Instances of subconscious social intelligent computing

M. Graña*, I. Rebollo**

*Computational Intelligence Group, UPV/EHU[1]
**Unidad I+D empresarial Grupo I68

August 13, 2013

Summary

- What is social computation?
- When social computation is intelligent?
- What is the difference between conscious and subconscious?
- Is there any difference between unconscious and subconscious?
- A couple of example systems under development

Contents

Contents

Introduction

Fact

Social networks can be seen as a repository of information and knowledge that can be queried when needed to solve problems or to learn procedures.

.

Fact

In the social sciences, social networks have been useful to spread educational innovations

- in health care training
- management of product development programs,
- engagement in agricultural innovations by farmers.

Introduction

Fact

developments on Social and Personal Information processing have strong impact

- *Economical*
- *Social*
- *Political*
- *others*

Introductions: defs

Definition

Computational Social Science aims to *understand* the dynamics of social systems from data that can be extracted from all existing sources of human behavior observation.
-The social players are subjects of observation and experimentation, searching for:

- Communitiy detection (Louvain algorithm)
- Diffusion processes

Introduction: defs

Definition

Social computing : "intra-group social and business actions practiced through group consensus, group cooperation, and group authority, where such actions are made possible through the mediation of information technologies, and where group interaction causes members to conform and influences others to join the group".

.

Definition

Social computing can be termed *intelligent* when new solutions to new or old problems are generated when posed by the social players.

Introduction: defs

Fact

Social Computing is developing into a productive model where rewarding mechanisms are required to control the desired output of the system

Introduction:defs

Definition

Social Intelligence is the emergence of problem solving behavior out of social interactions from the point of view of the social player.

Introduction: defs

Definition

Concious computing is defined by the decisions and actions performed by the social players on the basis of the information provided by the social service.

Introduction: defs

Definition

Subconscious computing

- intelligent data processing
- performed automatically and autonomously by the web service
- in order to search or produce the information requested by the social players,

Introduction

Definition

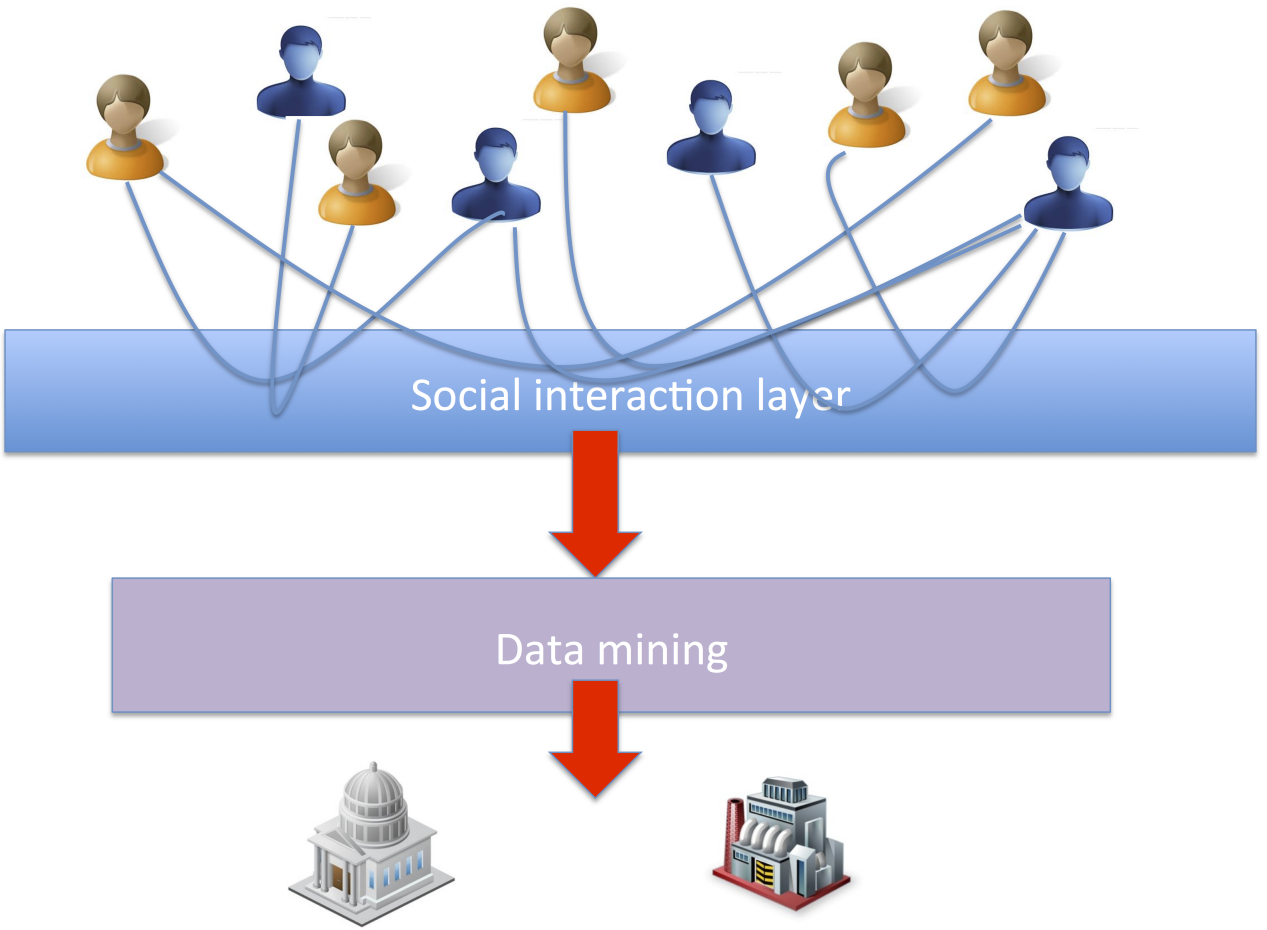
unconscious social computing,
the service providing company is milking the information generated by the users for its own profit.

- the social player is unaware, and
- the providing company wants him/her to stay so.
- end beneficiary is the corporation

introduction

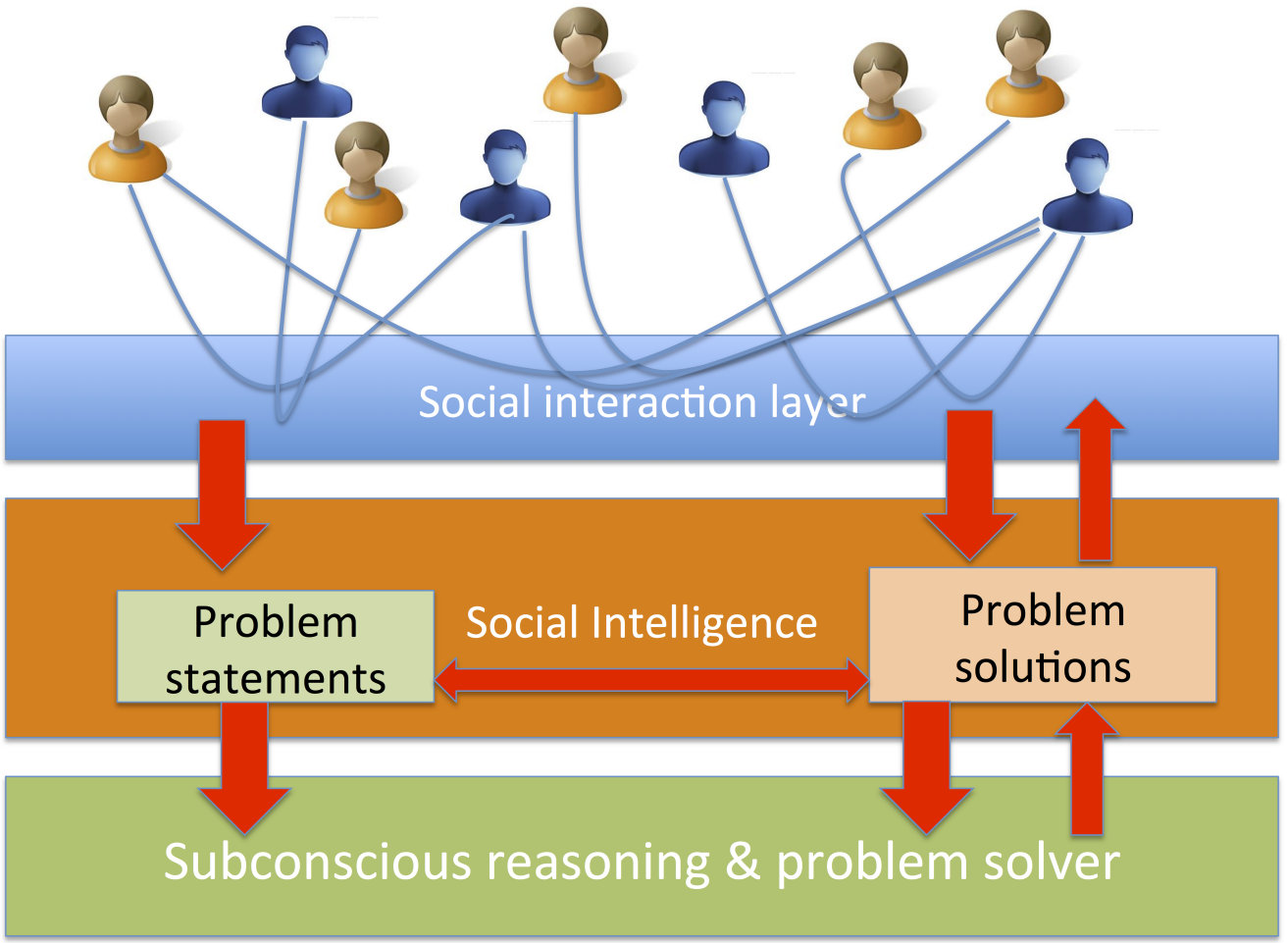
In the proposed subconscious social computing, the social players are the end beneficiaries, and all side value and uses of the social information is acknowledged and known by them.

Introduction



Social Computing and Computational Social Science paradigm

Introduction



Subconscious Social Intelligence paradigm

Taxonomy

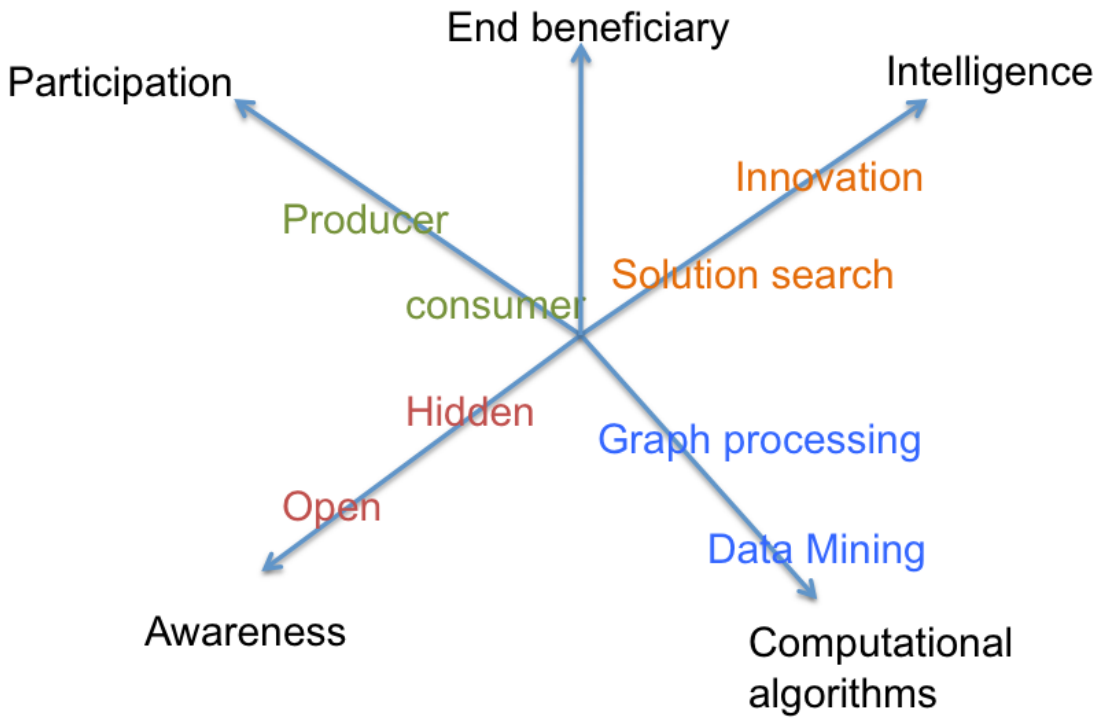
Crowd-sourcing: the social players explicitly cooperate to build a knowledge object following some explicit and acknowledged rules. i.e: wikipedia.

Information-gathering: The social player asks for a specific data and the social framework searches for it. , i.e. a restaurant.

Solution-recommendation: the social player asks for the solution of a problem, it is broadcasted, receiving recommendations by other social players. Answers can be tagged by trust values.

Solution-generation: the social player asks for the solution of a problem, and the social framework provides (innovative) solutions based on previous reported experience from other social players.

Taxonomy



Axes of social computing taxonomy

Taxonomy

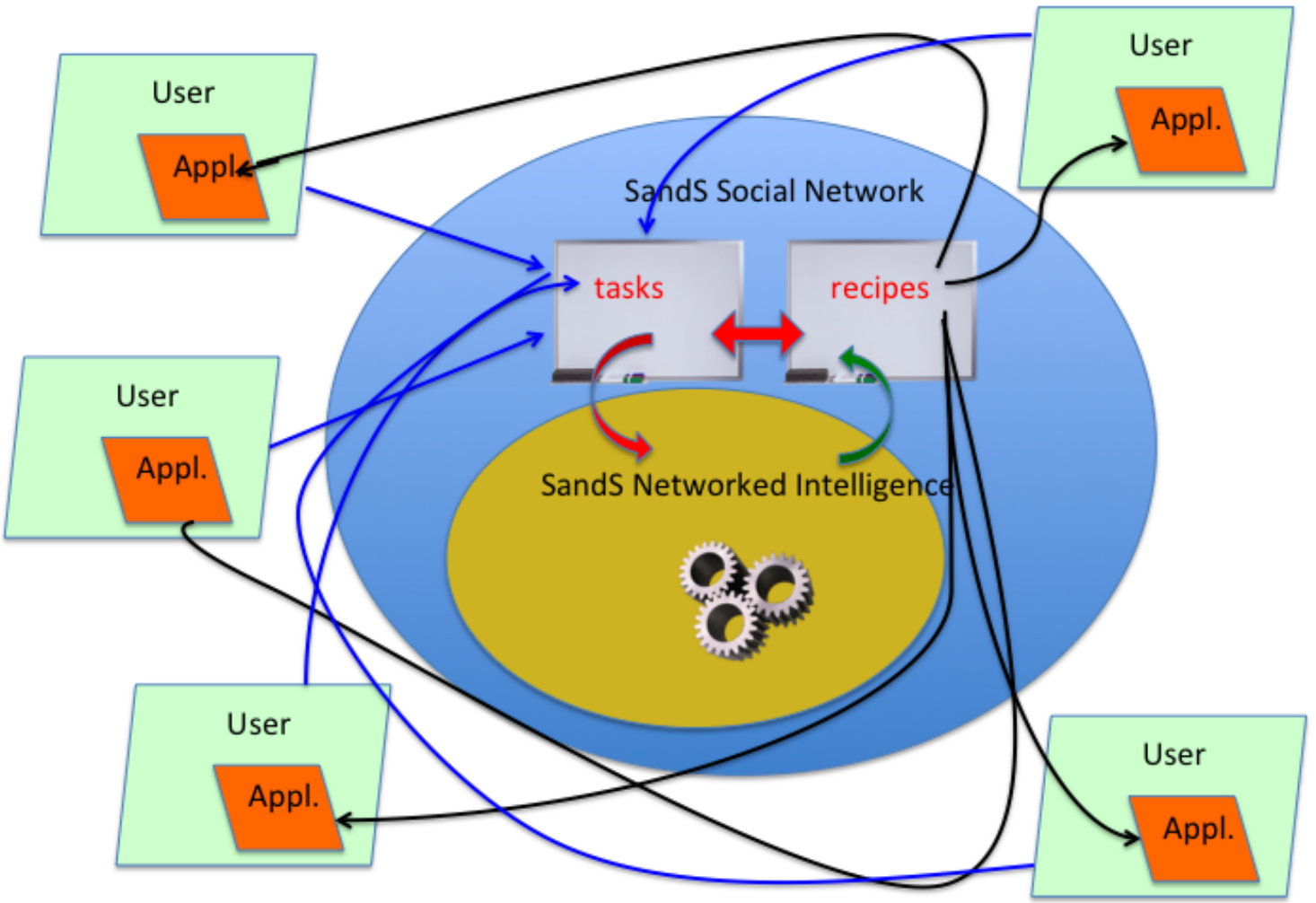
- Sources of confusion
  - Data gathering processes disguised as services
    - Service innovation is increasingly intrusive & aggresive
    - Free registration
  - Data mining algorithms are intelligent

Contents

SandS project

- The Social and Smart (SandS) project aims
  - to lay the foundations for a social network of home applicance users
  - endowed with a layer of intelligent systems
    - to produce new solutions to new problems
    - from knowledge accumulated by the social players.
- The system is not a symple recolection of tested appliance use recipes,
  - generate new recipes trying to satisfy user demands,
  - fine tuning of recipes on the basis of user satisfaction
    - by a hidden reinforcement learning process.

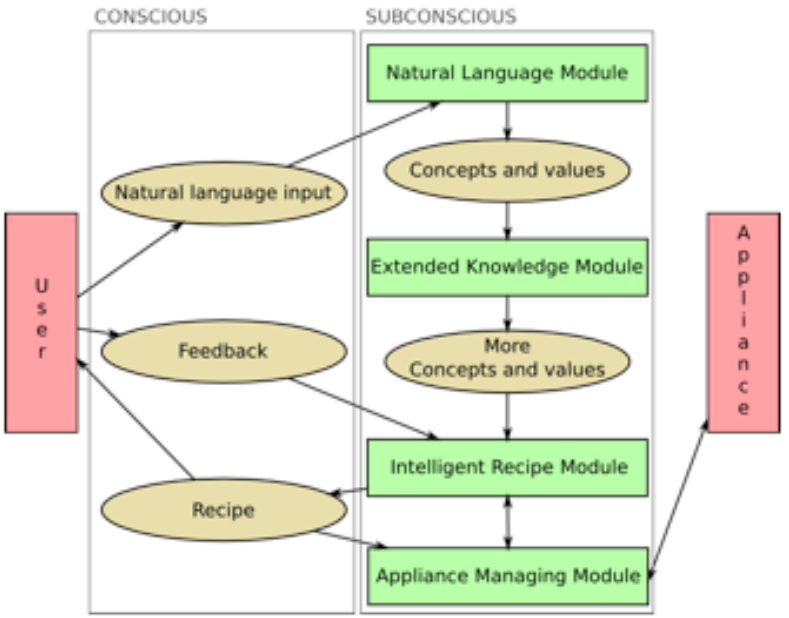
The SandS architecture



The SandS architecture

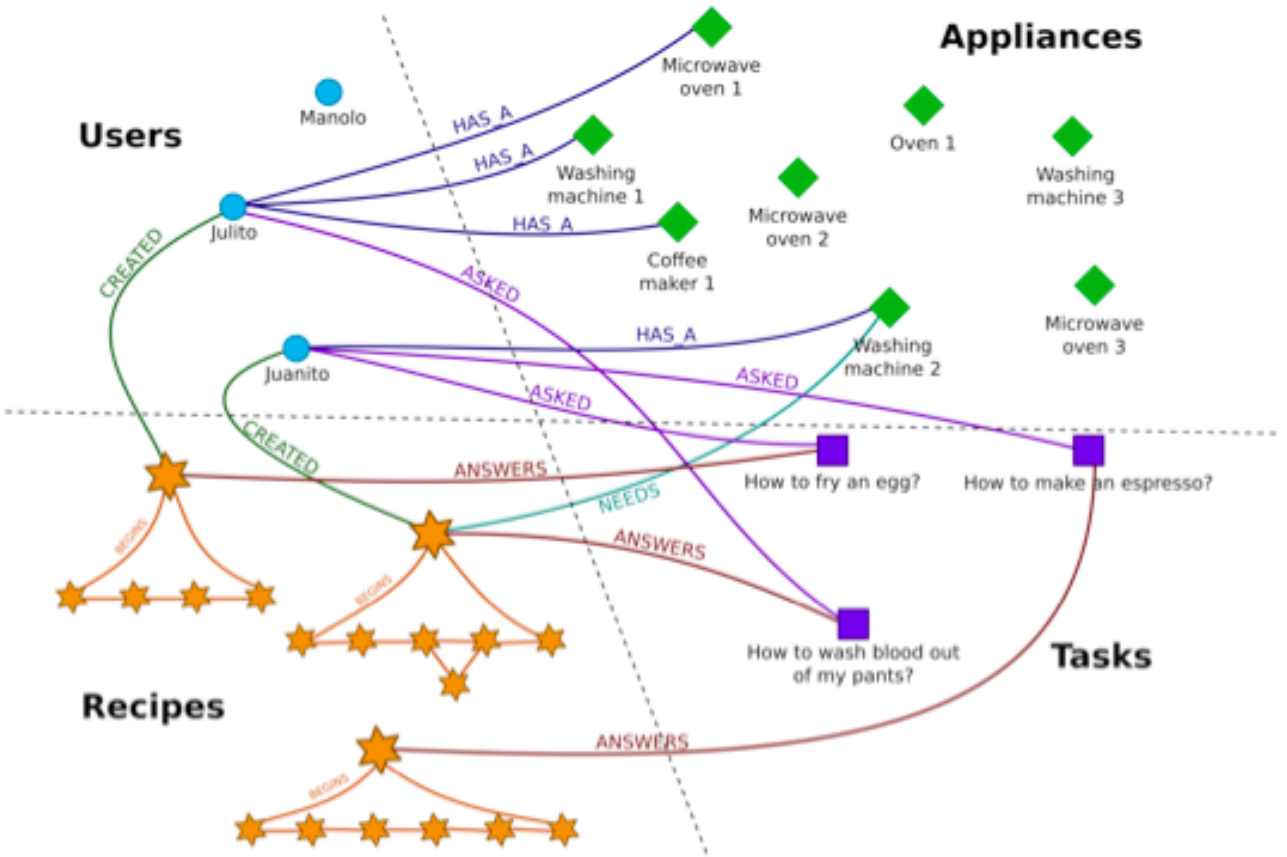
- Tasks
  - Specified by the user
- Recipes provided by
  - Appliance Manufacturer
  - User: conscious innovation
  - Networked intelligence: subconscious innovation

SandS service

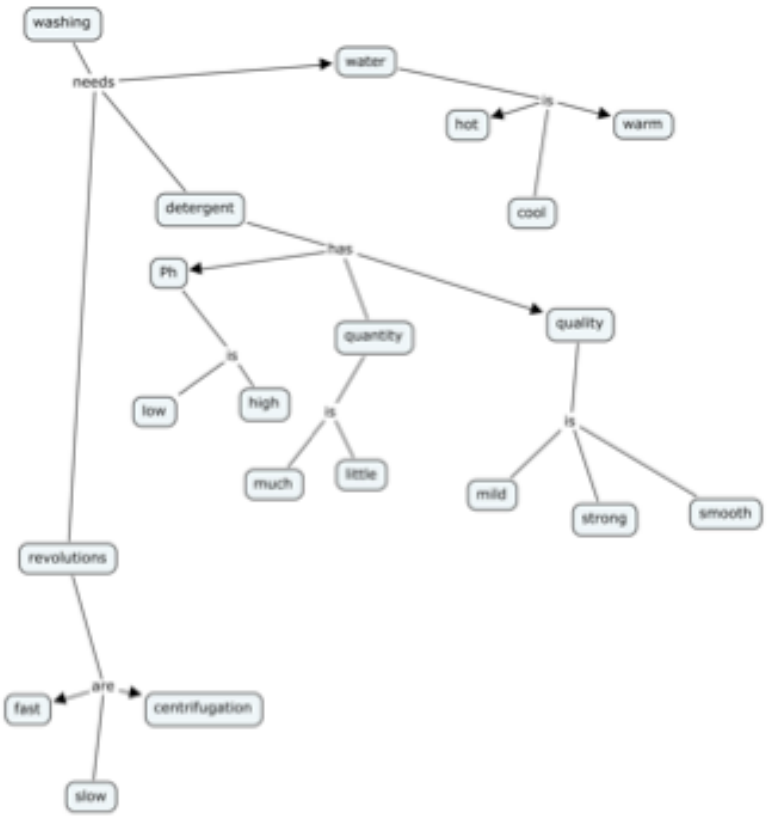


Conscious and subconscious processes in SandS

SandS knowledge representation

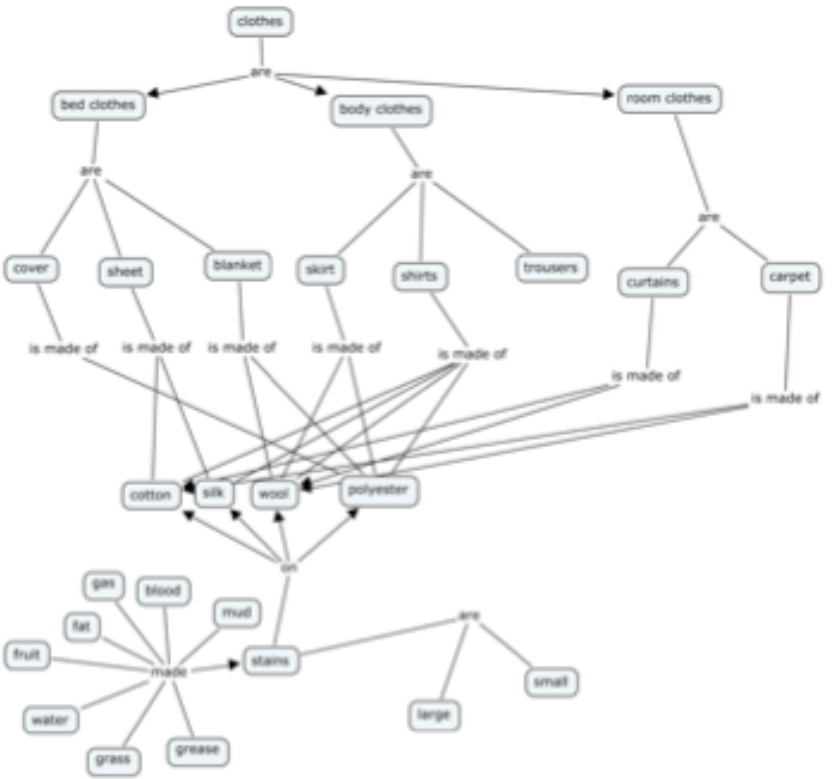


SandS knowledge representation



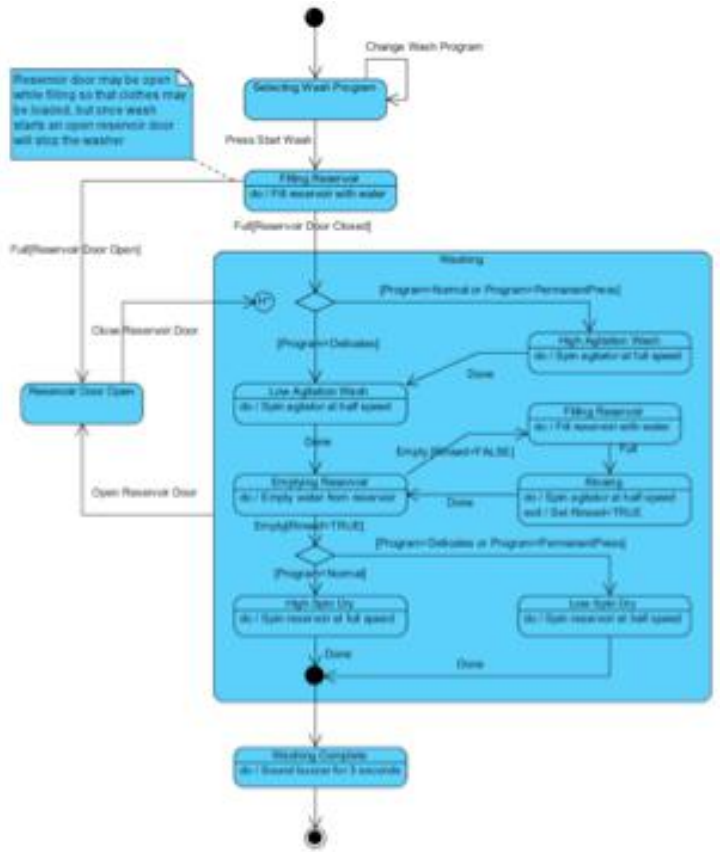
The ontology from the point of view of the appliance

SandS knowledge representation



The ontology from the point of view of the user.

SandS knowledge representation



Recipe (washing) as a process

SandS learning layer

- Requirements:
  - Task & recipe specification languages
  - User satisfaction feedback
  - Database collection of task, recipe, satisfaction
  - Training of classifier/regressor

Contents

Introduction

- Enterprise Resource Planning (ERP) systems
  - assist an organization to manage information across
    - finance/accounting, manufacturing, real-time planning, sales and service, customer relationship management, and any other task in the organization needing information processing, inventory control, order tracking, customer service, and managing human resources
- Nowadays, the ERP software tend to move towards the *cloud* offering agents and services accessible all over the world.

Introduction

- User Behavior Database (UBDB), user logs
  - initial/closing time for each module call by the user.
- A recommender system is proposed
  - to give recommendations on the next module to be used.
- Testing has been made on a costumer company
  - access to it's UBDB . The costumer has reviewed the result to evaluate them. The ERP details and the costumer's identity are confidential information.

Introduction

The recommendation system building process:

1. Build user profiles of module use
2. Define an implicit social network based on user profiles
3. Find user clusters in the social network
4. Determine "role model" user: the expert
5. Recommendations are based on the expert behavior

The user profiles

User profiles

- We built the list of programs $P^i = \{p_1, p_2, ..., p_n\}$ used by each user,
  - ordered by
    - the total time that the user has spent working with them measured in seconds or
    - the number of executions of each program s_p^i.

We have determined heuristically that ten programs provide enough information to evaluate the users

The user profiles

Table : Relation between user #42 and user #54

Prog User #42	#access	%access	Prog User #54	#access	%access
$p1$	174	52	$p1$	562	52
$p2$	109	34	$p5$	257	24
$p3$	30	9	$p2$	227	21
$p4$	7	3	$p6$	16	1.5
			$p4$	13	1.5
total	320	100	total	1075	100

The ERP Social network

Relation between two modules called by two users:

$$a_{i,j}(k) = \frac{s^i_{p_k} + s^j_{p_k}}{2} * m_k.$$

where m_k weights separation of $k-1$ positions of a program in the ordered lists.
Affinity between two users:

$$A_{ij} = \sum_k a_{i,j}(k)$$

The normalized similarity between users is obtained as

$$F(v_i, v_j) = \frac{A_{ij}}{\sum s^i_p}.$$

Apply a threshold to the normalized similarity to obtain the graph topology

The ERP social network

It is built without intervention of the users (unconscious vs. subconscious)
In addition, the Social Network will be time varying,

- because the relationship between users is recalculated each time a user calls a program,
- some users may leave the group to join another, or go from being lonely users to become part of a group or vice versa.

CLustering is not computed in real-time, but periodically, i.e. every night.
For clustering, we use the Gravitational Swarm for Graph Coloring (GS-GC) on the complementary grap

The ERP social network

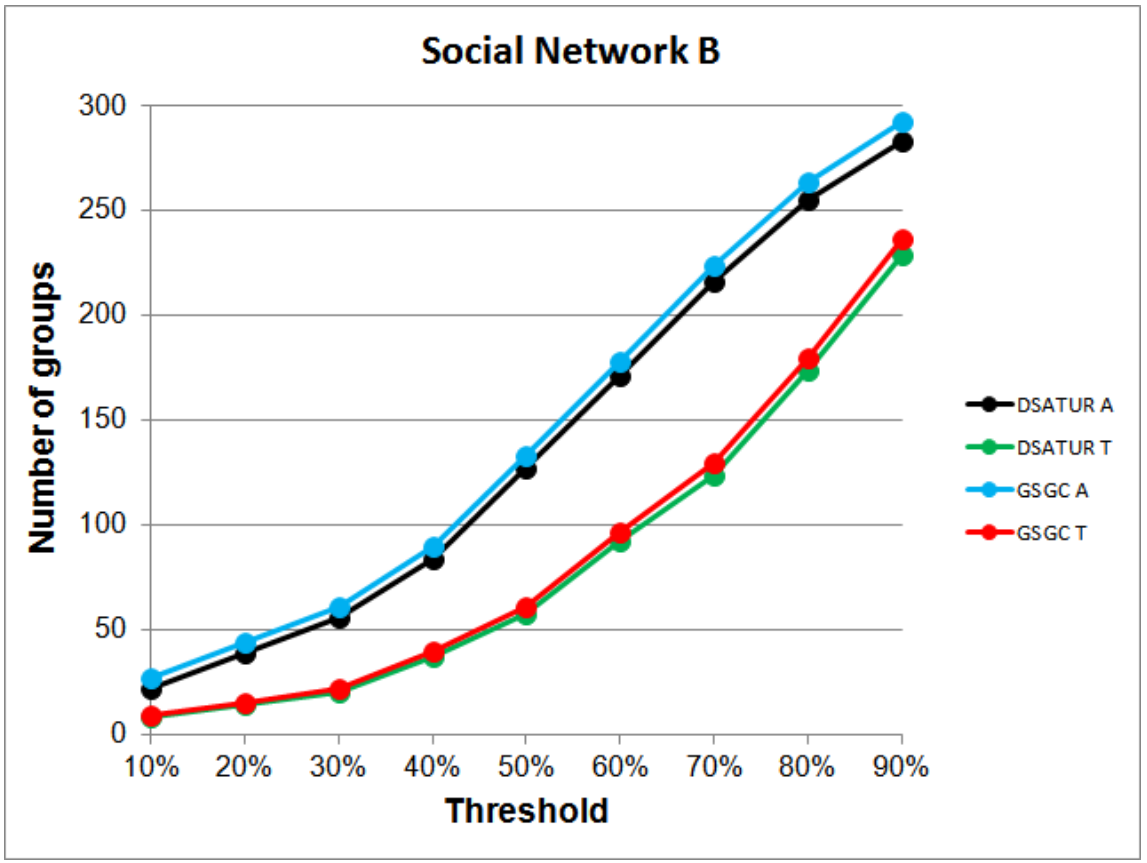


Figure : Clusters found in the Social Network of 400 users varying threshold value. Results on program access (A) and time (T) values, for the DSATUR, GSGC

Validation

- Are the GS-GC clusters meaningful?
  - A human expert validates if they correspond to natural user communities.
    - Agreement means that the human expert is finding users in the same group as expected.
    - Disagreement means that the human expert finds unexpected user relations or lack of relations.

Anonymous role models

Finding the role model user

- Looking for the higher affinity
  - confuses popularity with expertise
  - may affect negatively the remaining users

Some properties related with the expertise of the role model:

- Age and experience
- Training and formal studies
- Happiness and effort
- Privacy and impersonality(to avoid personal clashes)

Anonymous role models

- Anonymous studies and role models aim to recognize and exploit
  - Impersonal social influence is exerted regardless of personal traits, only on the basis of working performance.
- Minimizing conflicts
  - Employee rejection
  - Interleaving personal and working relations.
- Hence: we perform the whole process in anonymous fashion

Experimental details

- We have selected five different tasks consisting of six steps.
- The work had already been done by the users in the group, so that we known *a priori* their behavior.
- The system has recommended certain actions taking into account the experience of each user and group ownership, and the experience of the group expert.
- We plot the percentage of success of the expert on each task, measured as the percentage of users that perform the same action as the expert which performing a given task.

Experimental Results

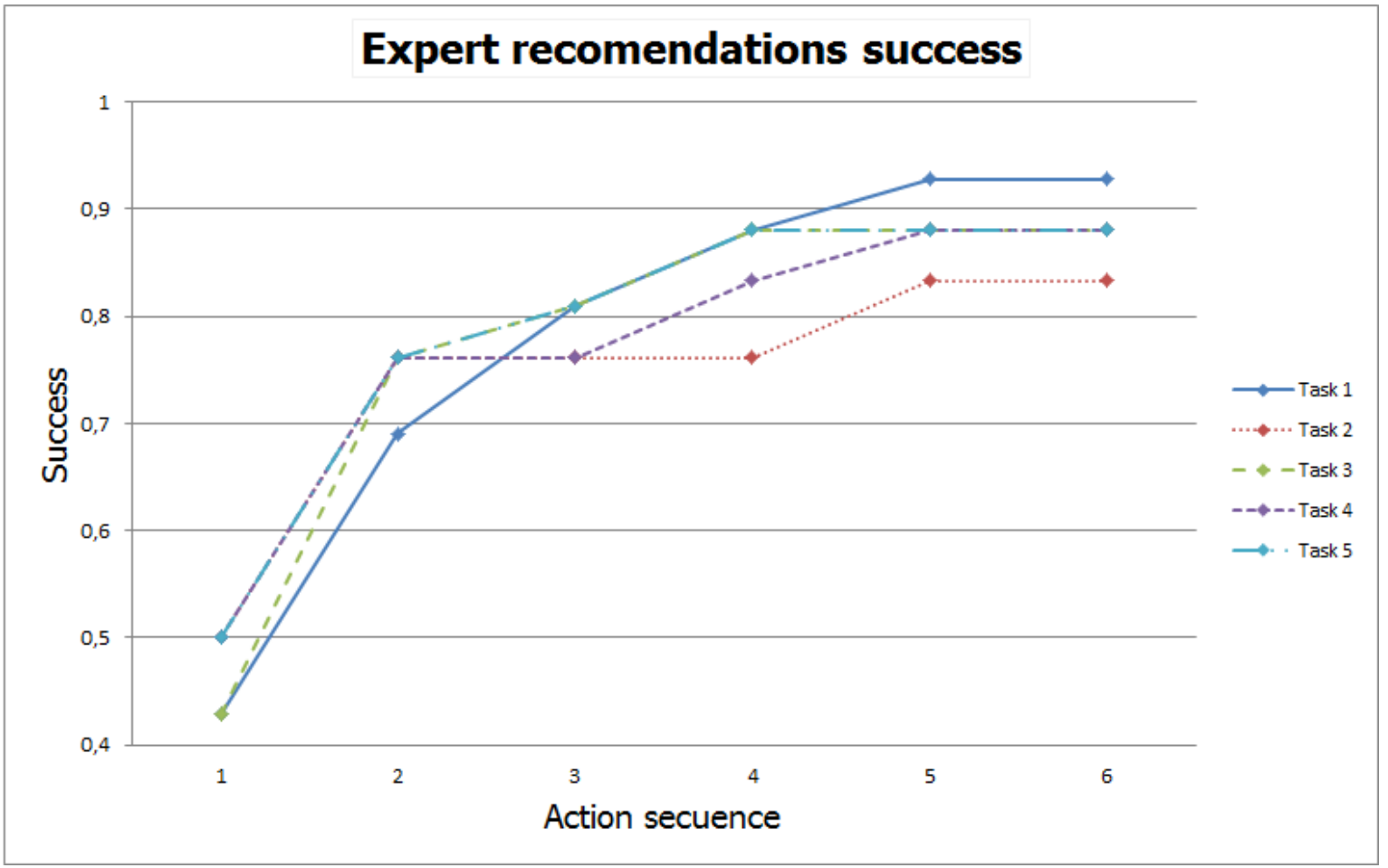


Figure : Expert recommendation success for different tasks

Contents

Conclusions

- Subconscious Social Intelligence
  - A new field of research and development
  - Offers great opprotunities for Computational Intelligence research
  - It aims to empower the social player

Conclusions

Challenges for learning systems

- Quick learning times that allow for quick adaptation to changing environments and supporting the effects of scale that potentially big social communities will introduce.
- Flexibility to cope with diverse data representations and desired outputs.
- Robust performance when dealing with multi-dimensional heterogenous output.
- Minimal uncertainty on system performance: One-shot training
- Robust incremental learning to process incoming batches of user feedback driving the adaptation process.
- Easy implementation/learning of forward and backward mappings.
- Hybridization of diverse computational paradigms to allow the composition of selection/classification/regression modules to

Acknowledgments

Grant agreement 317947 EU, SandS project. UFI11/07 of the UPV/EHU. The Unidad I+D empresarial Grupo I68 company encourages participation in academic meetings, and academic production, within the limits of business confidentiality. The work reported here has been supported by project Gaitek IG-2012/00989 funded by the Basque Government, and also by project of the CDTI IDI-20130070 funded by Spanish Government.