STiki: An Anti-Vandalism Tool for Wikipedia using Spatio-Temporal Analysis of Revision Metadata

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Wikimania `10 – July 10, 2010

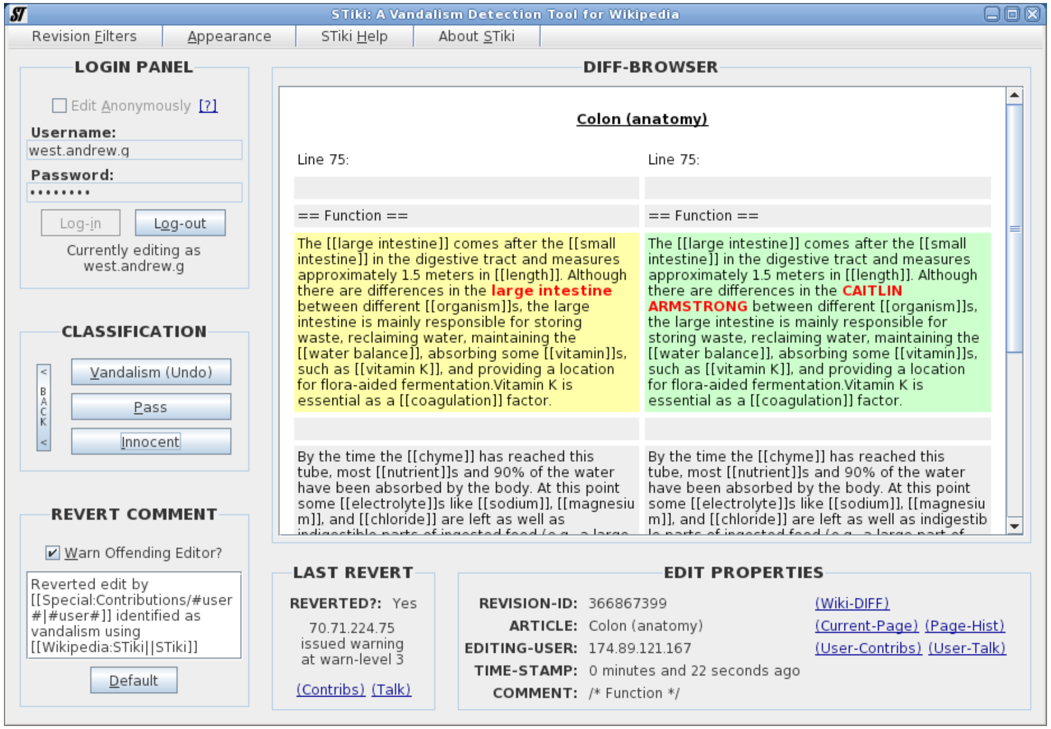
Penn Engineering

STiki = Huggl

STiki = Huggle, but:

CENTRALIZED: STiki is always scoring edits, in bot-like fashion.

QUEUING: STiki uses 15+ ML-features to set presentation order (not a static rule set)



□ Edit Anonymously [?]

Username: west.andrew.g

Password: ••••••••

Currently editing as west.andrew.g

☑ Warn Offending Editor?

Reverted edit by [[Special:Contributions/#user#|#user#]] identified as vandalism using [[Wikipedia:STiki||STiki]]

Colon (anatomy)

Line 75:	Line 75:
== Function ==	== Function ==
The [[large intestine]] comes after the [[small intestine]] in the digestive tract and measures approximately 1.5 meters in [[length]]. Although there are differences in the **large intestine** between different [[organism]]s, the large intestine is mainly responsible for storing waste, reclaiming water, maintaining the [[water balance]], absorbing some [[vitamin]]s, such as [[vitamin K]], and providing a location for flora-aided fermentation.Vitamin K is essential as a [[coagulation]] factor.	The [[large intestine]] comes after the [[small intestine]] in the digestive tract and measures approximately 1.5 meters in [[length]]. Although there are differences in the **CAITLIN ARMSTRONG** between different [[organism]]s, the large intestine is mainly responsible for storing waste, reclaiming water, maintaining the [[water balance]], absorbing some [[vitamin]]s, such as [[vitamin K]], and providing a location for flora-aided fermentation.Vitamin K is essential as a [[coagulation]] factor.
By the time the [[chyme]] has reached this tube, most [[nutrient]]s and 90% of the water have been absorbed by the body. At this point some [[electrolyte]]s like [[sodium]], [[magnesium]], and [[chloride]] are left as well as	By the time the [[chyme]] has reached this tube, most [[nutrient]]s and 90% of the water have been absorbed by the body. At this point some [[electrolyte]]s like [[sodium]], [[magnesium]], and [[chloride]] are left as well as indigestib

REVERTED?: Yes

70.71.224.75 issued warning at warn-level 3

REVISION-ID: 366867399

ARTICLE: Colon (anatomy)

EDITING-USER: 174.89.121.167

TIME-STAMP: 0 minutes and 22 seconds ago

COMMENT: /* Function */

- CROWD-SOURCED: No competition over edits. Greater efficiency

Outline/Summa

Vandalism detection methodology [6]

Wikipedia revision metadata (not the article or diff text) can be used to detect vandalism

ML over simple features and aggregate reputation values for articles, editors, spatial groups thereof

The STiki software tool

Straightforward application of above technique

Demonstration of the tool and functionality

Alternative uses for the open-source code

M

Wikipedia provides metadata via dumps/API:

#	METADATA ITEM	NOTES
(1)	**Timestamp** of edit	In GMT locale
(2)	**Article** being edited	Examine only articles in namespace zero (NS0)
(3)	**Editor** making edit	May be user-name (if registered editor), or IP address (if anonymous)
(4)	Revision **comment**	Text field where editor can summarize changes

Labeling Vandalism

ROLLBACK is used to label edits as vandalism:

Only true-rollback, no software-based ones

Edit summaries used to locate (Native, Huggle, Twinkle, ClueBot)

Bad ones= {OFF. EDITS}, others = {UNLABELED}

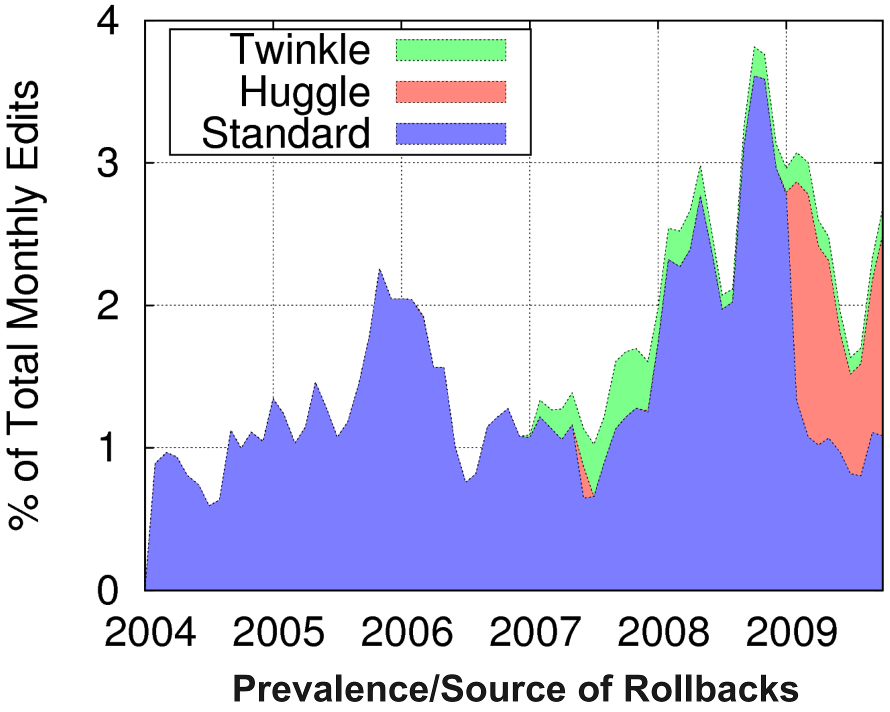
Why rollback?

Automated (v. manual)

High-confidence

Per case (vs. definition)

Why do edits need labels?:
· (1) To test features, and train ML
· (2) Building block of reputation building



Prevalence/Source of Rollbacks

Simple Features

- Temporal props: A function of when events occur
- Spatial props: Appropriate wherever a size, distance, or membership function can be defined

SIMPLE FEATURES

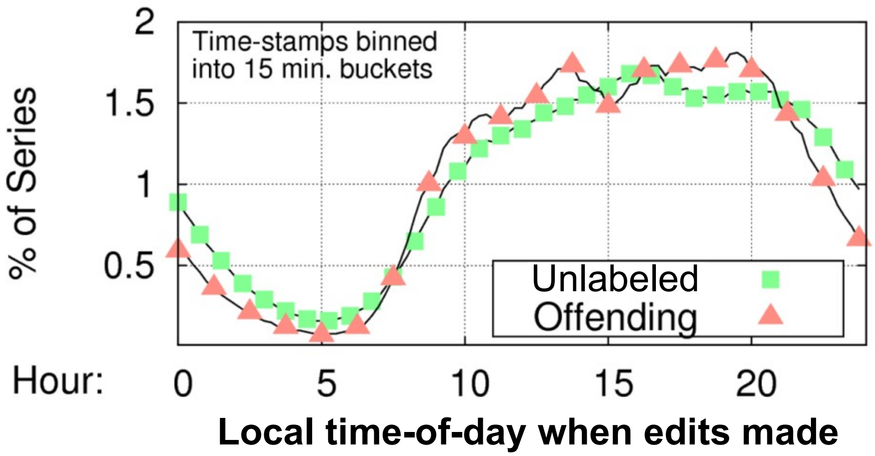
* Discussion abbreviated to concentrate on aggregate ones

Edit Time, Day-of-Week

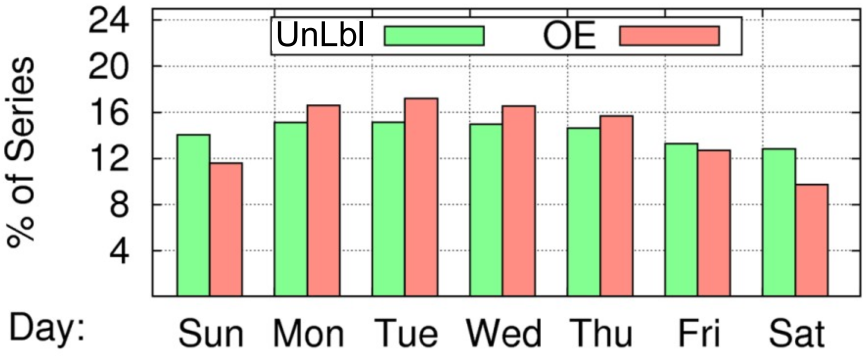
Use IP-geo-location data to determine origin time-zone, adjust UTC timestamp

Vandalism most prevalent during working hours/week: Kids are in school(?)

Fun fact: Vandalism almost twice as prevalent on a Tuesday versus a Sunday



Local time-of-day when edits made



Local day-of-week when edits made

Time-Since (T

TS Article Edited	OE	UnLbl
All edits (median, hrs.)	1.03	9.67
TS Editor Registration	**OE**	**UnLbl**
Regd., median (days)	0.07	765
Anon., median (days)	0.01	1.97

- Long-time participants vandalize very little
  - “Registration”: time-stamp of first edit made by user
  - Sybil-attack to abuse benefits?

High-edit pages most often vandalized

- ≈2% of pages have 5+ OEs, yet these pages have 52% of all edits
- Other work [3] has shown these are also articles most visited

Misc. Simple Features

FEATURE	OE	UnLbl
Revision comment (average length in characters)	17.73	41.56
Anonymous editors (percentage)	85.38%	28.97%
Bot editors (percentage)	00.46%	09.15%
Privileged editors (percentage)	00.78%	23.92%

Revision comment length

Vandals leave shorter comments
(lazy-ness? or just minimizing bandwidth?)

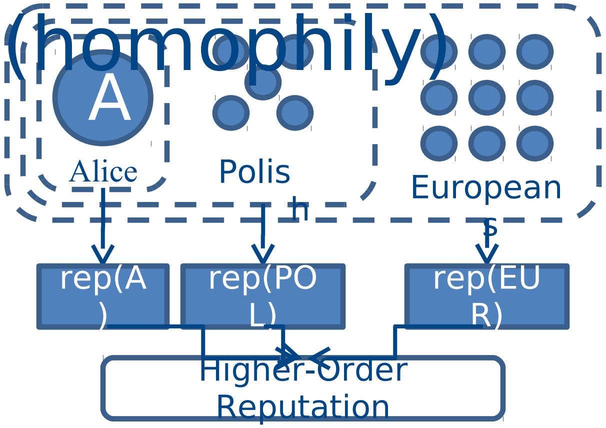
- Privileged editors (and bots)
  - – Huge contributors, but rarely vandalize

Aggregate Features

AGGREGATE FEATURES

PreSTA Algorith

CORE IDEA: No entity specific data? Examine spatially-adjacent entities (homophily)



PreSTA [5]: Model for ST-rep:

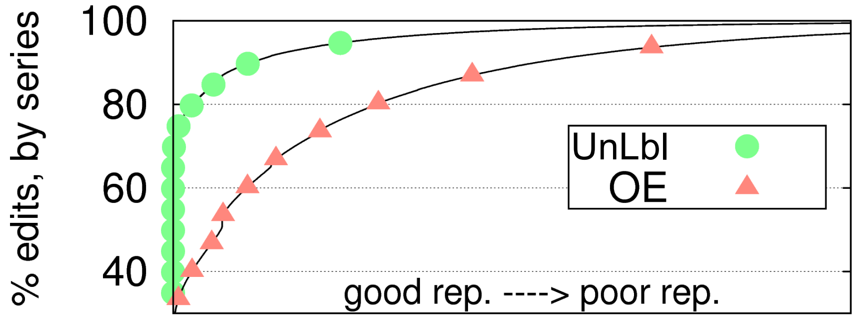
$$\mathrm{Rep}(\mathit{group}) = \frac{\sum \mathit{time\_decay}\,(\mathrm{TSvandalism})}{\mathit{size(group)}}$$

Timestamps (TS) of vandalism incidents by *group* members

Grouping functions (spatial) define memberships

Observations of misbehavior form feedback – and observ-ations are decayed (temporal)

Article Reputation



CDF of Article Reputation

ARTICLE	#OEs
George W. Bush	6546
Wikipedia	5589
Adolph Hitler	2612
United States	2161
World War II	1886

Articles w/most OEs

Intuitively some topics are controversial and likely targets for vandalism (or temporally so).

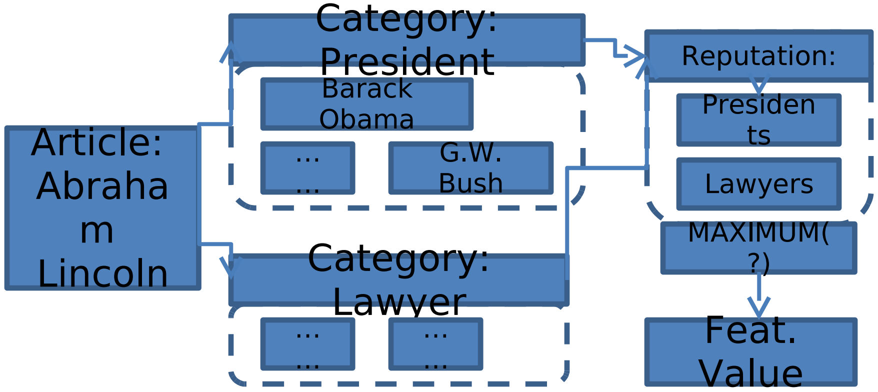
85% of OEs have non-zero rep (just 45% of random)

Category Reputation

- Category = spatial group over articles
- Wiki provides cats. /memberships – use only topical.
- 97% of OEs have non-zero reputation (85% in article case)

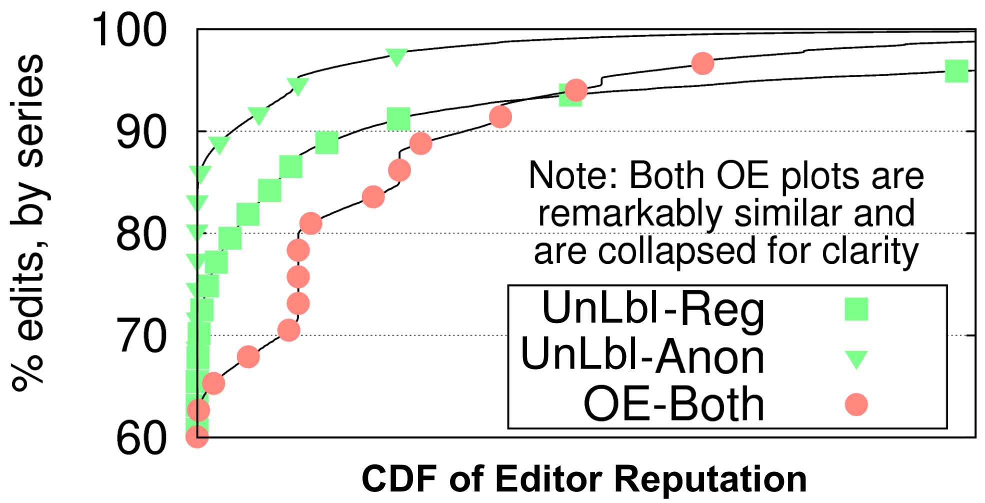
CATEGORY (with 100+ members)	PGs	OEs/PG
World Music Award Winners	125	162.27
Characters of Les Miserables	135	146.88
Former British Colonies	145	141.51

Categories with most OEs



Example of Category Rep. Calculation

Editor Reputati



Straightforward use of the *rep()* function, one-editor groups

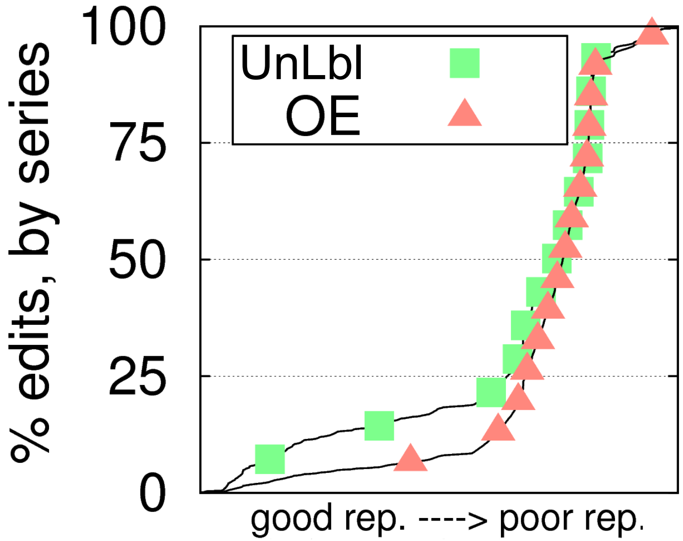
- Problem: Dedicated editors accumulate OEs, look as bad as attackers (normalize? No)
- Mediocre performance. Meaningful correlation with other features, however

Country Reputation

Country = spatial grouping over editors

Geo-location data maps IP → country

Straightforward: IP resides in one country



CDF of Country Reputation

RANK	COUNTRY	%-OEs
1	Italy	2.85%
2	France	3.46%
3	Germany	3.46%
…	…	…
12	Canada	11.35%
13	United States	11.63%
14	Australia	12.08%

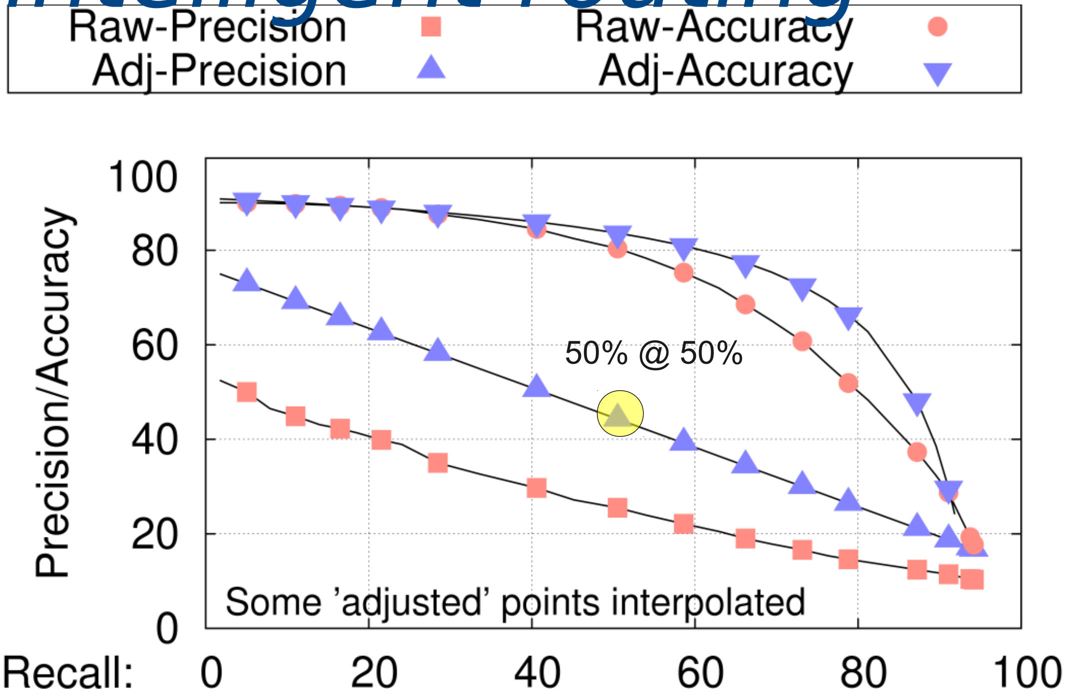
OE-rate (normalized) for countries with 100k+ edits

Off-line Performance

- Similar performance to NLP-efforts [2]
- Use as an *intelligent routing (IR)* tool

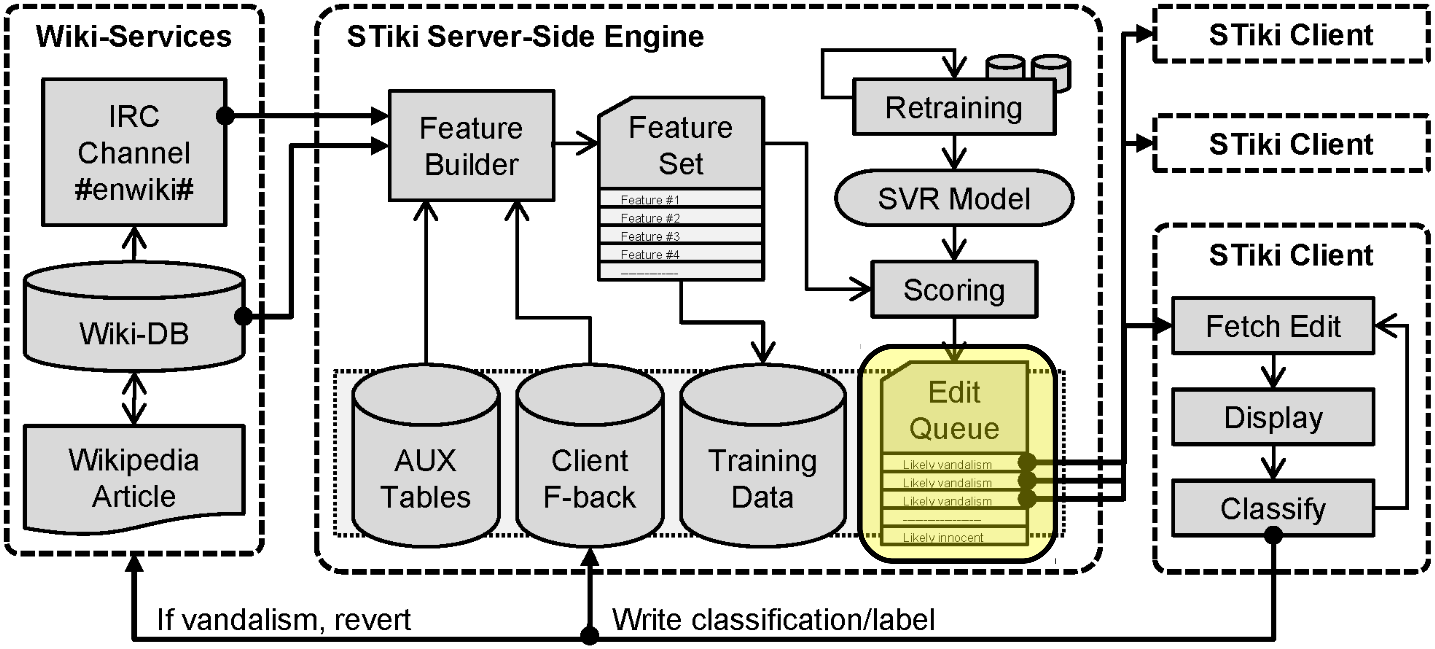
Recall: % total OEs classified correctly

Precision: % of edits classified OE that are vandalism



STiki [4]: A real-time, on-Wikipedia implementation of the technique

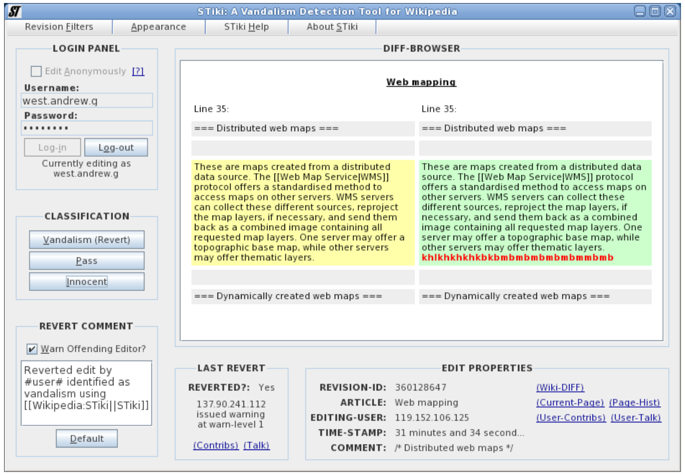
STiki Archit



EDIT QUEUE: Connection between server and client side

- Populated: Priority insertion based on *vandalism score*
- Popped: GUI client shows likely vandalism first
- De-queued: Edit removed if another made to

Client Demonstr



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Password: ••••••••

Currently editing as west.andrew.g

☑ Warn Offending Editor?

Reverted edit by #user# identified as vandalism using [[Wikipedia:STiki||STiki]]

Web mapping

Line 35:	Line 35:
=== Distributed web maps ===	=== Distributed web maps ===
These are maps created from a distributed data source. The [[Web Map Service|WMS]] protocol offers a standardised method to access maps on other servers. WMS servers can collect these different sources, reproject the map layers, if necessary, and send them back as a combined image containing all requested map layers. One server may offer a topographic base map, while other servers may offer thematic layers.	These are maps created from a distributed data source. The [[Web Map Service|WMS]] protocol offers a standardised method to access maps on other servers. WMS servers can collect these different sources, reproject the map layers, if necessary, and send them back as a combined image containing all requested map layers. One server may offer a topographic base map, while other servers may offer thematic layers. **khlkhkhkhkbkbmbmbmbmbmbmmbmb**
=== Dynamically created web maps ===	=== Dynamically created web maps ===

REVERTED?: Yes

137.90.241.112 issued warning at warn-level 1

REVISION-ID:	360128647
ARTICLE:	Web mapping
EDITING-USER:	119.152.106.125
TIME-STAMP:	31 minutes and 34 second...
COMMENT:	/* Distributed web maps */

STiki

Client

Demo

STiki Performan

Competition inhibits maximal performance

Metric: Hit-rate (% of edits displayed that are vandalism)

Offline analysis shows it could be 50%+

Competing (often autonomous) tools make it ≈10%

STiki successes and use-cases

Has reverted over 5000+ instances of vandalism

May be more appropriate in less patrolled installations

- Any of Wikipedia’s foreign language editions

Embedded vandalism: That escaping initial detection. Median age of STiki revert is 4.25 hours, 200× RBs.

- Further, average STiki revert had 210 views during active duration.

Alternative U

All code is available [4] and open source (Java)

Backend (server-side) re-use

Large portion of MediaWiki API implemented (bots)

Trivial to add new features (including NLP ones)

Frontend (client-side) re-use

Useful whenever edits require human inspection

Offline inspection tool for corpus building

Data re-use

Incorporate vandalism score into more robust tools

Willing to provide data to other researchers

Crowd-sourcing

Shared queue := Pending changes trial

Abuse of “pass” by an edit hoarding user

Do ‘reviewers’ need to be reviewed?

- Where does it stop?
- Multi-layer verification checks to find anomalies
- Could reviewer reputations also be created?

Threshold for queue access?

- Registered? Auto-confirmed? Or more?

Cache-22: Use vs. perceived success

More users = more vandalism found. But deep in queue, vandalism unlikely = User abandonment.

Refer

[1] S. Hao, N.A. Syed, N. Feamster, A.G. Gray, and S. Krasser. **Detecting spammers with SNARE: Spatiotemporal network-level automated reputation engine**. In *18th USENIX Security Symposium*, 2009

[2] M. Potthast, B. Stein, and R. Gerling. **Automatic vandalism detection in Wikipedia**. In *Advances in Information Retrieval*, 2008.

[3] R. Priedhorsky, J. Chen, S.K. Lam, K. Achier, L. Terveen, and J. Riedl. **Creating, destroying, and restoring value in Wikipedia**. In *GROUP `07, 2007.*

[4] A.G. West. **STiki: A vandalism detection tool for Wikipedia**. *http://en.wikipedia.org/wiki/Wikipedia:STiki*. Software, 2010.

[5] A.G. West, A.J. Aviv, J. Chang, and I. Lee. **Mitigating spam using spatio-temporal reputation**. *Technical report UPENN-MS-CIS-10-04*, Feb. 2010.

[6] A.G. West, S. Kannan, and I. Lee. **Detecting Wikipedia Vandalism via Spatio-Temporal Analysis of Revision Metadata**. In *EUROSEC `10*, April 2010.