IT Tralee Masters by Research Programme Details

Title of Project: Development of a computational model for automated functional progression of exercise prescriptions.

Name of Principle Supervisor: Pat Doody

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Brief Biography of Principle Supervisor:

Dr. Pat Doody is an experienced Researcher and Lecturer in the School of Science and Computing in the Institute of Technology Tralee (ITT). Pat is the Co-founder and Executive Director of the Centre for Innovation in Distributed Systems (CIDS) at ITT. Pat was also Co-Founder and Co-Leader of the Wireless and Mobility Research Group at the ITT.His research interests include AutoID technologies, wireless technologies, intelligent knowledge discovery, data mining, and application of artificial intelligence based neural network algorithms, quality of voice systems and energy initiatives. In partnership with ALTOBRIDGE Ltd. (www.altobridge .com), a network communications start-up located in the Kerry Technology Park, Pat was the principal investigator for this project to develop an integrated end-to-end RFID tag to back office architecture. Pat obtained his bachelor degree in mathematics from the University of Limerick, Ireland in 1991 and PhD in mathematics focusing on artificial intelligence and neural networks from the University Of Limerick, Ireland

Research Project Abstract

Exercise is a key component of the therapeutic management of many injuries, conditions and disease states. It is common for physiotherapists, occupational therapists, exercise physiologists, strength and conditioning professionals to prescribe exercises, which will load an individual's bodily structures in a manner that is designed to get specific results and improved clinical outcomes. The loading parameters and design of an exercise programme is typically customised to the individual. The clinical outcome of the exercise programme is dependant on factors related to the individual including, effort, adherence, tolerance to pain, individual genetic make-up and prior fitness levels. Hence it is impossible to devise a one size fits all or cookie cutter approach to exercise prescription. Physiological principles of specific adaptation to impose demand dictate that exercise programs should be functionally progressed regularly, to get the best functional gains and clinical outcomes. Typically, and exercise programme must be carries out for a minimum of 6-10 weeks in order for physiotherapy or other healthcare professionals to obtain a next level. Exercise progression is cost prohibitive for many people, leading to a less than optimal outcome from prescribed exercise programmes.

In this research, we wish to explore how functional progression of exercise programmes can be modelled computationally. Objectives of the research are to explore the development of a computational model for increasing or decreasing exercise dosage by combining subjective patient feedback following exercise completion, with clinical insights and data mining of large sets of exercise prescriptions available on Salaso's platform. The research will also explore how such a computational model can be validated and tested in a clinical context.

Research Context (Technical Merit & Impact)

Introduction (Background and Context).

Exercise is a key component of the therapeutic management of many injuries, conditions and disease states. It is common for physiotherapists, occupational therapists, exercise physiologists, strength and conditioning professionals to prescribe exercises which will load an individual's bodily structures in a manner that is designed to get specific results and improved clinical outcomes. The loading parameters and design of an exercise programme is typically customized to the individual. The clinical outcome of the exercise programme is dependent on factors related to the individual including, effort, adherence, tolerance to pain, individual genetic make-up and prior fitness levels. Hence it is impossible to devise a one size fits all or cookie cutter approach to exercise prescription.

Physiological principles of specific adaptation to imposed demand dictate that exercise programs should be functionally progressed regularly, to get the best functional gains and clinical outcomes. Typically, an exercise programme must be carried out for a minimum of 6-10 weeks in order to have any impact on body structures. However, multiple visits each week for a 6-10 week period to physiotherapy or other healthcare professionals to obtain a next level exercise progression are cost prohibitive for many people, leading to a less than optimal outcome from prescribed exercise programs.

In our research, we wish to explore how functional progression of exercise programs can be modelled computationally. Objectives of the research are to explore the development of a computational model for increasing or decreasing exercise dosage by combining subjective patient feedback following exercise completion, with clinical insights and data mining of large sets of exercise prescriptions available on Salaso's platform.

The research will also explore how such a computational model can be validated and tested in a clinical context. The model can be broken down as follows:

- Design the Subjective Inputs from patient related outcomes for example Rate of Perceived Effort or Pain
- Design the Objective Inputs for example monitors and sensors that will capture and compare against reference protocols for various exercises
- Design Artificial Intelligence or Machine Learning algorithms that will automated the progression or regression of a various exercises for various conditions for a patient or athlete. The design can include various weighed clinical inputs

Research Methodology

Aims

The aim of this project is the development of a computational model for automated functional progressions of exercise prescriptions.

Detailed Objectives:

- Mean progress and linear regression approach previously developed and applied to Salaso data incorporating subjective Inputs from Patient (PROMs) will be further developed to give a model for automated functional progression. Clinical Weighting Factors will be applied and a predictive model for progressing or regressing the exercises developed in conjunction with clinical input and logic.
- Data sets currently available on Salaso platform from exercise prescriptions by professionals, will be mined and the predictive model compared to typical patterns of exercise prescriptions and progression/regression by professionals.
- The model will be assessed and validated by a cohort of Salaso's professional customer base.

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PROJECT SCHEDULE – GANTT CHART