Modeling cardiac rhythm and heart rate using BFO and DOLCE

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Context

- **ICD** (Implantable cardiac devices), such as artificial pacemakers or implantable cardioverter-defibrillators, **manage cardiac rhythm disorders** called arrhythmias (bradycardias, tachycardias).
- ICD send **many remote alerts** about arrhythmias to physicians.
- Physicians have to **assess the relevance** of a given alert and its **emergency level according to patient history**.

Objectives

- **Improve** alert management
- Shift *from* strictly **device-centered** follow-up *to* **patient-centered**
 - reasoning capabilities & domain knowledge
 - **Design of an application ontology** according to the two following principles:
 1. Application purpose
 2. Use of foundational ontologies (BFO, DOLCE)

Resources

- **BFO** [2] (Basic Formal Ontology), **realist approach**.
- **DOLCE** [1] (Descriptive Ontology for Linguistic and Cognitive Engineering) with **cognitive bias**.

Results: Use case & Ontology

Discussion & Conclusion

DOLCE, with its cognitive bias, is more adapted than BFO to our telecardiology application requirements

Reasoning case: *When Heart rate is fast (slow) then Arrhythmia is fast (slow)*

BFO

- No qualities for perdurants (*realist approach*).
- Classification of **Arrhythmia** (as fast or slow) according to the **Heart rate** (fast or slow) is **not direct**.
- **Not suitable** to associate the **exact semantic** of the **Heart rate** according to the kind of **Arrhythmia** (mean frequency for AF, fastest frequency for VT).

DOLCE

- Perdurants can have qualities (*cognitive bias*).
- Classification of **Arrhythmia** (as fast or slow) according to the **Heart rate** (fast or slow) is **direct**.
- **Suitable** to associate the **exact semantic** of the **Heart rate** according to the kind of **Arrhythmia** (mean frequency for AF, fastest frequency for VT).

References :

- [1] Grenon P. Smith B. SNAP and SPAN: prolegomenon to geodynamic ontology. In Special. Cognitive & Computer, 2004.
- [2] Masolo C. Borgo S. Gangemi A. Guarino N. Oltamari A. WonderWeb Deliverable D18 Ontology Library (final). Technical report, ISTC-CNR, 2003.