Proposition de recherche doctorale

Securing biometric sensors by OCT (Optical Coherence Tomography) approach.

Mots clés :
- Directeur de thèse : Badr-Eddine BENKELFAT
- Co-encadrant(s) :
- Unité de recherche : Services répartis Architectures MOdélisation Validation Administration des Réseaux
- Ecole doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal: Divers

Résumé du projet de recherche (Langue 1)

Biometrics refers to various techniques used for personal identification. The most effective techniques are based on certain biological characteristics of individuals, such as fingerprints, and facial features, and the use of mathematical or statistical processing. Biometrics is a growing field and its application is becoming increasingly widespread. A recent example of the use of biometric technology is the biometric passport: two fingerprints as well as a numerical photo of the face must now be encoded in the chip that is integrated in all new passports. Other applications such as e-commerce and admittance into restricted areas (airports, administrative buildings, nuclear plants, etc) also take advantage of biometry.

One particularly critical element that must be considered for biometric systems is the robustness of the systems to potential attacks at the sensor level. To improve security, researchers have upgraded initial sensors by increasing their complexity, with counter-measure systems (for example measure of the skin capacitance, or of blood oxygenation) and also by increasing the number of modalities that are employed. However, despite all these precautions, security issues are not solved yet. From our point of view, the origin of the security weakness of the sensors resides in the poor amount of physical parameters that are effectively measured during the identity verification stage.

This leads us to design a sensor prototype that is based on Optical Coherence Tomography (OCT), with a singular architecture [1]. It is based on an interferometry technique that captures 3D images of biological elements (like tissues) by measuring and analyzing the electromagnetic field scattered by the sample under examination. In contrast to conventional OCT, the architecture that we have developed is also sensitive to the Doppler effects and permits optical characterization in spectral domain (with an important resolution of about 10 pm). It is in fact able to record the complete electromagnetic field scattered by biological samples. When considering linear optical regime, there is no loss of information over the spectral domain covered by its light source. Such a sensor now requires the development of dedicated tools for 3D image processing, the development of physical models of the instrument and of light scattering within the sample under analysis, and possibly some adaptation of its optical performance in the context of biometry.

The objective of this PhD project is to explore how the electromagnetic field that is backscattered from a fingertip, and recorded by OCT, can be exploited to measure important physical parameters (cardiac pulsations, aliveness of the finger, etc), in order to resolve security issues and enable personal identification.