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Health informatics — Categorial structure for representation of 3D human body position system —

Part 2: Body movement

Informatique de santé — Structure catégorielle pour la représentation du système de positionnement du corps humain en 3D —

Partie 2: Mouvement du corps

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Foreword

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Introduction

In the medical field, body movements are important parts of medical recording. Gait analysis, heart pulsation, blood flow, hemiplegic movement as well as extremity motion are representative body movements which can require medical description. However, conventional text-based terminology does not have the capability to express details of body movement.

With the popularity of virtual reality (VR), augmented reality (AR) and three-dimensional (3D) contents, many medical 3D animations are created without clear terminological concept representation. 3D animation messages can vary depending on the creator, audience or countries. For example, names of body parts in a VR scene are not clearly given by standard medical terminology. Sometimes, 3D animation concepts are described only by narrative text, which is insufficient to deliver precise medical concepts. Additionally, 3D animations without terminological coordination do not allow terminology-based searching capability and interoperability within the VR system.

Patients with movement disorder do not have a visual impression on their disease. The meaning of their symptoms and signs cannot be exactly delivered to their families. They cannot understand long-term trends of their movement. Quantitative assessments of their motions are very difficult to achieve.

This document explains how 3D medical animations are coordinated with standard medical terminology. Categories and relations among 3D models, actions and text terminology are given in Figure 7.

By coordinating 3D body movement to text-based standard terminology, 3D medical contents will allow standardized communication between users and creators. This is also helpful for exchanging medical information in health-related research. The coordination helps to deliver medical concepts of 3D body movement, and it allows search capability with standard medical terminology.

Clinicians are able to describe patient's movement in a more detailed manner. 3D movement models allow objective, independent assessment of patient's symptom and disease. Quantification and long-term assessment are more clearly achievable.

With technological advancement in sensors and optical device, it is possible to log patient's movements quantitatively. These data can be processed and animated in a 3D world. Continuous monitoring of patient's body movement is also feasible with visual impression. Patients are able to understand their disease status in a meaningful way.

ISO/TS 23541-1 is applied to a static model. Categorial structures for static models cannot be applied to 3D medical animations because 3D animations have one additional axis of information, which is the time dimension. Because of this additional dimension, the categorial structure of 3D animation differs in many ways form a static model.

In a static model, concepts are coordinated with the model and the coordination occurs only once between the model and text terminology. However, as movement of 3D model develops over time, text terminology is coordinated with a specific time segment as well as with a specific model. For example, the 3D gait action model of a Parkinson's disease patient can be sub-divided into multiple time segments. Since the action in a time segment can be normal or abnormal, repetitive coordination is required between text terminology, 3D model and time segment. Sometimes opposite concepts such as "normal gait" and "abnormal gait" can be coordinated with a single body part in an action which does not happen in a static human body model.

In static models, a body part is the target of description. Instead, action sequence, movement range, movement trajectory are the main targets of description in dynamic 3D human body model.

In dynamic models, a body part changes shape, location or size continuously. Accordingly, single body parts will have multiple models which are coordinated with the same text terminology, which is not allowed in fixed model. To handle this, two categories are given to the body part model, which are base model and actor.