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Problem

Background

Important to businesses' revenue!

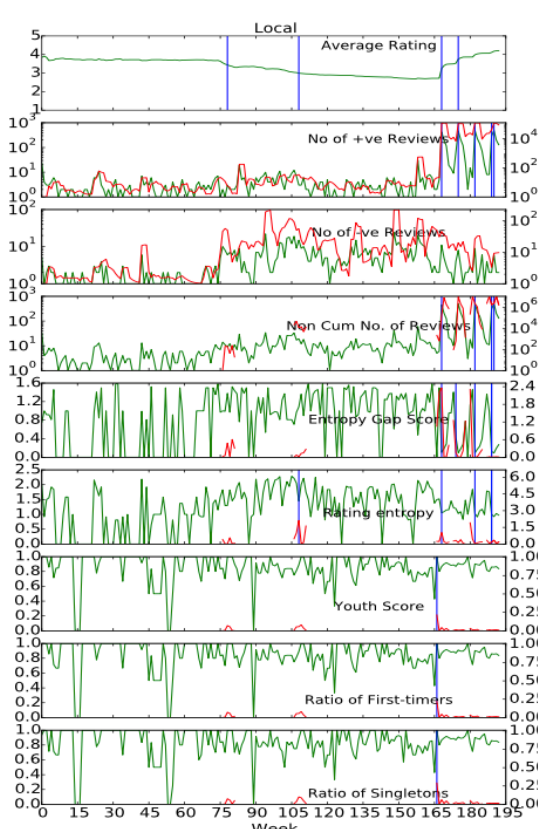
Pay spammers to write
fake reviews



Problem Statement

Input: products' review
streams

★★★★★ Love it
By Preston Rhubee on June 17, 2015
C: ★★★★★ Good for casual wear not workouts
I: By Jake Klinev on February 21, 2015
Color: ★★★★★ Accuracy not included
ne
I was By John Klett on January 27, 2015
real Color: Black Size: Large (6.2-7.6 in) Verified Purchase
Couldn't be more disappointed! I followed the directions,
better and it was never accurate.



Output: targeted
products at time t .

Approach

Indicative Signals

Name	Range	Suspicious if
Average Rating	[1, 5]	Change
Number of (+/-) Reviews	[0, ∞]	Increase
Rating Entropy	[0, log ₂ 5]	Decrease
Ratio of Singletons	[0, 1]	Increase
Ratio of First-timers	[0, 1]	Increase
Youth Score	[0, 1]	Increase
Temporal Gap Entropy	[0, max _e †]	Decrease

†With windows size ΔT and logarithmic binning, number of bins is $\lceil \log_2 \Delta T \rceil + 1$ and $max_e = \log_2(\lceil \log_2 \Delta T \rceil + 1)$.

Overview

1. Temporal Signal Extraction;

2. Anomaly Detection in **Lead Signal**;

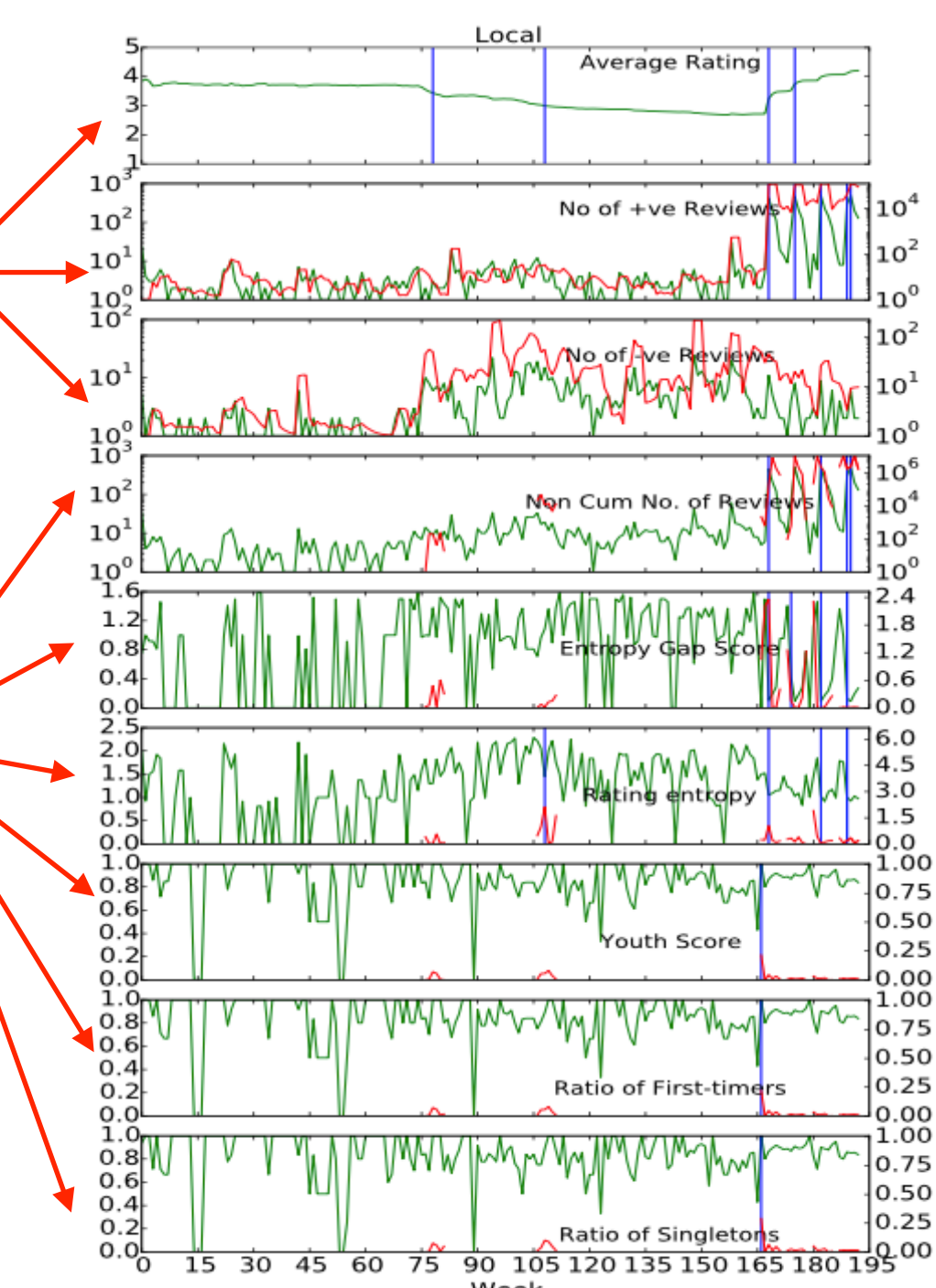
- CUSUM** for average rating;
- Autoregressive model (AR)** for others;

3. Anomaly Detection in **Supporting Signals**;

- Analyze **local values** only when "alarms" triggered by lead signal;
- Use **AR** to detect anomalies;

4. Suspiciousness Quantification;

- 4 features** to characterize anomalies;
- Integrate** features into single value;



Contributions

- Problem formulation:** Descriptive and general to detect spam reviews by monitoring indicative signals;
- New methodology:** Online and efficient algorithm;
- Validated** the method on real-world datasets.

Code and Data available:

<http://www3.cs.stonybrook.edu/~juyye/>

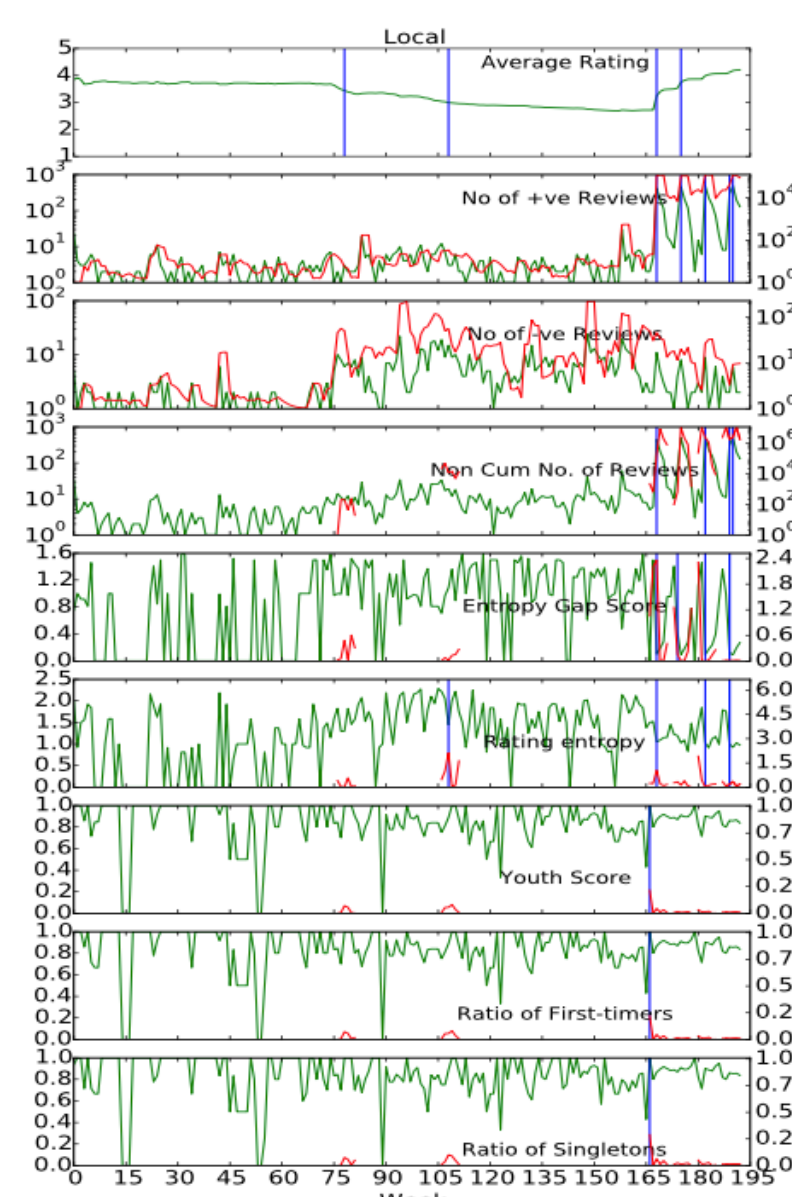
Experiments

Data sets

Dataset	Reviewer#	Product#	Review#	Start Date	End Date	Week#
iTunes	966K	15K	1.1M	Jul. 2008	Apr. 2012	198
Flipcart	1.1M	550K	3.3M	Aug. 2011	Jan. 2015	180

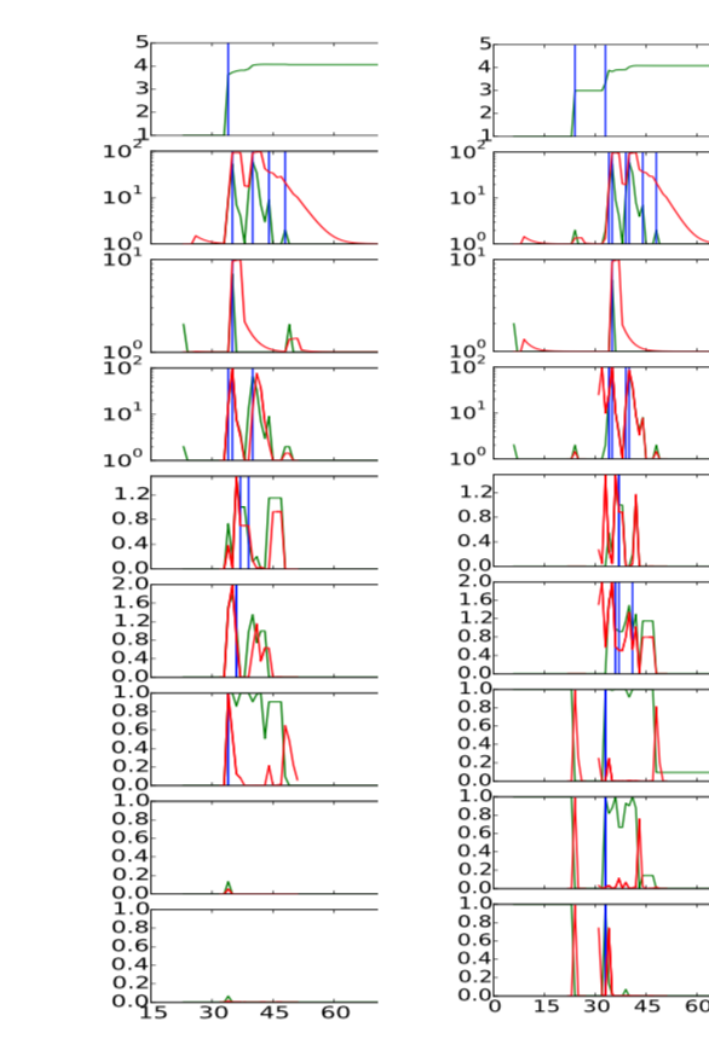
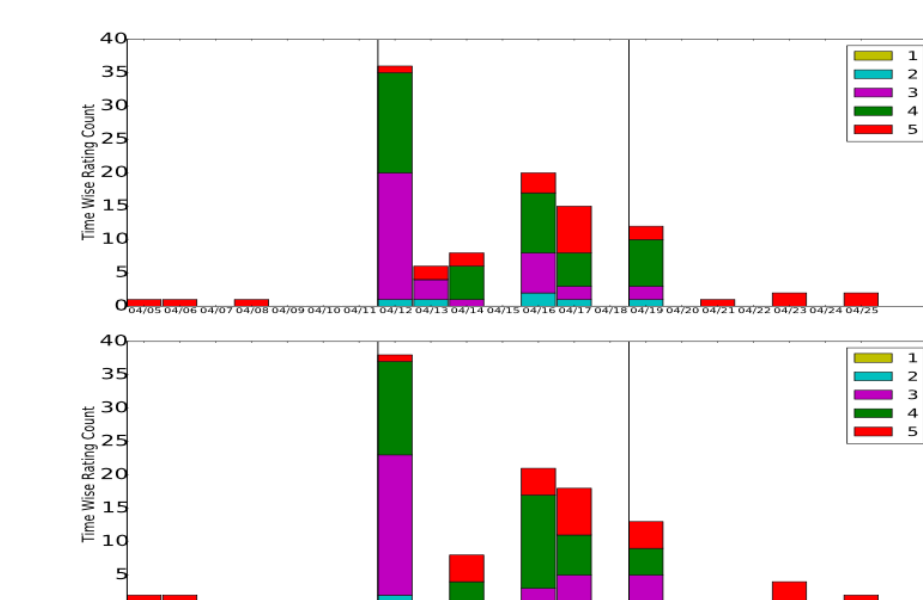
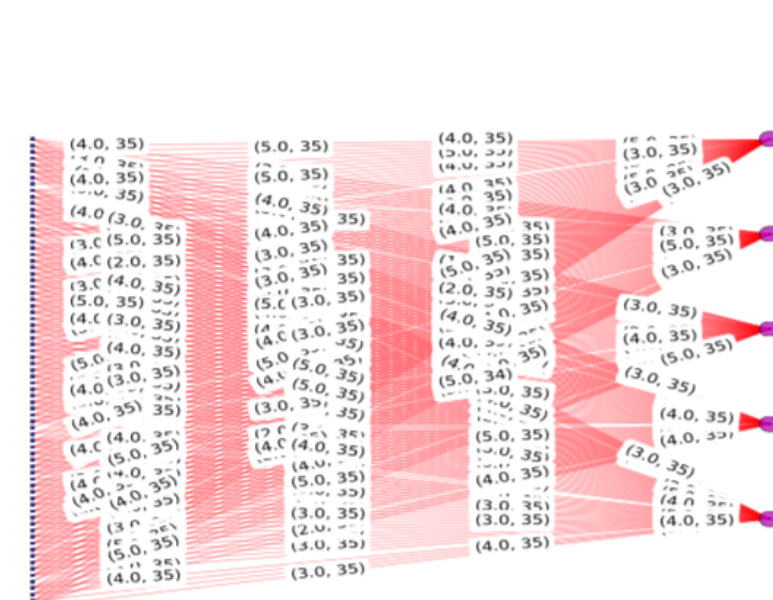
Case 1

- Product from iTunes
- Burst in # of positive reviews: **every 7 weeks**;
- Duplicate** review texts, e.g.
 - "Great app for gamers"
 - "Great App For Gaming news"
 - "Must have app for gamers"
 - "One of my favorite apps"
- Synchronized** extreme ratings (5-star)



Case 2

- Product from Flipcart
- Week 35** is detected suspicious;
- Spammer group** is detected;



Case 3

- Product from Flipcart
- 125** 5-star reviews in 2 days, while less than **10** reviews during other weeks;
- These reviewers also reviewed another book, **same author, same order** during the **same days**!

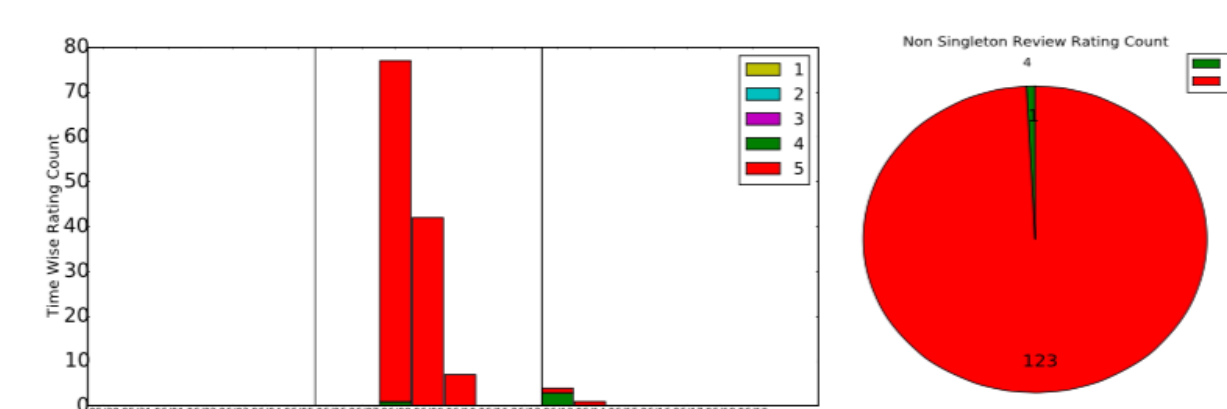
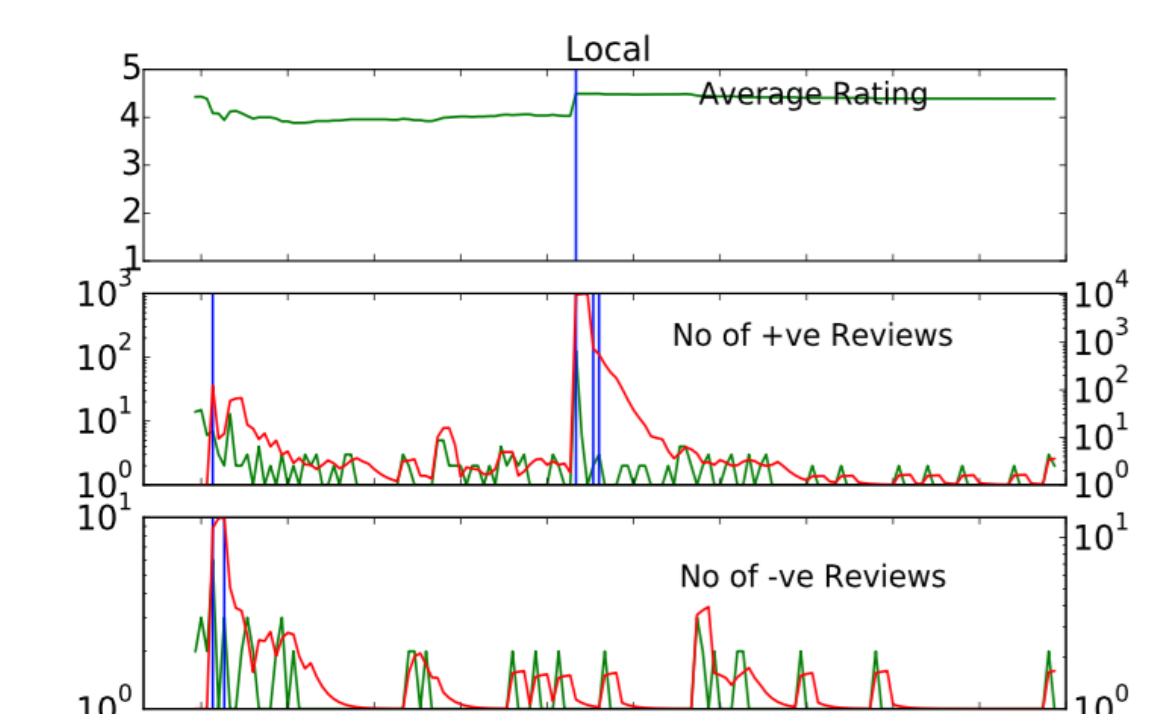


Figure 14: (left) Daily review counts, and (right) Rating distribution by non-singletons in week 35 for product in Figure 13.