Posture and Limb Detection for Pressure Ulcer Prevention

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ABSTRACT

Pressure ulcers impose an enormous burden on health care system. For hospitalized patients, the prevalence ranges from 3% to 11% increasing both the length of hospital stay and hospital cost. Pressure ulcer results in a skin breakdown that happens when a patient stays in bed for a long time without dynamically shifting the body weight over the surface. Bedridden patients, immobile nursing home residents and elderly are the main groups that have high risk of pressure ulcer. Prone areas of body for pressure ulcers are bony prominence areas such as heels, sacrum, elbows, shoulders and occiput.

Continuous risk assessment of sensitive body areas and effective treatment of affected areas during healing process require a long term recording of body posture and tracking of limbs over time. Monitoring patient's postures and limbs can be an important tool for care givers to prevent ulcer development. We have developed a monitoring platform using commercial pressure mapping system that records patient's bed posture and tracks different limbs along with associated statistical pressure image data. Turning the patient every two hours, as hospital staff are traditionally advised, is neither efficient nor practical. Our methodology allows care givers to utilize the postures/limbs stress data and schedule and reposition patient more effectively. It also allows continuous risk assessment and provides related information for creating an efficient healing/treatment plan.

The proposed algorithm has a training and test step. A cardboard body model is assigned to training samples for body limb detection. During training phase, a posture space is extracted using Principle Component Analysis. During test phase, all pressure images are projected to the posture space and K Nearest Neighbor (KNN) algorithm is used to classify different postures. Modeling parameters of the most correlated sample in KNN are used to have an initial estimation of limbs location. Then, a parameter tuning is done to improve the location accuracy. Our preliminary results indicate 97% accuracy in classifying postures for five standard bed postures.