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Personalized Infectious Disease Risk Prediction System: A Knowledge Model

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Abstract : This research describes a knowledge model for a system which give personalized alert to users about infectious disease risks in the context of weather, location and time. The knowledge model is based on established epidemiological concepts augmented by information gleaned from infection-related data repositories. The existing disease risk prediction research has more focuses on utilizing raw historical data and yield seasonal patterns of infectious disease risk emergence. This research incorporates both data and epidemiological concepts gathered from Atlas of Human Infectious Disease (AHID) and Centre of Disease Control (CDC) as basic reasoning of infectious disease risk prediction. Using CommonKADS methodology, the disease risk prediction task is an assignment synthetic task, starting from knowledge identification through specification, refinement to implementation. First, knowledge is gathered from AHID primarily from the epidemiology and risk group chapters for each infectious disease. The result of this stage is five major elements (Person, Infectious Disease, Weather, Location and Time) and their properties. At the knowledge specification stage, the initial tree model of each element and detailed relationships are produced. This research also includes a validation step as part of knowledge refinement: on the basis that the best model is formed using the most common features, Frequency-based Selection (FBS) is applied. The portion of the Infectious Disease risk model relating to Person comes out strongest, with Location next, and Weather weaker. For Person attribute, Age is the strongest, Activity and Habits are moderate, and Blood type is weakest. At the Location attribute, General category (e.g. continents, region, country, and island) results much stronger than Specific category (i.e. terrain feature). For Weather attribute, Less Precise category (i.e. season) comes out stronger than Precise category (i.e. exact temperature or humidity interval). However, given that some infectious diseases are significantly more serious than others, a frequency based metric may not be appropriate. Future work will incorporate epidemiological measurements of disease seriousness (e.g. odds ratio, hazard ratio and fatality rate) into the validation metrics. This research is limited to modelling existing knowledge about epidemiology and chain of infection concepts. Further step, verification in knowledge refinement stage, might cause some minor changes on the shape of tree.

Keywords : epidemiology, knowledge modelling, infectious disease, prediction, risk
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