

# IPSW - Modelling Change of Website Archives

Group 4

---

Ian Milligan, Ian Roper, Caoimhe Rooney,  
Nathan Taback, Jessica Williams, Nich Worby

May 9, 2019

# The Problem

---

# The Problem

- Decades of web archives with lots of vital historic information
- Gets overridden from history when the website is updated
- Ever increasing amount of data
- Scale overwhelms the search for the meaningful information

# The Problem

- Decades of web archives with lots of vital historic information
- Gets overridden from history when the website is updated
- Ever increasing amount of data
- Scale overwhelms the search for the meaningful information

Can we

- find out when large changes have occurred?
- predict when a big change is going to occur?

## Aims for this week

- Find and explore ways to quantify change in a website
- Compare these quantifications
- See if we can identify big changes in an organisation from our research

# Big events in the NDP

- 28 November 2005: election called.
- 23 January 2006: federal election.
- 14 October 2008: federal election.
- 2 May 2011: federal election.
- July 2011: NDP leader announces leave of absence; replaced by interim.
- 22 August 2011: NDP leader dies.
- 24 March 2012: New NDP leader selected.
- 19 October 2015: federal election.
- 10 April 2016: NDP leader loses vote of confidence.
- 1 October 2017: New NDP leader selected.

## Attempted Approaches

- How much words on the domain change
- How the links out of the domain change
- How the way the domain looks changes
- How the structure of the websites within the domain change

# Four Metrics

- Byte-wise comparison:
  - If any change in characters has occurred, = 1
  - If text is *exactly* the same, = 0
- TF-IDF
  - Calculates cosine distance between two different vectors of characters  $p$  and  $p'$
- Word distance
  - How many words have changed
- Edit distance
  -

$$1 - \frac{p \cdot p'}{\|p\|_2 \|p'\|_2}$$
$$1 - \frac{2|\text{common words}|}{m + n}$$



# The goal

- Construct and compare different metrics to quantify domain changes over time,
- Determine a single quantitative measure to describe magnitude of the change in the domain since the previous time-step.

$$\sigma(t) = (\text{change in links})w_1 + (\text{change in text})w_2 + (\text{change in content management server})w_3, \quad (1)$$

where  $t$  is time, and  $w_1$ ,  $w_2$ , and  $w_3$  weight the relevant contributions of URL changes, text changes, and CMS changes.

- Meaningful changes determined by comparing thumbnails manually.
- Could automate this by using image analysis to quantify the difference between website thumbnails at two time points.

# Game plan

- Run code to compare text.
- Do image analysis on thumbnails.
- Take link data and compare lists at different times:
  - Internal vs. external links.
  - Obtain  $a$ ,  $b$ , and  $c$ .
  - What is the best timestep?
- Determine whether the content management server (CMS) has changed.
- Look at different weightings - how best to choose these? We don't want to double-count changes.
- Run test cases.
- Look at the variability in change over time. What is the distribution?
- Compare measures for looking at the difference between URLs and text.

- Trying to quantify change using text, thumbnails and links.
- Lots of metrics about the how the text differs and some of these are similar.
  - There is one that is overly sensitive but there is still one timestamp that says there is absolutely no change and so could still be useful.
- Thumbnails obtained using the wayback archive which renders the homepage and takes a screenshot.
  - We've used a metric that looks at structural similarity instead of just pixel to pixel which is good.
  - We've had a problem with the website not always rendering and giving us just a white page which obviously causes a huge change. This needs to be accounted for tomorrow.

- The link data has been analysed
- - Unfortunately the dates for these data is shorter than the text data frame so it is difficult to get a good comparison.
  - We have Ian, the history professor on this task.
- Graphs of links
  - One last thing we were thinking of doing is getting the internal links within a whole domain instead of just the homepages, seeing how the structure of the graph of links between them changes.
  - This is more of a structural change than a content change, which could be useful for rapidly updating websites such as news websites and blogs whose words change rapidly but fairly meaninglessly.