Juryrapport
Philips Afstudeerprijs voor Biomedische Technologie 2019

M. (Maaike) Dotinga MSc, University of Twente
Machine Learning in Nuclear Medicine: Detection of Parkinson's disease, myocardial ischemia and major adverse cardiac events using support vector machines

This MSc thesis in Technical Medicine details the use of machine learning using support vector machines (SVM) in two distinct medical imaging applications – the detection of Parkinson's disease and the detection of myocardial ischemia and major adverse cardiac events.

In the former application, a SVM linear classifier model was built from a data set gathered from patients with a clinically confirmed diagnosis of Parkinson's disease using I-123 FP-CIT[1] SPECT imaging. The model was then validated on previously unseen data from the same site, and further validated with data from a different site where comparable data acquisition and processing protocols were used. Finally, the SVM model was used to discriminate between patients with and without Parkinson's disease, yielding an accuracy, sensitivity and specificity that was identical to the classification accuracy of nuclear medicine physicians. The machine learning based interpretation of these SPECT scans is thus equally accurate as standard visual assessment by expertly trained physicians, and has the potential to be used as a diagnostic aid in clinical practice.

In the latter case, the SVM model developed was suitable for reasonably accurate detection of myocardial ischemia, but did not yield a sufficiently generalizable model for major adverse cardiac events, due to an unacceptable number of false positives.

The jury was very impressed by the academic and technical quality of the thesis manuscript, as well as the structure and clarity of the document. The candidate has demonstrated the ability to delve deep into the technical details of machine learning, and to apply these approaches to compelling problems in a clinical situation. What was particularly striking is that the model developed for Parkinson's disease has led to the modification of clinical protocols, and to the adoption of the model for augmenting clinical practice. Science is not always successful, and the thesis also transparently reports about the hurdles to clinical implementation of the SVM model for detection of myocardial ischemia and major adverse cardiac events. Finally, the thesis was awarded the highest possible score of 10 by the graduation committee.

Based on the excellent content of the thesis, the clinical relevance, and the translation to clinical implementation, the jury chooses Maaike Dotinga as winner of the Philips Afstudeerprijs voor Biomedische Technologie.

Prof. dr. C.V.C. (Carlijn) Bouten, hoogleraar biomedische technologie TU Eindhoven
Prof. dr. V. (Vinod) Subramaniam, rector magnificus Vrije Universiteit

De jury vergaderde op 7 oktober 2019 onder leiding van Dr. J.Th.M. van der Schoot, directeur KHMW. Daarnaast waren ter vergadering aanwezig Prof. dr. A.P. IJzerman, secretaris natuurwetenschappen en Drs. S. van Manen, secretaris.

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[1] N-ω-fluoropropyl 2β-carbomethoxy-3β-(4-iodophenyl)nortropane