# *Machine learning to classify dementia wandering patterns*

*N.K. VUONG, S. CHAN, C.T. LAU.* ***Application of machine learning to classify dementia wandering patterns.*** *Gerontechnology 2014;13(2):294;* doi:10.4017/gt.2014.13.02.146.00 **Purpose** Wandering is a diagnostic sign of several psychiatric syndromes, including dementia and geriatric depression. Scientifically, wandering linked to dementia is characterized by pacing, lapping, and random locomotion[1]. We are developing an automated system for real-time recognition of wandering patterns by multiple residents in dementia day care centres. This paper reports the progress of our feasibility study for the technology, and its early results. **Method** We conducted an experiment to detect patient travel patterns including direct, pacing, lapping, and random in a laboratory area (6mx4m). Using a commercially available system (Ubisense, Inc.), we collected movement trajectories comprising 155 travel patterns from 3 volunteers. We pre-processed the raw trajectories with a redundant distance filter and a motion average smoother to reject corrupt readings and smooth out short-term irregularities in the raw data. *Figure 1* shows a lapping trajectory before and after pre-processing. We characterise each trajectory by a feature vector comprising the following information: displacement, path length, total travel time, average velocity, straightness index, directional mean, and circular variance[2]. The normalized feature vectors were used for supervised training machine learning algorithms to classify trajectories into direct, pacing, lapping and random locomotion. 6 classifiers were used: Bayes Net, Multilayer Perceptron (MLP), Bagging, Boosting, Decision Tree, and Random Forest[3]. Using 10-fold cross validation, the accuracy of each classifier was obtained by comparing the classification results with the ground truths. **Results & Discussion** *Figure 2* reports the accuracy of each classifier for the entire data set. The best accuracy, 72%, is achieved by a Random Forest classifier. We conclude that machine learning is capable of detecting individuals' wandering patterns they move within a confined area. Currently, movement data from other volunteers are being collected to obtain normative estimates of diurnal travel pattern variability across different individuals. We are also exploring the recognition of other patterns - such as zigzag or figure eight types. Early results will be presented. The implications for the technology as a clinical application for wandering and early dementia detection are discussed.

**References**

1. Algase D, Moore H, Vandeweerd C, Gavin-Dreschnack D. Aging and Mental Health 2007;11(6):686-698; doi:10.1080/13607860701366434
2. Almeida PJAL, Vieira MV, Kajin M, Forero-Medina G, Rui Cerqueira R. Zoologia Curitiba Impresso 2010;27(5):674-680; doi:10.1590/S1984-46702010000500002
3. Hall M, Frank E, Holmes G, Pfahringer B, Reutemann P, Witten I. SIGKDD Explorations 2009;11(1):1; doi:10.1145/1656274.1656278

*Keywords*: health & self-esteem, wandering, wandering patterns, dementia, classification
*Address*: School of Computer Engineering, Nanyang Technological University, Singapore
*E*: vuon0004@e.ntu.edu.sg

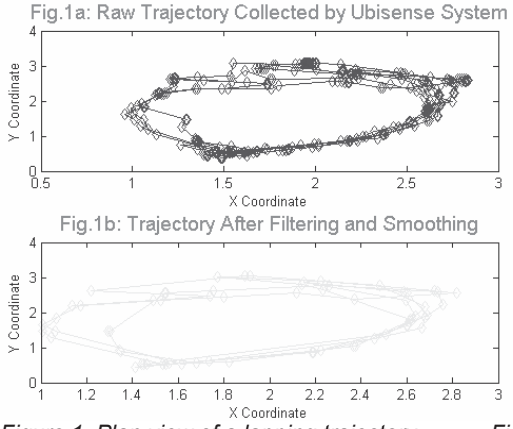


*Figure 1. Plan view of a lapping trajectory*

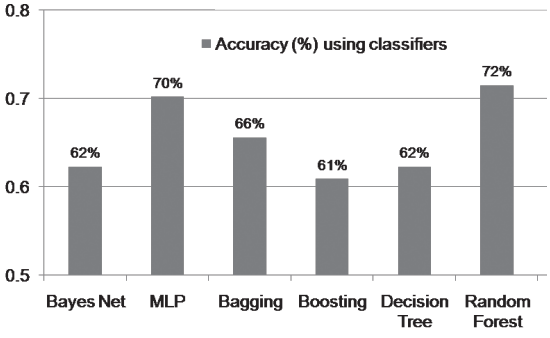


*Figure 2. Machine learning accuracy*