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Lalit Garg

University of Malta, Malta

Infectious disease progression modeling

Models which can predict disease progression are useful for aiding clinicians in prescribing the correct treatment at the optimal time to produce the best outcome for the patient. Positive correlations between changes in a patient's infection state with respect to other factors of the patient's profile such as age, gender and treatment. We utilize artificial neural networks and phase type survival trees with differing combinations of input covariates to find which ones provide the best predictor of the future state. To demonstrate the model, we used a dataset of 1,838 patients infected with the human immunodeficiency virus (HIV) which were enrolled in the Italian public structures between January 1996 and January 2008. The proposed disease progression models effectively cluster, identify and quantify the effects of these covariates and their interaction in the prediction of HIV disease progression. Our results show that antiretroviral treatment (ART) is the best prognosticator of a patient's future state followed by the CD4+ T-lymphocyte measurement. Other covariates such as gender and age have little impact on the overall accuracy in prediction. Results improved dramatically when predicting if the patients' next state was AIDS (Acquired immunodeficiency syndrome). These results should aid in the management of HIV and its treatment while the methods developed through this research can also be useful for modeling disease progression in patients who have other chronic conditions or diseases such as tuberculosis (TB), the severe acute respiratory syndrome (SARS), cardiovascular disease (CVD), cancer and diabetes.

Biography

Lalit Garg has received his PhD degree from the University of Ulster, UK in 2010. He has received his first degree in Electronics & Communication Engineering from the Barkatullah University, India in 1999 and Postgraduate degree in Information Technology from ABV-IIITM, Gwalior, India in 2001. He is currently a Senior Lecturer in Computer Information Systems at the University of Malta, Malta. He was a Researcher at the Nanyang Technological University, Singapore and at the University of Ulster, UK. His research interests include missing data handling, machine learning, data mining and their applications especially in the healthcare domain. He has published more than 60 technical papers in refereed journals and conferences.

lalit.garg@um.edu.mt

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