Using machine learning to help manage the "last mile" in the application of skill science

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The overall goal of skill science is to develop models and tools appropriate to the identification of the highly skilled physical performance of humans, including that related to professional musicians and athletes. The identification of physical performance models provides the basis to distinguish the difference in the physical performance of some like Yo-yo Ma the cellist, or Tiger Woods the golfer. Existing results in Skill Science have made progress by focusing on some nearly independent physical performance models, like the use of classical physics models of the acceleration of whipping action to explain the arm action of cellists; or the isolation of forearm muscles and their frequency of contraction to explain an expert cellist's ease of playing spiccato.

The next step beyond the identification of component models of physical skills includes the development of reasoning tools that can reveal special elusive dynamic models of physical behaviour. For example, it is sometimes possible to consider alternative dynamic sequences that distinguish a professional from an amateur … these special dynamic skills can be called a "knack," or a special sequence or set of motions well within the scope of a physical model, but distinguished as a preferred explanation for professional level performance.

If the development of reasoning models for discovering knacks within the envelope of a physical model is considered as a search problem, then a comparison of any individual performance that attempts to mimic that discovered knack can be thought of as a machine learning problem. Simply stated, the training or practise required to achieve knack performance can exploit simple machine learning: the idea is to use the baseline knack model to calibrate an individual performance, and then record and compare successive practise attempts and provide feedback against knack baseline performance as a learning objective.

We refer to this application of skill science and the exploitation of knacks as the “last mile” in the sense that simple machine learning calibration can help provide the feedback to help an individual achieve the “last mile” in performance goals. The delivery of incremental knack performance can be done in a variety of ways, including visualization and virtual reality modeling of physical systems, as is done in the application of machine learning to rehabilitation medicine.