# PhD Proposal – MAP-I Doctoral Programme 2013-14

**Title:** *HeartSafe – Assessing Heart Function for Unsupervised Homecare applications through Multi-Channel Auscultation*

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**Research Area**: Biomedical Signal Processing
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**Abstract**: Cardiovascular diseases are the leading cause of death in developed and developing countries and one of the major causes of hospitalization. Cardiovascular diseases are highly constraining diseases associated to aging. In Europe, the proportion of the population aged > 65 years is projected to increase 25% in 2025. These two facts combined together are inducing a major pressure in Europe's heath care system. Another important group is neonates, which often have prolonged intensive care stays due to cardiovascular decompensation. Effective preventive healthcare strategies require a robust and inexpensive solution for early detection heart failure decompensation, in this context heart sound is a very valuable vital signal once it directly encodes the mechanical status of the heart. The main goal of this project is to research algorithms applicable in long-term home monitoring contexts for the assessment of cardiac function, using a multi-channel heart sound auscultation approach.

**Objective:**
The main objectives of this project are:

- Extract information from the auscultation heart signals, namely the systolic and diastolic time intervals (STIs), S3 sounds.
- Decompose the second sound (S2) into its aortic (A2) and pulmonary (P2) components.
- Understand the relationship between electrocardiogram and auscultation heart signals, with physiological phenomena (blood pressure, respiration cycles, age, etc).
- Correlate characteristics (shape , amplitude, delay) of the pulmonary component (P2) of the second heart sound with the presence of pulmonary hypertension on an individual.

**Methodology:**

- Overview the current state-of-the-art and identify possibles work lines.
- Implement state-of-the-art (SOA) algorithms and measure performance for auscultation and ECG signals of neonates.
- Research, implement and test novel signal processing algorithms for multi-channel auscultation signals.
- Integrate algorithms as plug-in of existing prototypes.