VEWS: A Wikipedia Vandal Early Warning System

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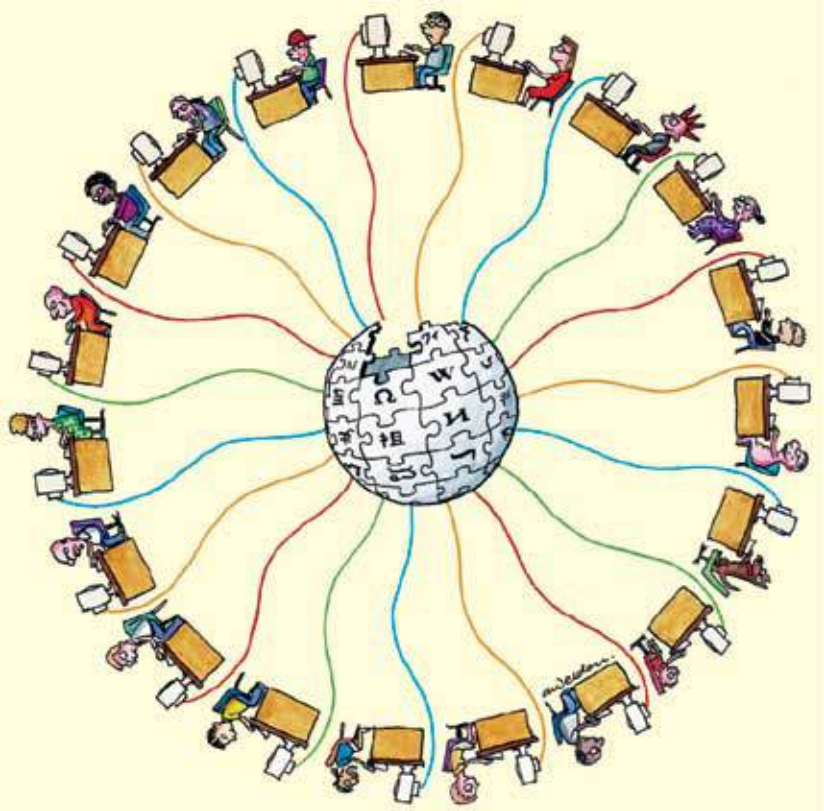
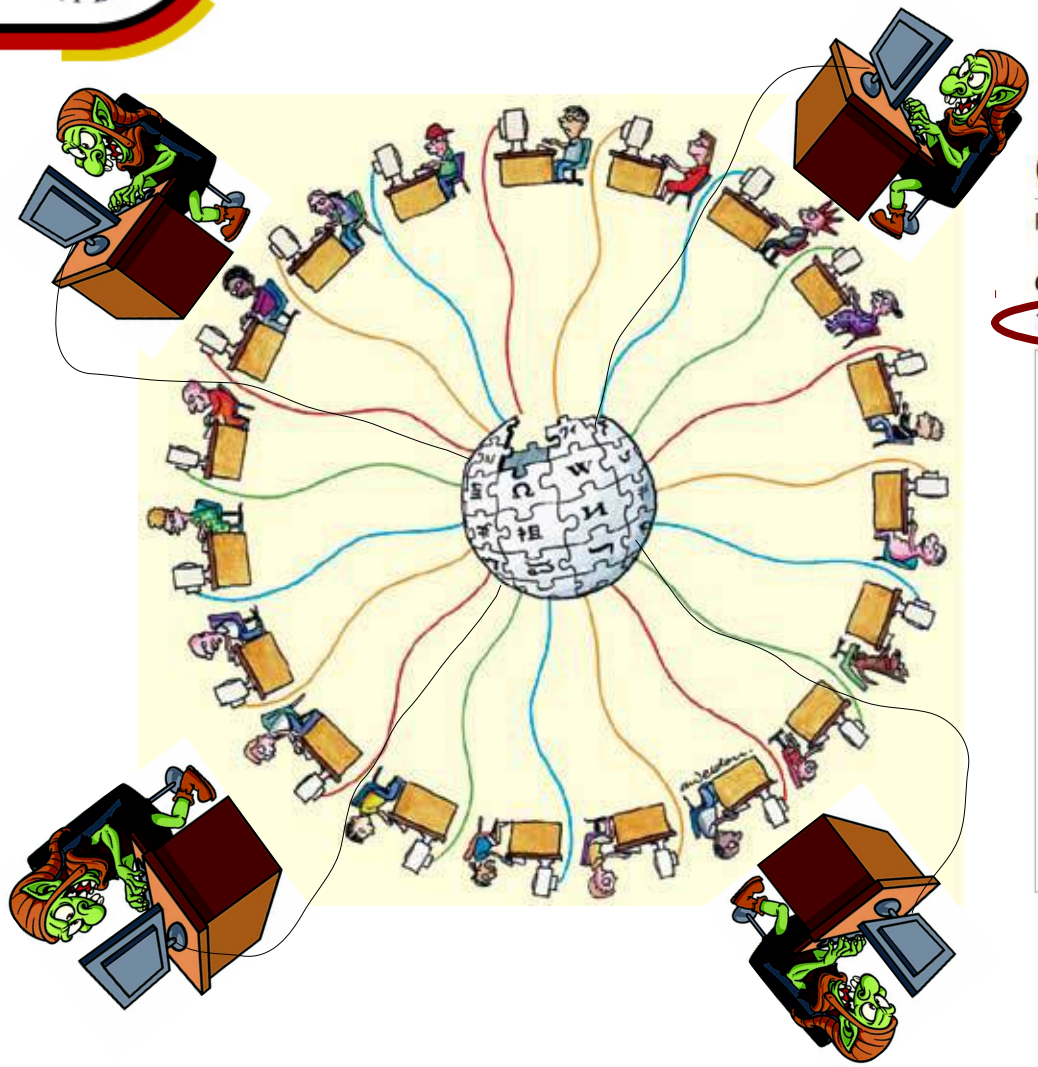
Wikipedia



The largest encyclopedia

- 35M articles over 290 languages
- 73K+ active editors

Vandals on Wikipedia



Charlie Sheen

From Wikipedia, the free encyclopedia

Charlie Sheen (born September 3, 1965) is half man, half cocaine.

Contents [hide]

1 Early life
2 Career
3 Political views and activities
3.1 Charitable activities
3.2 September 11 attacks
4 Personal life
5 Awards and honors
6 Filmography
6.1 Films
6.2 Short films
6.3 Television
7 References
8 External links

Charlie Sheen

Sheen in March 2009

Born	Carlos Irwin Estevez September 3, 1965 (age 45) New York City, New York, U.S.
Occupation	Actor

Current Tools: Detect Vandalism

ClueBot NG
Bot to detect vandalism edits

STiki
Tool available to trusted users for reverting vandalism

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Our Goal

DETECT VANDALS BEFORE THEY ARE DETECTED BY OTHER WIKIPEDIA USERS/BOTS

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VEWS

USES EDITING BEHAVIOR DIFFERENCE TO CATCH VANDALS

Outline

- UMDWikipedia Dataset
- User Editing Behavior: Similarities and Differences
- VEWS: Vandal Early Warning System
- Efficiency of VEWS
- Comparison with State of the Art Tools

UMDWikipedia Dataset

- 1 M users who registered between Jan 2013 – July 2014:
  - 17k vandals - All users blocked by administrators for vandalism
  - 17k benign users

- 770k edits: 160k vandals, 610k benign users

  edit(ID, user, page, timestamp, reverted)

- Information about each page:

  page(ID, title, article/meta, categories)

  page_distance(p1, p2)
- STiki and ClueBot NG data

The dataset is available at *http://cs.umd.edu/~vs/vews/*

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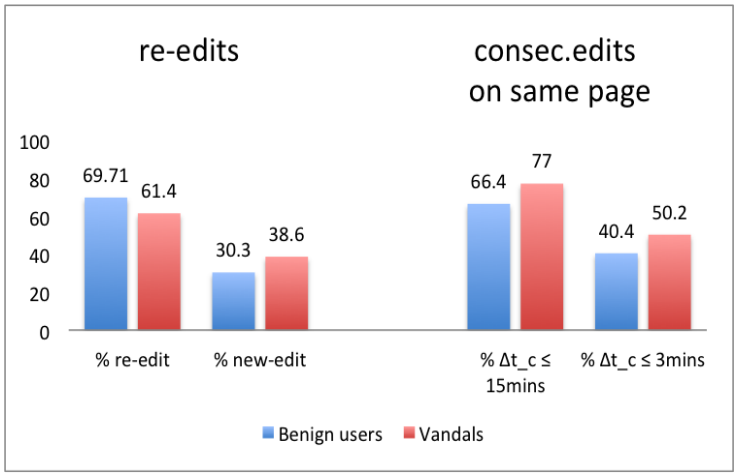
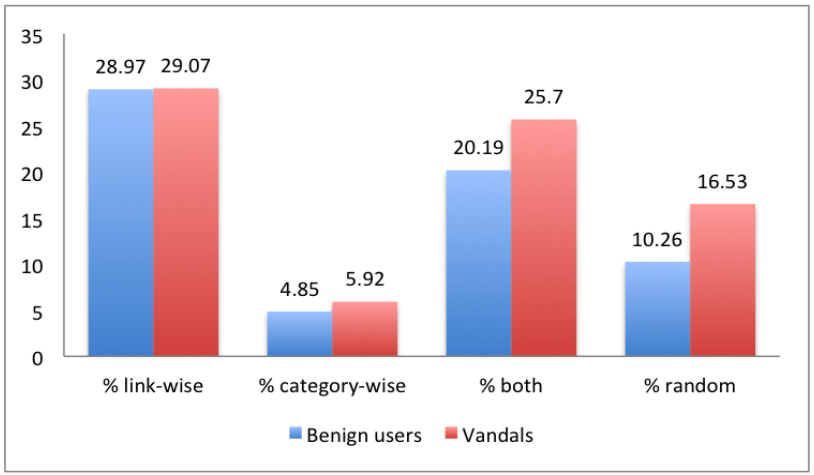
Editing Behavior: Similarities

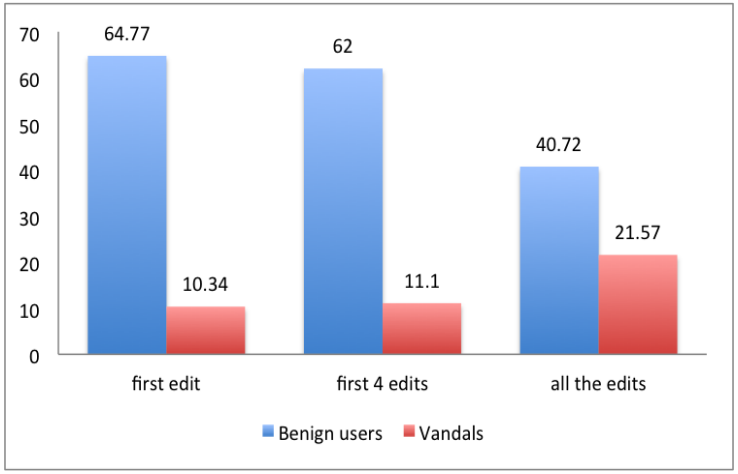


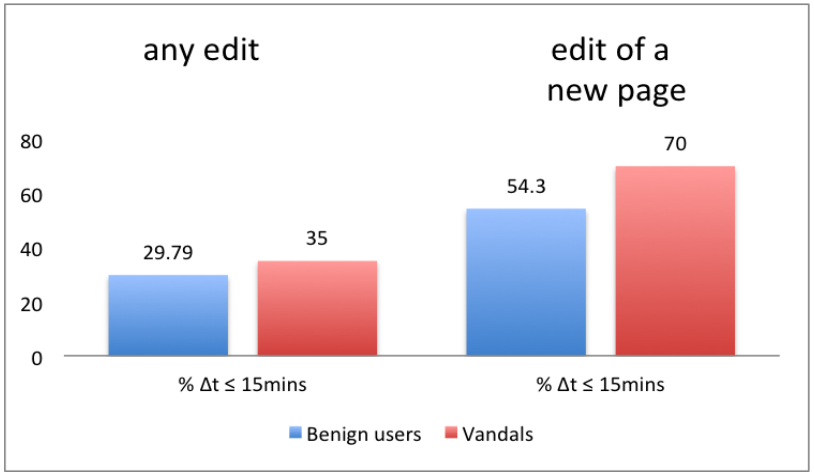


- Wikipedia users are more likely to re-edit a page than edit a new page
- Wikipedia users re-edit the same page quickly

- Both vandals and benign users exhibit similar navigation patterns:
  - Link-wise: Close but low semantic similarity
  - Category-wise: High semantic similarity, but not close

Editing Behavior: Differences





- Benign users edit far more meta-pages than vandals (even in the first edit)

- Vandals make faster edits than benign users
- Vandals spend less time editing a new page

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VEWS Features

VEWS

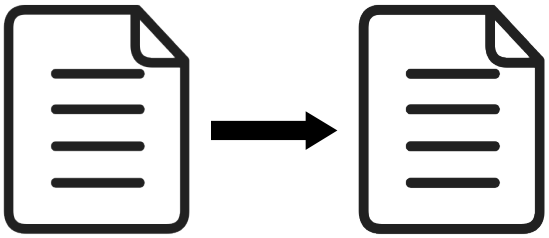
Behavioral Features

Features inspired from the editing behavior analysis

State Transition Features

Patterns in sequence of edits made by users

Behavioral Features



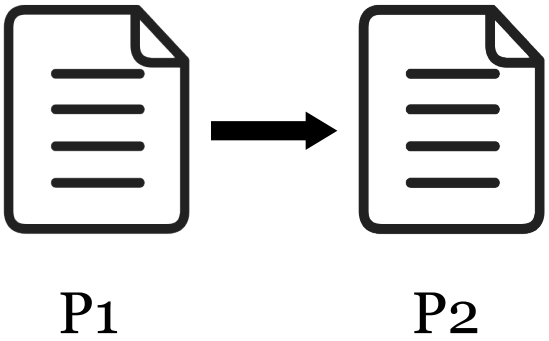
User U

Use consecutive edits made by user

Requirement:

- Unified representation for consecutive edits

Behavioral Features

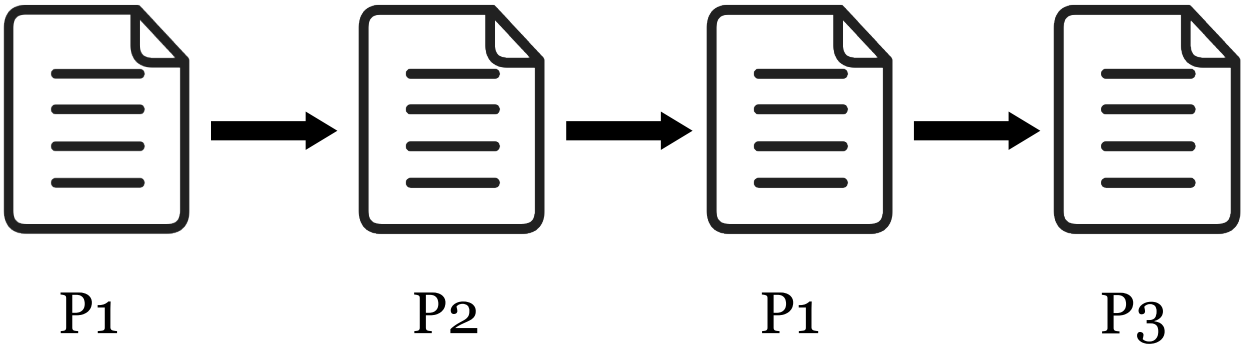


User U: f(U, P1,P2)

Reduces any pair of edits *(U, P1, P2)* into a feature vector:

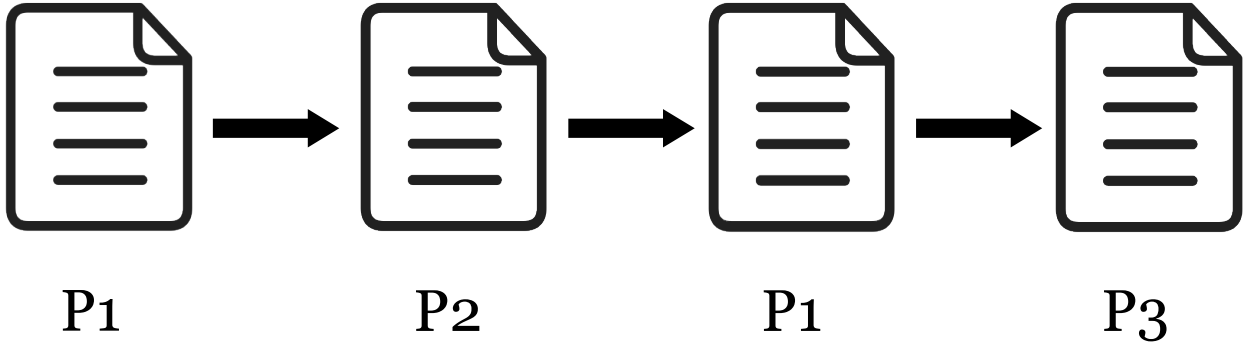
- Is P2 an article page?
- Time difference:
  very fast/fast/slow
- Is P2 U's First edit?
- P1 = P2?
- First time edit on P2?
- Hops from P1 to P2:
  <= 3, > 3 or null
- Number of common categories

Behavioral Features



User U: f(U, P1,P2) f(U, P2,P1) f(U, P1,P3)

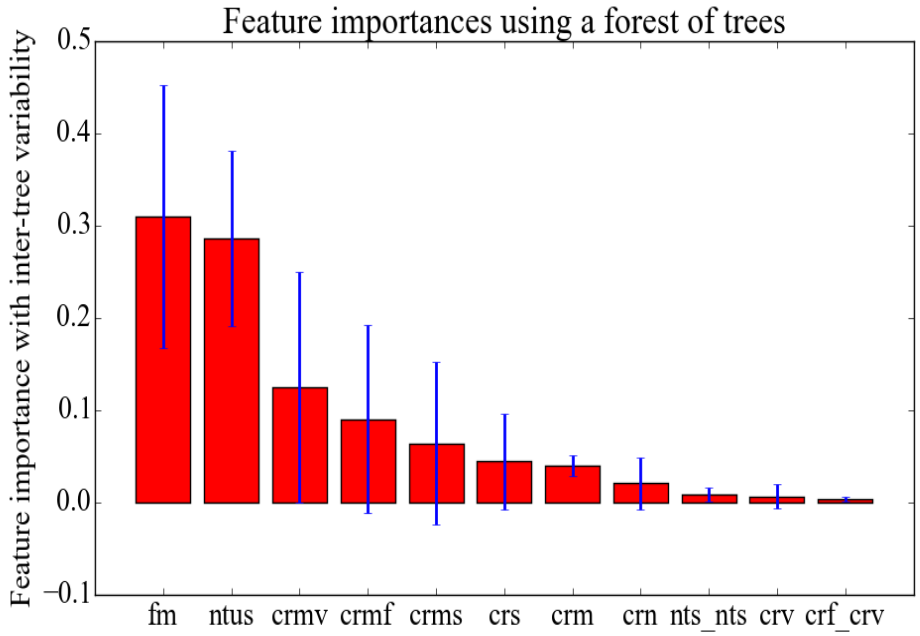
Behavioral Features



User U: f(U, P1,P2) f(U, P2,P1) f(U, P1,P3)

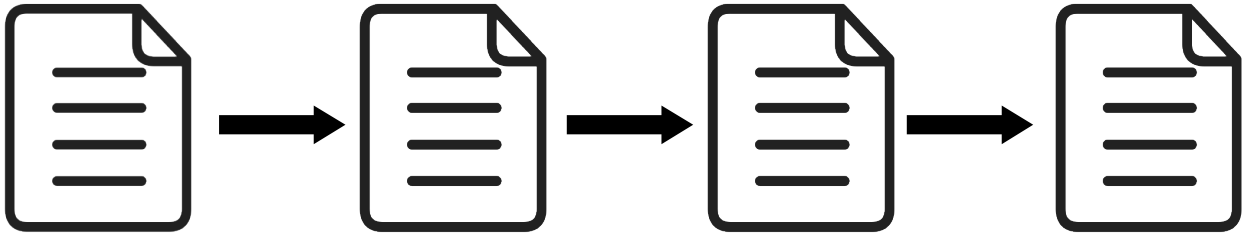
Frequent Pattern Mining on vandal and benign users
11 features with large difference

Behavioral Features



- ***fm***: If the first edit is on a meta page, then user is more likely to be benign.
- ***ntus***: Benign users are likely to take longer to edit a new page than a vandal.

State Transition Features



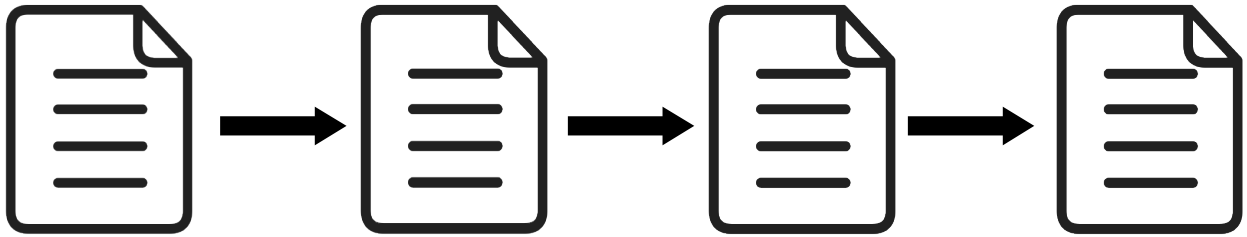
P1 P2 P1 P3

User U: f(U, P1,P2) f(U, P2,P1) f(U, P1,P3)

Use the entire sequence of edits of the user

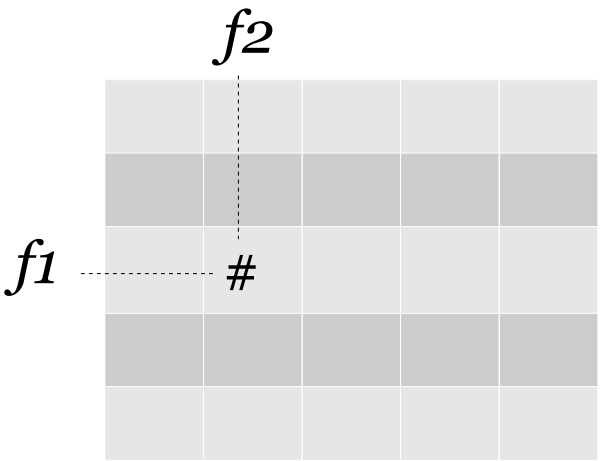
- But each user can have variable number of edits!

State Transition Features



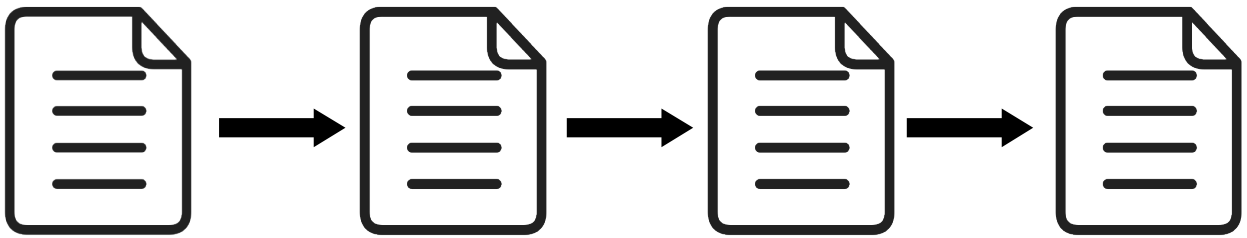
P1 P2 P1 P3

User U: f(U, P1,P2) f(U, P2,P1) f(U, P1,P3)



60 x 60

State Transition Features



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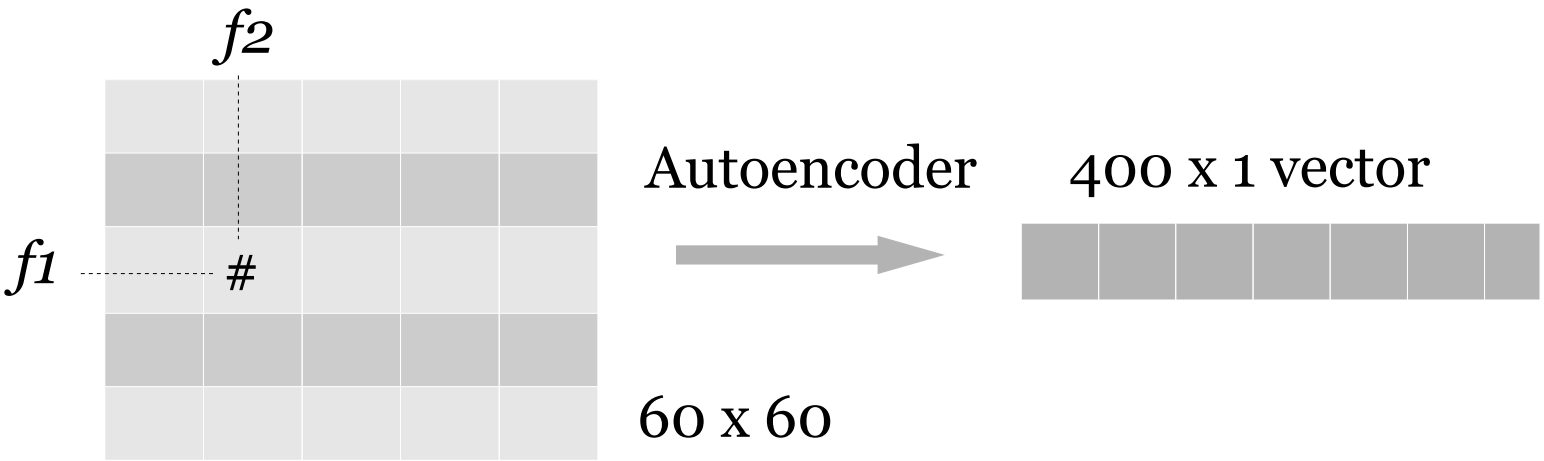

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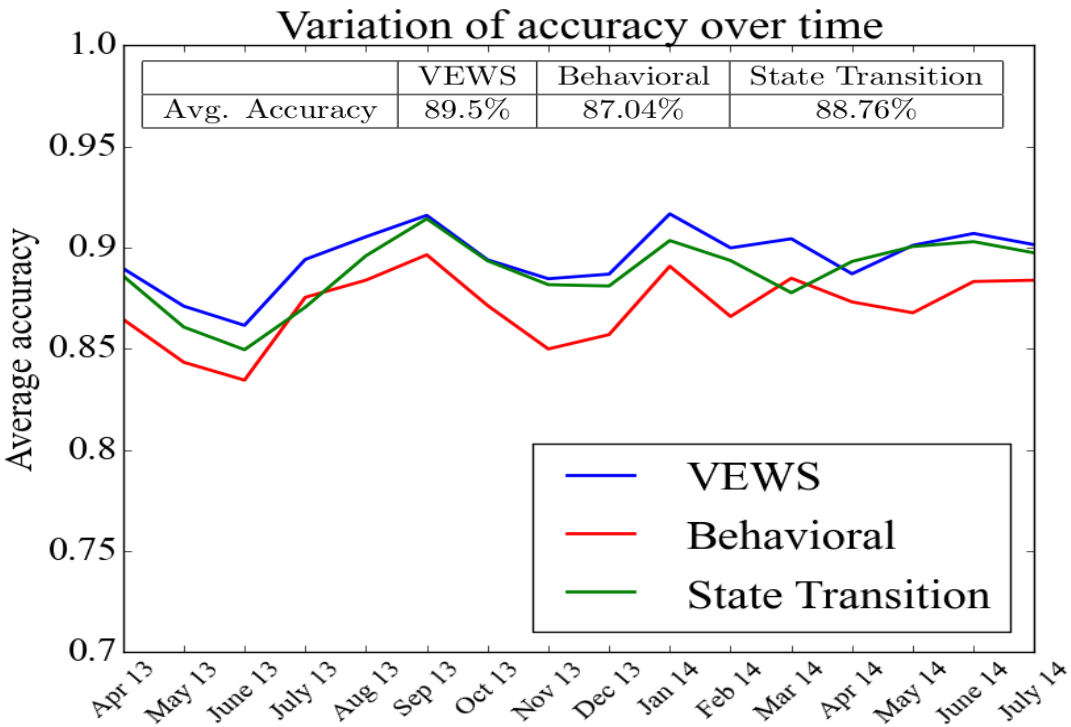
Efficiency of VEWS

	Accuracy	TPR	TNR	FPR	FNR
Behavioral	86.5%	0.85	0.89	0.11	0.15
State Transition	87.39%	0.88	0.90	0.10	0.12
VEWS	87.82%	0.87	0.92	0.08	0.13

- 10 fold cross validation using Support Vector Machine
- VEWS has the highest accuracy.

Temporal Advantage

Using recent data improves accuracy!

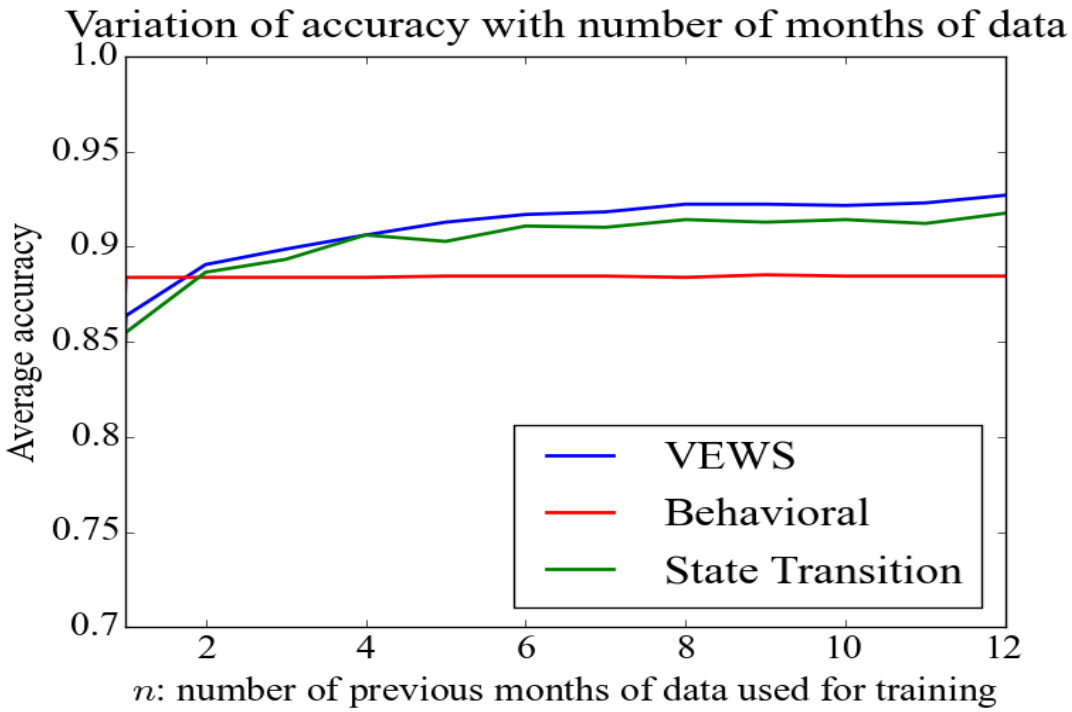


	VEWS	Behavioral	State Transition
Avg. Accuracy	89.5%	87.04%	88.76%

Training using previous 3 months of data

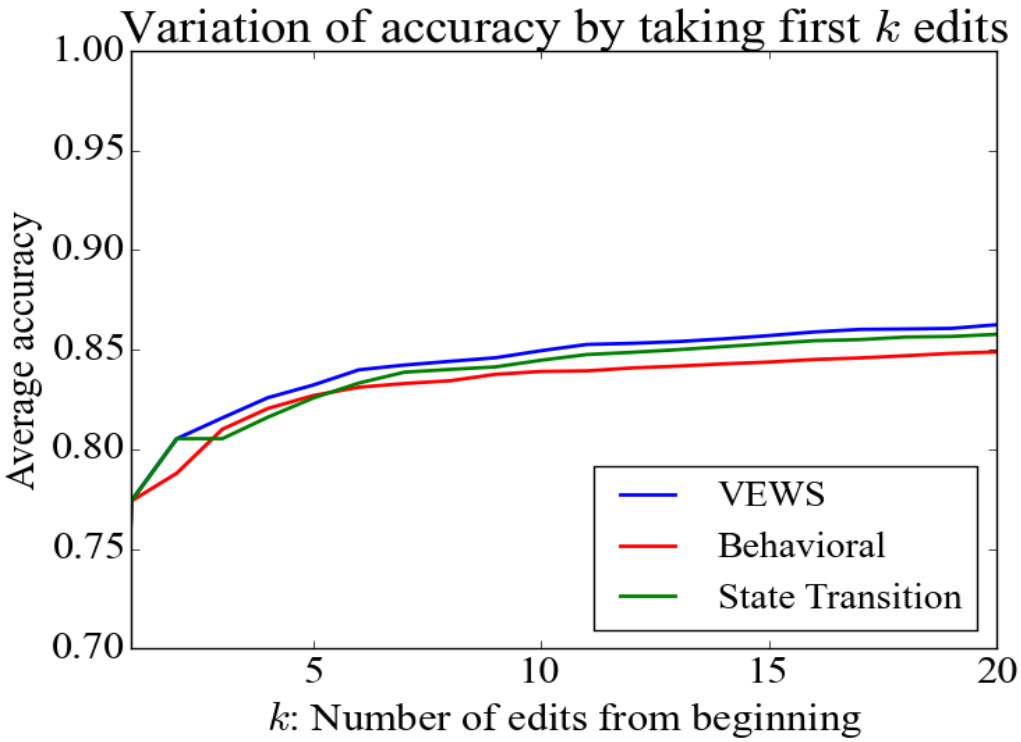
Temporal Advantage

More temporal data, more accuracy!



Previous n months of data for training and testing on July 2014

Early warning system



- Only first few edits needed to accurately identify the vandal
- With only the first edit, VEWS has 78% accuracy
- In 43.68% cases, vandal is identified before its first reversion.

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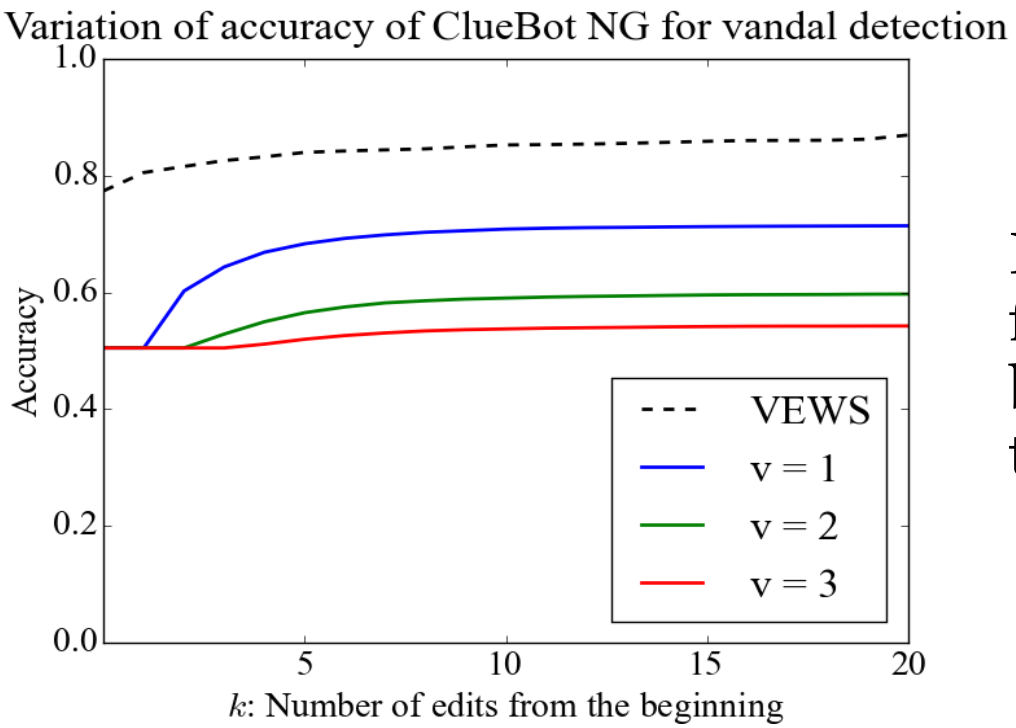
State of the Art tools

ClueBot NG

STiki

Detect vandalism, not vandals!

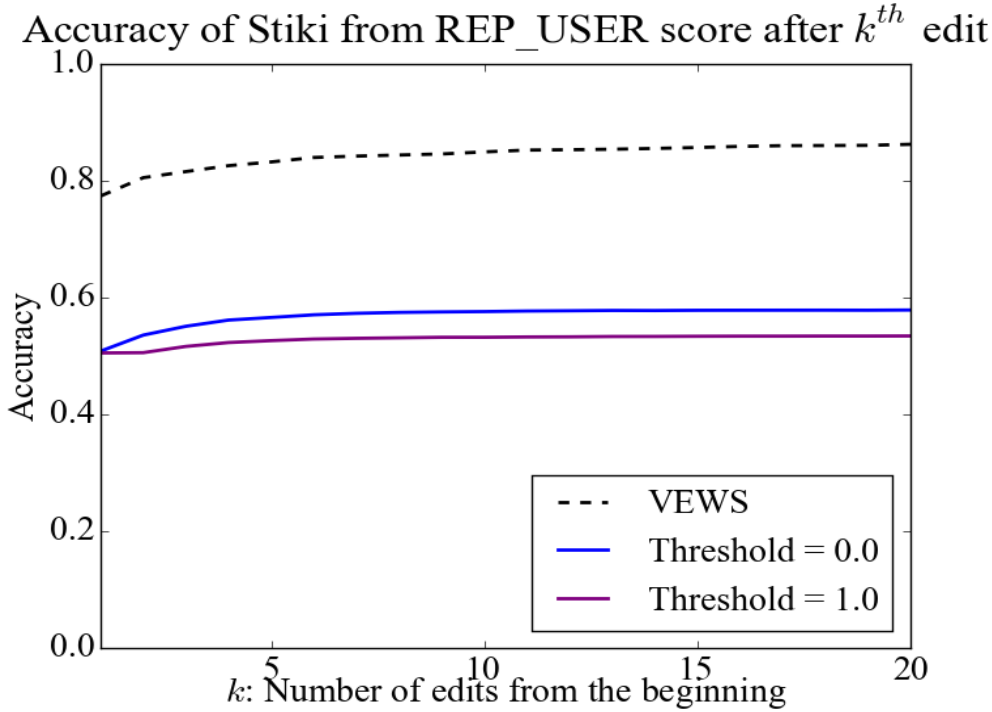
Comparison with ClueBot NG



Rule:
If v edits of a user's first k edits are caught by ClueBot NG, then the user is a vandal.

- ClueBot NG has accuracy of 70%
- When both VEWS and ClueBot NG detect the vandal, VEWS does it 2.39 edits earlier.

Comparison with STiki



Rule:
If the STiki user reputation score after the kth edit is above the threshold, then the user is a vandal.

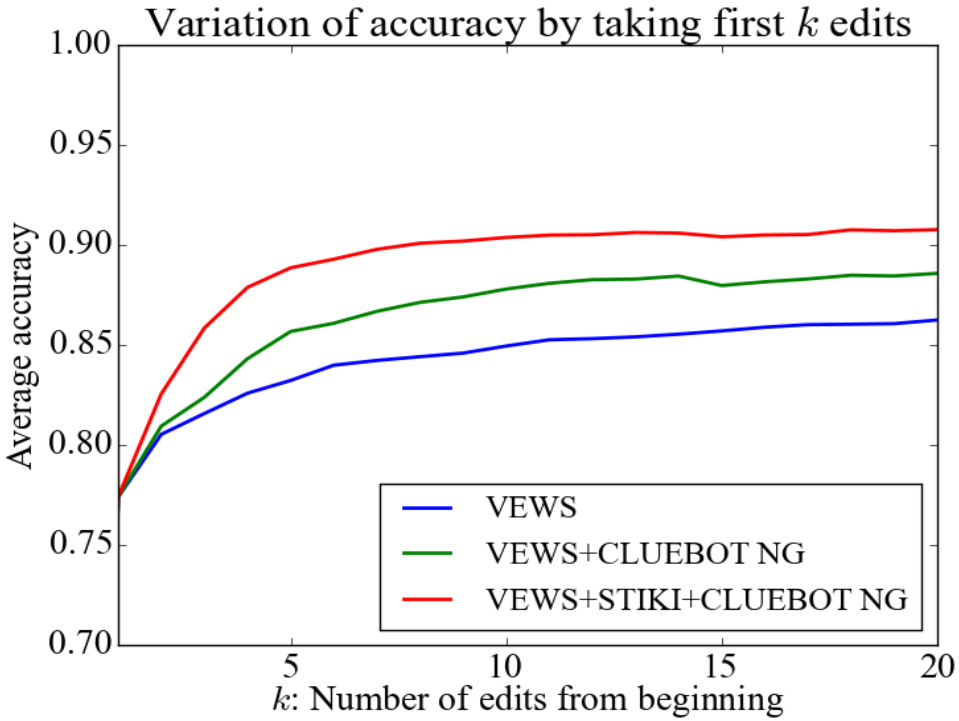
- STiki has an accuracy of 60%
- VEWS consistently finds vandals much more effectively than STiki's user reputation score and vandalism probability score.

State of the Art tools

ClueBot NG and STiki: Revert edit based on content

ClueBot NG STiki	VEWS
Natural Language Processing features	Editing Behavior features

Combination is the best!



- Adding features from ClueBot NG and STiki improves VEWS !
- VEWS + ClueBot NG: A fully automated system with 88.6% accuracy.

Summary

VEWS:

- Is a fully automated vandal early warning system
- Detects vandals by exploiting editing behavior differences
- Detects vandals within a few edits with high accuracy
- Improves by combining with state-of-the-art tools

Related Work

- Vandalism detection algorithms and PAN-WVC-2010 dataset:
  [Potthast et al. 2008], [Mola-Velasco 2010], [West et al. 2010], [Adler et al. 2010], [Adler et al. 2011], [Sumbana et al. 2012], [Ferschke et al. 2013]

- Automated/Semi-automated tools for vandalism detection:
  ClueBot NG, Stiki [West et al. 2010], WikiTrust (now defunct) [Adler et al. 2010]

- User navigation behavior:
  [Catledge et al. 1995], [Cockburn et al. 2001], [Adar et al. 2008], [West et al. 2012]

Thank you!

UMDWikipedia dataset is available at
http://cs.umd.edu/~vs/vews

Please drop by our poster!

Questions?