Photo by Simon Bruty

Validation of a class allocation method for wheelchair track athletes with impaired strength – a proof of concept study

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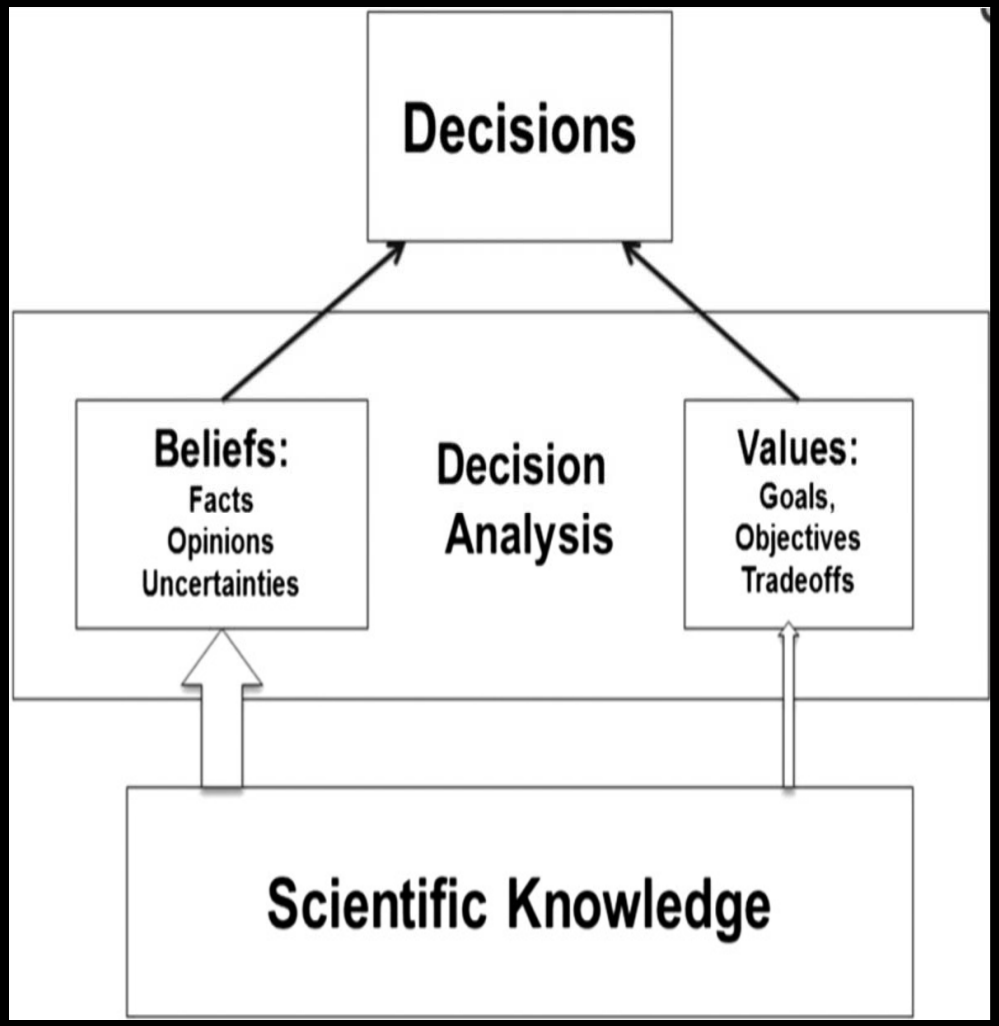
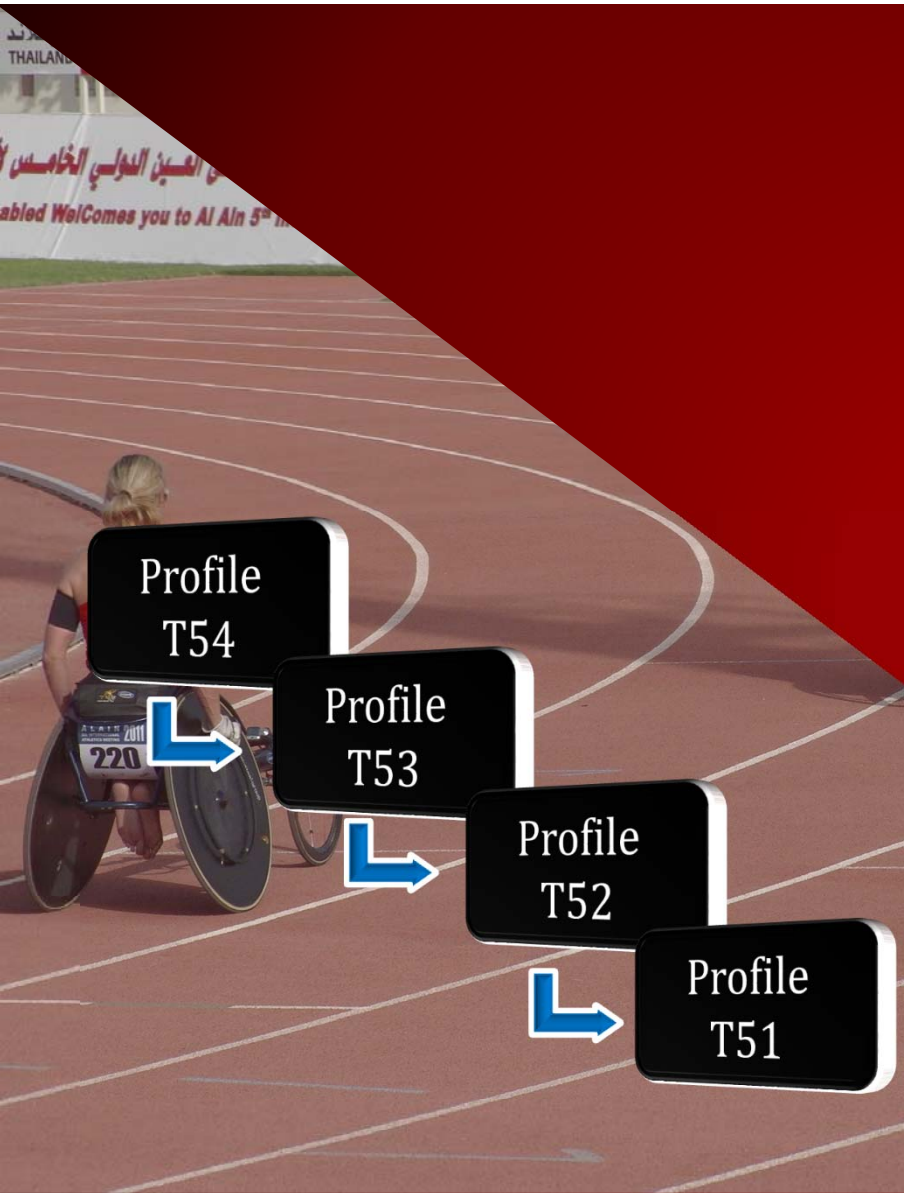


Von Winterfeldt (2013). Proc. Natl. Acad. Sci. U.S.A. 2013 Aug 20; 110(Suppl 3): 14055–14061

EVIDENCE-BASED DECISION MAKING

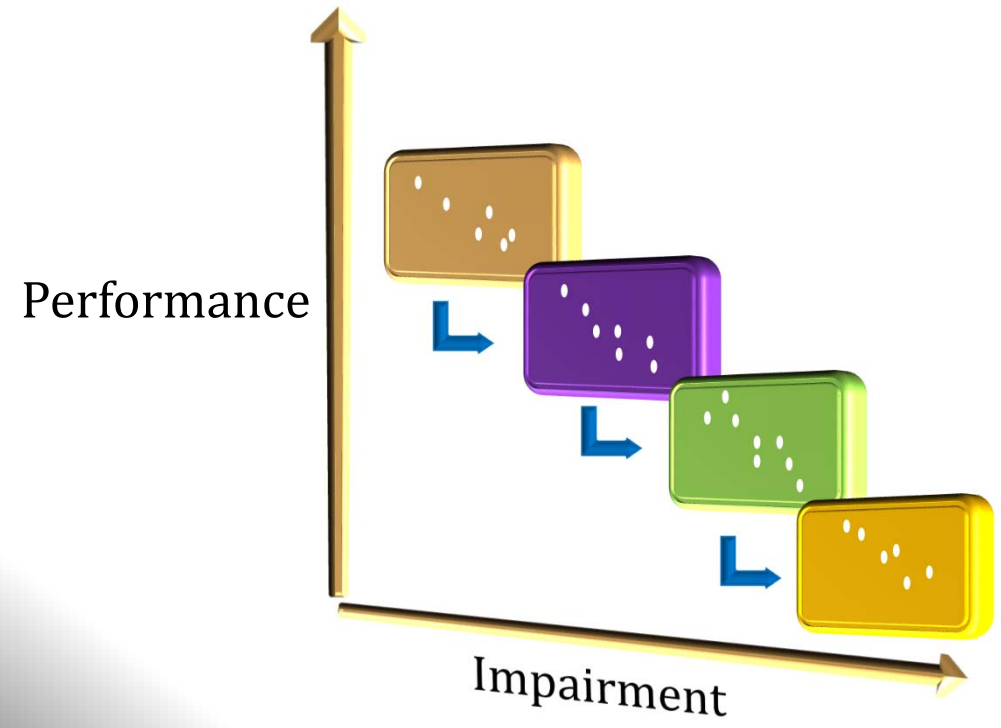
- Similarities with evidence-based medicine?
- Central tenets?
- How should we proceed?



DECISION-MAKING IN THE CURRENT SYSTEM

BASED ON CLINICAL REASONING

SCIENTIFIC BASIS?



EVIDENCE-BASED SYSTEM

TRANSPARENT, VALIDATED DECISIONS

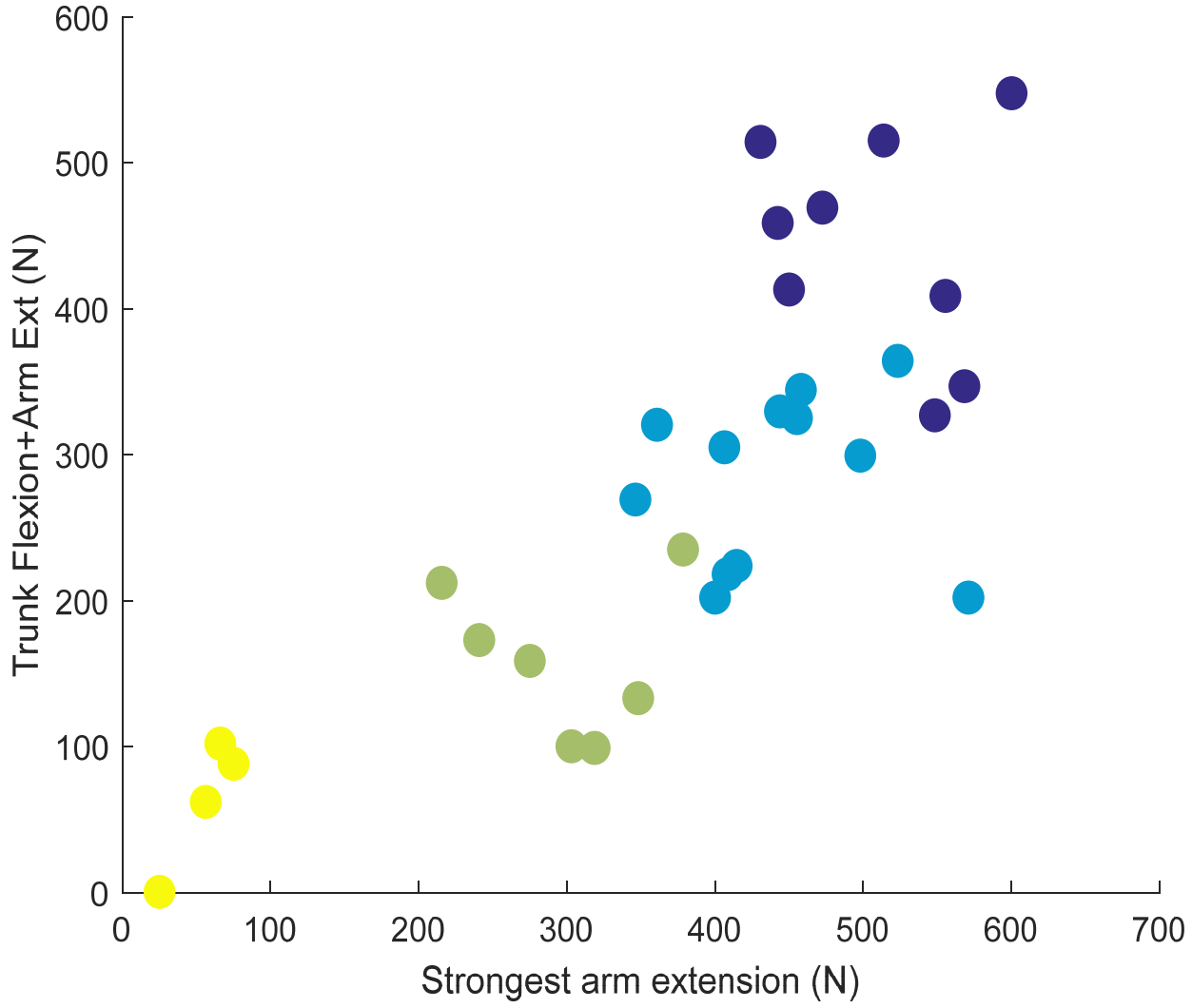
IDENTIFICATION OF IMPAIRMENT TESTS

Isometric strength measure	Performance Outcome	
	Top-Speed (0-15m) correlation	Top-Speed (Absolute) correlation
Strongest Forearm Pronation	0.70*	0.79*
Weakest Forearm Pronation	0.70*	0.79*
Strongest Arm Extension	0.83*	0.88*
Weakest Arm Extension	0.81*	0.87*
Isolated Trunk	0.54*	0.61*
Arm+Trunk	0.73*	0.78*

- 32 International-level wheelchair track racers
- Classes T54-T51
- Six isometric strength tests

Connick, M. J., Beckman, E., Vanlandewijck, Y., Malone, L., Blomqvist, S. and Tweedy, S. (Under review). Novel isometric strength measures produce a valid and evidence-based classification structure for wheelchair track racing: A cluster analysis. British Journal of Sports Medicine

IDENTIFICATION OF A CLASS STRUCTURE

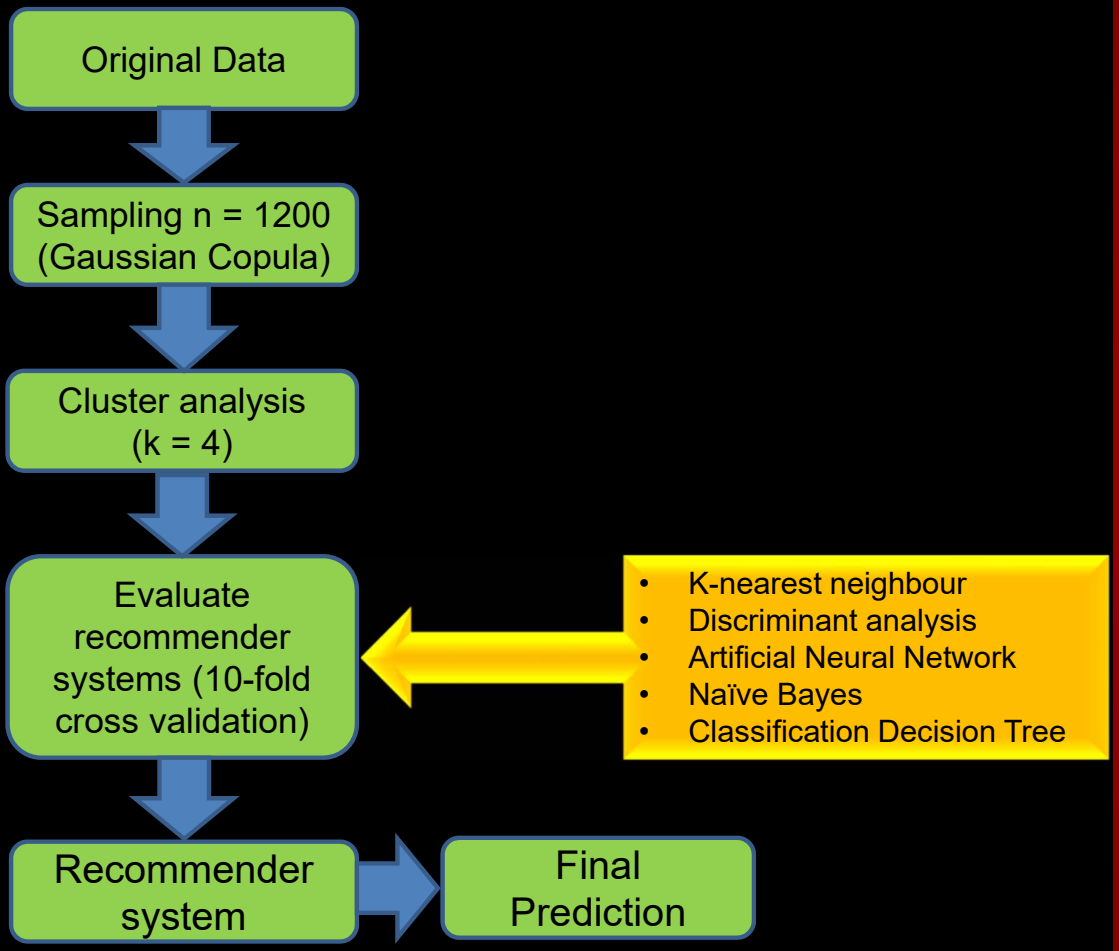


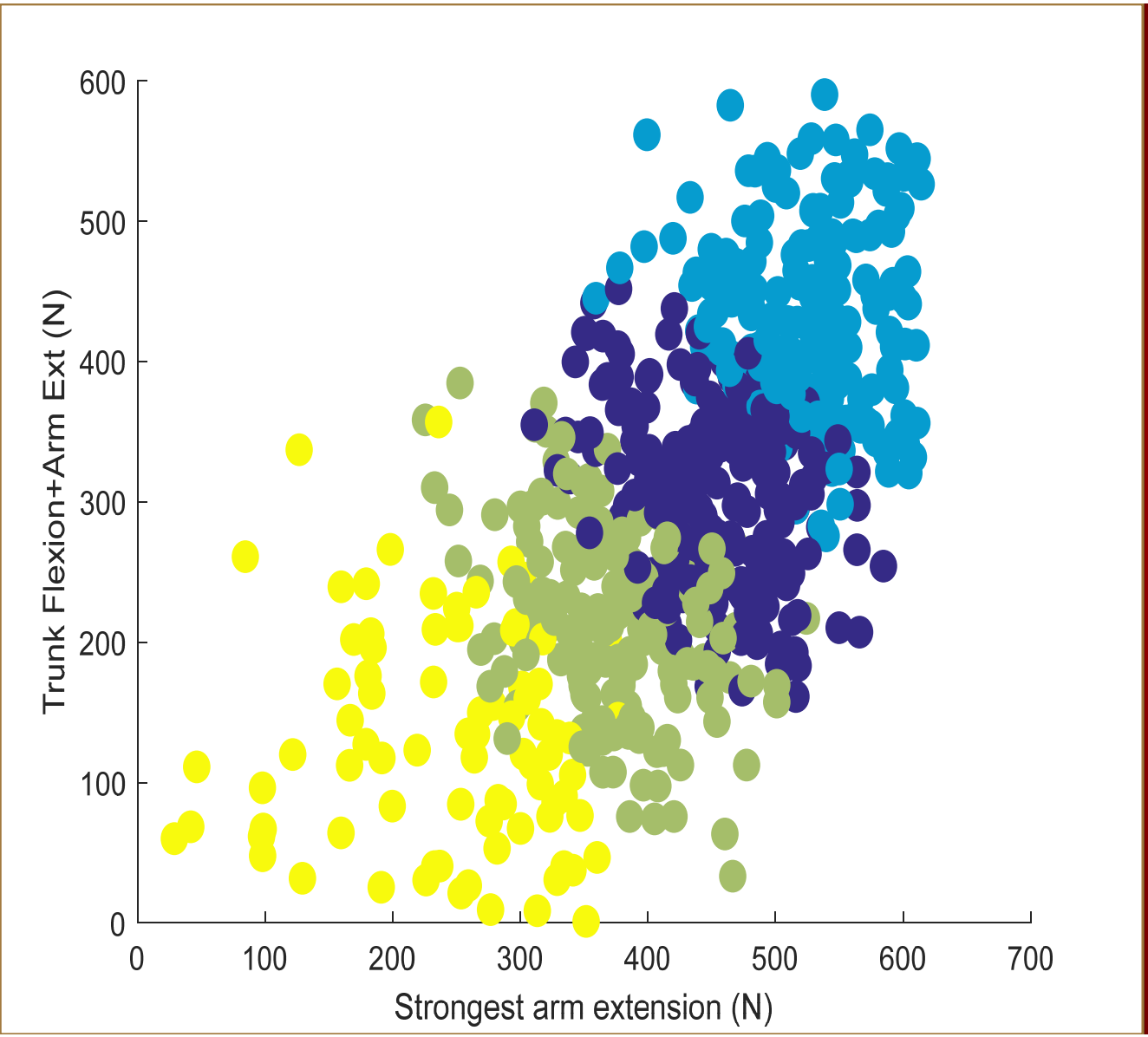
- 4 clusters
- Differences found in the 6 strength tests and 2 performance-related outcomes

AIM

To evaluate the validity of statistical recommender systems for allocating class in wheelchair track racing athletes.

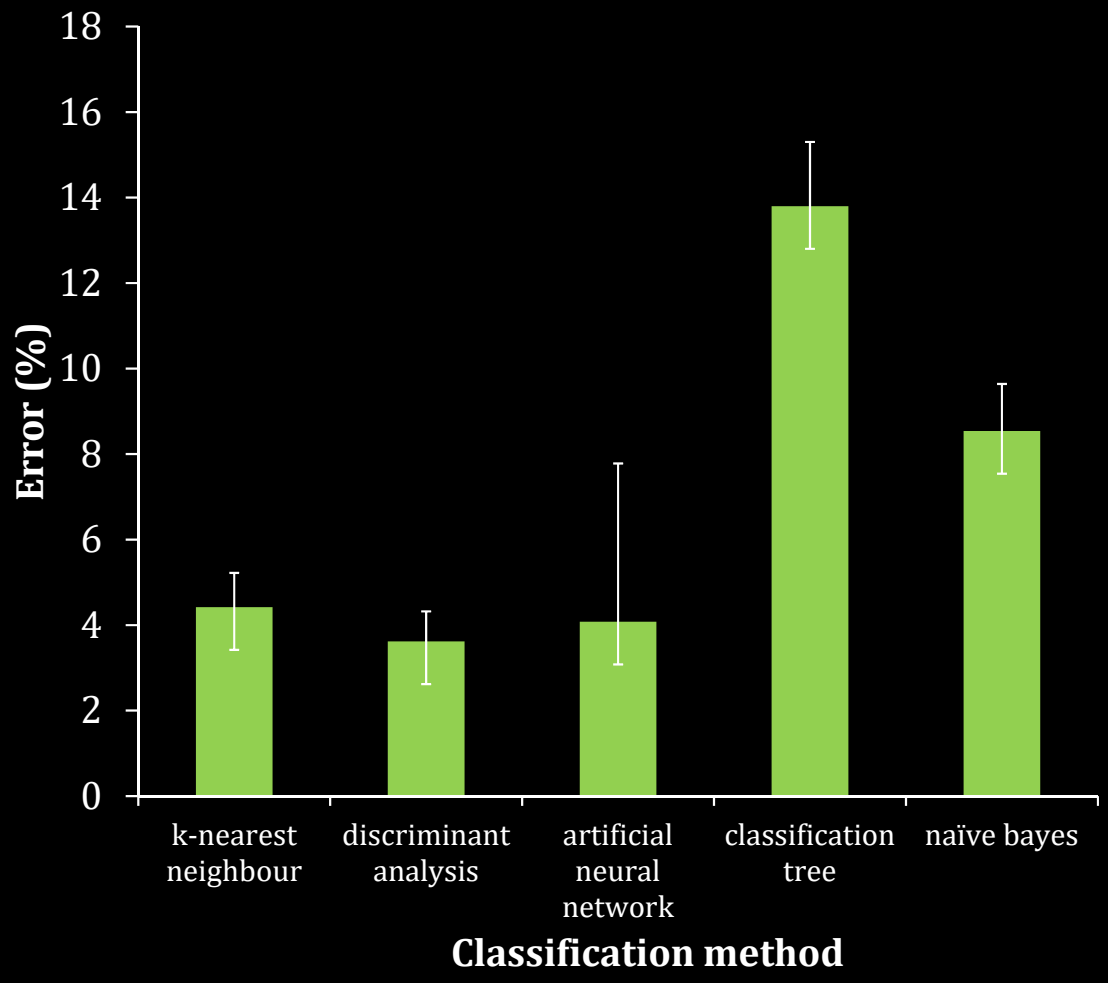
METHODS


Original Data
Sampling n = 1200 (Gaussian Copula)
Cluster analysis (k = 4)
Evaluate recommender systems (10-fold cross validation)
Recommender system
Final Prediction
K-nearest neighbour
Discriminant analysis
Artificial Neural Network
Naïve Bayes
Classification Decision Tree

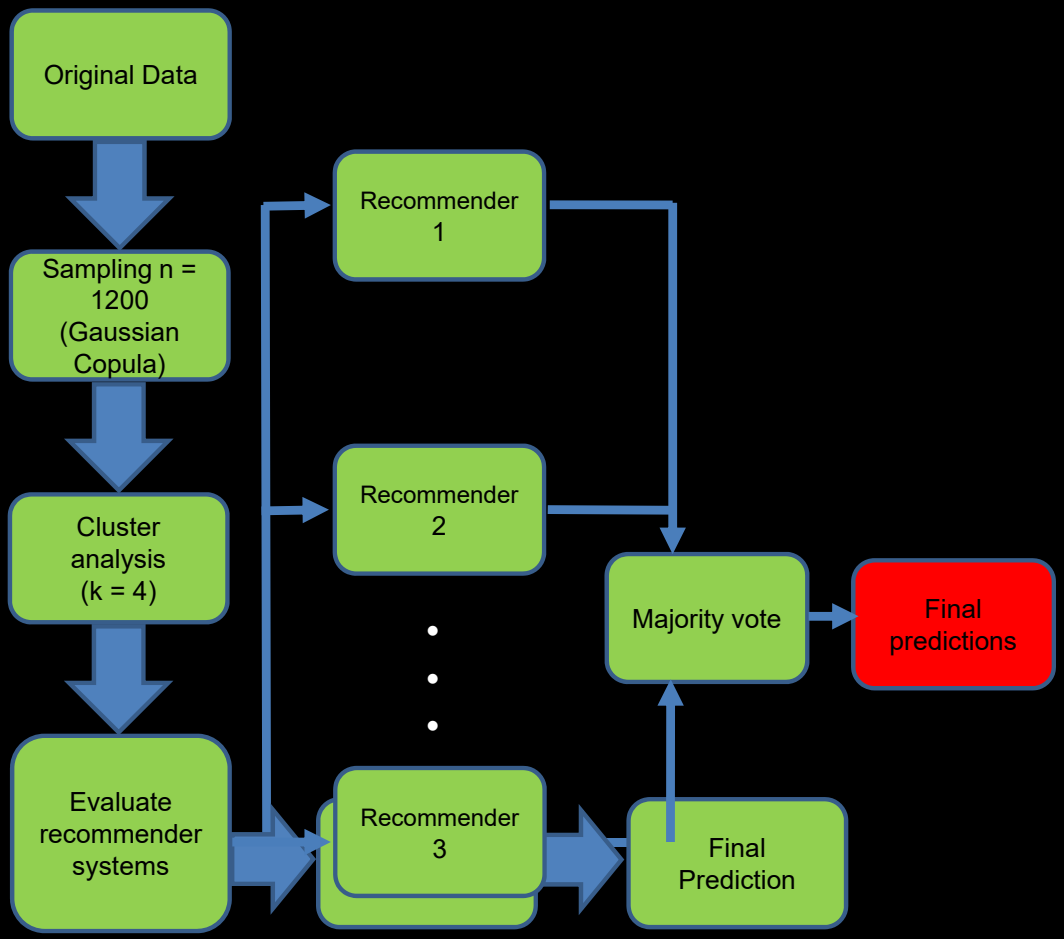

600
500
400
300
200
100
0
Trunk Flexion+Arm Ext (N)
0
100
200
300
400
500
600
700
Strongest arm extension (N)

RESULTS

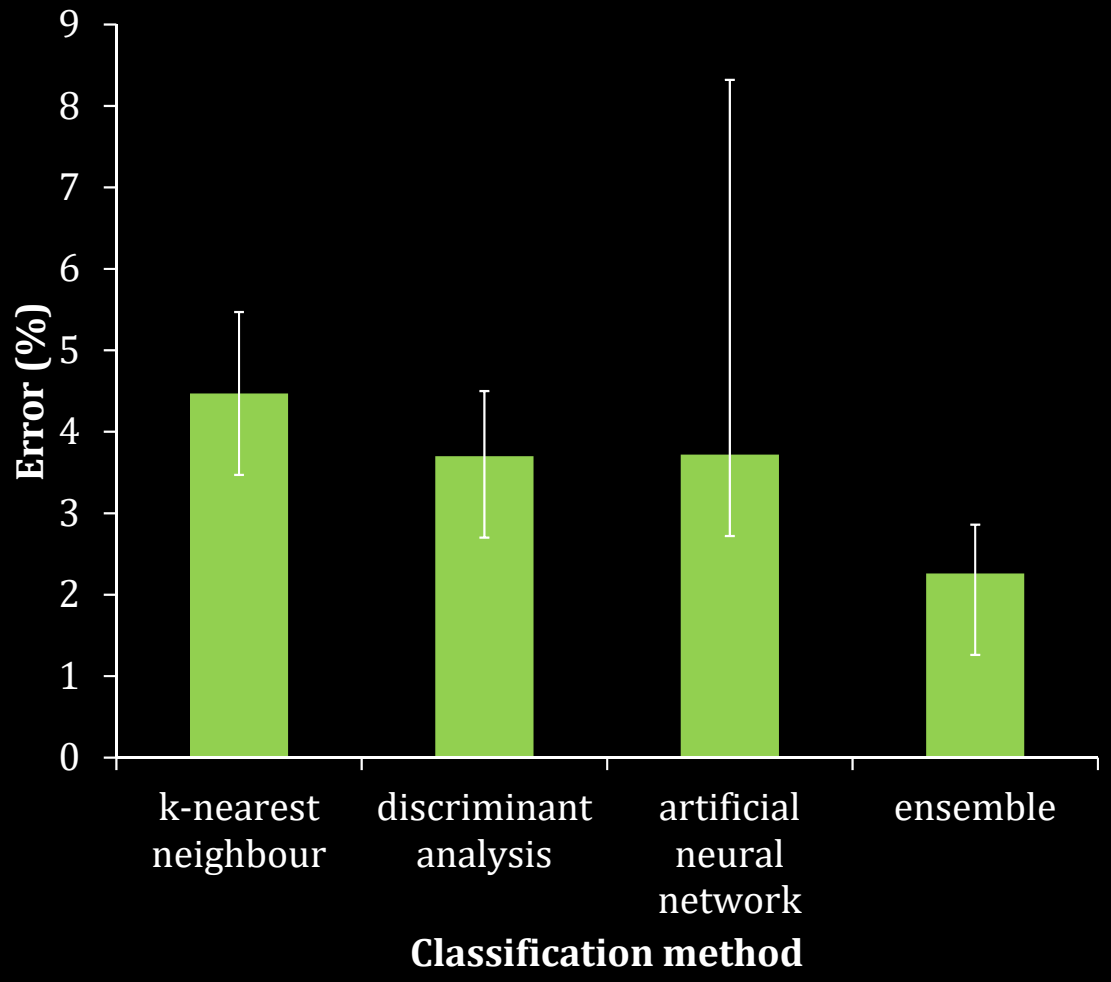
RESULTS


18
16
14
12
10
8
6
4
2
0
Error (%)
k-nearest neighbour
discriminant analysis
artificial neural network
classification tree
naïve bayes
Classification method

METHOD


Original Data
Sampling n = 1200 (Gaussian Copula)
Cluster analysis (k = 4)
Evaluate recommender systems
Recommender 1
Recommender 2
Recommender 3
Majority vote
Final predictions
Final Prediction

RESULTS


Error (%)
9
8
7
6
5
4
3
2
1
0
k-nearest neighbour
discriminant analysis
artificial neural network
ensemble
Classification method

DISCUSSION

- In this population, statistical recommender systems provide valid tools that classifiers can use to allocate class
- However, this was proof-of-concept and philosophical discussions are needed
  - Potential translation of these methods
- Precise parameters must be calculated in a large-scale study (i.e. test close to 100% of the population)
- Influence of training and intentional misrepresentation
- Remember, retain expert opinion and athlete context

THANK YOU

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- Ergotest
- The athletes

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