Automated Detection and Fingerprinting of Censorship Block Pages

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Block Pages: a Common Form of Censorship

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Block Page Detection is Important

• Censorship measurement is important
  – Censorship is pervasive
  – Transparency and accountability

• Block page detection is important
  – Common form of censorship
  – State of the art is manual analysis
  – We need automated, reliable, consistent methods
Detecting Block Pages

Known good page

Classifier

Test page

Not Censored

Censored
Challenges to Detecting Block Pages
Our Solution

Classifier

More similar
Problem Statements

• We need reliable, consistent, automated ways:
  – To detect censorship block pages
  – To detect the appearance of new censorship tools

• These techniques are necessary because:
  – The state of the art is not automated or consistent
  – Censorship measurement is important
Our Data

Known good page

Classifier

Test page
Our Data

• Gathered by the OpenNet Initiative (ONI)
  – Collected in 49 countries from 2007 to 2012

• Has pairs of test pages and known good pages
  – Each pair is labeled as censored or not
  – ~480,000 pairs where the test page is accessible
  – ~28,000 pairs where the test page is a block page
Block Page Detection

Known good page

Classifier

Test page

?
Detecting Block Pages

• Feature extraction

• Evaluate features with precision-recall curve

• Best feature: Page length ratio
  – Size of smaller page / size of larger page
Detecting Block Pages

Precision-Recall curve for varying thresholds

- Page length ratio was best classifier
- Best classifier achieved 80% precision, 95% true positive rate, 1.37% false positive
Finding New Censorship Tools

• Assumptions
  1. Censorship tools generate block pages from a template
  2. Different censorship tools use different templates

• Solution
  – Cluster block pages to find templates
  – Analyze cluster exemplars to determine what tool generated the template

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Fingerprinting Evaluation

• Experimental Validation
  – Use F-1 measure to compare clusters against manually generated regular expressions
  – Best clustering F-1 = 0.98
  – Only 36 unique block page HTML structures

• Practical validation with retroactive analysis
  – Found a new filtering tool in Saudi Arabia: WireFilter
Real World Impact

• Real world deployment
  – ICLab collaboration between Citizen Lab, Stony Brook, and Georgia Tech
  – Deploying with censorship measurement platform
Conclusion

- We can accurately detect block pages and fingerprint the tools that create them

- Download our code from https://github.com/iclab/blockpage-detection

- Email me: bjones99@gatech.edu