Biomedical Discussion Group

Non-invasive fall detection using 3D Deep Convolutional Autoencoder

Thursday January 18, 2018
3:00 –4:00 pm, East Campus 4 Boardroom (EC4-2101a)
Coffee and Cookies available - RSVP required

Dr. Shehroz Khan, Post-doctoral researcher at the Intelligent Assistive Technology and Systems Lab, University of Toronto

Abstract: Detecting falls is important from health and safety perspective. However, falls occur rarely and infrequently. Therefore, it is difficult to build supervised classifiers that can handle such skewed data. Another challenge is to extract the right features for the problem; however, it is very difficult in the absence of fall data during training. The data for falls can be collected through wearable devices, video cameras or ambient sensors. However, wearable devices may be invasive, video cameras may impose privacy concerns and ambient sensors may result in too many false alarms. In this work, we use thermal and depth camera to record activities data, which provides a good compromise in terms of preserving privacy and being non-invasive. From the machine learning perspective, we explored the use of autoencoders that can learn generic features from the videos containing normal activities. An autoencoder tries to reconstruct the input by minimizing the reconstruction error. We consider a fall as an anomaly that can be detected at the testing time based on their high reconstruction error. We present the novel use of 2D and 3D deep convolutional autoencoders (DCA) for detecting unseen falls. The general idea is to train the 2D/3D DCA on videos of normal activities as they are available in abundance. Then, we present a new context-based score method to identify a fall during testing phase that takes into consideration the reconstruction error of the position of a given frame across different time windows. We tested our methods on three publicly available datasets collected through thermal and depth cameras. Our result show that 3D DCA consistently outperforms the 2D DCA and traditional deep autoencoder for detecting falls in a non-invasive manner.

Biosketch: Dr. Shehroz Khan is a Post-doctoral researcher at the Intelligent Assistive Technology and Systems Lab, University of Toronto. He earned his PhD degree from the University of Waterloo with specialization in machine learning and health informatics. His current research interests are the development of machine learning algorithms for solving health and aging problems, and supporting assistive technologies. He has published 24 peer-reviewed research papers in international journals, conferences and workshops that have garnered more than 1000 citations. He is the reviewer of more than 20 high impact-factor international journals. He is Quora Top Writer for the year 2016 and 2017.

Keywords: fall detection, non-invasive, machine learning, autoencoders, thermal cameras, depth cameras, aging, health informatics, assistive technologies.

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