

Thesis proposal

Title : Deep Learning with Big Data for improved diagnosis and treatment of individuals

Director : Amir HAJJAM EL HASSANI, MCF HDR
University of Technology of Belfort Montbeliard
amir.hajjam@utbm.fr

General context

Both European Union and China is experiencing population ageing. This development will jeopardize the future balance of public finance, including that of health care. Life expectancy at birth continues to rise worldwide, and in Europe, it is approaching or exceeding 85 years for women and 80 years for men. The quality of life in these extra years, experienced after age 80 or 85, is of increasing concern to authorities seeking to delay the onset of chronic diseases, senescence, functional decline, frailty and loss of autonomy. The growing number of elderly people in the French population causes increased usage of the healthcare system. In 1997, people aged 60 and over represented almost one-third of the total medical expenditure and almost half of drug expenditure, while making up only 20% of the total population. These figures highlight the impact of the increasing number of elderly people in our country.

The development of information and communication technologies (ICTs) for the elderly is a promising venture. They create new opportunities to assist and care for elderly people at home or in specialized institutions, including nursing homes and hospitals. Grouped under the term gerontotechnology, the first analyses of their contributions to this field appeared in the mid-1990s. Gerontotechnology examines technology and aging in order to improve living conditions and working environments, as well as medical care for dependent seniors.

Preventive medicine

Telemedicine [1][2] has shown its effectiveness in the management of chronic diseases, such as heart failure and high blood pressure, among others. Monitoring patients with chronic diseases through the use of telemedicine is a way to optimize their care. It also offers a better quality of life for elderly patients. Telemonitoring could lead to a significant reduction in the number of readmissions, which would consequently result in lower costs for society. These solutions also encourage the accurate collection of medical data to enable improved monitoring of patient health. The objectives are thus ambitious, ranging from improved rates of morbidity and mortality, to decreased readmissions, improved quality of life and reduced economic costs.

Deep Learning and Big Data

The use of computer science, especially machine learning, arrives as a solution to assist the practitioners. The literature presents different machine learning models that provide recommendations and alerts in case of anomalies, such as the case of heart diseases. The major problem of machine learning is the high dimensionality. The key to the success of

machine learning models is to select the best features. It can be observed in the literature that the use of feature selection techniques helped the performance of a classification algorithm in the prediction.

Expected contribution

The aim of this work is to propose in Big Data context, combination between supervised machine learning models with feature selection to achieve two main objectives: (1) to learn the best feature representation of data set used; and (2) to use machine learning techniques as a classifier using the features obtained. The data set used came from the experimentation of the E-care platform and its uses in different project. The E-care [3][4] intelligent telemedicine platform, winner of the Investissements d'Avenir (Future Investments) in 2012 and the Fondation d'Avenir (Future Foundation) in 2015 and 2017. The platform assists caregivers by automating the processing of information from sensors and questionnaires to detect anomalies and make early diagnoses of medically risky situations. the platform is currently deployed in the PRADO-INCADO project in Strasbourg (a collaborative project between the Strasbourg University Hospital, the Bas-Rhin Medical Insurance and the Grand-Est Regional Health Agency) to monitor heart failure patients where they live.

The work will be done in partnership with the CHRU of Strabsourg, the CHRU of Besançon in France and the hospital of rehabilitation No. 3 of Shanghai.

[1] Andrès E et al. "Telemedicine to monitor elderly patients with chronic diseases, with special focus on patients with chronic heart failure." J Gerontol Geriatr Res 2016, 5:311. <http://dx.doi.org/10.4172/2167-7182.1000311>.

[2] A. A. Zulfiqar et al. "Telemedicine and Cardiology in the Elderly in France: Inventory of Experiments", DOI: 10.1155/2019/2102156

[3] E. ANDRES et al. "E-Care Project: A Promising E-Platform for Optimizing Management of Chronic Heart Failure and Other Chronic Diseases." In Heart Research Open Journal, vol. 2(1), pp. 39-45, Openvention Publisher ISSN: 2377-164X. 2015.

[4] Andrès et al. "E-care project: a promising e-plateform for the optimizing management of chronic heart failure and other chronic diseases." Heart Res Open J 2015;1: 39- 45. <http://dx.doi.org/10.17140/HROJ-2-107>.