# Partitioning instead of Clustering:

## An alternative approach for mining structured content in folksonomies

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# Agenda

- Introduction
- Motivation

- Partitioning Algorithm
  - Idea
  - Implementation and Cost Functions
- Results

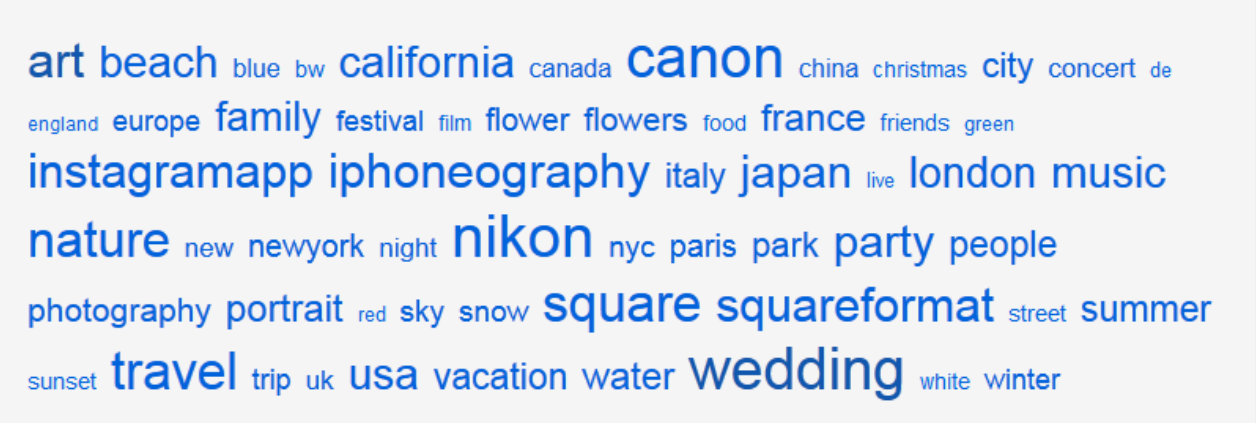
- Conclusion

# Tagging Systems

- Tag: unstructured keyword
- Folksonomies: Folk & Taxonomy



# Tagging Systems




www.flickr.com

- Freely chosen (no dictionary)
- No clear structure
  → can be chaotic!

# Browsing & Navigating

- To improve the access and navigation additional aid required

- Two common techniques
  - Clustering
    - Grouping tags with high Co-Occurrence
    - Determining similarity
  - Hierarchical Relationships
    - Assuming hierarchical relationships between tags
    - Subsumption

# Clustering

**Explore / Tags / rain / clusters**

**storm**, **clouds**, **sky**, weather, cloud, dark, landscape, rainbow, lightning, thunder

**See more in this cluster...**

**water**, **bw**, **raindrops**, window, droplets, white, black, red, light, canon

**See more in this cluster...**

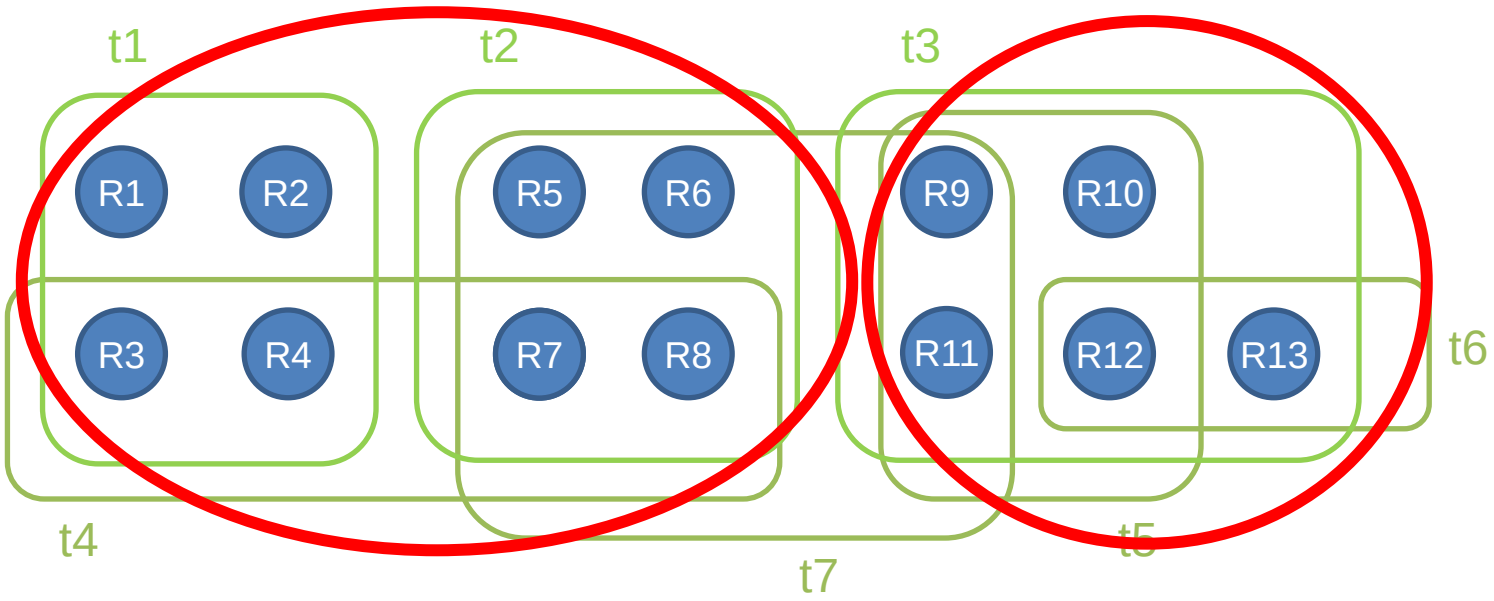
**wet**, **green**, **street**, drops, leaves, night, reflection, umbrella, bokeh, city

**See more in this cluster...**

**macro**, **flower**, **nature**, drop, leaf, flowers, garden, rose, closeup, purple

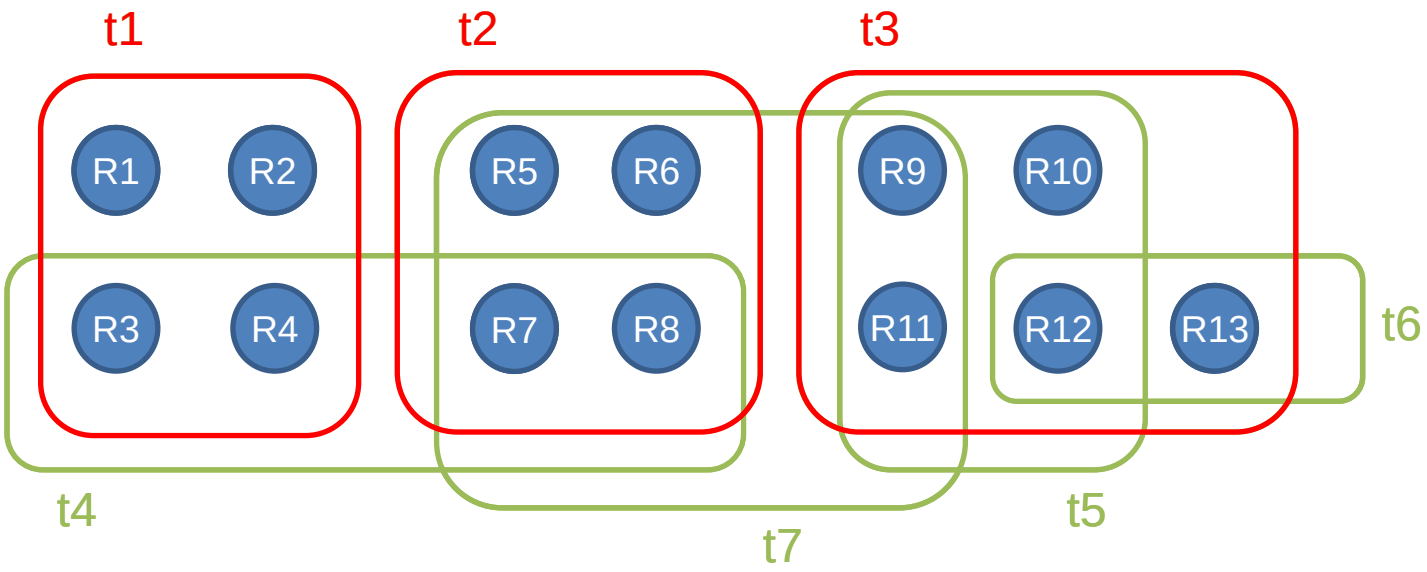
**See more in this cluster...**

# Looking for Structure



# Discovering Structure

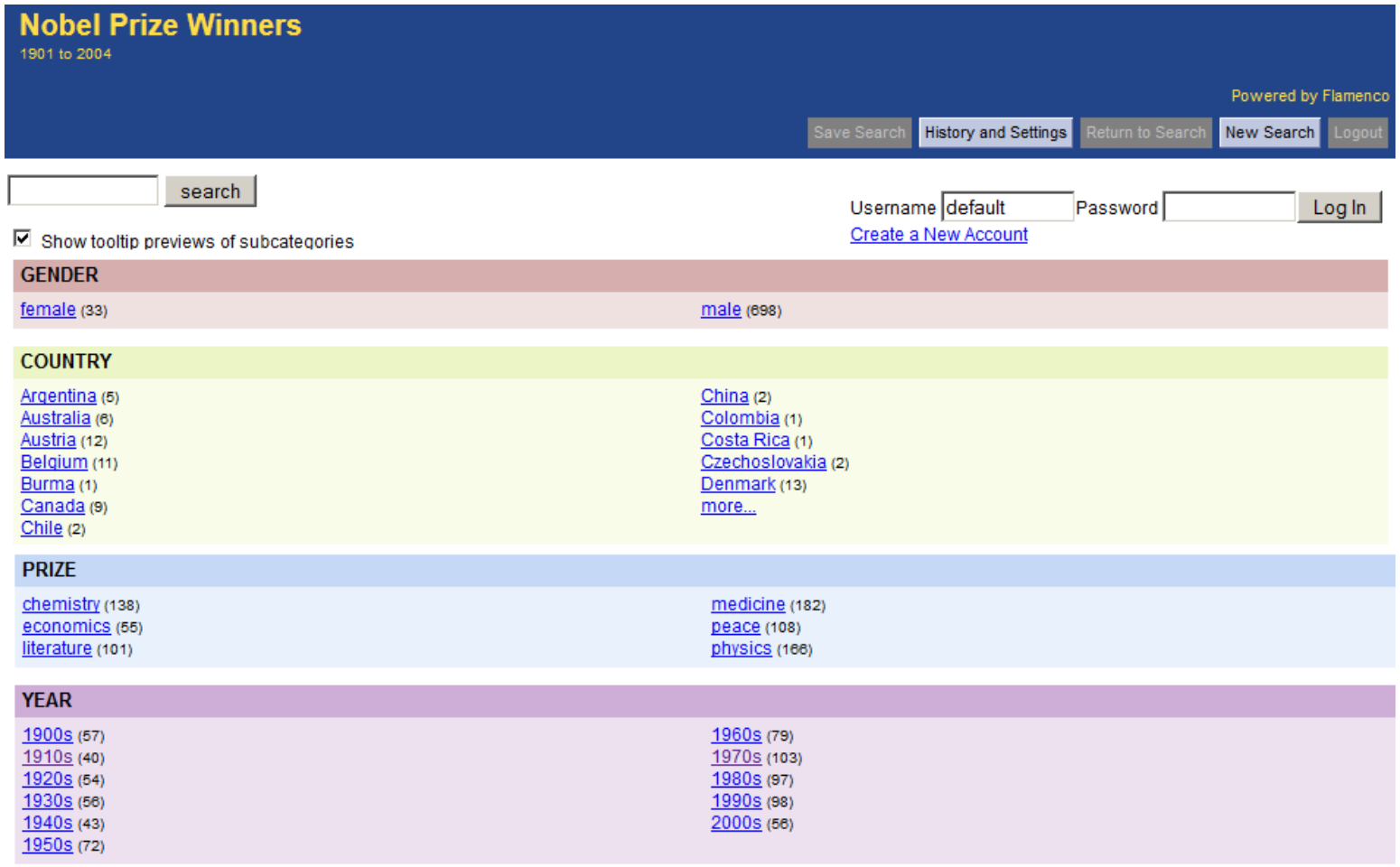
- How can structure be discovered?



# Partitioning Algorithm

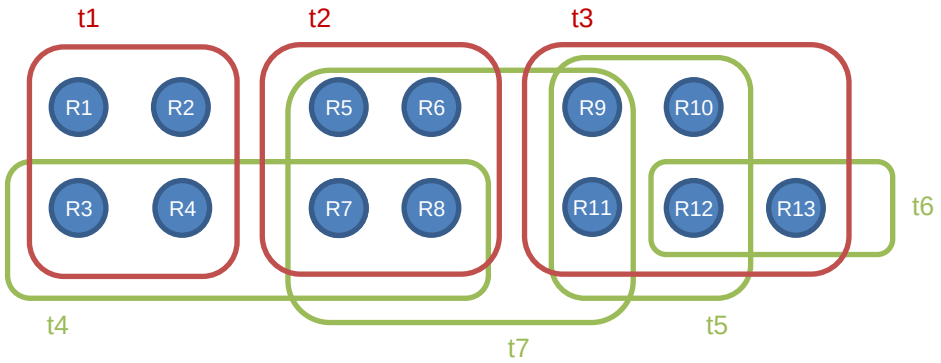
- Idea
  - Find patterns within a folksonomy
    - NO clustering
    - NO hierarchical relationship
  - Providing facets
    - Represent different categories of one dimension
    - Faceted search provide a flexible and intuitive way to explore large collections of items (Yee et al., 2003)

# Faceted Search



# Discovering Facets

- A facet is a set of tags
  - Example: $\{t1, t2, t3\}$




- Tags within a facet have to satisfy specific constraints
  - No overlap regarding to their extensions
  - Two tags that are labeled on the same resources must not appear within the same facet
- Determination using Linear Programming

# Linear Programming

- Optimization with linear relationships

$$\begin{aligned} \max \quad & c^T x \\ \text{s.t.} \quad & Ax \leq b \\ & x \geq 0 \end{aligned}$$

| | |
|---|---|
| $x \; with \; x_i \in \{0,1\}$ | Vector that represents the tag selection |
| $c \; with \; c_i \in \mathbb{R}$ | „Value“ vector of the tags *(„objective function“)* |
| $A$ | A matrix representing the constraints |
| $b$ | Coefficients of the inequalities |

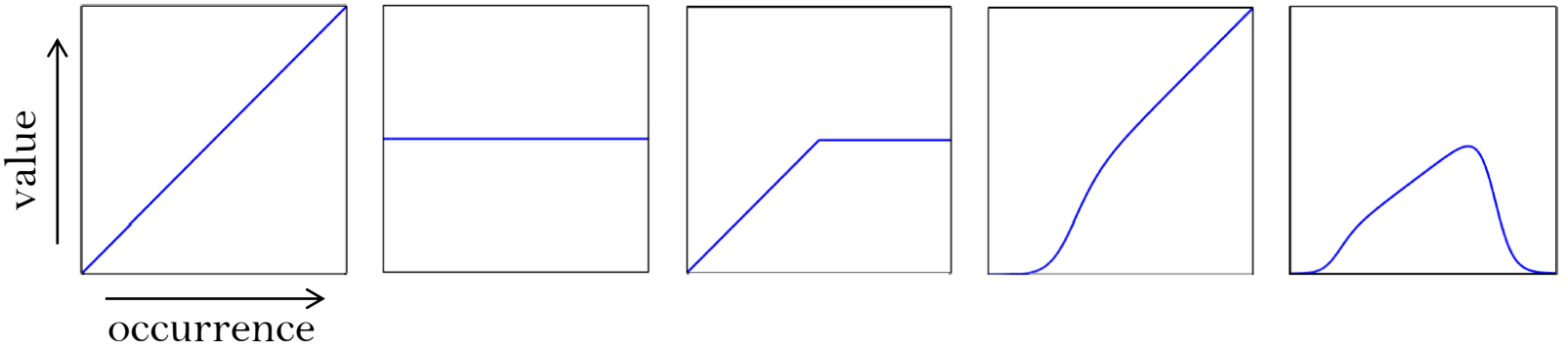
# Cost Function

$$\begin{aligned} \max \quad & c^T x \\ \text{s.t.} \quad & Ax \leq b \\ & x \geq 0 \end{aligned}$$

- Since linear programming maximizes outcome, cost function has huge effect!
- A value is assigned to each tag, depending on the number of their frequency

# Cost Function

- 5 different cost functions are implemented
  - Number of Occurrences
  - Uniformly
  - Capped
  - Logistic
  - Logistic with Cutoff



# Results

- Dataset
  - Photos from the online photo sharing platform Flickr
  - Public Group “Munich, Germany”

| | |
|---|---|
| Number of Photos | > 30.000 |
| Number of Tags | > 30.000 |
| Number of Members | ca. 3.700 |

Stand: 20 August, 2012

# Partitioning Facets

- Some very representative facets could be determined

„Canon“

| Partitioning Facet | |
|---|---|
| 1000d | (37) |
| 300d | (57) |
| 350d | (50) |
| 400d | (120) |
| 40d | (37) |
| 450d | (44) |
| 500d | (135) |
| 550d | (87) |
| 5dmarkii | (108) |
| 7d | (60) |
| ixus | (39) |
| moment | (41) |
| powershot | (85) |
| robert | (35) |

„Olympus“

| Partitioning Facet | |
|---|---|
| e3 | (20) |
| e30 | (10) |
| e410 | (18) |
| e420 | (38) |
| e500 | (43) |
| e510 | (26) |
| ep2 | (9) |
| equirectangular | (16) |
| trip | (13) |
| xa | (42) |
| xa2 | (47) |
| xa4 | (26) |

„Museum“

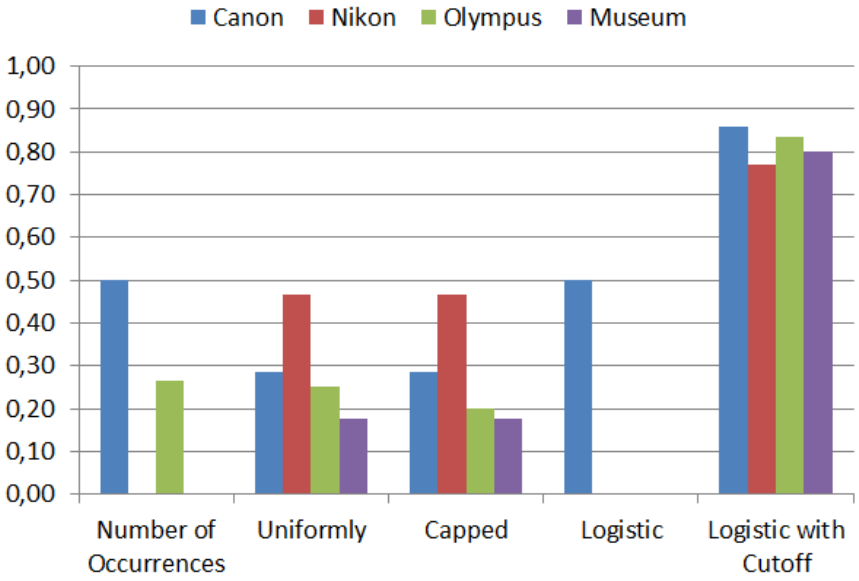
| Partitioning Facet | |
|---|---|
| altepinakothek | (38) |
| artgallery | (34) |
| bmw | (148) |
| brandhorst | (137) |
| deutsches | (67) |
| glyptothek | (39) |
| musée | (40) |
| neuepinakothek | (18) |
| residenz | (17) |
| theatermuseum | (41) |

# Results

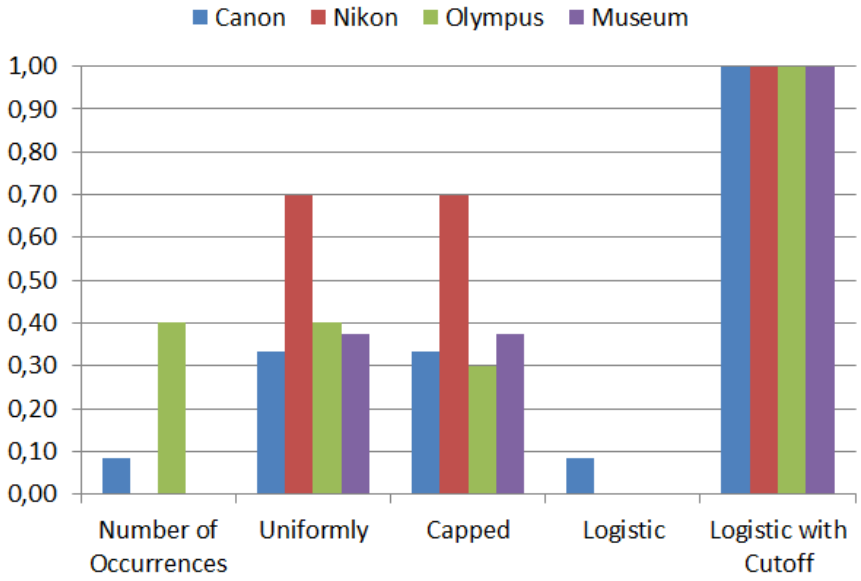
- Although some very meaningful facets could be extracted, noisiness is challenging!

| Tag | Number of Occ. | Uniformly | Capped | Logistic | Logistic w. Cutoff |
|---|---|---|---|---|---|
| Canon | 1 / 2 | 4 / 14 | 4 / 14 | 1 / 2 | 12 / 14 |
| Nikon | 0 / 3 | 7 / 15 | 7 / 15 | 0 / 2 | 10 / 13 |
| Olympus | 4 / 15 | 4 / 16 | 3 / 17 | 0 / 1 | 10 / 12 |
| Museum | 0 / 1 | 3 / 17 | 3 / 17 | 0 / 1 | 8 / 10 |

# Results




Precision




Recall

# Conclusion

- The partitioning algorithm works well on consistently tagged resources
  - Noisiness and ambiguity impair the result
- Cost function has huge impact
  - Further research necessary!
- However, it provides a new method to discover the latent structure of text-labeled objects!

# Thanks for your attention!

Questions?!