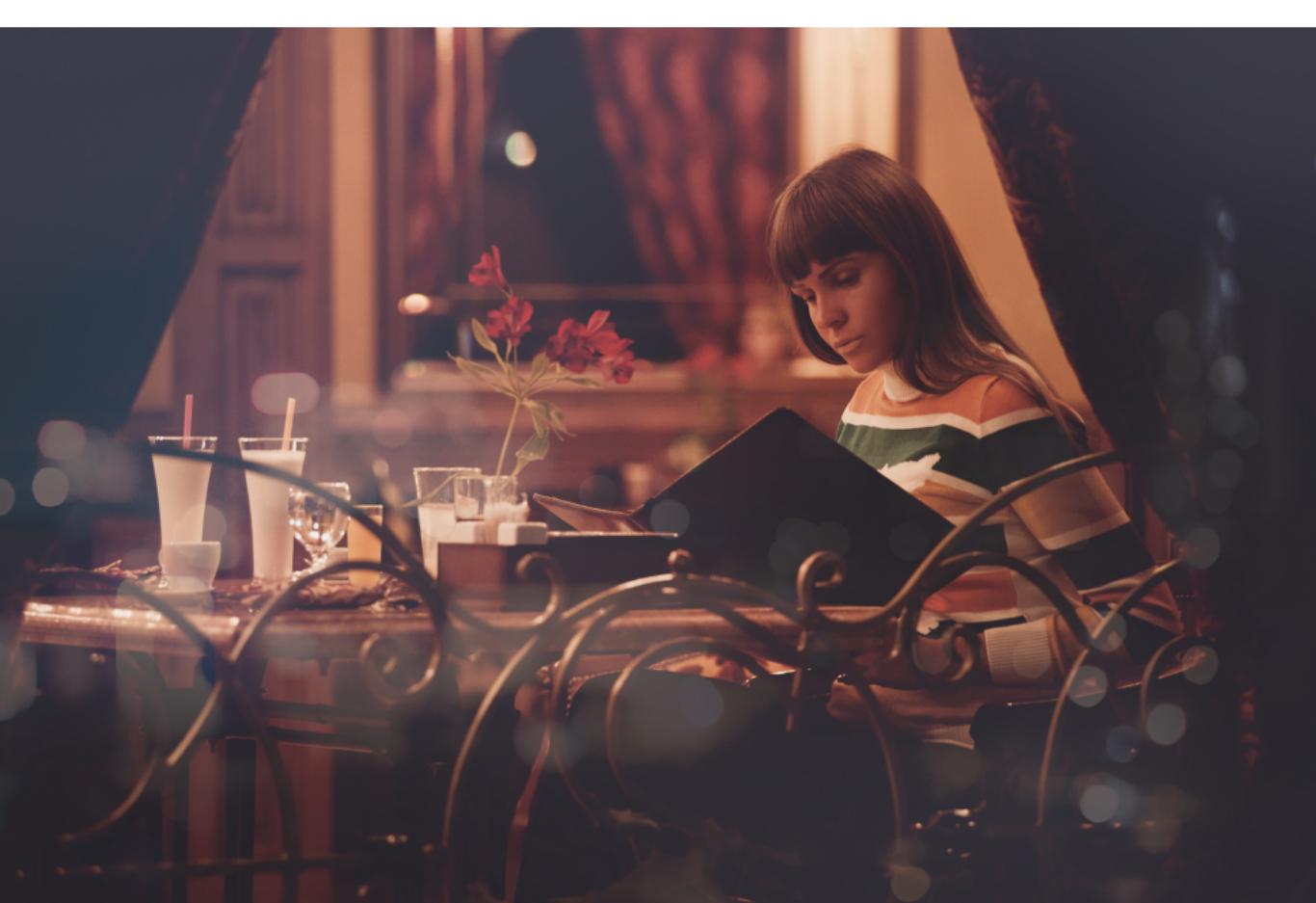


# Machine Learning

About those machines that are going to eat your job

Jeff Abrahamson

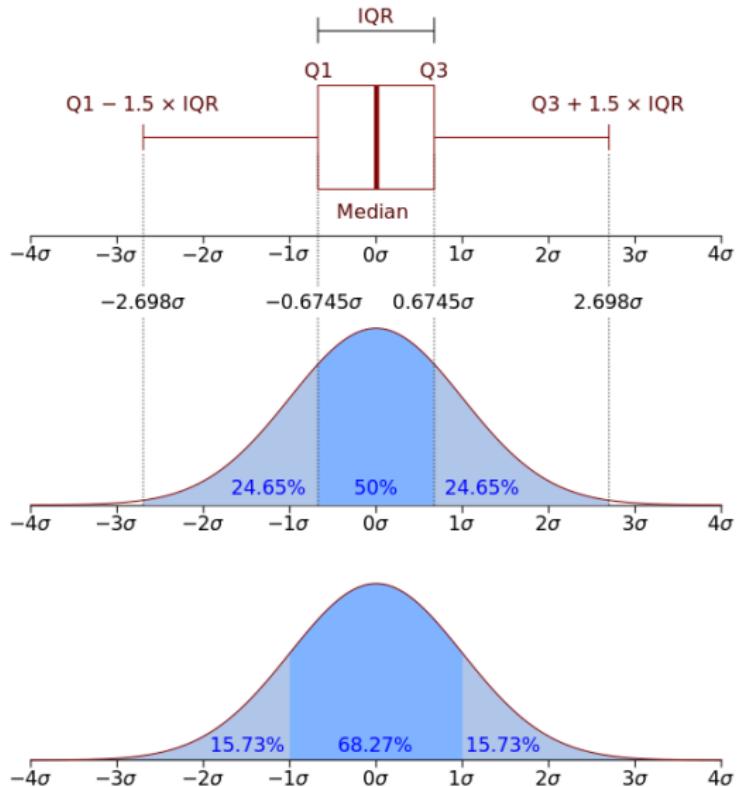
1 March 2017

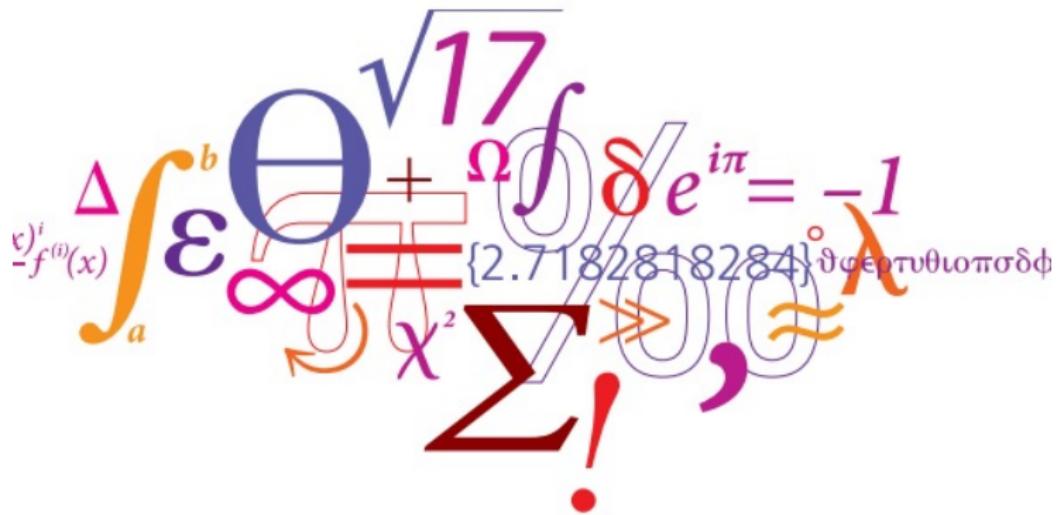


# **Machine Learning**

# **Data Science**

# **Statistics**



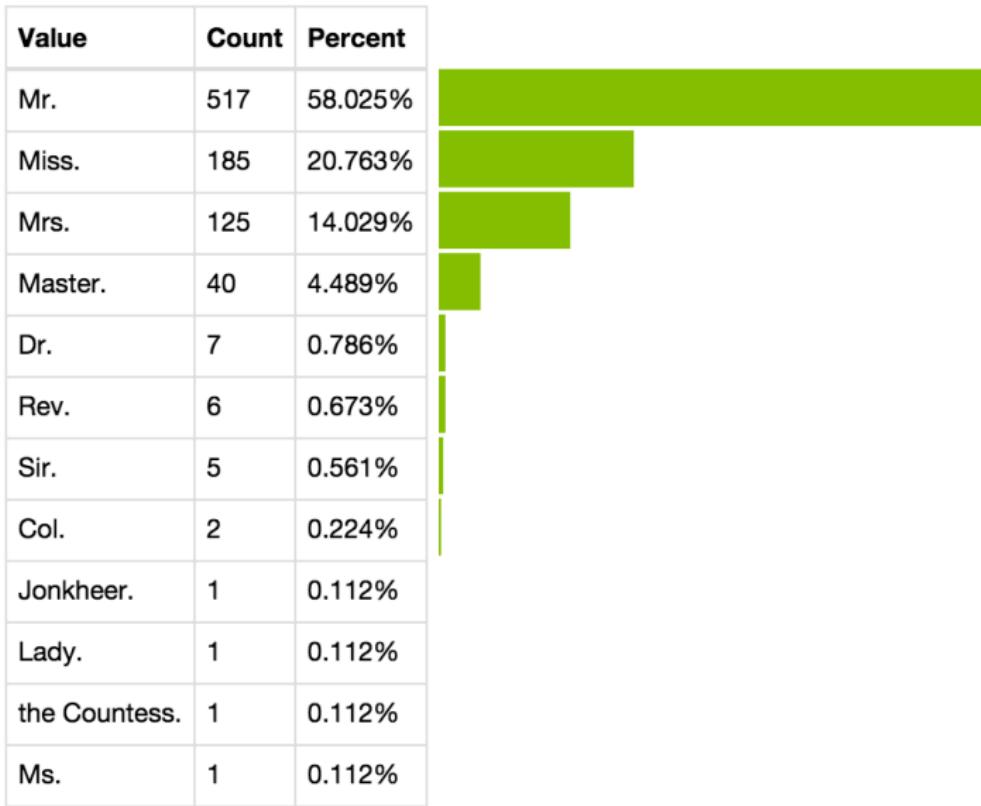


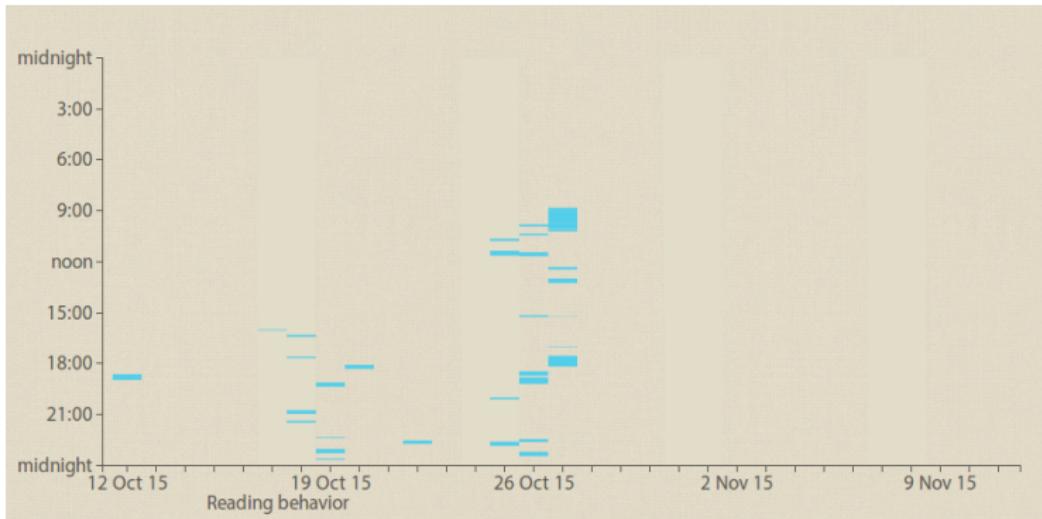
# Maths

Vector Space

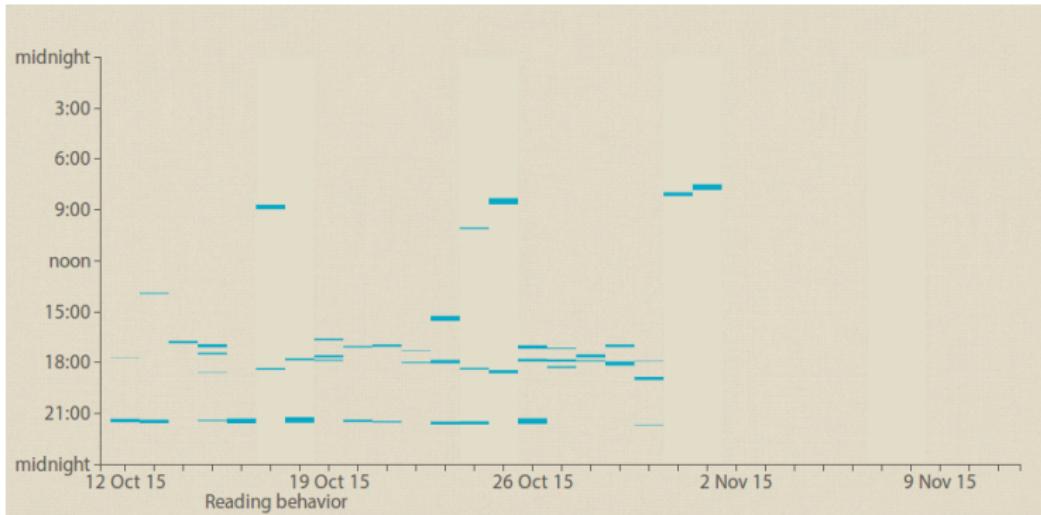
Features

Feature engineering

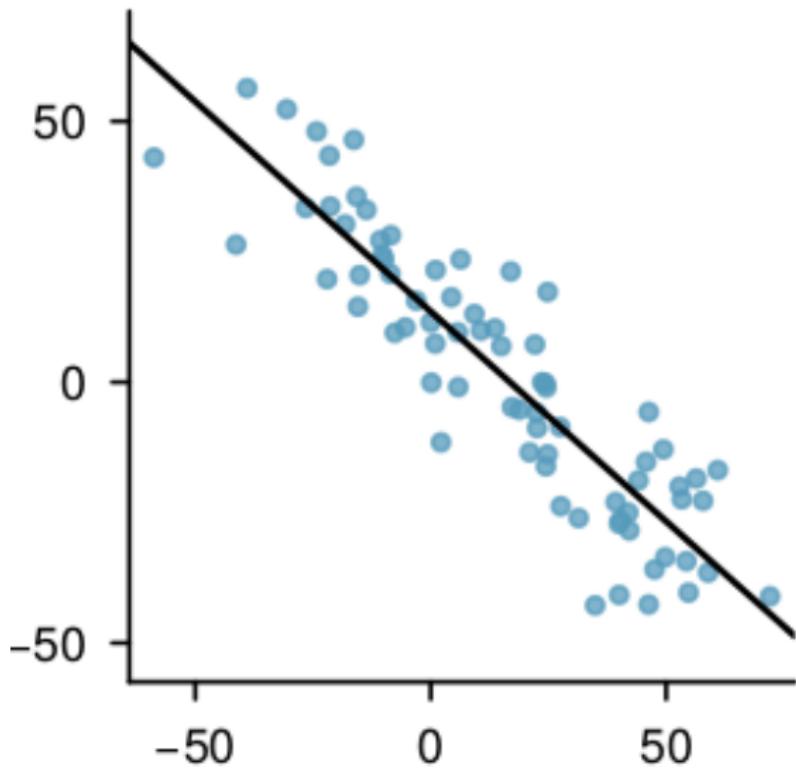


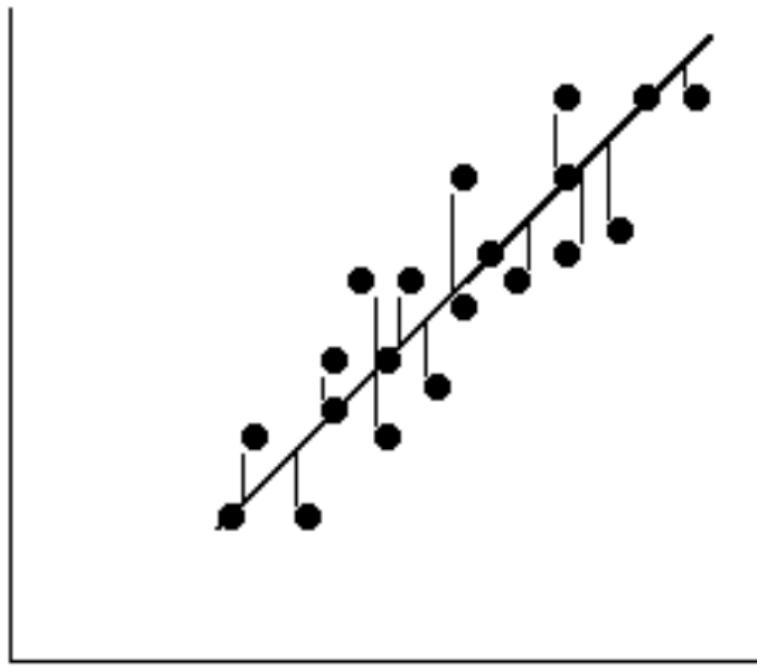


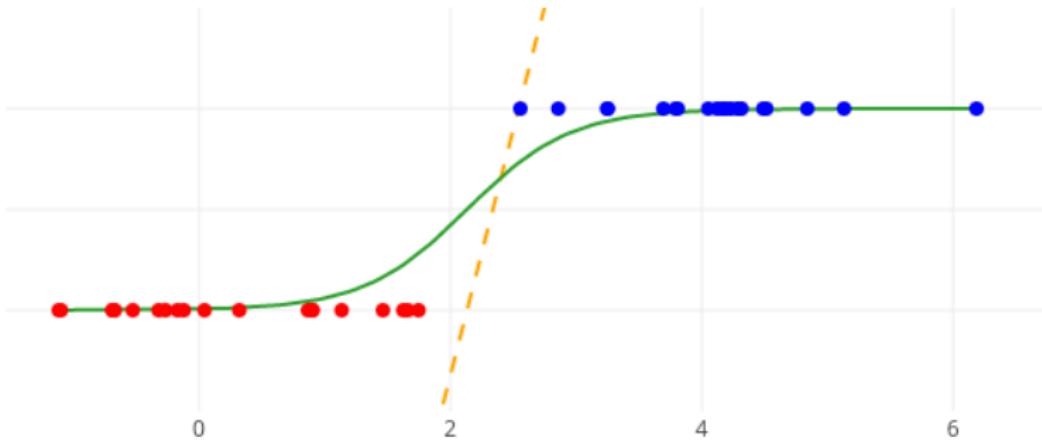
*Jellybooks*

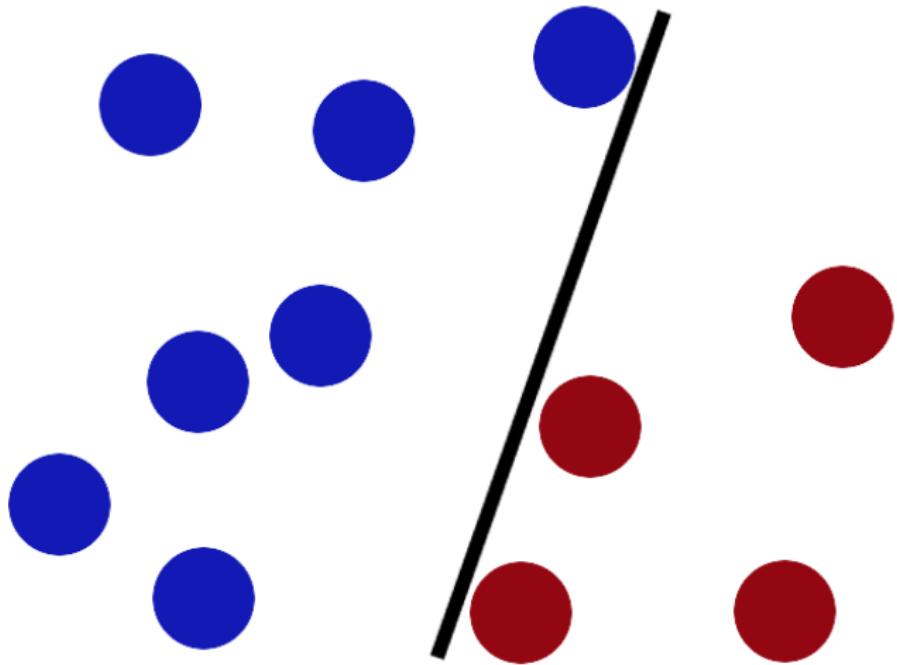


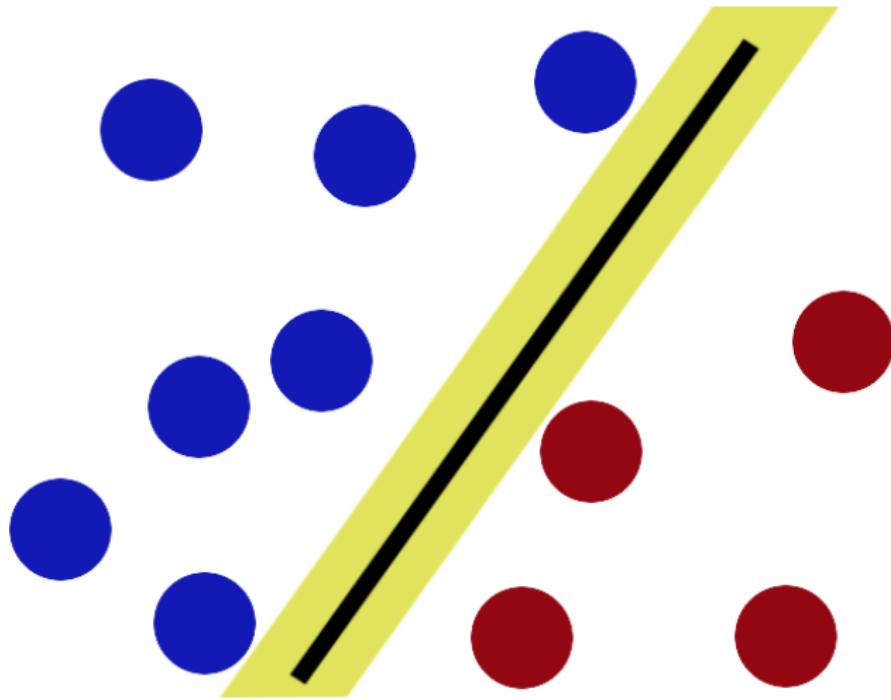
*Jellybooks*

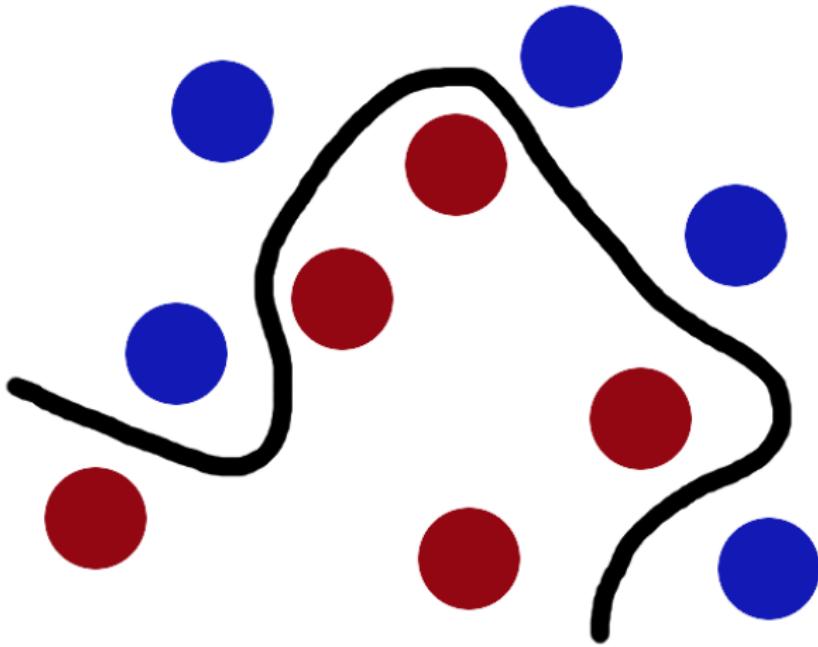


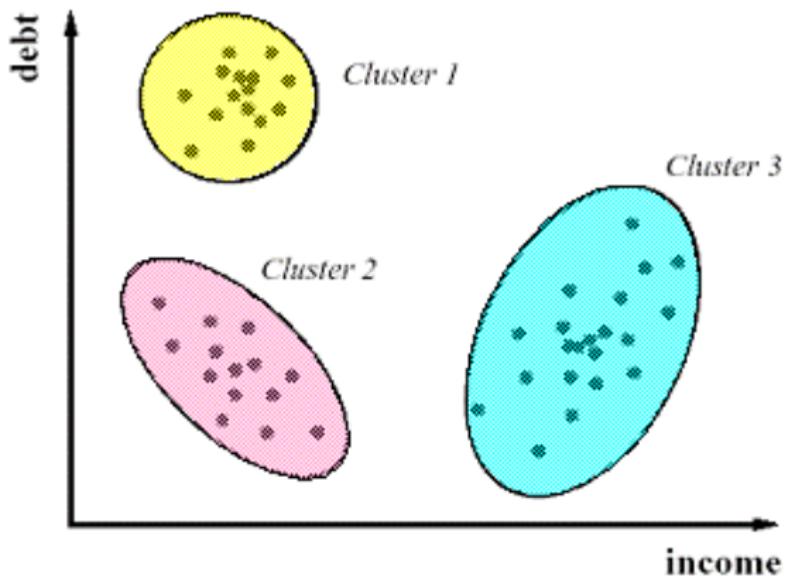




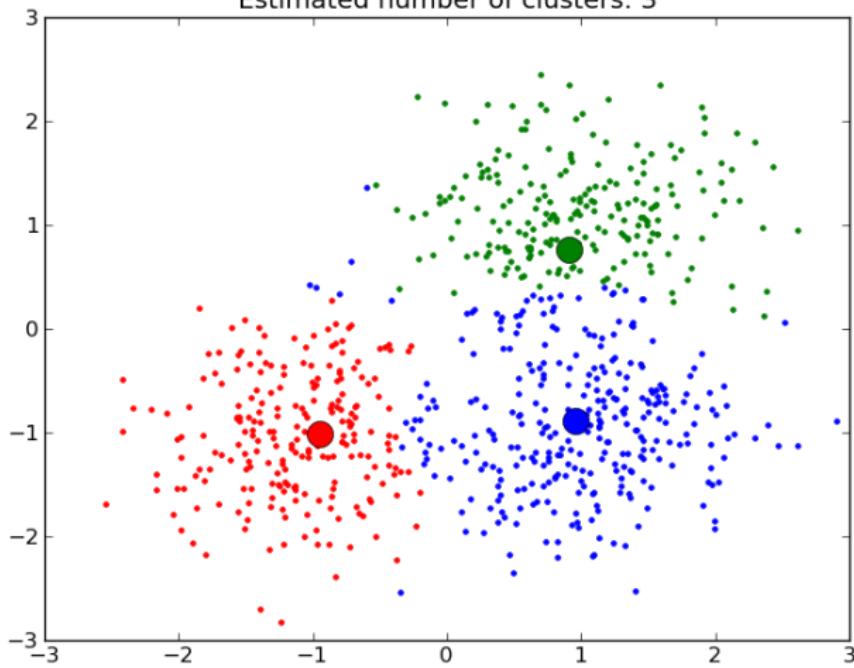


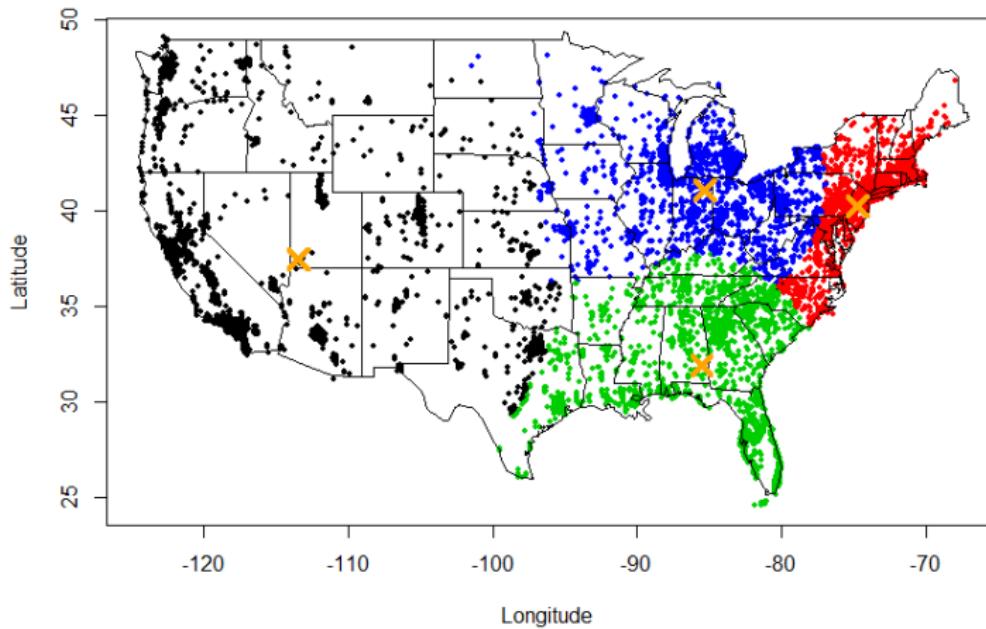




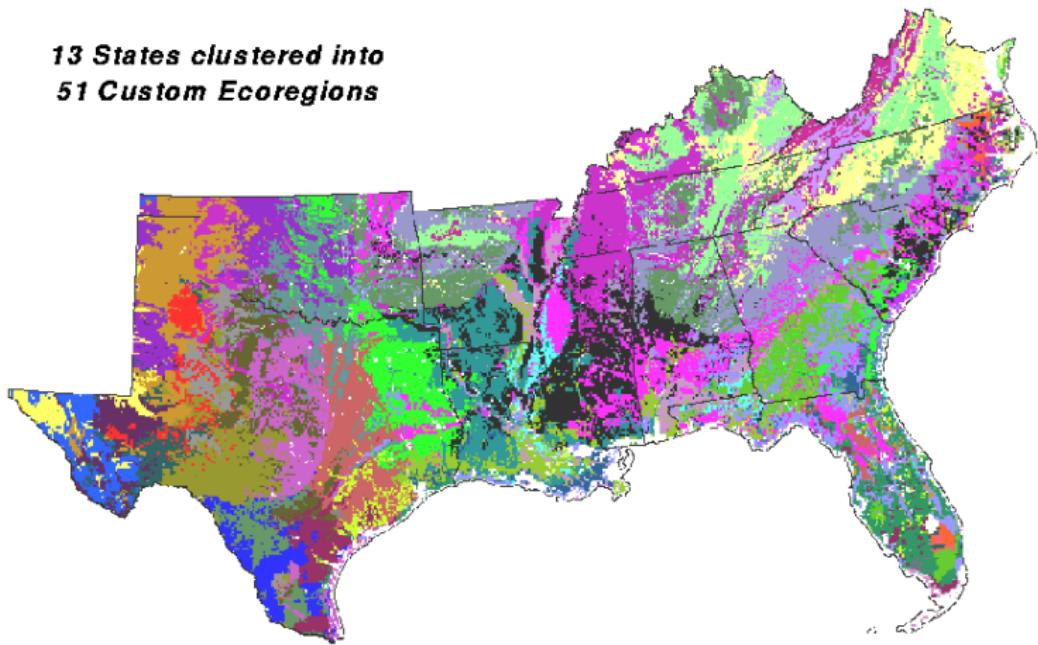


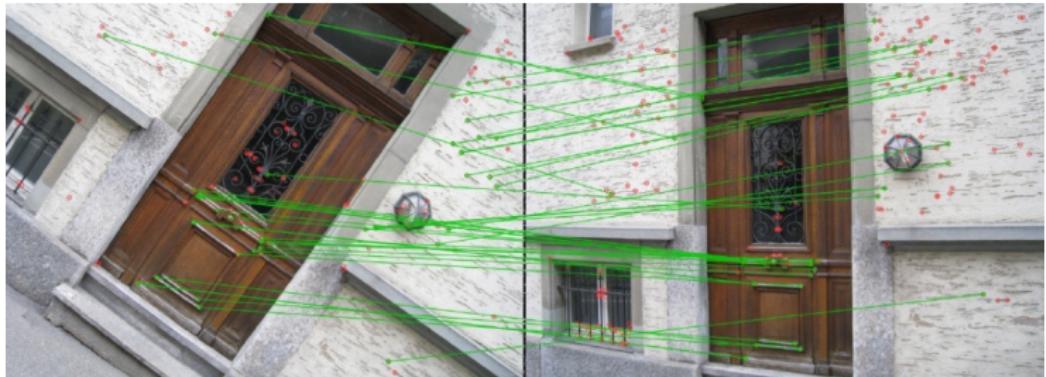
Estimated number of clusters: 3





***13 States clustered into  
51 Custom Ecoregions***





*Eddie Bell @ Lyst*



*Eddie Bell @ Lyst*



*Eddie Bell @ Lyst*



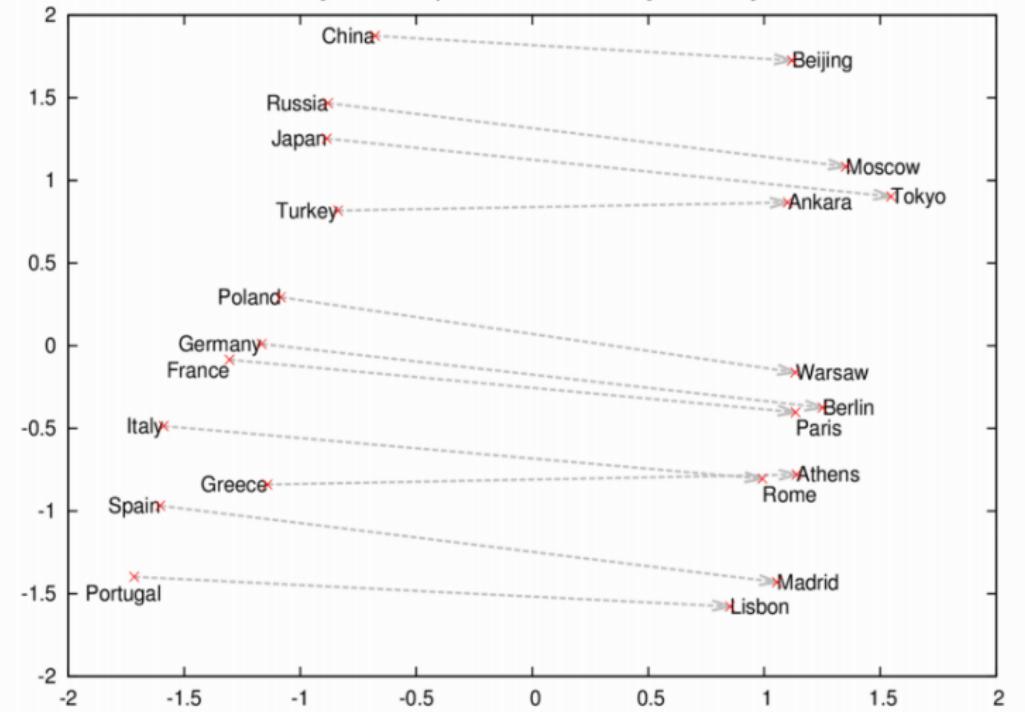
*Eddie Bell @ Lyst*



-1	0	+1
-2	0	+2
-1	0	+1
-1	-2	-1
0	0	0
+1	+2	+1



## Country and Capital Vectors Projected by PCA



Term	Similarity	
	"shift"	0.933104
	"gown"	0.887743
	"skirt"	0.881672
	"bandage"	0.880162
	"midi"	0.869786

**Similar to 'dress'**

*Eddie Bell @ Lyst*



a group of young girls standing next  
to each other on the beach



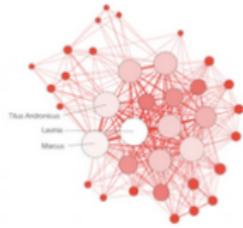
A clock tower with a clock on top of it

*Google?*



**A bunch of bananas hanging from a tree**

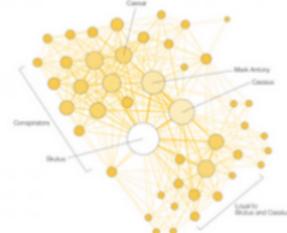
*Google?*



TITUS ANDRONICUS  
Number of characters **36** | 50% Network density



ROMEO AND JULIET  
Number of characters **41** | 37% Network density



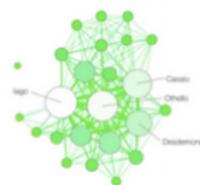
JULIUS CAESAR  
Number of characters **46** | 34% Network density



HAMLET  
Number of characters **37** | 39% Network density



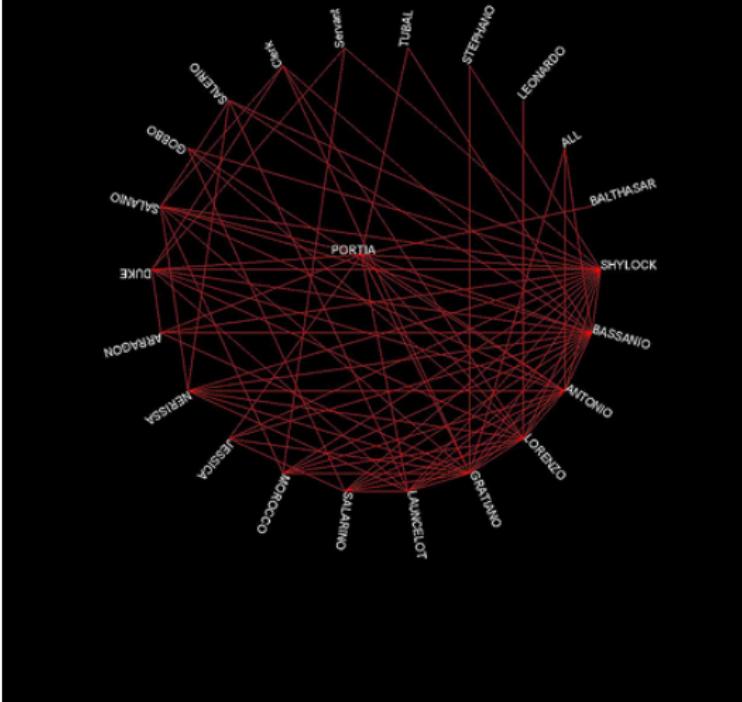
TROILUS AND CRESSIDA  
Number of characters **35** | 40% Network density



OTHELLO  
Number of characters **24** | 55% Network density

[https://flowingdata.com/2015/12/30/  
shakespeare-tragedies-as-network-graphs/](https://flowingdata.com/2015/12/30/shakespeare-tragedies-as-network-graphs/)

Merchant of Venice : diagram showing who speaks to who (most connected in the middle)  
Public Domain - <http://www.pgogy.com/bill/>



Act 4, Scene 1

Shakespeare	And nothing else to start his friends.
Percy	Choose as the course, I like at not.
<h2>And therefore have I little talked of love.</h2>	
Shakespeare	Cook, we, come now the belly towards my self.
Percy	Heaven send me a belly full of ale.
Percy	Then we are done, when we are full.
Percy	What is this? a bell?
Percy	What is this? a bell?
Shakespeare	Frome to make mirth in the beth.
Percy	By answere that I alwaies am a ple.
Percy	My best beth is to drinke you rone.
Percy	With drinke to your new bethes.
Percy	No wile I can see, but to have the
Percy	Ring syng before your belly, than in your beth.
Percy	And then drinke a most shewy and rare.
Percy	The tyme haue god selfe witing by that.
Percy	This shalpe a mirthfullnes, and haire res.
Percy	And what I spake, I spake it by that.
Percy	The tyme haue god selfe witing by that.
Percy	Or shall I come to you at evening mass...
Shakespeare	My brewe remov me, persone da ghet, now.
Percy	juliet, on Thursday early will I nose ye,
Percy	pre hote, pre curte, pre help.
Shakespeare	I hear thou must, and nothing may prouerage it.

Tell me not, friar, that thou  
hear'st of this.

Thou hast the strength of will to slay thyself.

Act 5, Scene 1

My dreams presage some joyful news at hand.

**Below** Her body sleeps in Capels' monument.

I will hence to-night.  
I do beseech you, sir, have patience.  
Tush, thou art deceived.

87

get thee gone.

80 J. B. Hearn

— That the life-weary taker may fall dead.

© 2002 by Pearson Education, Inc.

— famine is in thy cheeks.

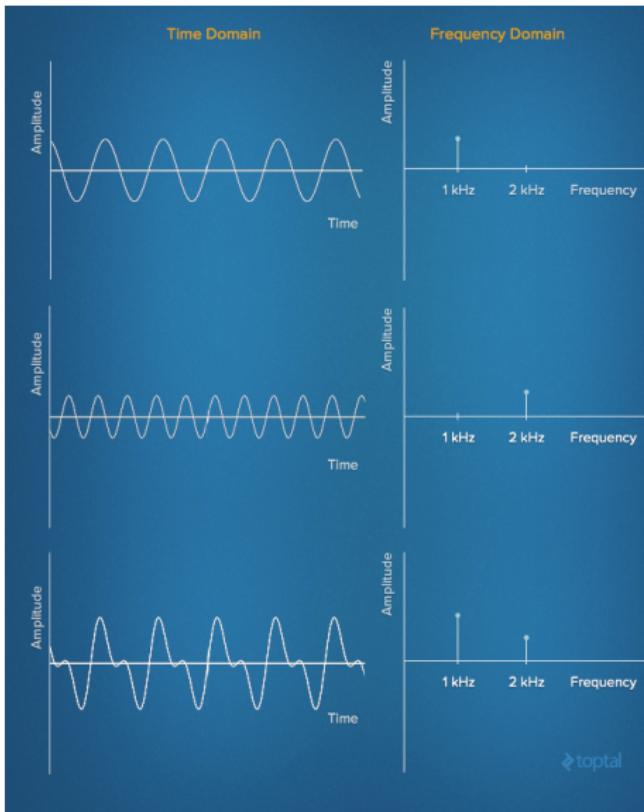
10 of 10

**REMEMBER:** Put this in any liquid thing you will.

10

*http:*

//www.nand.io/visualisation/understanding-shakespeare



<http://www.toptal.com/algorithms/>

*shazam-it-music-processing-fingerprinting-and-recognition*

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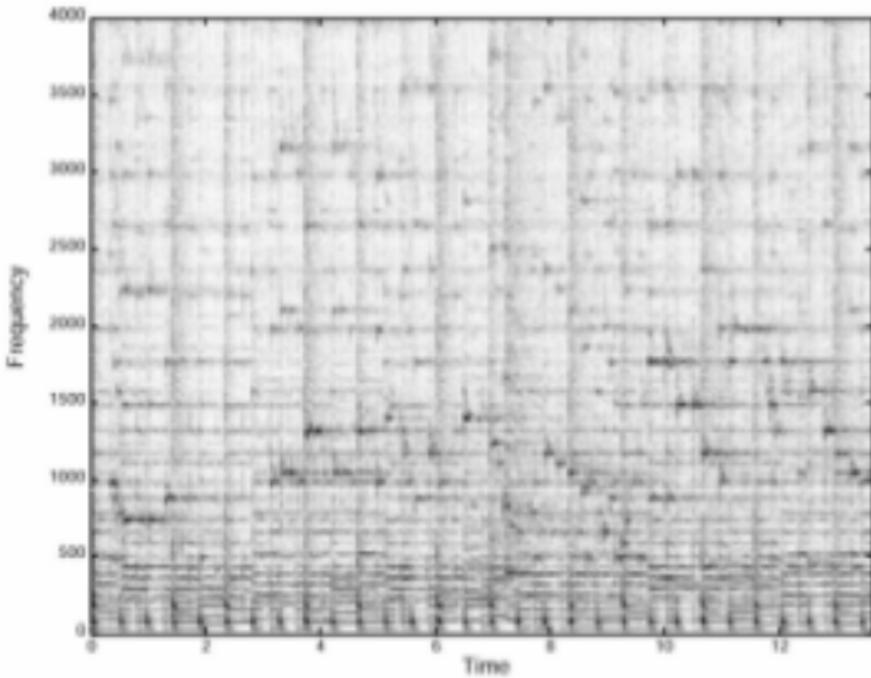


Fig. 1A - Spectrogram

[https:](https://www.ee.columbia.edu/~dpwe/papers/Wang03-shazam.pdf)

//www.ee.columbia.edu/~dpwe/papers/Wang03-shazam.pdf

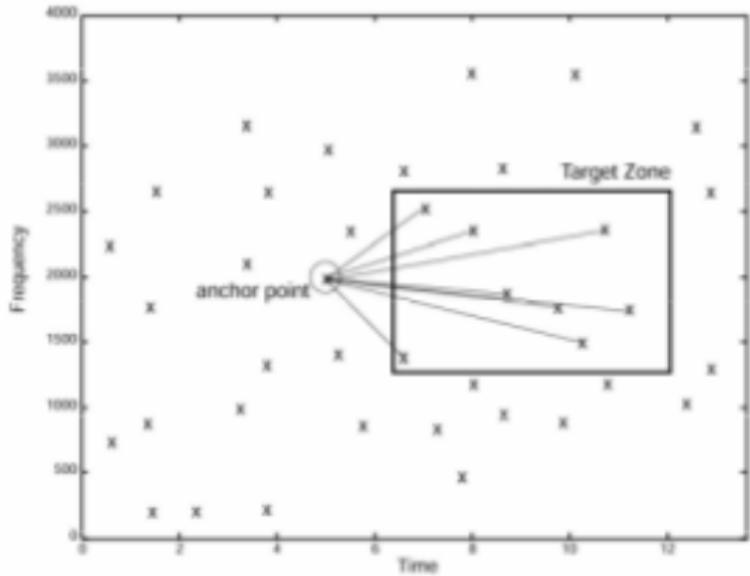
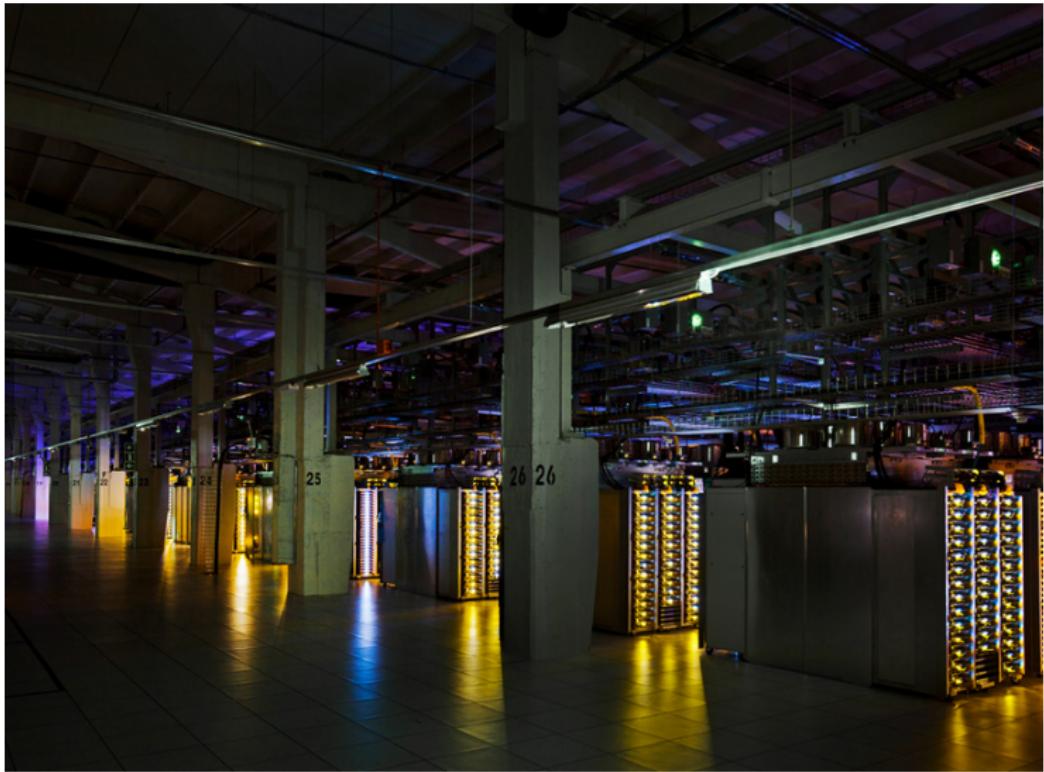


Fig. 1C - Combinatorial Hash Generation

[https:](https://www.ee.columbia.edu/~dpwe/papers/Wang03-shazam.pdf)

//www.ee.columbia.edu/~dpwe/papers/Wang03-shazam.pdf



*Google*

## **Big data?**

*http://aadrake.com/*

*command-line-tools-can-be-235x-faster-than-your-hadoop-cluster.html*

# Some maths...

- 100 features
- int (*4 bytes per feature*)
- 16 GB RAM
- $O(n \log n)$  in RAM

$$400N + (400N) \log(400N) < 16 \cdot 10^9$$

# Some maths...

- 100 features
- int (*4 bytes per feature*)
- 16 GB RAM
- $O(n \log n)$  in RAM

$$400N + (400N) \log(400N) < 16 \cdot 10^9$$

$$N \approx 2 \cdot 10^6$$

A photograph of several Terracotta Army figures standing in a row. They are made of terracotta and wearing traditional Chinese armor and hats. The figures are weathered and have different expressions. In the foreground, the word "Questions?" is overlaid in large, orange, sans-serif font.

Questions?