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10.4 An investigation on transfer in motor skill acquisition with machine learning.

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The evaluation of motor skill learning traditionally relates to compare performances and skills prior and after a period of constant practice. Recent research highlighted the interest of investigating variable practice and of modelling the dynamics of skill learning to better understand individual pathways of learners. Such modelling did not allow any prediction on future performance, both in terms of retention and transfer to new tasks. The present study attempts to quantify, by the means of machine learning algorithm, the prediction of transfer test with two conditions of practice in a climbing task: constant practice (with no changes applied during learning) and variable practice (with graded contextual changes, i.e. the variants of the climbing route). The proposed pipeline allows us to measure adjustment of the test to the dataset, i.e. the ability of the dataset to be *predictive* for the skill transfer test. Despite the difficulty of using the behavioral data in the machine learning framework, we achieved to find a working pipeline.

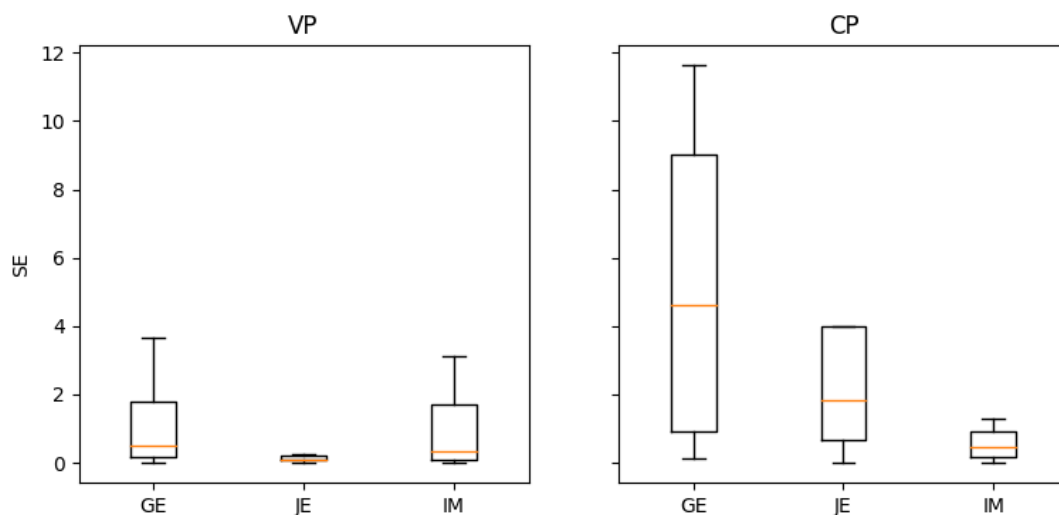


Figure 26: Comparison of the transfer predictivity for variable practice (VP) and constant practice (CP) groups.

In our research, we represented the history of individual performance due to the theoretical findings of the motor learning theory [1] which allows to model the learning progress as the descending exponential. Further, with the parameters of the exponential function fitting, thanks to the usage of the two-stage linear regression model with Lasso selection method [2], we attempted to predict the skill fluency transfer for the two practicing groups separately.

Overall, with our method, we were able to assess the generalisation of learning through the prediction of the outcome on the transfer test. Moreover, we found that the variable practice results in a more stable prediction than the constant one. This supports the importance of variable training for the skill transfer to a new context.

References

- [1] K.M. Newell, G. Mayer-Kress, S. Lee Hong & Y.-T. Liu. Adaptation and learning: Characteristic time scales of performance dynamics. *HumanMovementScience* **28**, 655-687 (2009)
- [2] A. Belloni & V. Chernozhukov. Least squares after model selection in high-dimensional sparse models. *Bernoulli* **19(2)** (2013)