Contextual Intelligence: Scalability Issues in Personal Semantic Networks

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Vision

With the increasing scale of pervasive systems, more and more information is constantly collected and stored. The amount of information that is accumulated for each user becomes enormous. *Contextual intelligence* technologies identify relationships among information, people, and places, and use the resulting context to construct knowledge and provide services. In the triarchic theory of human intelligence [5], *contextual intelligence* describes the kind of "street smarts" or practical common sense that a person uses to infer the relationships of him/herself with respect to other items. While computers today excel at one of the three forms of intelligence (analytic intelligence[1]), they are traditionally incapable of contextual intelligence because information needs to be explicitly structured to identify relationships. Fortunately, increasingly powerful content analysis and contextual inferencing technologies make it possible to extract and construct a *personal semantic network (PSN)* of the contextual relationships across one's digital and physical interactions. Entities that represent locations, people, topics, activities etc. serve as pivotal elements empowering the user to navigate their PSN. The contextual properties associated with collected information bits will enable the calculation of the importance and semantics of the relationships. The integration of physical context and digital content will provide the critical mass (density) of connection points rich enough to serve as a "second brain" to augment the user's cognition on a constant basis.

Constructing and exploiting PSNs for Contextual Intelligence poses a number of challenges, including

- *Silos of Information:* how can we guarantee that all (sensor) data is available and nothing gets lost or trapped in some distributed device?
- *Relevance:* how can we guarantee that the users are able to find and get the right information they need in large scale PSNs?
- *Latency:* how can we guarantee that the access and reasoning about information is quick enough to be useful?
- *Bootstrapping and Longevity:* how are PSNs systems bootstrapped for new users? How are systems maintained over long periods of time so performance does not degrade?
- *Reasoning Intelligence:* how can we guarantee that the reasoning of PSN in terms of connection points is accurate and in sync with the user's reasoning?
- *Human-Human Interaction:* how could users interact via their PSN? Which information should (not) be shared?

[1] Creative intelligence is the third part of the Triarchic theory and is beyond the scope of this paper.

- *Interfacing:* how could users interface with their PSN (in addition or instead of using traditional devices like phones, tablet, computer…)? Could the PSN be or become part of the user himself (e.g., via a brain-interface)?

Impact

The recent developments in the area of cloud computing enable the distributed storage of huge amounts of information coupled with the necessary computing power. In parallel, semantic indexing technologies from the natural language processing community (e.g., included in BING) as well as ubiquitous computing devices (e.g., smart phones) have reached maturity and the consumer markets. All these developments enable Contextual Intelligence. On the other hand, the realization of Contextual Intelligence and personal semantic network may accelerate the penetration of pervasive computing even further because users will want to access and index all their information everywhere they go. Similarly, users will require real-time access to and accurate reasoning of their personal data, which will lead to the need for and advances in efficient reasoning algorithms in the areas of natural language processing, data fusion and machine learning in general.

Background and Experience of the Participant to the Workshop

Oliver Brdiczka is scientific researcher at PARC and serves as Chief Scientist for the PARC incubated start-up meshin.com . Dr. Brdiczka's research background is in computer vision, human activity recognition, situation modeling, and machine learning. His research has tackled the problem of learning and recognizing human activity models from a variety of sensor data both on the desktop (task modeling) [1, 2] and in smart environments (situation modeling) [3]. His recent research efforts have further focused on integrating richer semantics into these models leveraging natural language processing technology ([4], meshin.com). Prototypes of Dr. Brdiczka's situation modeling and recognizing framework have been used and sold by France Telecom R&D, Meylan, France in the area of domestic smart environments and elderly care. His recent work on semantics is commercialized through meshin.com.

More information: http://www.parc.com/about/people/22/oliver-brdiczka.html

References

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