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Extracting Semantic User Networks From Informal Communication Exchanges

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Introduction

- Exploit Organisational Knowledge that is often **buried**
- Generate Semantic Profiles
- Application

  Organisational Knowledge Management Context

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Informal Communication

- Emails
- Meeting Requests
- Meeting Records
- Chats

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Informal Communication

From:13
To:18

I thought the first prize would have been a copy of the Guardian or a pair of sandals...

From:13
To:3

Potential Xmas buffet?

Interesting blog post from Mischa Tufffield (of Garlik) here about tracking web users passively through Facebook's like button:

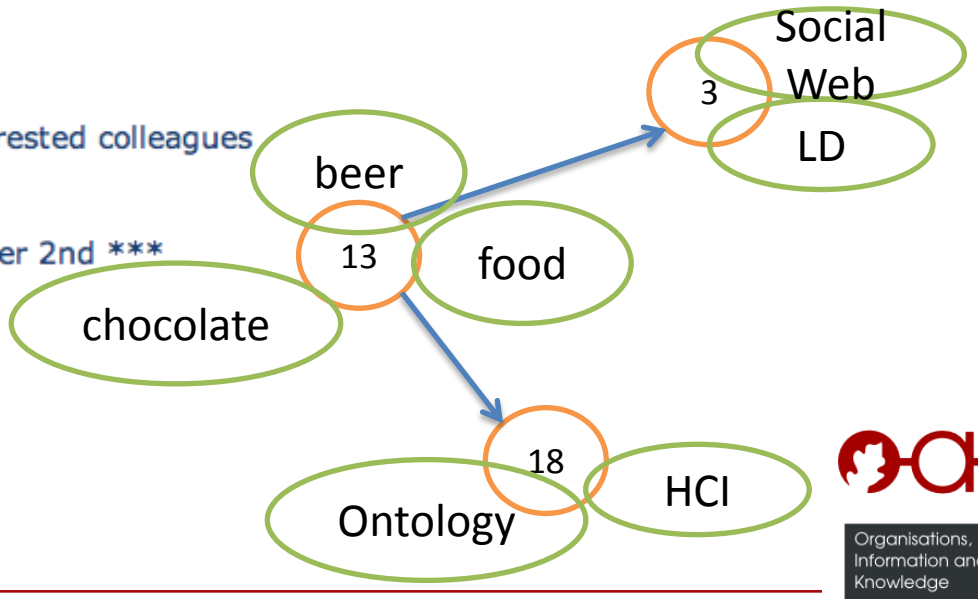
http://mmt.me.uk/blog/2010/07/30/the-facebook-like-button/

From:13
To:18

Apologies for cross-postings. Please forward to interested colleagues and mailing lists.

*** Submissions deadline extended until September 2nd ***

CALL FOR PAPERS: SDoW2010



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Approach

Collect Features

Generate User Profiles

User Profile Usage

- Determine Expertise
- Visualise interactions
- Browse and Retrieve information

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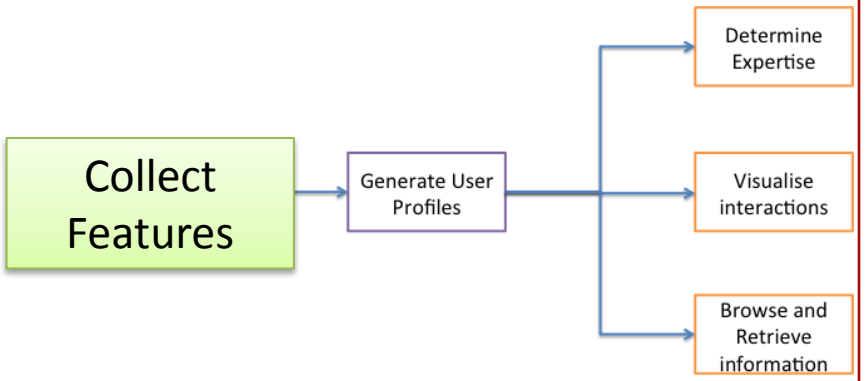
State of the Art

Collect Features from Emails



Exchange Frequency

- Absolute frequency thresholds (Tyler et al. 2005)
- Time-dependent thresholds (Cortes et al. 2003)

Content-Based Analysis

- Determine expertise (Schwartz and Wood, 1993)
- Analyse relations between content and people (Campbell et. al., 2003)
- Extract personal information (names, addresses, contacts) (Laclavik et. al., 2011)

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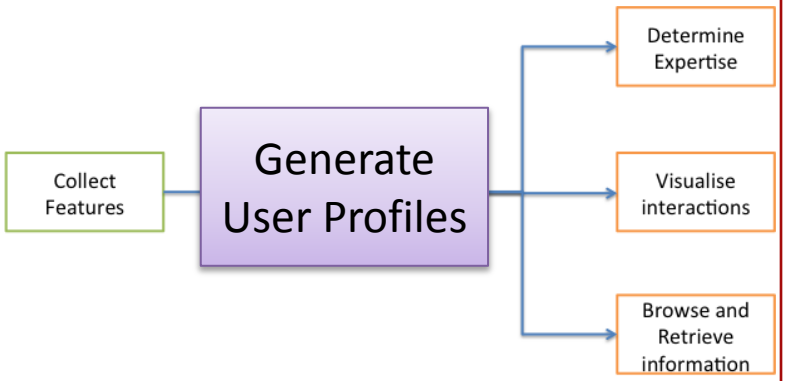
State of the Art

Generate User Profiles



Monitoring User activities on the web

(Kramar,2011)

Analysing user generated content (Tweets)

(Abel et. al., 2011a)

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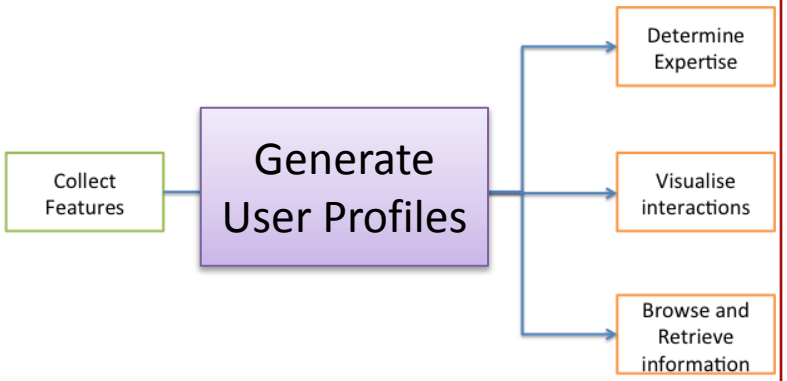
State of the Art

Measures for User Similarity



Binary Function (are the two users connected?)

Non Binary Function (how strong is their connection?)

Features typically exploited

- geographical location, age, interests, social connections
- Facebook friends, interactions, pictures

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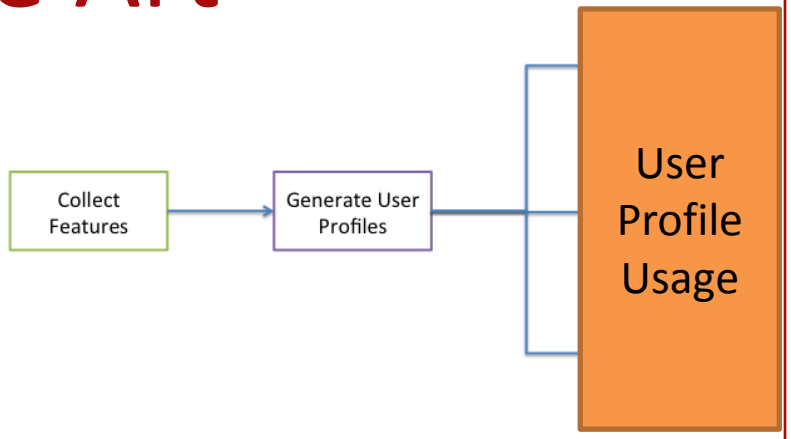
User Profile Usage



Information Retrieval – Customised search results

(Daoud et. al., 2010)

Recommender Systems - Effective customised suggestions

(Abel et. al., 2011b)

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Research Question

Does increasing the level of semantics in user profiles outperform current methods?

Task: Inferring similarity among users

Assessment: Correlation with human judgement

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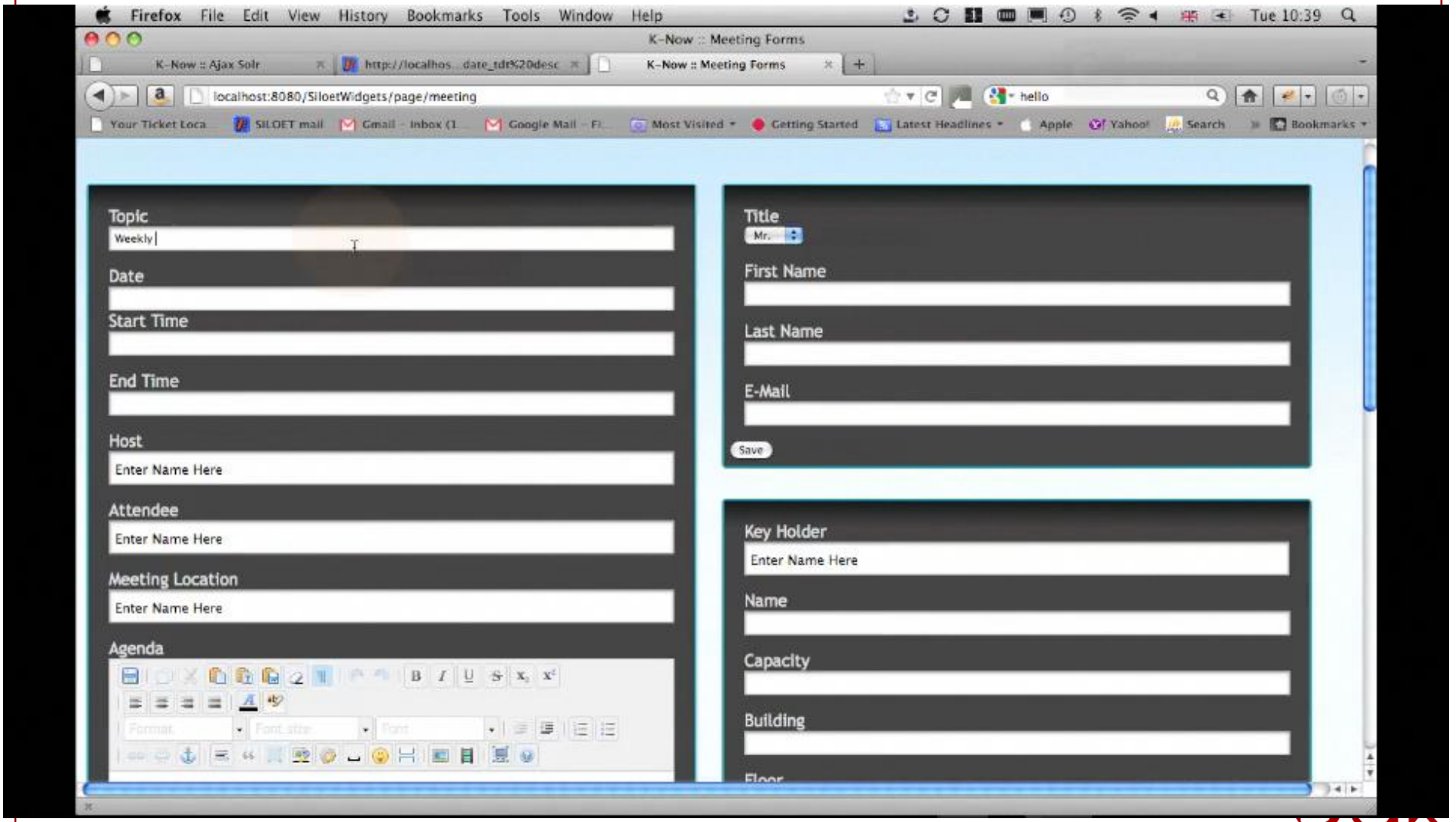
Capture Information



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Experiment Settings

Corpus

Internal mailing list of the OAK group in the Computer Science Department of the University of Sheffield

- 1001 emails
- Users in mailing list : 40
- Active users (sending emails to list) : 25
- Users participating in the evaluation: 15

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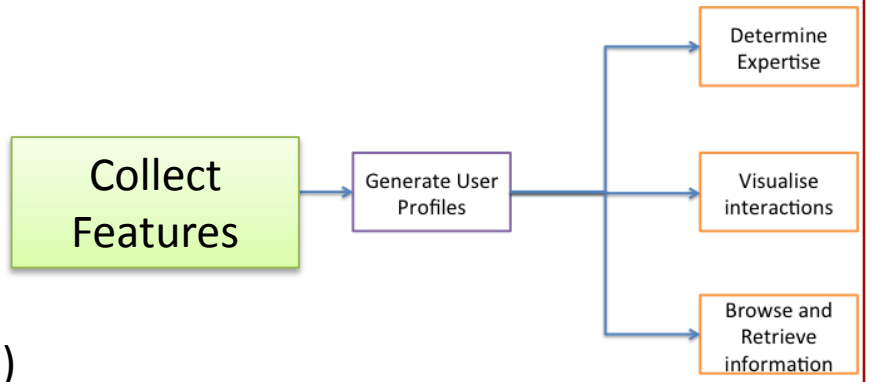
Collect Features

For each email e_i in the collection E



Keywords (Java Automatic Term Recognition)

Bag of keywords representation: $e_i = \{k_1,\ldots,k_n\}$

Named Entities (Open Calais web service)

Bag of Entities representation: $e_i = \{ne_1,\ldots,ne_n\}$

Concepts (Wikify, Milne and Witten, 2008)

Bag of Concepts representation: $e_i = \{c_1,\ldots,c_n\}$

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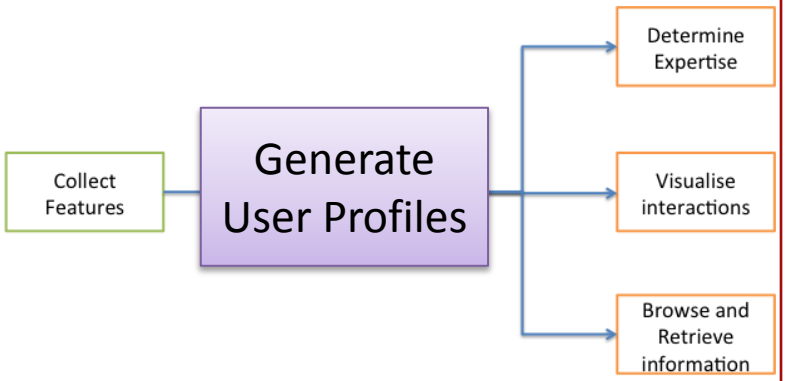
Generate User Profiles



Amount of knowledge shared among individuals

(Keywords, Entities, Concepts)

Similarity strength on a [0,1] range

$$Jaccard(P_1, P_2) = \frac{P_1 \cap P_2}{P_1 \cup P_2}$$

Sample sets for P_1, P_2: Keywords, Named entities or Concepts

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Evaluation

- Participants were asked their perceived similarity with colleagues
  - Professional and social point of view
  - Topics of interest
- Similarity on a scale of 1 to 10

  1 – Not similar at all

  10 – Very similar

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Evaluation

- Compare user's perceived similarity with achieved similarity

Pearson's correlation

$$\rho_{xy} = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$$

σ_{xy} - Covariance of X and Y (how much they change together)

σ_x, σ_y - Standard deviation for X and Y (how much variation from the average)

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Results

User ID	Correlation Keyword	Correlation Entity	Correlation Concept	Inter-Annotator Agreement
14	0.55	0.41	0.68	0.91
7	0.48	0.39	0.58	0.87
28	0.5	0.41	0.57	0.89
10	0.47	0.39	0.57	0.94
27	0.32	0.29	0.48	0.92
21	0.34	0.42	0.42	0.91
1	0.35	0.32	0.42	0.94
3	0.3	0.31	0.38	0.86
9	0.28	0.36	0.38	0.9
18	0.5	0.5	0.36	0.87
8	0.17	0.19	0.35	0.82
11	0.59	0.42	0.34	0.83
25	0.25	0.33	0.3	0.73
23	0.21	0.33	0.19	0.86

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Results

Keyword (Avg)	Named Entities (Avg)	Concepts (Avg)
0.379	0.362	**0.430**

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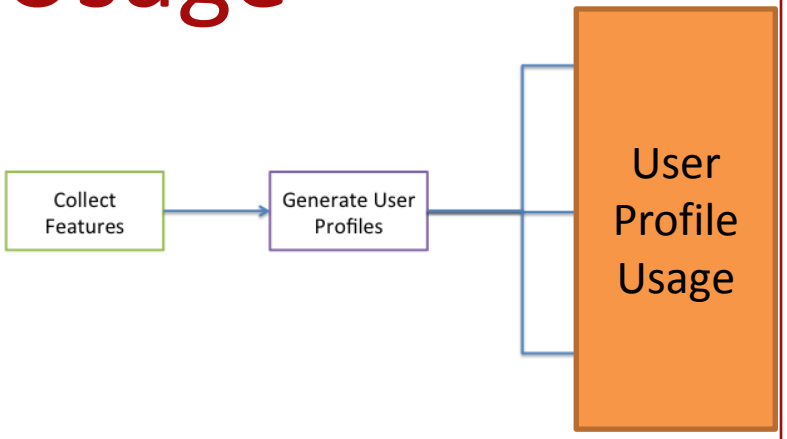
User Profile Usage



- Email Browsing

  Topics of communication

  User expertise

- Email Retrieval

  Perform specific queries

  Selecting individuals

- Email Visualisations

  Investigate interaction networks

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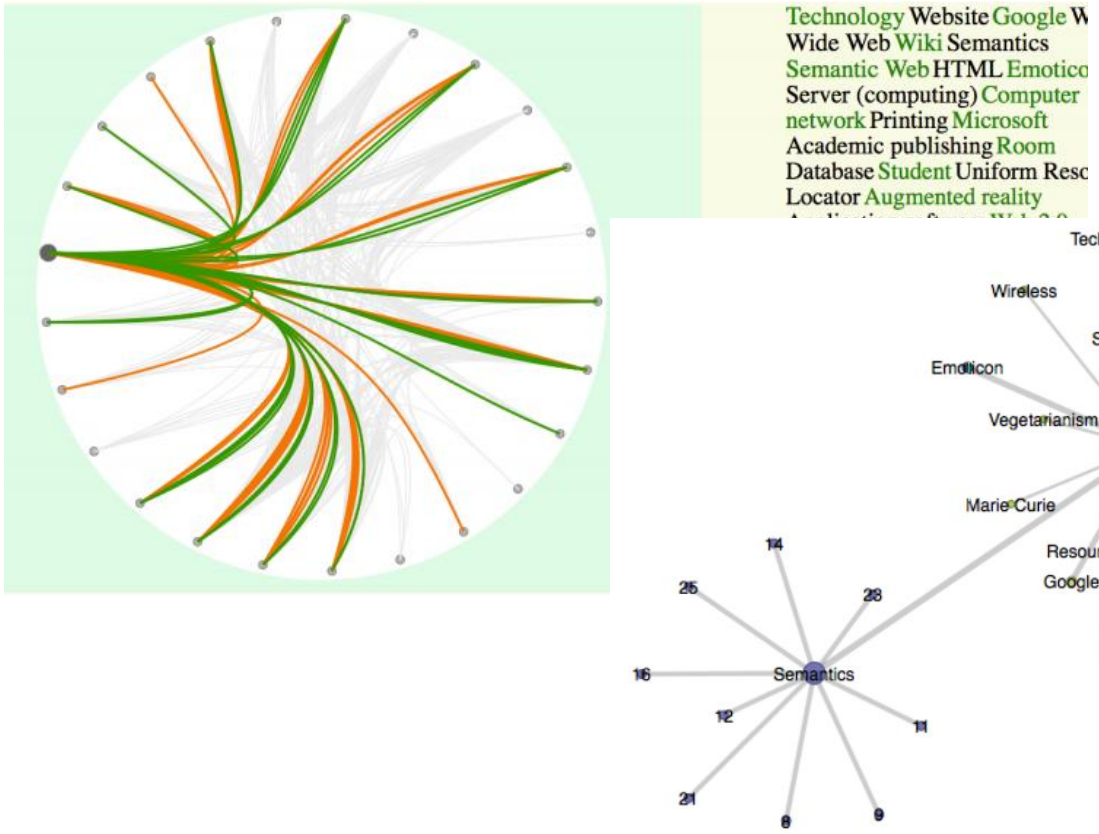
SimNET – Exploring Interaction Networks



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SimNET

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Conclusions

- Dynamically model user expertise from informal communication exchanges
- Generate semantic user profiles from textual content, generated by users
- Making use of buried knowledge within an organisation

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Future Directions

- Long term trials of the system in an organisation with ‘knowledge workers’
- Explore new visualisations to facilitate real time visualisation of dynamic networks and profiles
- Connect user profiles to Linked Open Data
  - Investigate how profiles can be further enriched using Linked Data

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