

# Using supervised learning machine algorithm to identify future fallers based on gait patterns : a two-year longitudinal study



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**INTRODUCTION :** Given the potential consequences of falls, a major challenge is to identify old people at risk to fall before the first event.

**HYPOTHESIS :** The use of data mining tools could allow to obtain a classification tree able to detect future fallers and based on the gait parameters recorded in challenging tasks

## METHOD :

A two-year, longitudinal, observational study has included 105 adults older than 65 years, living independently at home, without a recent fall history (<12 month) and without pain or osteoarticular, muscular, neurologic, cognitive or thymic disorder (based on CGA).

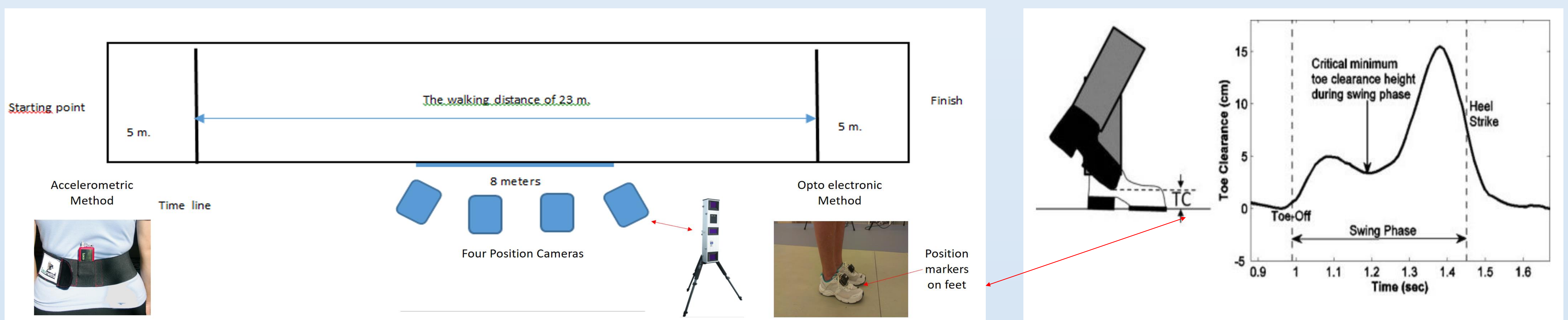
At inclusion gait parameters have been recorded in three different walking conditions : Comfortable (CW), Fast (FW) and Dual Task (DTW), where the cognitive task is an arithmetical task

Gait parameters have been obtained using both accelerometric and opto electronic methods  
Gait speed (m/s), Stride length (m), stride frequency (cycle/s), stride regularity and stride symmetry (dimensionless) and Minimal Toe Clearance (MTC) which is the minimal distance between the toe and the ground during the swing phase.

Gait parameters changes have been calculated between CW and FW or between CW and DTW as (if X = gait parameter)

$$DTW \text{ cost } (\%) = [(X)_{CW} - (X)_{DTW}] / (X)_{CW} \times 100$$

$$FW \text{ improvement } (\%) = [(x)_{FW} - (X)_{CW}] / (X)_{CW} \times 100$$



During the two-year follow-up, fall events were recorded using fall diaries.

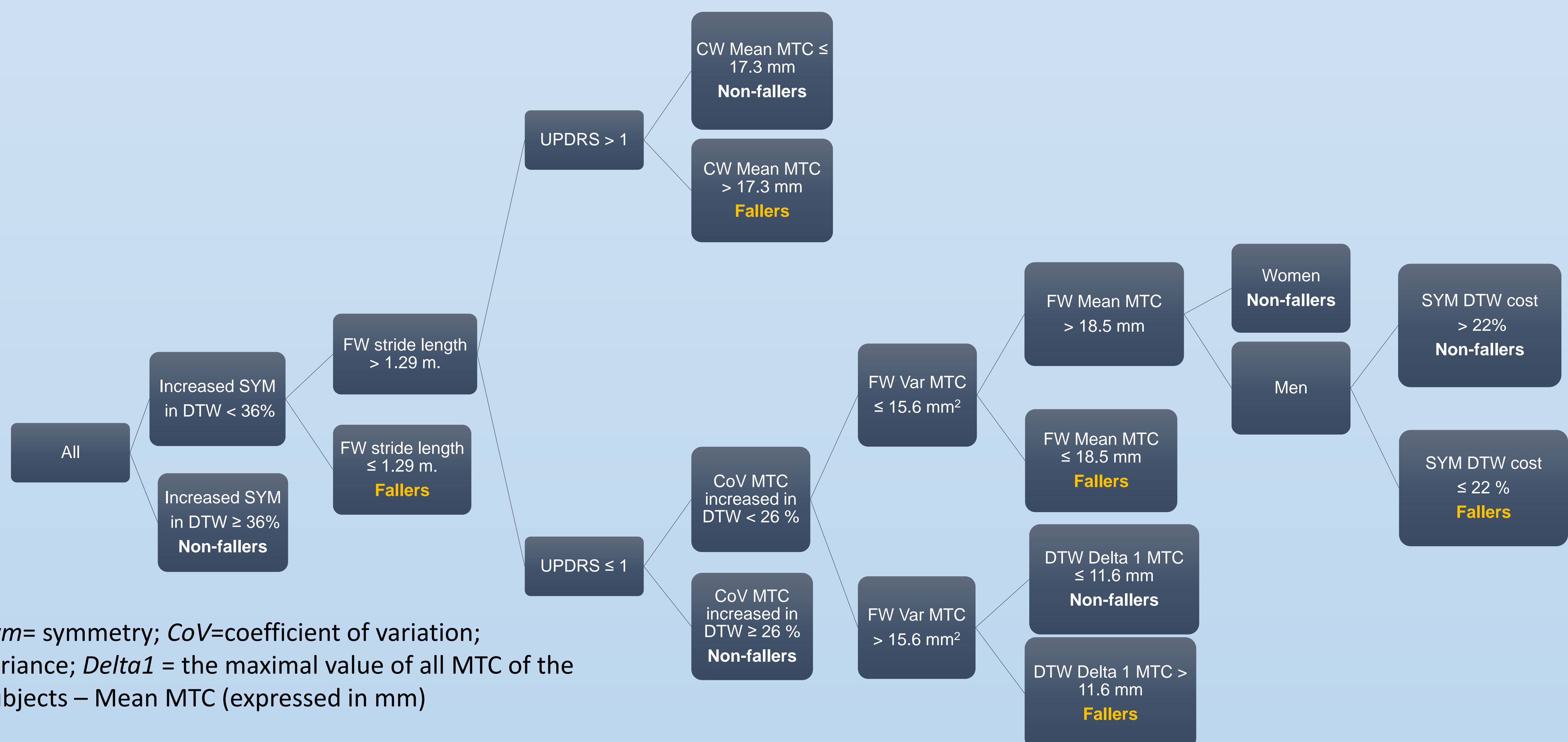
Data Mining tools use :

A supervised machine learning algorithm (J48) has been applied to the data recorded at inclusion in order to obtain a classification tree able to identify future fallers.

## Results :

A two-year follow-up was available for 96 participants, of whom 35 (36.5%) fell at least once.

Based on fall information from 96 volunteers, a classification tree correctly identifying 80% of future fallers based on gait patterns, gender, and stiffness, was obtained, with an accuracy of 84%, a sensitivity of 80%, a specificity of 87%, a positive predictive value of 78%, and a negative predictive value of 88%.



Were Sym= symmetry; CoV=coefficient of variation; Var = variance; Delta1 = the maximal value of all MTC of the same subjects – Mean MTC (expressed in mm)

## Conclusion:

This original longitudinal pilot study using a supervised machine learning algorithm, shows that gait parameters and clinical data can be used to identify future fallers among older adults. Further prospective study including non-fallers old people would allow to confirm our results.

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