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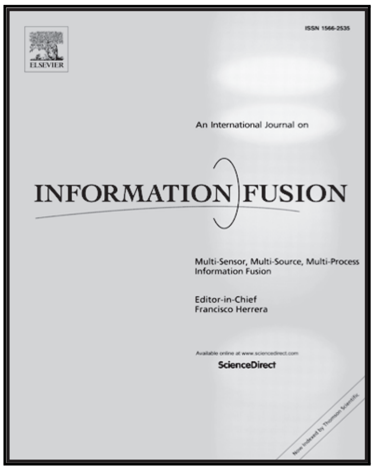

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Abstract

Human motion sensing based on wearable sensors could be viewed as a multi-objects tracking issue of human body joints. Sensor drift errors and distortion are the main challenges of the tracking accuracy of human motion. Traditional filtering and fusion methods, such as Kalman filter, can to some extent reduce the instantaneous error but cannot avoid sensor drift fundamentally. Physical characteristics of human body should be considered and human motion models should be exhibited to describe human motions. The existing models such as skeleton model and cylinder model are either too simple or too complicated for practical applications. In this study, we put forward a geometrical kinematic characteristics based human motion model. The whole human body is viewed as an articulated skeleton and Denavit-Hartenberg convention is adopted to describe the forward kinematics structure. Theoretical analysis is conducted with the derivation of Posterior Cramer-Rao Lower Bound (PCRLB) in human movement scenes based on proposed model. Significant superiority is shown in simulation results. An experiment on human lower limb motions is carried out to verify the validity of the proposed human motion model in practice applications, from the angles of both capturing accuracy and energy consumption. The capturing accuracy has an obvious increase in the testing results, with acceptable energy consumption. It is far more efficient than traditional methods.

Keywords: human motion, geometrical characteristics, Denavit-Hartenberg convention, PCRLB, wearable sensors.

1. Introduction

With the booming of body sensor networks (BSNs), people-centric motion sensing applications have been developing very fast. Due to the advantages of low cost and small size, wearable sensors have been drawing attention. They

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