Universidad
Carlos III de Madrid

OO/UC3M/37- AUTOMATIZATION TECHNIQUES FOR PROCESSING BIOMEDICAL SIGNALS USING MACHINE LEARNING METHODS

The Signal Processing Group (Department of Signal Theory and Communications, University Carlos III, Madrid, Spain) offers the expertise of its members in the automatic processing of biomedical signals. The main advantages in this technology are the decreased cost, the time saved and the increased reliability of the results. Technical cooperation for the research and development with internal and external funding is sought.

Description and special features

Sensor networks, with which the group has a wide working experience, allow the acquisition of multimedia data using a set of different sensors: acoustic, visual (i.e. video cameras), temperature, humidity, pressure, movement, speed, etc.

In wide area networks this sensors are usually wireless, small, cheap, and have a low energy-consumption and limited processing capacity. In closed areas they can be wireless or wired, bigger, more sophisticated and expensive, have a greater processing power, and not be limited by energy-consumption. Of course, there are many networks where multiple low-cost wireless sensors are combined with a few more expensive wired ones. The number of sensors can also vary a lot: from a few to hundreds or even thousands.

Given the flexibility of sensor networks, they have a huge range of applications:

- **Military:** reconnaissance of terrain or opposing forces, monitoring friendly forces, early detection of chemical or biological attacks, battlefield damage assessment, etc.
- **Environmental:** tracking the movement of animals (e.g. birds), forest fire detection, flood detection and prevention, intelligent irrigation systems, etc.
- **Domotics:** home automation for the creation of an intelligent home.
- **Security:** automatic intruder detection and tracking, monitoring dependent patients, intelligent access systems, etc.
- **Tracking:** of vehicles and pedestrians for location, navigation, steering, etc.
- **Other commercial applications:** remote inventory management, interactive museums, automatic control of air conditioning and heat in office buildings, etc.

In this kind of networks there are many problems that have to be solved: location and auto-location of sensors, data fusion, data association, transmission and processing techniques to maximize the life-time of wireless sensors, coding and compression of the transmitted information, detection methods, tracking of multiple targets inside the network, etc.

Nevertheless, the algorithms developed by the members of the group span almost all the aspects of sensor networks, both from a theoretical point of view (design of algorithms for coding, transmission, detection and processing of information) and from a practical point of view (planning and building real sensor networks, integration of heterogeneous sensor networks, and programming application interfaces for gathering, processing and displaying information).

Innovative aspects

Building intelligent monitoring systems using sensor networks is still recent. Thus, there are still many potential applications that have not been considered yet. Moreover, there are still a good deal of unsolved theoretical problems. Hence, the development of theoretical solutions and algorithms tailored to them is an area with a huge research activity currently.

The difference is given by the ample experience of the members of the group in the development and

Innovative aspects

validation of algorithms, endorsed by the participation in many research projects and industrial contracts, as well as the multiple publications in international conferences and journals.

Competitive advantages

The main advantages of this technology are:

- Cost reduction, due to the optimization in the use of the resources and the availability of very low-cost sensors.
- Capability of integrating multimedia data from very different sensors.
- Reduced processing time of the information, thanks to the use of automatic techniques for gathering, fusion and processing all the available data.
- Increased processing capability, thanks to the availability of an increased set of data on which more and more sophisticated algorithms can be applied.
- More reliability of the results, allowing noise removal from the signals and their easy reproducibility.

Technology Keywords

Communications technologies (wireless, Wi-Fi, Bluetooth, RFID); Security management; Signal processing; Communication protocols; Remote sensors technology;

Contact Person: María Dolores García-Plaza
Phone: + 34 916249016
E-mail: comercializacion@pcf.uc3m.es