Diversity of Exercise Plans using Evolutionary Inspired Adaptation

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Abstract. The work[3] presented is part of the SELFBACK EU project and describes a case-based recommendation system that creates exercise plans for patients with non-specific low back pain (LBP). The submodule of SELFBACK presented in this work focuses on the adaptation process of exercise plans: An evolutionary inspired method is created to increase the variation of personalized exercise plans, which today are crafted by medical professionals. Experiments are conducted using real patients' characteristics with expert-crafted solutions and automatically generated solutions. In the evaluation we compare the quality of the solutions generated by Genetic Algorithm to null-adaptation solutions.

Keywords: Case-Based Reasoning, Adaptation, Diversity

1 Introduction

The life-time prevalence of low back pain is about 80%, and about 50% in the adult population will experience low back symptoms within a year [6]. About 85% of these will experience non-specific low back pain, i.e., pain without a known pathomechanism [3]. As an example, back pain is the largest single cause of sickness leave in Norway, and it costs approximate about 2% of the gross domestic product. Although the research in this area is very extensive the costs have significantly increased over the last 30 years. General physical activity along with specific strength and stretching exercises constitute the core components in the prevention and management of non-specific low back pain[5]. There is strong evidence that tailoring the advice on physical activity and exercise is more effective in preventing and managing low back pain than standard advice.

Case-Based Reasoning (CBR) has been used in the domain of health science for a long time, because it uses past experiences to solve a new problem and therewith resembles how clinical practice is performed by specialists today. It is also a field where past cases are available when reviewing a new problem. The use of CBR in health sciences has proven to be so popular that over the past ten

[3] This paper is a resubmission from the 25th International Conference on Case Based Reasoning. Full paper: http://www.idi.ntnu.no/ kerstinb/paper/2017-ICCBR-Prestmo-etal.pdf

years it has become a specialized sub-area within CBR research and application. There exist CBR systems that are used commercially in the field of medicine, but it has still not become as successful here, in terms of successfully deployed applications, as in many other domains [2], [4].

The SELFBACK project aims at creating a self-management tool for patients with non-specific low back pain, which will support them to self-manage their pain by obtaining personalized advice and continuous follow-up. In SELFBACK, CBR is used as the main methodology for generating patient-specific advice for managing non-specific LBP. A more thorough description of the CBR approach in SELFBACK is given in [1]. This work focuses on how an adaptation phase can further improve the creation of exercise plans. In this work we present how to apply genetic algorithms for adapting cases in order to increase the solution variety, which might be necessary when deploying a new CBR system. The results from the experiments show that the solutions created by the genetic algorithm copes better with the cold start problem since it creates a variation of solutions that are of good quality. With information obtained during the follow-up periods within the SELFBACK project, we will gather more information on user preferences and outcomes in terms of pain and function. This information will then allow us to create a better fitness function to further improve the results. Within SELFBACK, this approach can be used for recommending and implementing behavioural changes or educational sessions. More generally, the approach could fit other applications where some degree of creativity is possible, while user feedback on preferences is available. This could, for example, be exercises for other rehabilitation programs, product recommendations, or meal planning.

Acknowledgement The SELFBACK project has received funding from the European Unions Horizon 2020 research and innovation programme under grant agreement No 689043.

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