

MIS 0855 Fall 2016 – Data Science *Week 11 – Predictive Analytics*

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Guess what...

What is the product that a male customer in mid-30s is most likely to purchase with a bag of six-bottle beer in a grocery store?

- Snacks
- Frozen Pizza
- Cigarette
- Diaper



Crime Hotspots



http://www.theomegagroup.com/police/crimeview_desktop.html

Collaborative Filtering



Credit Scores Predict Divorces

BloombergBusiness

Now Reading:
The Federal Reserve Has Some Advice for Your Love Life

The Federal Reserve Has Some Advice for Your Love Life

You'll never loo

- People with higher credit scores are more likely to be in a committed relationship and stay together
- People tend to form relationships with others who have a similar credit score as them
- The strength of the match, both in the headline credit score and its details, is predictive of whether or not a couple is more likely to break up for observable reasons pertaining to finance and household spending; and

<http://www.bloomberg.com/news/articles/2015-10-02/the-federal-reserve-has-some-advice-for-your-love-life>

Big Data Knows When You're Going to Quit Your Job Before You Do

By Jack Clark | Dec 30, 2014 8:03 AM ET | **44 Comments**  **Email**  **Print**

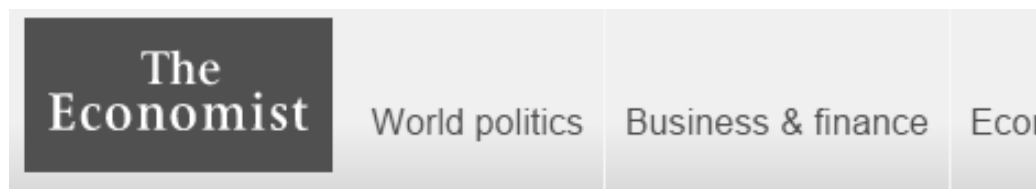
Good bosses have an uncanny ability to sense when employees are unhappy and work with them to fix problems in the office before it's too late. At VMware in Silicon Valley, they let the machines figure it out.

VMware has been testing a new prediction technology from Workday, which makes software for human resources departments. The system delivers notifications about when employees might be getting ready to quit, and allows managers to intervene before



<http://www.bloomberg.com/news/2014-12-29/big-data-knows-when-you-re-going-to-quit-your-job-before-you-do.html>

Don't Use Internet Explorer to Apply for a Job.



Big data and hiring

Robot recruiters

How software helps firms hire workers more efficiently


For instance, people who fill out online job applications using browsers that did not come with the computer (such as Microsoft's Internet Explorer on a Windows PC) but had to be deliberately installed (like Firefox or Google's Chrome) perform better and change jobs less often.

It could just be coincidence, but some analysts think that people who bother to install a new browser may be the sort who take the time to reach informed decisions. Such people should be better employees. Evolv, a company that monitors recruitment and workplace data, pored over nearly 3m data points from more than 30,000 employees to find this nugget.

<http://www.bloomberg.com/news/2014-12-29/big-data-knows-when-you-re-going-to-quit-your-job-before-you-do.html>

MICROTARGETING

Election profiteering or political precision?

- 
- **Single father of one**
 - **Science teacher**
 - **Cares most strongly about education issues**
 - **Registered independent, but always votes Democratic**

- **Married couple**
- **Four children**
- **Dentist**
- **Mormon**
- **\$285,000 mortgage**
- **Strong Republican leaning**

<https://raymondpronk.wordpress.com/2013/06/12/digital-campaigns-using-microtargeting-and-data-mining-to-target-voters-videos/>



<http://www.emprender-facil.com/es/network-marketing/>

Cruz Campaign called voters



http://www.huffingtonpost.com/nancy-leamond/improving-the-voter-exper_b_5128654.html
https://www.washingtonpost.com/politics/cruz-campaign-credits-psychological-data-and-analytics-for-its-rising-success/2015/12/13/4cb0baf8-9dc5-11e5-bce4-708fe33e3288_story.html

Which customer is most valuable?



Jamie visited the store six months ago and purchased a \$2,000 blouse. She never showed up again.



Linda has come by three times a month for the last two years and bought as much as \$150 each visit.



Rachel began to shop at our store two months ago, visited three times, and bought \$500 each time.

Predicting Customer Value

R F M

- Recency: How *recently* a customer purchased an item
- Frequency: How *frequently* she purchases an item
- Monetary value: How *much* she spends each time

Who is our MVC (most valuable customer)?



Jamie visited the store six months ago and purchased a \$2,000 blouse. She never showed up again.



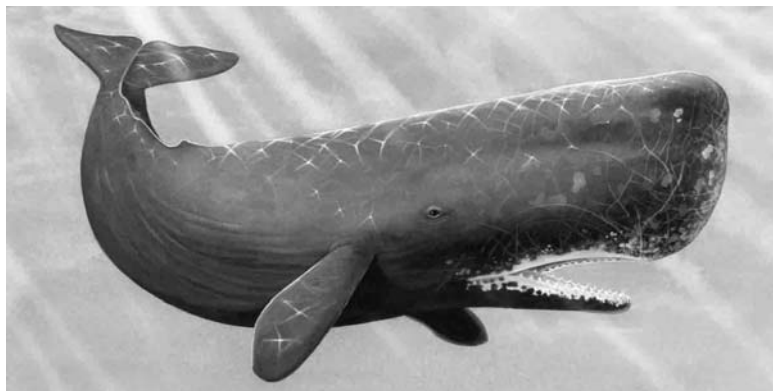
Linda has come by three times a month for the last two years and bought as much as \$150 each visit.

She returns 20% of what she bought.



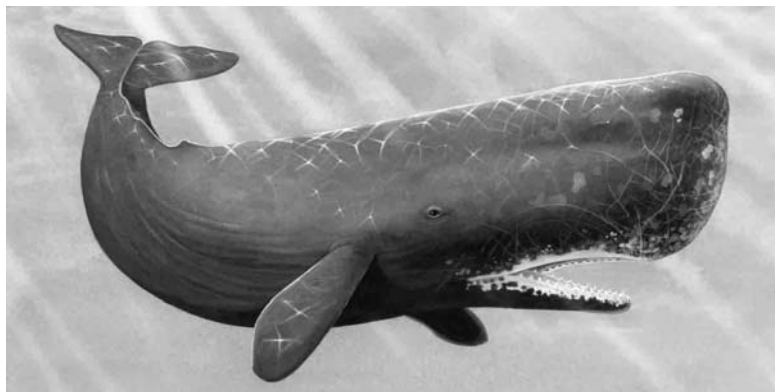
Rachel began to shop at our store two months ago, visited three times, and bought \$500 each time.

Valuing Customers at a Casino (1/2)



- Two customers
 - One who visits once a month and spends more than \$50,000 each visit, aka, a big whale
 - One who visits once or twice a week and spends amount \$200-\$300 each time.
- Which one is more valuable (or more profitable)?

Valuing Customers at a Casino (2/2)



- Conventional industry wisdom used to say that the big whale is to catch, since they are more valuable than the small fishes.
- Analysis of data show that the small fishes are more profitable. Why?
- The big whale spends more, but it is more expensive to serve them.

Three Types of Predictive Analytics

● Decisions

- Will Customer A purchase beer and diaper together?
- Will crimes occur in Neighborhood B?
- Will Voter C vote for Candidate D?

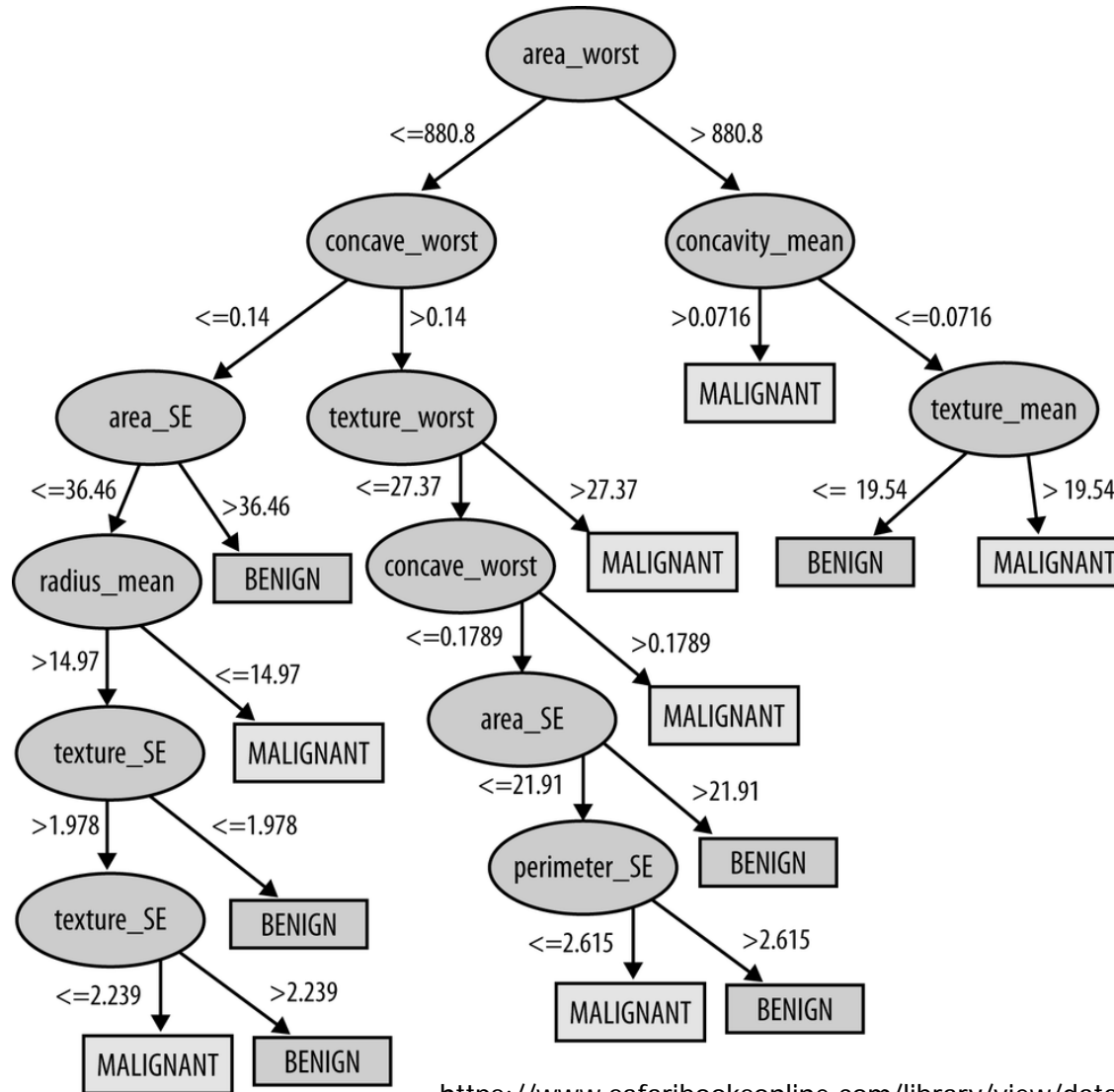
● Rankings

- Who will win the World Series?
- Who are the most credible borrowers? (credit score)

● Estimates

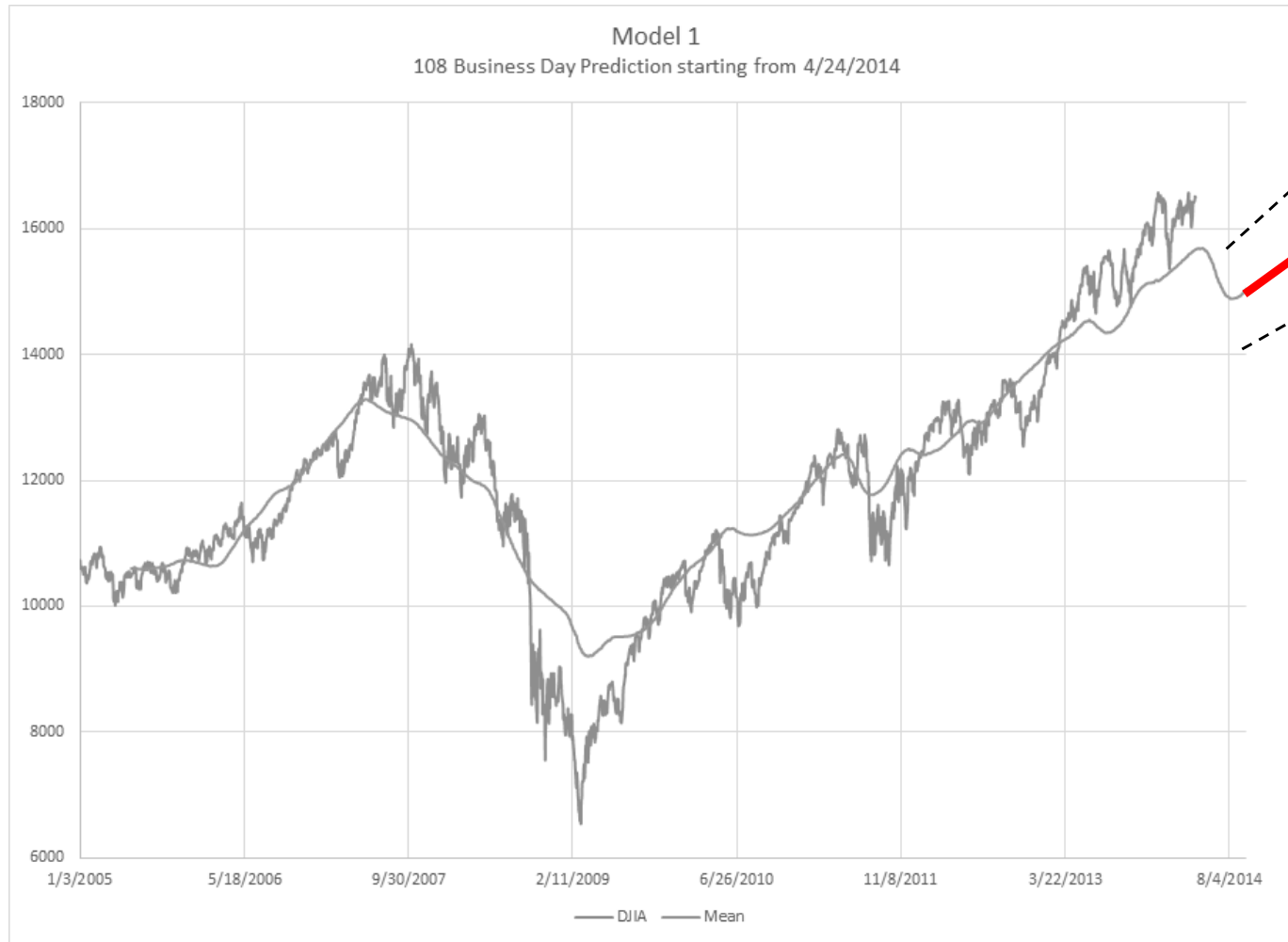
- What is the value of Customer E for his/her lifetime?
- What is the stock price of Company F next month?

A Decision Tree to Predict Breast Cancers



<https://www.safaribooksonline.com/library/view/data-science-for/9781449374273/ch04.html>

A Regression to Predict Stock Prices



Confidence Interval

An Association Detection

Which products are likely to be purchased together?

product nam..	Bizarro T-..	Black and..	Blurb Vis..	Boca Bre..	Bomb Def..	Bombabl..	Botticell
Anti-Dentite ..	■	■	■	■	■	■	■
Anytown, US..	■	■	■	■	■	■	■
Armoire T-S..	■	■	■	■	■	■	■
Astronaut Pe..	■	■	■	■	■	■	■
B-O-S-C-O T..	■	■	■	■	■	■	■
Babka T-Shirt	■	■	■	■	■	■	■
Baby Blue T..	■	■	■	■	■	■	■
Baby Boxers	■	■	■	■	■	■	■
Backslide Br..	■	■	■	■	■	■	■
Bad Breaker ..	■	■	■	■	■	■	■
Bald Paradis..	■	■	■	■	■	■	■
Baldist T-Shi..	■	■	■	■	■	■	■
Barometer T..	■	■	■	■	■	■	■
Beautiful Go..	■	■	■	■	■	■	■
Beef-A-Reen..	■	■	■	■	■	■	■
Big Boy Swe..	■	■	■	■	■	■	■
Big Salad S..	■	■	■	■	■	■	■
Bizarro T-Shi..	■	■	■	■	■	■	■
Black and W..	■	■	■	■	■	■	■
Blurb Visor	■	■	■	■	■	■	■
Boca Breeze	■	■	■	■	■	■	■

What to Use to Predict Crimes?



- What factors to use to predict future crimes?
- What are the most significant predictors?
- The more factors we use, the more accurate the prediction becomes,
- BUT, the more computing power we need.

In-Class Exercise – What to Use to Predict Mortgage Default?

- What factors to use to predict a failure to pay back home mortgage?
- What are the most significant predictors?

