# Self-organized Semantic NeLI

## Through Self-organized Approaches Using Semantic Web, Social Networking and Web 2.0 Frameworks

M. O. Faruque Sarker

PhD Candidate
Cognitive Robotics Research Centre
Newport Business School
University of Wales, Newport

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# Outline

# Background: Web 2.0, Semantic web and Self-organization

## Why self-organization is relevant?

- Web 2.0 is based on bottom-up processes
  $\longrightarrow$ users generate contents through explicit and implicit social interactions.
- Complex patterns can be resulted from simple behavioural rules
  $\longrightarrow$ complexity is not necessarily outcome of sophisticated agent cognition

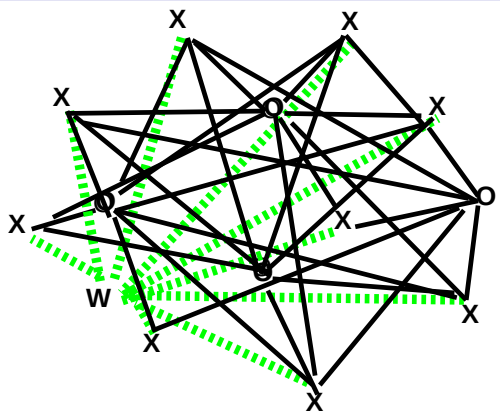
## A Self-organized approach

- Pattern formation through the local interactions internal to the system [a]
- Needs four elements:[b]
  i) continuous flow of information, ii) concurrence, iii) learning and iv) forgetting of agents
- Scalable, adaptable and robust solutions
  $\longrightarrow$ Depends on less communication/computation, almost no user/environment modelling

[a] Camazine *et al.*, Self-organization in Biological Systems, 2001.
[b] Sarker & Dahl. *LNCS* 6234, 2010.

**Figure:** A termite nest from bottom-up approach

# Self-organized Semantic Search through Attractive Field Model




| | |
|---|---|
| Source nodes (o) | items to be searched |
| Agent nodes (x) | user search agents e.g., mozilla browser |
| Black solid edges | attractive fields that correspond to an agent's stimuli for related items |
| Green edges | attractive fields of unrelated items shown as (w) |

**Figure:** The attractive filed model (AFM)

Strength of an attractive field: $S_j^i \propto \frac{k_j^i}{d_{ij}} \phi_j$

## Parameters

$k_j^i$ $i$ agent's sensitization for item $j$
$\longrightarrow$ How much $i$ is sensitive to $j$ item?

$d_{ij}$: $i$ agent's location preference
$\longrightarrow$ How far $j$ is located from $i$?

$\phi_j$: relative urgencies of item $j$.
$\longrightarrow$ What is the level of urgency of $j$?

## Learning search patterns

E.g.: Increasing item sensitization of agents by a rate $k_{INC}$

$$If\ item\ is\ rated: \ k_j^i \rightarrow k_j^i + k_{INC}$$

$\longrightarrow$ A form of positive feedback

# A Frameworks for Semantic Search and Navigation

## Key aspects

- Easy and interactive, compatible, support for different users' personalization
- Reasoning new information from existing information

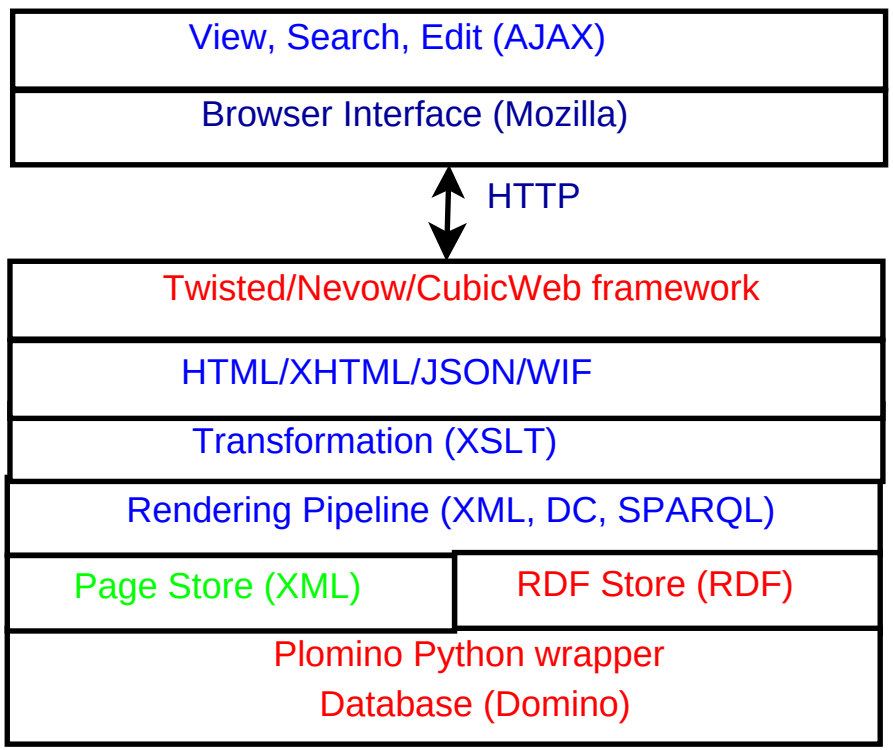



**Figure:** Python based semantic wiki framework

| Model | Tools/Frameworks |
|---|---|
| Database storage | Domino, Plomino.dominoimport |
| Webpage /Knowl-edge base | XML, Resource Description Framework, RDF/XML |
| Data rendering | XML, Dublin Core, SPARQL Protocol and RDF Query Language |
| Page transfor-mation | XML Stylesheet XSLT |
| Web publishing | HTML/XHTML, JavaScript Object Notation, Wiki Ex-change Format |
| Backend | Python web frameworks |
| Frontend | JavaScript/AJAX |

# Web 2.0 in NeLI: Wiki, Blogs, RSS, Podcast and more

## Adopting web 2.0 in NeLI

- Blogs: One-to-many interactive timely discussions → e.g. Dimov's *Clinical Cases & Images*[a]
- Wikis: Bottom-up content creation, editing and discussions → e.g. Flu Wiki[b]
- RSS Feeds: Up-to-date feeds on mobile devices *anytime anywhere*
- Social Bookmarking: Collaborative tagging, link sharing → e.g. IBM's Dogear
- Podcast or Vodcast: Audio-visual material for increasing awareness

[a] http://casesblog.blogspot.com/
[b] http://www.fluwikie.com/

## Constraints

- Lack of authoritative control over content
- Lack of accuracy
- Information overload
- Anonymity
- Requires moderating → e.g. Ganfyd[a]
- Roll-back is costly
- Requires enforcing policies for ensuring privacy and copyright issues

[a] http://www.ganfyd.org/

# A System for Exploiting Social Networking (SN) Tools

## Mining SN

- Relevant page identification, pre-processing and extraction
  $\longrightarrow$ Facebook/Twitter API
- Integration
  $\longrightarrow$ Probabilistic approach for name disambiguation, classification
- Database storage, indexing and access
  $\longrightarrow$ Domino, Python wrapper
- Social network modelling
  $\longrightarrow$ semantic modelling, clustering using statistical and socio-biological models
- Search services
  $\longrightarrow$ Hot topic, disease outbreak, expert search

## Disseminating public health information over SN Tools

- Automated delivery based on SN clusters/ subscription
- Relevant information (recall self-organized search)
- Low overhead of information based on user feedback

# A Framework for Infectious Disease Monitoring through SN Tools

## HealthMap: Global Infectious Disease Monitoring Site

- Popular news-based
  → alerts from multi-sources, last 30 day stats
- web 1.0 framework
  → no metadata storage, no knowledge-base, needs human intervention

## Going Beyond HealthMap

- Social-network based:
  → biological & statistical models
- Semantic web technology:
  → inferred knowledge
- Personalized alerts
  → over Facebook, Twitter, mobile devices
- Self-organized design and operation
  → scalable, minimum site maintenance overhead, fault-tolerant and mostly automated

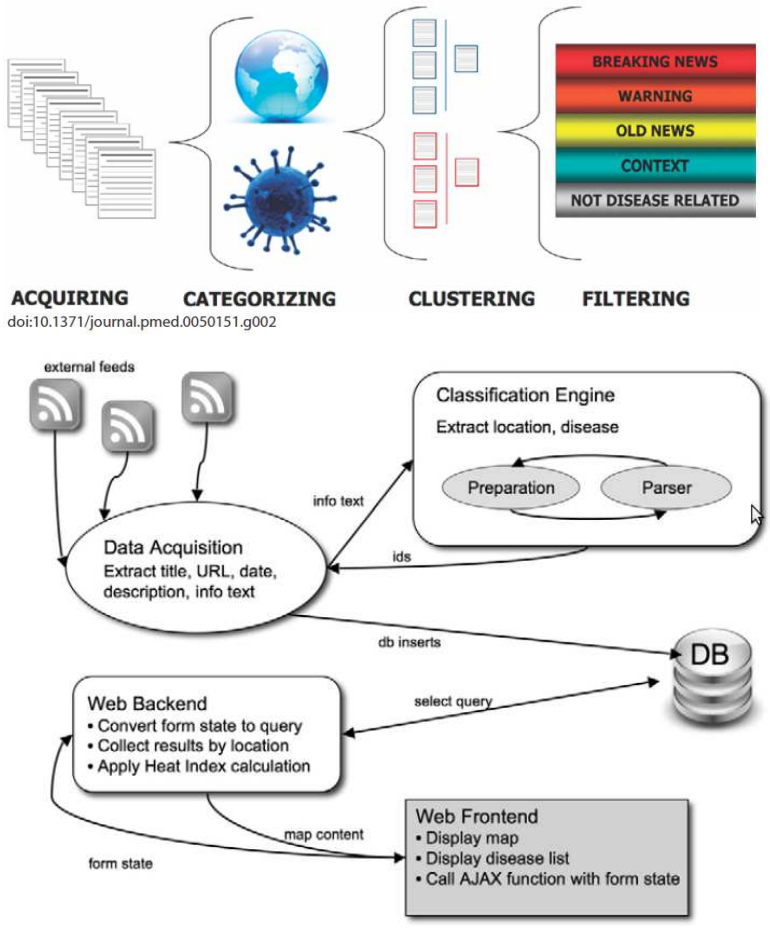



**Figure:** HealthMap architecture (Freifeld et al. *J. of the American Medical Informatics Association*:15, 150, 2008)

# Conclusion and Outlook

- Web 2.0 is based on bottom-up processes
- Self-organized approaches has potential to manage NeLI's large semantic web system
- Both biological and statistical approaches can be used to exploit the social networking tools for data mining and information dissemination
- NeLI's infectious disease monitoring framework can potentially be built by putting semantic web technology into existing frameworks.