Advancing Diabetes' self-management supported by user data in a mobile platform

Networked Systems

Background and challenges

- MyDiabetes is a mobile application that helps type I diabetics with their daily records (glycaemia, carbohydrates, insulin, exercise, etc.). We added to this application a logical rule-based system, responsible for providing advice to its users. The advice is based on medical protocols and directives, developed and implemented with the cooperation of the endocrinology service of the São João Hospital. In order to increase the applications’ capability of advising the user, we are developing a datamining component. By applying data-mining methods to the gathered user’s data, it is possible to uncover hidden usage patterns, relevant to the user’s diabetes management.

Description and main innovation

Diabetes management is a complex and a sensible problem as each diabetic is a unique case with particular needs. Our approach was to design a system able to accompany, advise and guide the user through different diabetes known problems. To accomplish this goal, we created a rule-based system constituted by medical protocols, directives and medical advice translated into logical rules. These logical rules are defined so that both programmers and medical doctors can understand them being able to create, modify and validate new rules into the system.

The system is based on general advice to suit the broad diabetic population. With the continuous use of the application, it is possible to create new rules, adapted to the user’s needs.

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\text{inRisk(start, carboHydrate, 3, mealExercisedRecently) :- hasRecently(exercise)}.
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Avoiding crisis can be accomplished by warning the user of inappropriate actions ("you exercised recently, perhaps you should reduce the insulin intake for this meal"), and by explaining the crisis’ possible causes ("is your hypoglycaemia related with extra activity?"). This allows introspective analysis, enabling behaviour adaptations or consulting a doctor with added information.

Achievements

Education is a crucial element in diabetes management. Considering this, we believe that diabetes requires lucid care in order to avoid crisis. Our approach aims to help the user to not only manage glycaemic values but also to educate the user with alerts and notifications (recalling the doctor’s advises).

We are incorporating the advice system in the existent MyDiabetes Android application. We used it to collect registers from 5 diabetic patients (from 15 volunteers) for initial data mining. Currently, it was possible to derive general patterns such as “on Sundays’ mornings with heavy breakfast, hyperglycaemia is common”.

In order to address the problem of lack of data, we developed a gamification component. In a survey, where the gamification component was introduced, 78% of the patients showed interest in using the MyDiabetes application as their main management control device.

We also believe that the addition of feedback based on detected patterns and the inclusion of the advice system will further encourage and benefit patients driving their usage of the platform.