Cyclos - Preventing Low Back Pain Among Cyclists Using the Autoregressive Model with a Real-Time Feedback Mechanism

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Incessant backaches are an intrinsic part of cycling. Preliminary research revealed that 45% of the cyclists in the world suffer from back pains of which 23% remain chronic. Today, these cyclists either opt for curative treatment through physiotherapy or muscle movement analysis in a gait lab using the expensive electro goniometer. Instead, I propose a preventive solution which eliminates white noise so that it can be used on field for real time feedback to warn the cyclist of his posture. The device is an ergonomically designed Bluetooth enabled Inertial Measurement Unit (IMU) that is placed on the first vertebrae of the lumbar (L1). The sensor values were correlated to the pelvic flexion, on a 3D Motion Capture System, calculated by assessing the angle between the palpated Anterior Superior Iliac Spine and the Posterior Superior Iliac Spine with a very high statistical significance obtained from male and female subjects from different age categories having varying heights and weights. It was identified that every individual has a personalized pelvic flexion threshold dependent on their fatigue levels, flexibility and core strength. Also, it was noticed that the sensor values were affected by the uneven terrain and the natural inclination of the road. An Autoregressive Model (AR) combined with the least square estimate of order 20 is used to eliminate white noise due to the terrain. The model uses the same sensor input to analyze the parameters and variance that are re-calibrated with a moving average to generate a personalized threshold, to warn the cyclist and avoid false alarms from supervised algorithms which forecast values beyond the training set. The three case experiment examined the effect of change in terrain on the parameters and variance of the model.

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