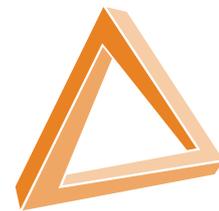


Byte-sized edtech research



Support Your Team

Enhancing Staff Training & Recruitment with Machine Learning

Fig. 1 - Use data to learn more about your staff and their training needs



- If you want learners to **understand** something, presenting them with a **simplified model** of it is helpful (Seel, 2017)
- What learners picture in their heads - **their mental models** - will not normally exactly match the simplified model that was presented, but learners' mental models **are normally influenced by it**, and these simplified models can also help towards a better understanding of **the more complex truth** from which the simplified model has been derived
- The use of simplified models can assist **organisations as well as individuals** in learning new material, even helping them **learn about themselves**. Organisational data that has had **Machine Learning (ML) methods** applied to it can help managers in the organisation **self-reflect**, and it can act as a mirror facing back to the organisation (Echeverria et al., 2019)
- Kent et al. (2021) propose ML models, generated by **unsupervised ML learning methods**, can be used as a '**learning affordance**' to support the mental models (the beliefs and assumptions) of managers
- The Kent et al. team present a case study where a financial training organisation that teaches **the art of trading** wished to support their new recruits after an initial 2-month training period. The managers of this organisation were asked to examine what they thought trading looked like in their context, after years of nurturing an **implied set of mental models and ideas about it**
- Managers wrote down several **profiles** of their traders' **trading behaviours**. At the same time, the Kent et al. team used unsupervised ML methods to arrive at their own **multidimensional trading behaviour profiles**
- After comparison and validation of the two sets, the profiles generated via the unsupervised ML methods were **welcomed**, and used as the basis of a **predictive decision support tool** in the organisation's **recruitment and training**
- The data-driven models had created a handy, bias-fencing shorthand to encapsulate a large number of **low-level behavioral variables**. These variables would not usually be **directly observable** by managers unless **some kind of modelling** took place, and developing a mental model of them would have typically taken **significant time and effort**
- The unsupervised models, however, more likely to reveal **unexpected findings in the behavioural data**, gave managers a sense of **validation**, as well as of **standardisation across the organisation's different locations**, changing the **language** within the organisation, and opening up **new dialogues about the shift of focus** from **performance to behaviour**, mobilising traders **between profiles** as part of their progress. It also opened up the possibility for more **targeted recruitment and mentorship**, as well as for a potential **better matching** of traders to types of markets and mentors

“Having a **data-fed model** gives a mentor more confidence to **forward plan, anticipate and react quicker** to the obstacles and barriers that each trader may face when **progressing**.”

Feedback from the Kent et al. (2021) Case Study



01 Unsupervised Machine Learning Methods

- Supervised ML and reinforcement algorithms **inherently include in them the aspiration to mimic some specific human behaviour** and to optimise on the basis of **human observations**
- **Unsupervised learning**, on the other hand, can reveal **factors and behaviors** that human guidance might have **prevented us from seeing**
- A child might be able to learn purely from **observing** (even if a scene is to some extent orchestrated by an adult), and not always by **following** an adult deliberately supervising and **pointing out things**, rewarding or punishing them in the process (reinforcing)
- Unsupervised algorithms are more about **identification** than **recognition** with data, and are **freer to observe**, and **freer to learn**
- The main rationale for using unsupervised ML models is the **exposing of unexpected patterns** in data, and therefore the ability to **add data-driven semantics** to the existing semantics of **human expertise**

02 What is a Learning Affordance?

- A learning affordance is the **perceived learning-related value** that an object has for a user, **in addition to its actual value**
- For example, an email app can have different affordances for different users. It could afford:
 - The ability to communicate asynchronously with our loved ones, a way to manage our professional network, or a way to prioritize our tasks
- When it comes to data modelling, value can be given to data by **deliberately attaching particular meaning to it**
- **Hidden or implicit meaning** can be revealed when **unsupervised ML methods** are applied to the data instead
- **Hidden statistical relationships, or other statistical constructs will emerge**, to be interpreted through a stakeholder's **original mental model** (which will be based on expectations, projections, cognitive biases, and emotions). **New inferences and assumptions** will emerge about the object in question
- The model generated by unsupervised methods provides a learning affordance, not just because it **simplifies, corrects, and highlights** different aspects of an existing mental model, but because it can also allow for new ways to **revise** the mental model

03 Mental Models in Humans

- A mental model is one thought up “by individuals to create a **representation or structure** of a phenomenon, or solution, to a problem” (Edwards-Leis, 2012)
- In order for humans to the make best use of the redundant sensory observations we use to build our own **mental models** (Johnson-Laird, 1983), our cognitive systems must make those models **accessible to our future everyday perception**. Mental models are **internal representations of the environment** that provide a conceptual framework for **describing, explaining, and predicting** future system states
- Mental models can lead to **misconceptions** (Vosniadu & Brewer, 1992). They are channeled and processed through human long-term memory, which is essentially **faulty**, and thus they are not immune to **biases and changes over time**
- **Computational models**, on the other hand, such as those produced via supervised or unsupervised ML methods, are more accurate, and less prone to leading to misconceptions, as they are anchored on **observed evidence** and are externalised by **statistical statements**. Their quality, however, is **highly correlated with the quality of the data from which they're curated**, which means using them requires a level of **caution and understanding**

04 Conclusions and Implications

- In the case of the Kent et al (2021) case study, trading and training managers **reflected on the comparisons between their own mental models of trader behaviour**, and an **unsupervised ML model** produced through a **participatory process**
- Unsupervised models, which could be referred to as learning affordances, had the potential to **reduce the complexity of highly-dimensional behavior, revealing unexpected patterns, introducing new concepts to the language of the organisation**, and generally affecting its **learning**
- The organisation's managers were now able to discuss how traders could be encouraged to move **between** different behaviours in their trading, and how their behaviours might **relate to performance**
- When using the participatory process, the unsupervised ML model enabled **space and time** for a **continuous interaction** between the managers' thoughts and feelings around the traders' **behaviours**
- The participatory process used in the case study could be applied to other organisations that have **large amounts of behavioural data** on their employees