Evolutionary Inspired Adaptation of Exercise Plans for Increasing Solution Variety

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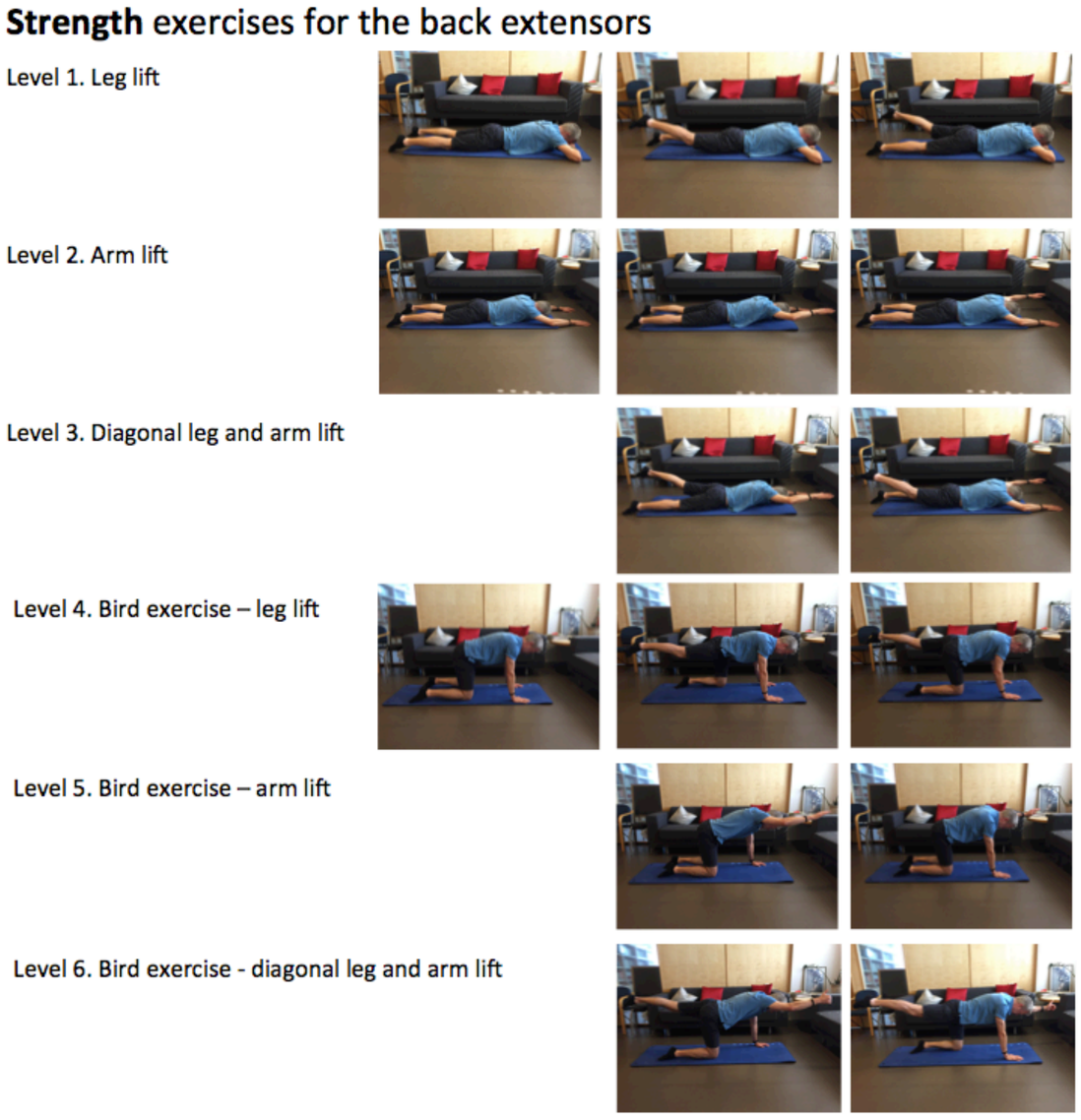
SELFBACK Decision Support System

- Provide patients with a tool to facilitate, improve and reinforce the self-management of non-specific low back pain
- Prevent recurrence, pain-related disability and chronification

Case Representation for Exercises

- Consist of description, level, repetitions and set
- The level describes a more advanced version of the exercise
- Repetitions have four levels, 8, 10, 12 and 15. When a patient is able to perform 12-15 repetitions, he/she should get a more advanced exercise



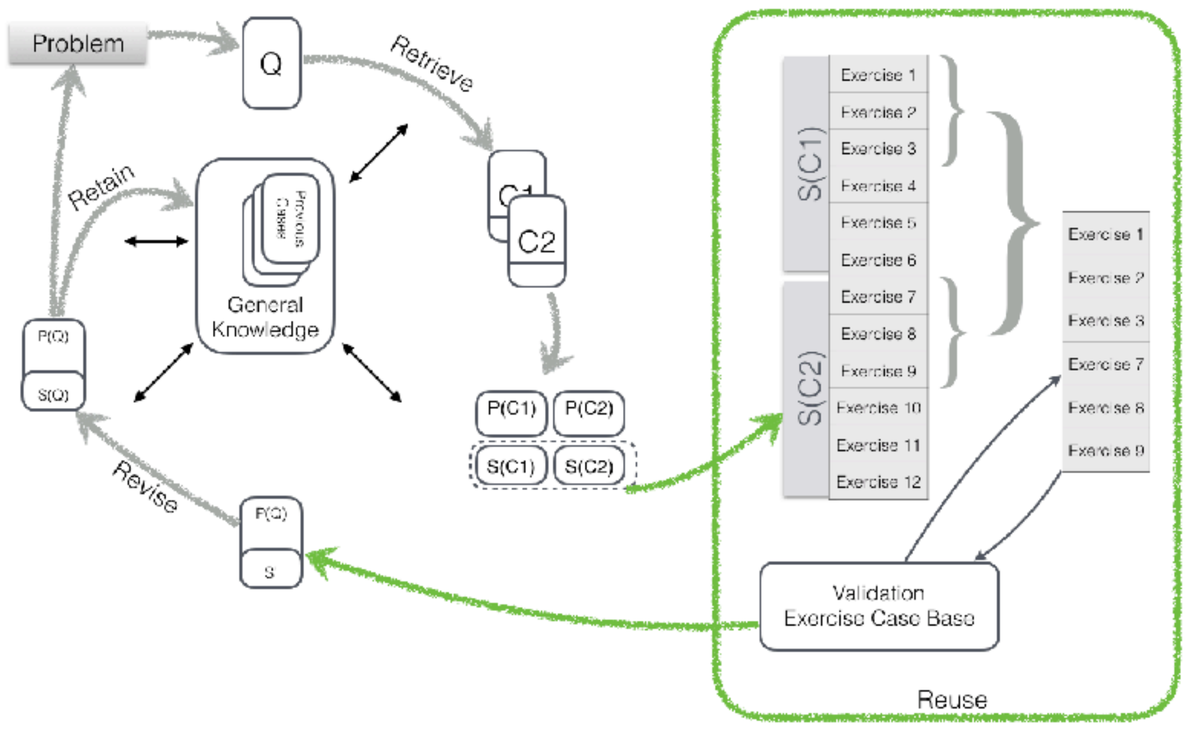
Exercise example: Shows the exercise with description “Strength exercises for the back extensors with its corresponding levels”.

Exercise Case Representation: Shows the case representation for one possible strength exercise for the back extensors.

Exercise Composition in Cases: Shows the set of exercises that are used as advice for a patient. Such exercise sets are used to initiate the evolutionary inspired adaptation.

Adaptation Methodology

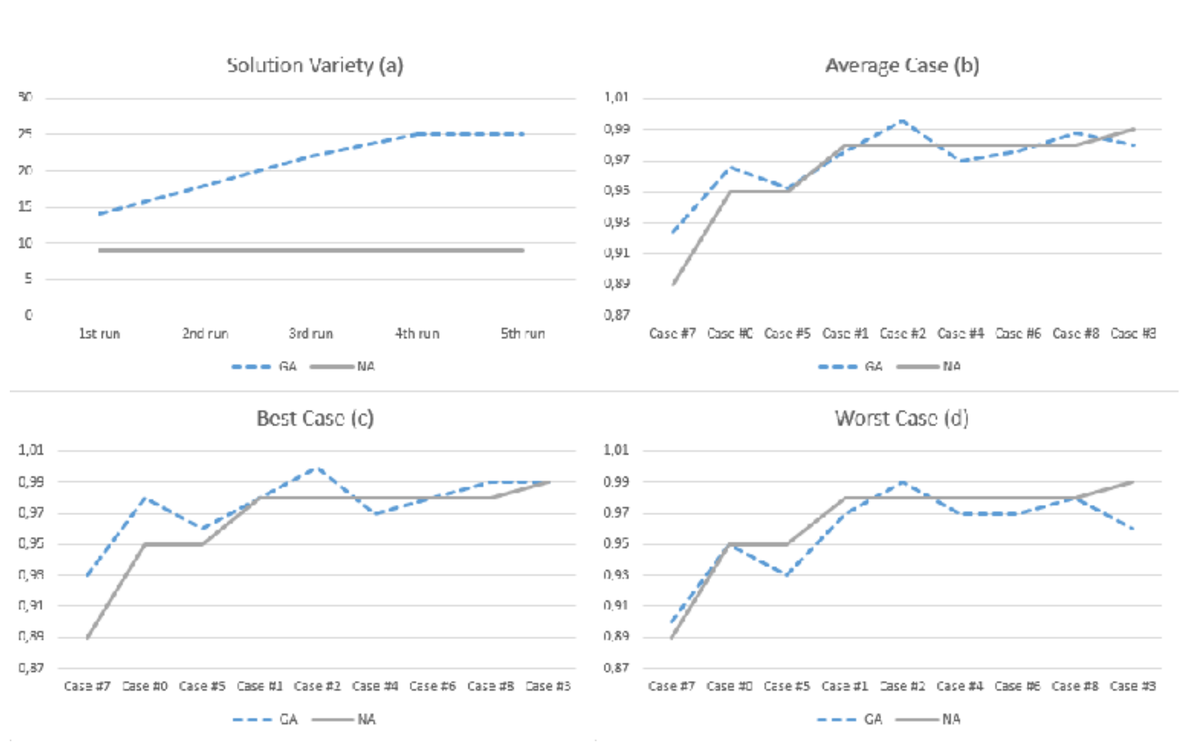
- Genetic algorithms (GA) inspired the approach as they usually come up with a partially optimal solution
- The two fittest individuals are chosen based on the similarity measures
- The solutions of the fittest individuals are mapped to a chromosome, each exercise description is a gene in the chromosome



4R-cycle including adaptation: Based on the patient description the two best matching cases are retrieved (C1 and C2). The two chromosomes representing the solution parts (S(C1) and S(C2)) are then sent to the crossover function. Here a new individual is created of the parent chromosomes, and it is done with a uniform crossover. The mixing ratio is set to 0.5, since the solution is desired to have a close to equal mix of the parents’ genes. The adapted algorithm finishes after one crossover at this moment as there exists no good measures to describe how well a patient will progress before they have executed the exercise plan.

Experiments

- 9 initial cases in the case base with expert crafted solutions, used leave-one-out cross-validation for experiments
- Goal was to get increased solution variety, with solutions of quality
- Five runs were performed to find evolution over time
- Results compared to no-adaptation
- Adaptation increased solution variety as expected
- On average the GA-inspired approach scores higher in terms of quality



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