Abstract

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Advances in Elderly Monitoring Systems: A non-invasive thermal imaging technique for the monitoring of falls in the homecare environment of cardiodiabetic patients

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Abstract

The advancements in modern medicine and healthcare have resulted in an increased life expectancy amongst men and women in the western world. However, the rise in the life expectancy has been followed with an increasing number of cases of diabetes and cardiovascular diseases (CVD) amongst that population due to less healthier lifestyle changes. Diabetes patients can suffer from eye retinopathy and also from muscular neuropathy as well as other thyroid function and endocrinology related diseases. Similarly, CVD patients can suffer from blood pressure related conditions, too. Thus, in both categories of patients their mobility and stability are affected which can lead to a higher occurrence of falls inside the home and other indoors living environments. Recent advances in Artificial Intelligence (AI) and Machine Learning (ML) algorithms have focused in developing video analytics algorithms for the purpose of elderly monitoring. More specifically, recent studies have been conducted in developing advanced AI and ML algorithms for either preventing the falls of the elderly men and women or detecting in time when an elder person has fallen down for alerting the carer. In this paper, we review the commercially available elderly monitoring systems (EMS) and devices. We categorise them in (1) wearable pendants type and (2) streaming video type of EMS. Additionally, we categorise the state-of-the-art AI and ML algorithms used in those EMS based on the type of Internet-of-Things (IoT) smart connected sensor(s). Those sensor based categories are: (a) camera sensor-based only, (b) any other type of IoT sensor(s), and (c) combination (combo) of camera and other smart connected IoT sensors. We further break down those camera sensor-based algorithms into (i) spatial domain, (ii) frequency/Fourier domain algorithms and (iii) hybrid domain or spatio-temporal domain algorithms. Finally, we propose a novel biologically inspired hybrid domain EMS. It uses a 'loose' model-based solution for multi-class object recognition with an advanced dynamic background segmentation and scene interpretation AI algorithms. Our proposed hybrid domain EMS is able to use a thermal imaging sensor for non-invasive monitoring and marker-less human pose estimation in the indoors environment.

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Biography

Dr. Kypraios is the author of over 35 scientific articles in peer-reviewed international conferences and journals. He has over 18 years of experience in conducting scientific research in Artificial Intelligence (AI) and Machine Learning (ML) areas with applications in healthcare technologies, intelligent transport, and others. Previously, Dr. Kypraios held academic or scientific positions at the University of Sussex, University of Gent (Belgium), ICTM (assoc. London South Bank University), University of Oxford (Begbroke Science Park) and Anglia Ruskin University. He also worked in industry for several years and had senior roles at Continental ADAS SV Systems (US and Europe), FotoNation (Tessera Technologies Group/xPeri) and elsewhere. In 2020, Dr. Kypraios became at De Montfort University an Associate Professor in Games and AI and the Co-Director of the translation medicine Centre for Primary Care Research (CfPCR) with Willows Health.

