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Objective Clinical Gait Analysis Using Inertial Sensors and Six Minute Walking Test

Sina Ameli^{1*}, Fazel Naghdy², David Stirling³, Golshah Naghdy⁴,
Morteza Aghmesheh⁵

^{1,2,3,4}University of Wollongong,
School of Electrical, Computer & Telecommunication (SECTE)
⁵Wollongong hospital, Illawarra Cancer Care Centre

*Corresponding author: sa811@uow.edu.au

Abstract

The most common side-effect of chemotherapy is fatigue. Because of its impact on Physical Performance Status (PPS), the degree of fatigue is a factor considered in chemotherapy administration. Conventionally, a questionnaire-based method known as the ECOG table, devised by the Eastern Cooperation Oncology Group (ECOG), is employed to assess the chemotherapy-induced fatigue. The approach is qualitative, subjective, inaccurate and prone to error. To achieve a more reliable method, an objective, quantitative and precise method is proposed to assess the PPS of different groups of cancer patients. The approach was developed based on a six-minute walk test (6MWT) during which the kinematic data of 23 body segments were measured using body-mounted inertial sensors. The data streams were subsequently segmented by a clustering algorithm known as 'minimum-message-length-encoding' (MML) producing a Gaussian mixture model (GMM). Several postural states were captured from the model to derive a holistic index representing the PPS of a patient undergoing chemotherapy. The proposed method was validated by applying it to simulated and real data. For the simulation study, a typical gait behaviour simulating post-chemotherapy conditions was devised in consultation with an oncologist while the real data comprised the gait information obtained from 4 cancer patients. The results indicate that the proposed algorithm clearly identifies the characteristics of ambulatory motion affected by chemotherapy and provides a more accurate measure of fatigue that can assist oncologists to make a more objective decision regarding continuation or termination of treatment.

Keyword- physical performance status; six minute walking test; inertial sensors; Gaussian mixture model;

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