu (joseph ...	3	soc.religion.christian	[From, :, jodfishe, @, silver.ucs.indiana.edu,...	[0, 0, 0, 1]
7	From: aldridge@netcom.com (Jacquelin Aldridge)...	2	sci.med	[From, :, aldridge, @, netcom.com, (, Jacqueli...	[0, 0, 1, 0]
8	From: geb@cs.pitt.edu (Gordon Banks) Subject: ...	2	sci.med	[From, :, geb, @, cs.pitt.edu, (, Gordon, Bank...	[0, 0, 1, 0]

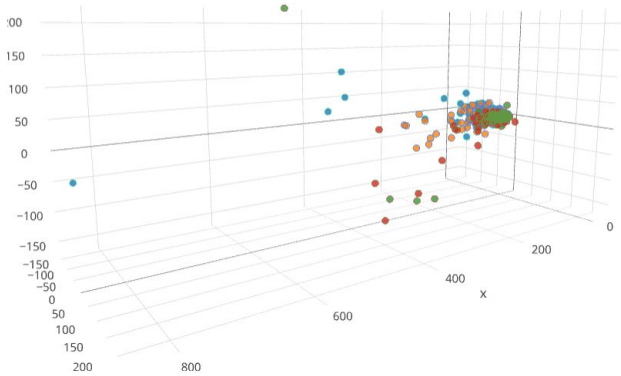
Transformation and Binarization



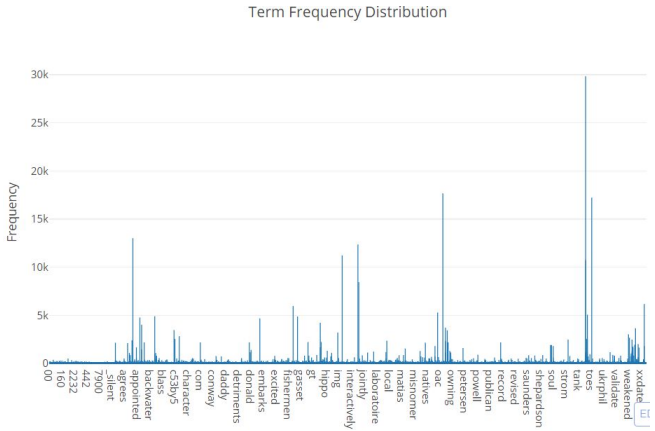
Data Distribution

	team	coach	play	ball	score	game	win	lost	timeout	season
Document 1	3	0	5	0	2	6	0	2	0	2
Document 2	0	7	0	2	1	0	0	3	0	0
Document 3	0	1	0	0	1	2	2	0	3	0
	3	8	5	2	5	8	2	5	3	2

Matrix Operations (Pandas)



PCA (Dimensionality Reduction)



Term Frequency Distribution

Demo Time

https://goo.gl/Fh8R9j