Unobtrusive Monitoring for Individuals Using Inertial Systems

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ABSTRACT: The use of inertial measurement units for tracking and monitoring applications is gaining in importance as the size, power consumption and cost of these sensors have all been decreased by their wide spread use in smartphones and other consumer electronics. As such, inertial sensors are becoming the preferred sensing modality for a growing number of applications, including human and animal movement. In this presentation, I will first present an overview of how data from inertial sensors, in conjunction with the requisite algorithm development, enabled personal dead reckoning for 3D localization. Next, I will describe current work that uses these sensors and algorithms to help understand “how the person walks” instead of simply “where the person is”. Further, analysis of human movement is typically confined to specialized labs instrumented with expensive motion capture systems. To address this, we have demonstrated that inertial systems can be used not only to obtain comparable measurements at a much lower cost, but also effectively monitor subjects in daily life conditions outside of the lab. We have collected week-long, real-world sensor data on subjects, and for the first time, we have been able to capture and reproduce loss of balances in older adults who self-report balance difficulty. Finally, work extending inertial systems to free swimming marine mammals will be presented. Our preliminary results provide accurate estimates of mechanical work on swimming animals for the first time. The work presented here demonstrates the advantages of inertial systems for monitoring and quantifying health and well-being of both people and animals.