Title

Written by
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AALBORG UNIVERSITY
STUDENT REPORT

1. Semester
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Biomedical Engineering and Informatics
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Title:
title title

Theme:
Biomedical Signals and Information

Project Period:
Fall semester 2017

Project Group:
17gr7402

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Page Numbers:
Appendix:
Date of Completion: 20/12/2017

Abstract

Preface

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Contents

Chapter 1

Background

This chapter will contain the background knowledge for the anatomy and physiology of the knee and the definition of pain. Furthermore is the pattern recognition described, where machine learning and deep learning are specified.

1.1 Anatomy and Physiology

In this section are the anatomy of the knee and the definition of pain described to optimise the understanding of patellofemoral pain.

1.1.1 Knee

The knee is the largest joint in the body and consists of a hinge and a gliding joint. The hinge joint is placed between the lateral and medial femoral condyles and the lateral and medial tibial condyles. Between the patella and femur is the gliding joint formed. There is three separate articulations in the knee joint, which is one between the patella and the patellar surface of the femur and two between the femoral and tibial condyles. Additionally, the knee consist of seven major ligaments that stabilize the knee joint.[1]

- The patellar ligament
- Two popliteal ligaments
- The anterior cruciate ligament (ACI) and posterior cruciate ligament (PCI)
- The tibial collateral ligament and the fibular collateral ligament [1]

1.1.2 Pain

Pain is experienced and perceived subjectively and there is a lack of methods to measure pain accurately [2, 3]. The International Association for the Study of Pain (IASP) has defined pain as being "an unpleasant sensory and emotional experience associated with actual or potential tissue damage" [2].

Physiologically pain can be divided into three categories: Acute pain (less than three months), persistent or chronic pain and cancer pain. Furthermore, pain can be either nociceptive or neuropathic. Nociceptive pain is associated with tissue damage. Neuropathic is associated with damage to the nervous system.[4]

1.2 Pattern recognition

1.2.1 Machine learning

Deep Learning

Chapter 2

Aim of the project

The aim of the project.....

Chapter 3

Materials

3.1 Pain mapping

Pain mapping is a technique that is used to transfer a patient's perceived pain into an objective graph or map by drawing the pain area. Pain maps can be made by the patients who draw their pain areas on a display on which a body outline is shown, or it can be made by observers who observe the patients and then draw from the signs the patients are showing. Pain maps can consist of only the drawings, but sometimes a questionnaire is added to get a more detailed overview of the pain.[5]

Pain mapping are commonly used in clinical practice [5], and can be useful for patients when they try to communicate their pain. Pain maps may also be helpful in diagnosing patients and follow-ups during or after treatment to get an indicator of the patient's response to the treatment.[6] According to Schott there is some issues with the graphical representations of pain, some of which are problems with drawing a three-dimensional feeling of pain on a two-dimensional surface, and distinguishing between internal and external perceived pain on a map.[5] Lately there has been made some research about digital pain drawings where the drawings are done on a tablet or smartphone, either in 2-D like the paper versions or in 3-D body schemas.[6]

Benefits of using digital pain drawings instead of paper drawings are according to the study by Boudreau and et.al Badsberg the reduced human error found when evaluating the pain areas/pain maps. It is also timesaving as there is no need to transfer the paper drawings into digital records. The study concludes furthermore that the benefits of 3-D pain drawings are to be explored further.[6] There are several studies that examines pain patterns. Another study by Boudreau and et.al. Kamavuako uses pain drawings obtained by using three-dimensional body schemas to locate pain areas in the knees to investigate pain patterns [7]. Studies about pain patterns have been made for other parts of the body as well, for example the study by Bayam and et.al. Arumilli which considers pain patterns in the shoulder. In this study it is investigated whether pain mapping and pain patterns of shoulder pain can be useful in a clinical setting, and it is concluded that it would be useful in the primary and secondary sector and for research as well.[8]

3.2 Data

3.3 Program

Chapter 4

Methodology

4.1 Subject

4.2 Literature Searching

Chapter 5

Data Processing and results

5.1 Data

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Appendix A

Appendix