Argumentation-based clinical decision support system in ROAD2H

Francesca Toni
Imperial College London

Abstract

The ROAD2H project aims to build a clinical support system integrating argumentation and optimisation techniques to reconcile guidelines providing conflicting recommendations for patients with comorbidities, and taking into account national and regional specificities and constraints imposed by local health ensurance schemes. Here I provide a high-level overview of the project.

ROAD2H[1] (standing for **R**esource **O**ptimisation, **A**rgumentation, **D**ecision support and knowledge transfer **to** create value via learning **H**ealth systems) is an international project funded by EPSRC (the Engineering and Physical Sciences Research Council) in the UK, bringing together computer scientists, health informaticians, clinicians, health economists, data scientists and policy makers to deliver integrated solutions for a class of decision support systems using standardised representations of clinical guidelines and of billing information to provide explained recommendations to users (notably clinicians and patients), taking their preferences into account, while also being able to accommodate user feedback and improve with use, in the spirit of the Learning Health Systems vision (McGinnis 2010).

The project is focusing on two classes of diseases – CKD (Chronic Kidney Disease) and COPD (Chronic Obstructive Pulmonary Disease): these are challenging diseases to treat, as patients affected by these diseases often suffer or several comorbidities (e.g. hypertension and diabetes), with conflicting treatments suggested by the different, relevant guidelines; moreover, being chronic, these diseases require prolonged treatment over time.

In the context of ROAD2H, we are considering supporting decision-making for patients with CKD and COPD in Low and Middle Income Countries (LMICs), focusing on Serbia and (rural and urban) China. In these countries, national or regional insurance schemes have recently been introduced to regulate provision of treatments. In particular, these schemes set excess and maximal amounts, potentially differently for different classes of patients (e.g. farmers and town workers), and include *positive* lists (of treatments covered by the schemes), while allowing out-of-pocket payments for other,

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[1] www.road2h.org

excluded treatments, if they are locally available. Furthermore, LMICs often suffer from limited resource availability, e.g. dialysis machines and oxygen machines.

Given that there are so many factors contributing to the decision on treatments in the settings of interest, it is important that any recommendation is explained to the (relevant) users, so as to allow users to interact with the recommendation. For example, if the recommendation is that a particular patient uses a specific dialysis machine but the machine breaks down, it should be "easy" for the user (e.g. nurse or clinician) to feedback into the system so as to have an updated, reasoned recommendation (for this and possibly other patients).

Within ROAD2H we are addressing these challenges by integrating argumentation, as understood in AI (e.g. see (Simari and Rahwan 2009) for an overview) and mathematical optimisation to identify candidate treatments that follow guidelines, modulo resolution of conflicts between them as necessitated for specific patients, and minimising out-of-pocket payments while maximising resource usage. On the argumentation front, we are using a mixture of abstract argumentation (Dung 1995) and assumption-based argumentation (Dung, Kowalski, and Toni 2009; Toni 2014; Čyras et al. 2018), possibly with preferences (Čyras and Toni 2016) and probabilities (Thang, Dung, and Hung 2012).

Finally, ROAD2H aims at integrate decision support with available electronic data, notably electronic health records, billing data and standardised representations of guidelines, e.g. as in (Zamborlini et al. 2017).

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