

Starting Cold: The Power of Social Networks in Predicting Non-Contractual Customer Behavior

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Digital Economy is Booming



THE DIGITAL ECONOMY IS THE NEW REALITY

88%

FORTUNE 500 COMPANIES DISAPPEARED, MERGED, OR CONTRACTED

70%







NUMBER OF NEW COMPANIES IN TOP 10 LIST OF LARGEST GLOBAL FIRMS

66

NEW VENTURE-BACKED STARTUPS WITH \$1B VALUATIONS, UP FROM 11 IN 2012

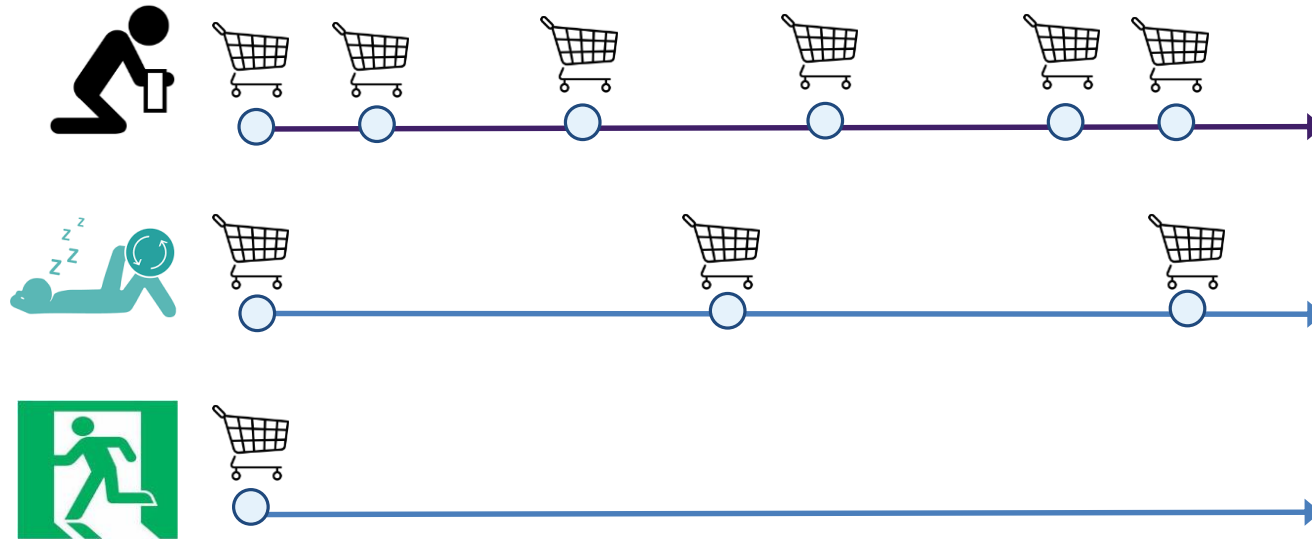


Contractual VS Non-Contractual Settings

	Contractual	Non-Contractual
Subscription fee	✓	✗
Pay-per-use	✗	✓
Observed customer attrition	✓	✗
Example companies	  	  

Why Non-Contractual is Challenging?

- Who has churned?



Why is it important?

1. Marketing Resource Allocation:

- Up to 68% of newly acquired customers are unprofitable (McCarthy and Fader, 2017)



2. Customer Based Corporate Valuations (CBCV)

- Non-contractual firms are prone to misvaluations, due to latent attrition (McCarthy and Fader, 2017)



Can we do something?



Research Questions

- Power of social networks in predicting:
 1. **Customer activity**
 2. **Transaction volume**
 3. **Top customers**
- Can we solve the **cold-start** problem?
“show me your friend and I will tell you who you are”

Venmo

venmo

The easiest way to pay your friends.



venmo

Growth Continues to Climb

Total payment volume over time



Chiara Atik
@ChiaraAtik

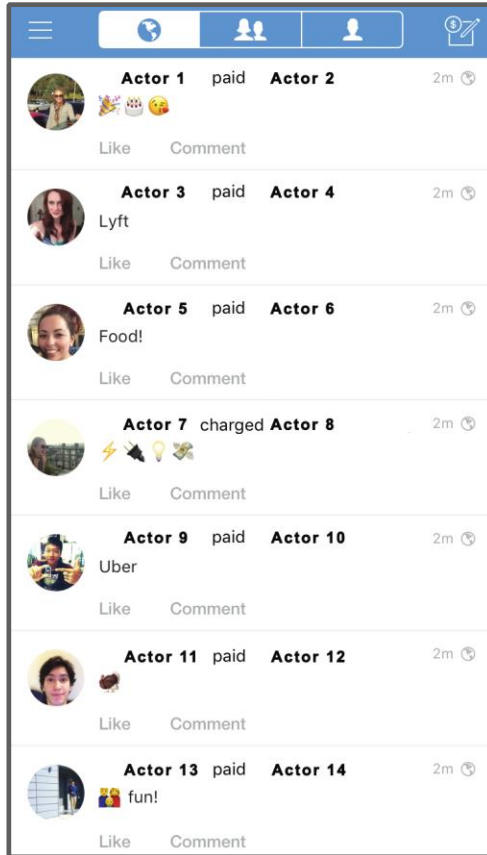
Follow

Just lying in bed, scrolling through my Venmo newsfeed

4:48 PM - 20 Apr 2014

6 10

Dataset



- Crawl **Venmo's API**:
 - **120M** Public Transactions
 - **2.3M** Users
 - **Python Scraping!**
- Final dataset contained:
 - **1M users.**

Data Pre-Processing: **Apache Spark**

User based



- Recency
- Frequency
- Date & month joined
- Facebook sign-up
- Early adopter
- Night average

Social Network based



1st degree

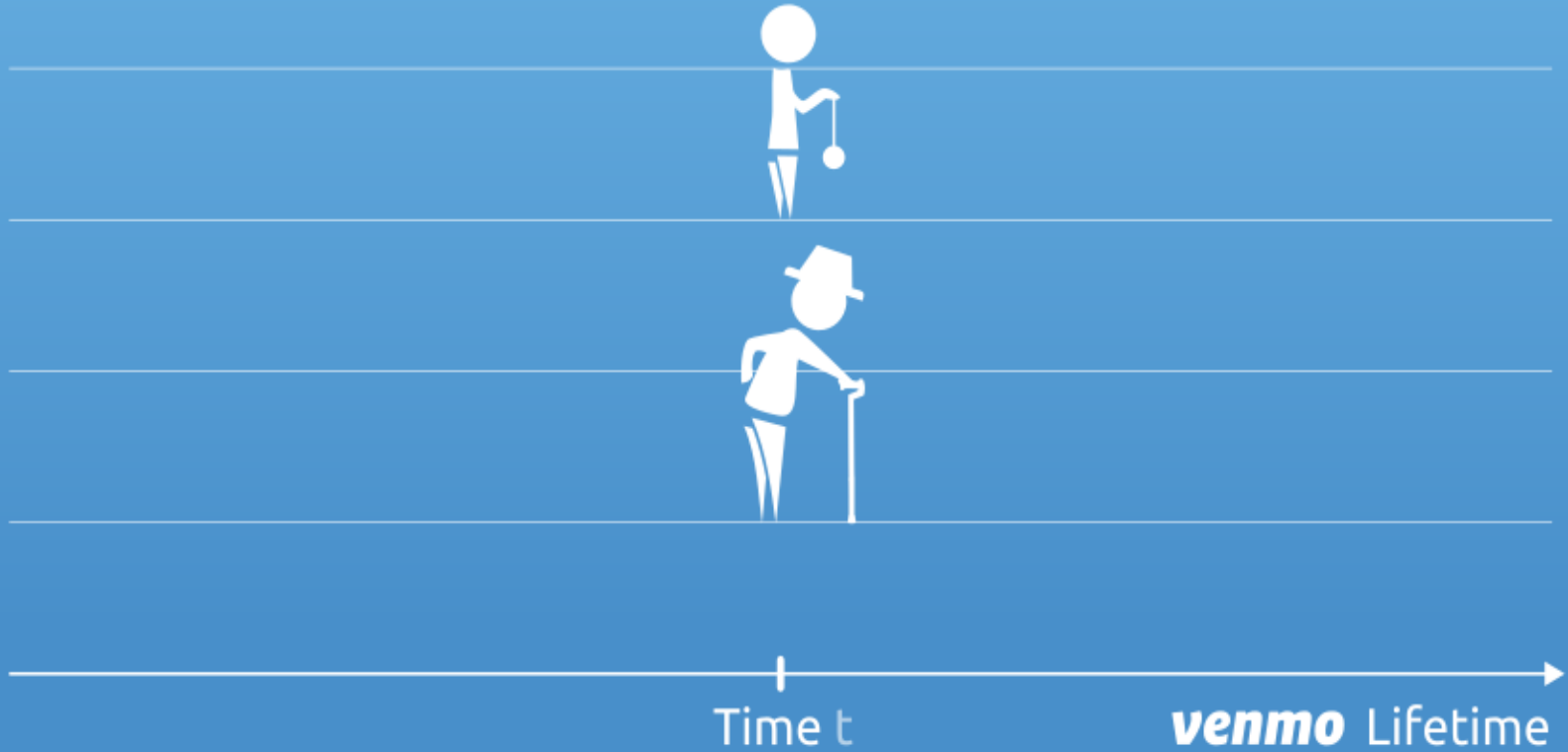
- Degree
- Triangle count
- Cohesion
- Page rank
- % of outgoing trans.
- Avg. frequency of friends



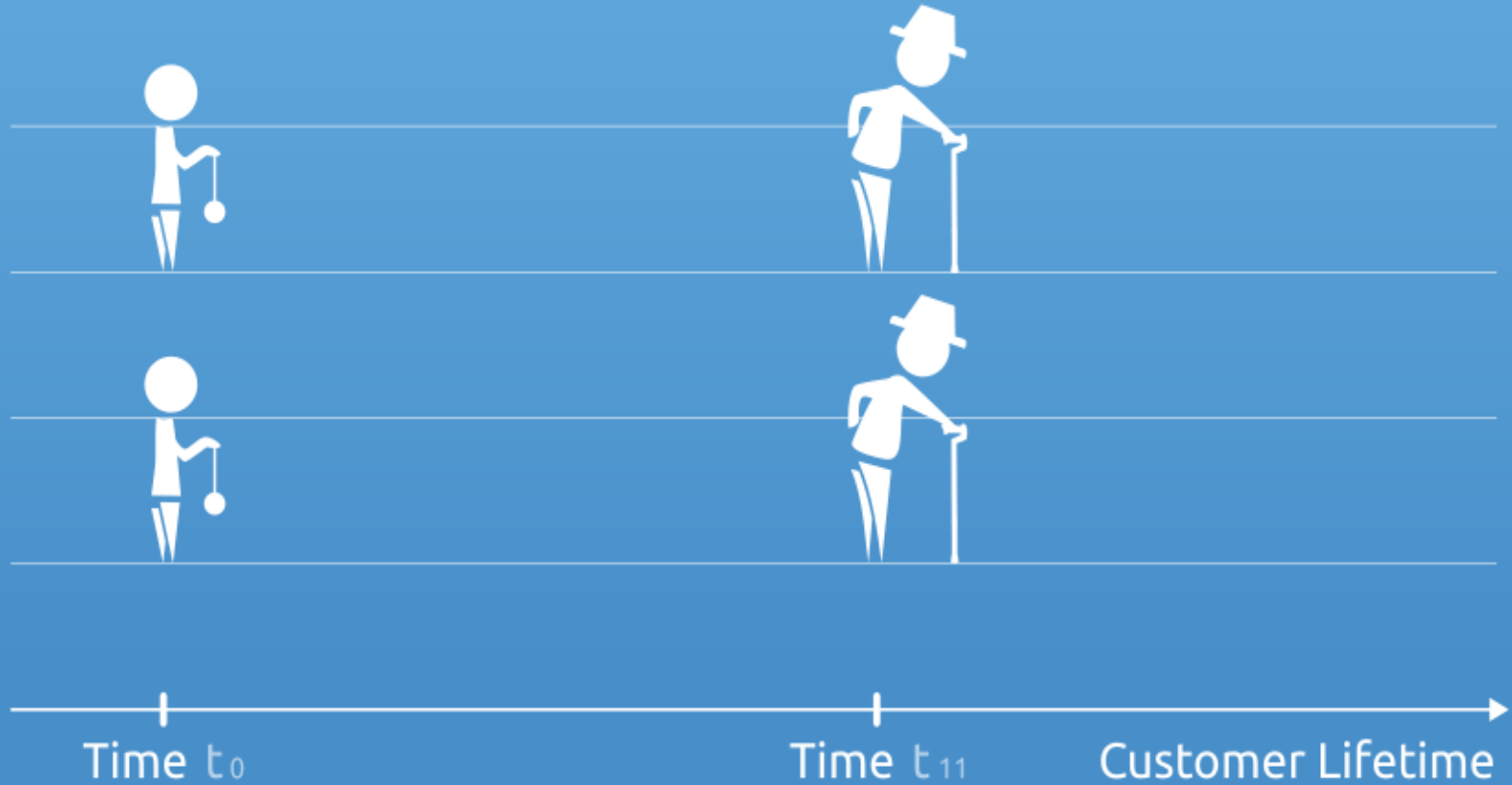
2nd degree

- Avg. number of friends of friends
- Mutual friends of friends
- Avg. frequency of friends of friends

Methods: Dynamic Analysis



Methods: Dynamic Analysis

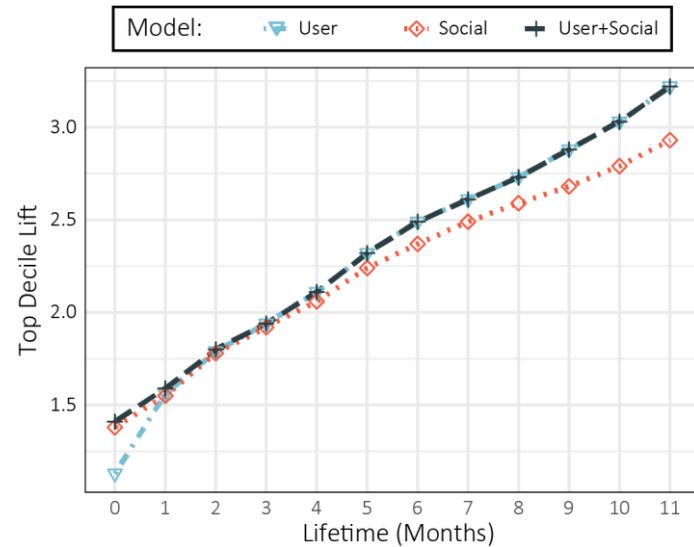
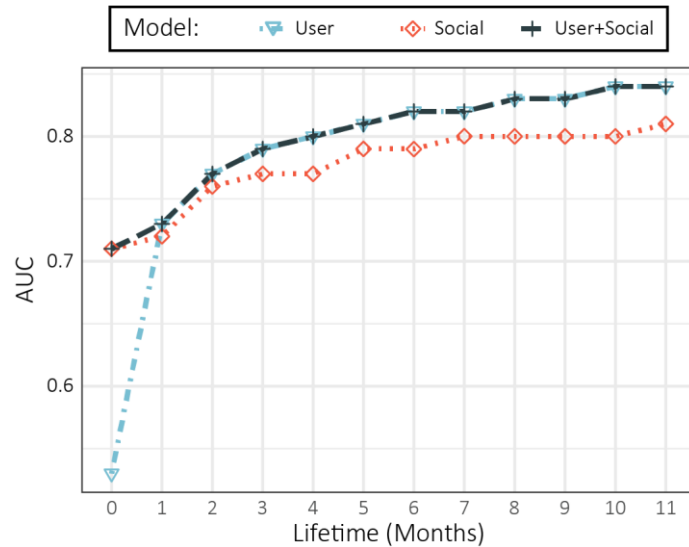


Methodology – Modeling

Predictive Task	Problem Type	Prediction Horizon	Functional Form
Customer Activity	Binary classification	1 - 4 months	Logistic, Lasso , Random Forests
Transaction Volume	Regression	12 months	Linear Regression , Random Forests
Top Customers (10%)	Binary classification	12 months	Logistic, Lasso , Random Forests

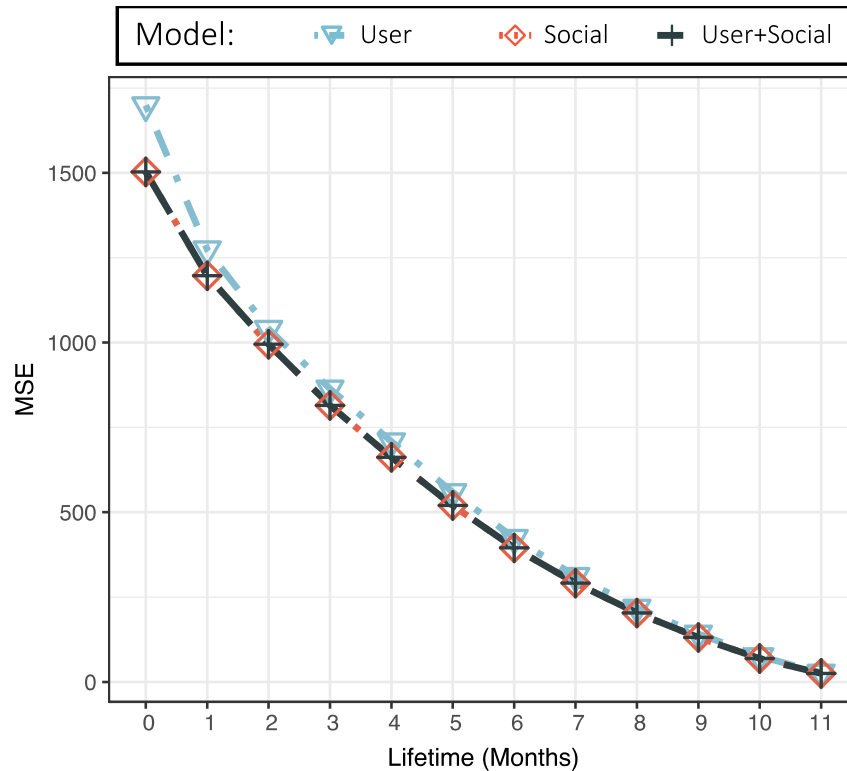
- Build 3 models:
 - User only
 - Social Only
 - User + Social

Results: Predicting Short-term activity



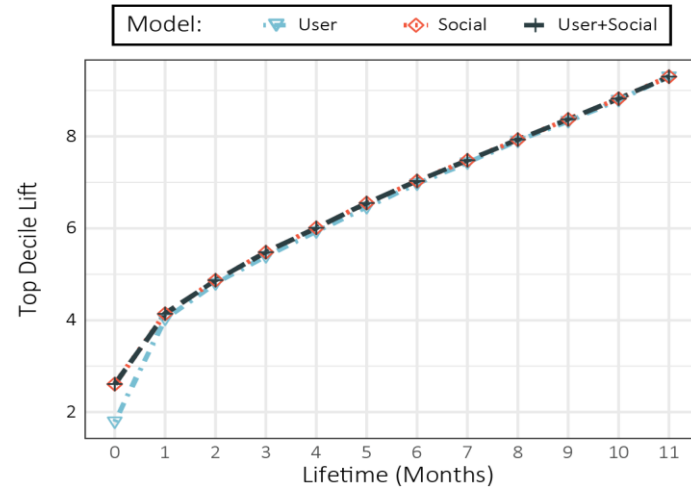
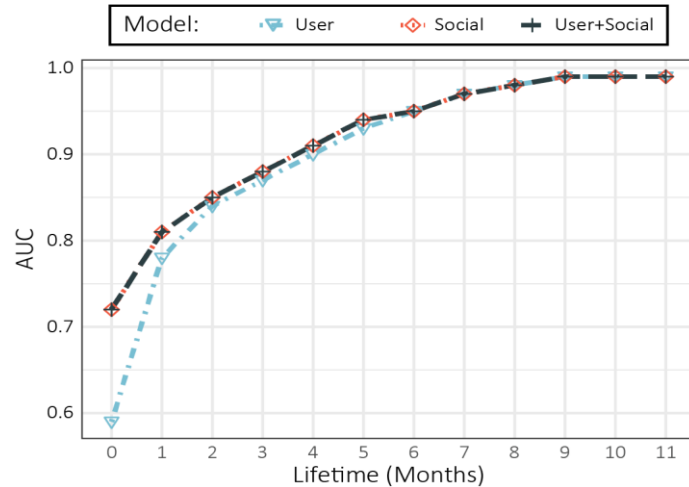
- Relative increase at lifetime 0:
 - AUC: 15% - 28%
 - Top-decile Lift: 28% - 35%
- User & Social are **complimentary!**

Results: Long-term Transaction Volume



- Cold-start results also hold here.
- Relative difference at lifetime 0:
 - Test MSE: 13.0%

Results: Predicting Top Customers



- Relative increase at lifetime 0:
 - AUC: 22.0%
 - Top-decile Lift: 45.8%

Results: Structural Dissimilarities

Measure	Lifetime = 0		
	Top 10 %	Top 90 %	Cohen's D
Triangle count	0.75 (4.22)	0.18 (0.97)	0.35**
Cohesion	0.24 (0.39)	0.10 (0.28)	0.49**
Mutual Friends of Friends	0.06 (0.14)	0.02 (0.09)	0.43**
Number of friends	1.28 (1.11)	1.13 (0.51)	0.25**
Outgoing transaction percentage	0.52 (0.48)	0.52 (0.49)	0
Friends average number of friends	9.36 (10.62)	7.87 (10.38)	0.14*
Friends of friends average number of friends	10.06 (7.98)	8.19 (7.69)	0.24**
Giant component	0.87 (0.33)	0.80 (0.40)	0.18*
Page rank	0.32 (0.40)	0.26 (0.29)	0.21**

Very small: *

Small: **

Cohen's effect size on group mean differences at lifetime 0.

- With **Big Data** use **Cohen's Effect Size**
- Top 10% of customer join dense & connected communities:
 - **Cohesion**
 - **Mutual Friends of Friends**

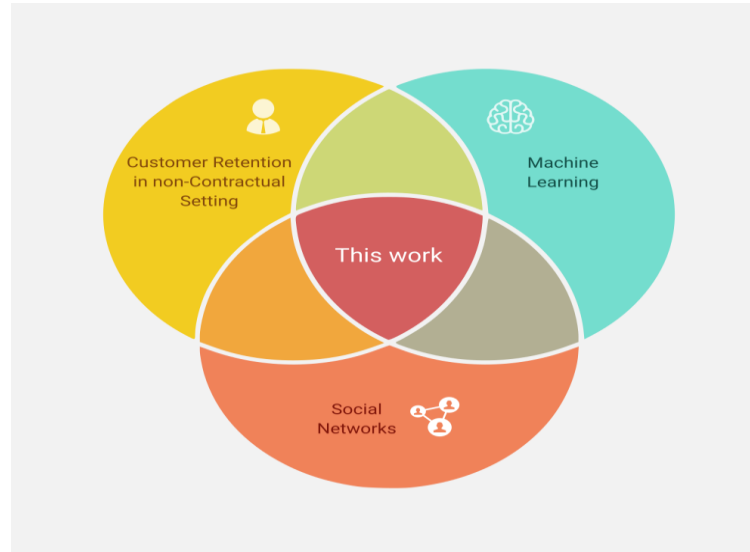
Conclusions

- **Power of Social Networks** in Predicting Customer Behavior
 - User and Social are complimentary!
 - Solve Cold-Start Problem:
 - Better Targeted Marketing
 - Enhance CBCV
- **Network Structural Properties**
 - Cohesion
 - Mutual Friends of Friends
 - Acquisition insights: Best customers tend to join highly dense and connected communities.

Thank you very much!

- **Any questions?**

Literature Review



- **Telecom**

- Dasgupta K, Singh R, Viswanathan B, Chakraborty D, Mukherjea S, Nanavati AA, Joshi A (2008) Social ties and their relevance to churn in mobile telecom networks. ACM
- Benedek G, Lubloy A, Vastag G (2014) The importance of social embeddedness: Churn models at mobile providers. Decision Sciences.

- **Banking**

- Benoit DF, Van den Poel D (2012) Improving customer retention in financial services using kinship network information. Expert Systems with Applications.