A Semantic-enabled Platform For Supporting Healthy Lifestyles

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Project goal

FBK’s 2-years pilot project involving three research groups.

- e-Health
- Process & Data Intelligence
- Human language Technologies - HLT

PerKApp (Persuasive Knowledge-based Application) aims at designing and developing a flexible, context-aware motivational semantic platform for:

- promoting healthier lifestyles
- supporting self management of chronic diseases.
The Op den Akker model

“A comprehensive and practical framework for automatic generation of real-time tailored messages in behavior change applications.”

The PerKApp Platform
INRAN Database (Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione)
«Banca Dati di Composizione degli Alimenti per Studi Epidemiologici in Italia» (BDA) IEO
Fine-grained level of food description

- 248 Classes, 44 Properties, 16698 Instances, 151525 Axioms, 40937 Inferred Axioms
Rule design GUI for

- Ontology concepts are used for populating interfaces used for modeling monitoring rules.

Rules Designer
The Reasoning process

Experts → Rules → SPARQL-based Reasoner (RDFpro) → Violations

Users → Data → SPARQL-based Reasoner (RDFpro) → Violations
Rules and reasoner: example

- Dietary rule «At most one glass of fruit juice per day»
  - hasRuleDefinition(Rule1, «hasConsumedFood(FullDay, ‘type: <FruitJuices>’, ‘quantity: <=1’)»)

- When Rule 1 is violated, the reasoner outputs a «bean»:

- The output of the reasoning activity is exploited by the persuasion layer with the aim of providing structured information for message generation.
Persuasive Layer: Motivational Strategies

- **PL Meta-strategies**
  - **How:**
    - UNDERMINE NEGATIVE BEHAVIORs (rule violations)
    - REINFORCE POSITIVE BEHAVIORs (non-violations of rules)
  - **When:**
    - MESSAGE POST-EVENT – e.g., violation detected
    - MESSAGE PRE-EVENT – e.g., violation expected (from violation history)
5 ≤ violations ≤ 6 \implies \langle\text{discourage\_and\_encourage}\rangle ::= \langle\text{discourage\_food}\rangle \text{ “rather” } \langle\text{encourage\_alternative}\rangle

Unhealthy Behavior (B₁)

Persuasive\_Goal (\neg B₁)

Discourage(B₁)

Intention

Encourage(B₂)

Neg\_Property(data₁)

Feedback

“Non eccedere con [data₁]”

Argument

“Contengono (molto | troppo) [element]”

Suggestion

“Prova con [data₂]”

Feedback & Argument & Suggestion

“Non eccedere con i dolci, contengono troppi zuccheri. Piuttosto, prova con un frutto fresco”

Final Message
PL: Message composition templates

FEEDBACK : Violazione per eccesso

<negative_feedback_B1_eccesso> ::= ("Stai assumendo" | "Stai mangiando" | "Hai mangiato" | "Hai consumato") \text{rand timing\&rule}
("molti" | "troppi" | "una quantità esagerata") \text{livello\_violazione}[\text{nome\_alimento}]
("oggi" | "questa settimana", "a pranzo" | "a cena" | "a colazione") \text{timing\&rule}

ARGUMENT : Violazione per eccesso

<negative_property_B1> ::= (art) \text{Morphit}[\text{nome\_alimento}]("contiene") [property]
<negative_conseq_B1> ::= "che " (potere)\text{morphit} "provocare" [consequence]

SUGGESTION: Violazione per eccesso

<suggestion\_encourage> ::= (oggi | oggi a pranzo | ecc..)par\_time("prova a scegliere" | 
"prova a mangiare") \text{rand} (del)par\_cibo [alternative] *

*alternative = food.getProperty().get(i) \text{NOT IN} (violations) ;
Case study: PerKApp in KeyTo Health

04-04-2017 13:33:15
Hai consumato poca frutta a pranzo. La frutta è ricca di vitamina c che aiuta ad aumentare le difese immunitarie. La prossima volta sostituisi suggestione.

04-04-2017 09:53:52
Continua così! Oggi a colazione hai consumato la giusta quantità di biscotti o prodotti da forno.

03-04-2017 11:40:02
Consigli e buone pratiche: Durante un pasto è buona regola concentrarsi sul
What’s Next?

The PerkApp platform is being used in a Work Health Promotion project started last Monday in FBK (Project KeyToHealth).

- Integration of cooking recipes (to facilitate data input) and of knowledge coming from the domain of physical activities.

- Development of a crowdsourcing platform for collecting information about commercial products.

- Extension of the modeling tool with facilities for connecting each concept with linguistic information exploitable by the persuasion layer.

- Design and development of intelligent chatbots for dialogue-based user interaction.

- Application of PerkApp to the Diabetes II domain for supporting disease self-management support.
It’s time for questions...

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The PerKApp Ontology Service

- The ontology is available through a RESTful service.
  - URL: http://shellvm1.fbk.eu:8080/virtualcoach-webservice;
  - Three methods are currently available;
  - Output is provided in JSON.

- "/GetFoodList": returns the list of foods contained in the ontology
  - no parameters.

- "/SingleFoodData":
  - “food” (mandatory): the conceptId of the food;
  - “quantity” (optional): the reference quantity for computing nutritional values.

- "/CheckMeal":
  - “mealFoods”: foods contained in the consumed meal;
  - “mealFoodsQuantity”: associated quantities.