Exploring new services using data obtained from sensors embedded in vests

1. Short Description

Advances in technology are making possible the widespread and pervasiveness of sensing technology (see, e.g., the eZ430 Chronos[1]) and the use of mobile devices to take advantage of multiple sources of sensing to enrich user's experience or to achieve pro-active, context-aware applications and services. At the core of those systems are the methods to infer contexts and/or classify activities from the data streams acquired by the sensors.

In this project we will research data streaming methods in order to accomplish tasks for the development of services with business potential. Data is obtained by sensors embedded in vests and/or in mobile devices. Those sensors include: 3-axis accelerometers, temperature, humidity, light, sound, GPS, ECG, and virtual sensors such as time and calendar. We will use data collected representing daily life human activities to study such methods regarding their performance and bearing in mind their ultimate implementation in embedded systems (such as a PDA or a smartphone). The UPCASE prototype[2] previously R&D will be used for the initial experiences. Our research prototype will also use a VitalJacket®[3].

The methods that we expect to explore are the ones on classifying activities, anomaly detection, data summarization, etc. Obviously, it is not expected that all these areas of research will be addressed. The methods to explore will depend on the business objective. Anyway, whichever is the area to explore it will use data streaming approaches obtained through embedded systems with the implicit constraints in terms of memory and other computational restrictions. Whichever supervised tasks are needed, they are expected to have strong limitations of labeled data. This limitation will necessarily drive these tasks for semi-supervised learning.

2. Objectives

- Identification of a problem with potential for both:
  - Development of a new service using data obtained from sensors embedded in vests;
  - Research on state-of-the art data streaming approaches with preference, but not limited, to supervised learning.
- Development of state-of-the-art machine learning methodologies for streaming data.

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[1] http://wiki.msp430.com/index.php/EZ430-Chronos

[2] André C. Santos, João M. P. Cardoso, Diogo R. Ferreira, Pedro C. Diniz, and Paulo Chainho, "Providing User Context for Mobile and Social Networking Applications," Pervasive and Mobile Computing (PMC), Elsevier, In Press, Corrected Proof, Available online 11 January 2010, ISSN 1574-1192.

[3] http://www.biodevices.pt/

- Development of a prototype to be used in embedded systems (such as a PDA or a smartphone)

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