

# **Self-organized Semantic NeLI**

## **Through Self-organized Intelligent Frameworks Using Semantic Web, Web 2.0 and Social Networking Tools**

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

### Interconnections with self-organization

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

### A Self-organized approach

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

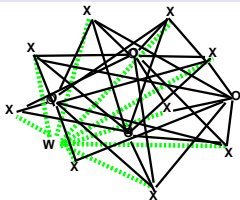
<sup>a</sup> Camazine *et al.*, Self-organization in Biological Systems, 2001.

<sup>b</sup> 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  $j$

→ How much  $i$  is sensitive to  $j$  item?

$d_{ij}$ :  $i$  agent's location preference

→ How far  $j$  is located from  $i$ ?

$\phi_j$ : relative urgencies of item  $j$ .

→ What is the level of urgency of  $j$ ?

## Learning search patterns

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

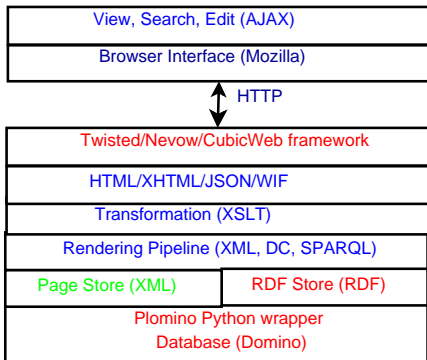
If item is rated:  $k_j^i \rightarrow k_j^i + k_{INC}$

→ 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



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
Web publishing	HTML/XHTML, JavaScript Object Notation, Wiki Exchange Format
Backend	Python web frameworks
Frontend	JavaScript/AJAX

**Figure:** Python based semantic wiki framework

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

### Adopting web 2.0 in NeLI

- **Blogs:** One-to-many interactive timely discussions → e.g. Dimov's *Clinical Cases & Images*<sup>a</sup>
- **Wikis:** Bottom-up content creation, editing and discussions → e.g. Flu Wiki<sup>b</sup>
- **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

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<sup>a</sup><http://casesblog.blogspot.com/>

<sup>b</sup><http://www.fluwikie.com/>

### Constraints

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

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<sup>a</sup><http://www.ganfyd.org/>

# A System for Exploiting Social Networks (SN)

## Mining SN

- Relevant page **identification, pre-processing and extraction**  
→ Facebook/Twitter API
- **Integration**  
→ Probabilistic approach for name disambiguation, classification
- Database **storage, indexing and access**  
→ Domino, Python wrapper
- Social network **modelling**  
→ semantic modelling, clustering
- **Search** services  
→ Hot topic, expert search

## Disseminating public health information over SN

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

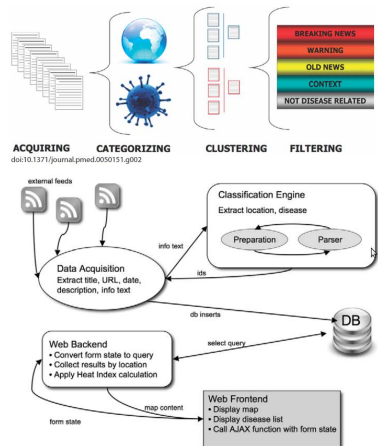
# A Framework for Infectious Disease Monitoring through SN

## 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