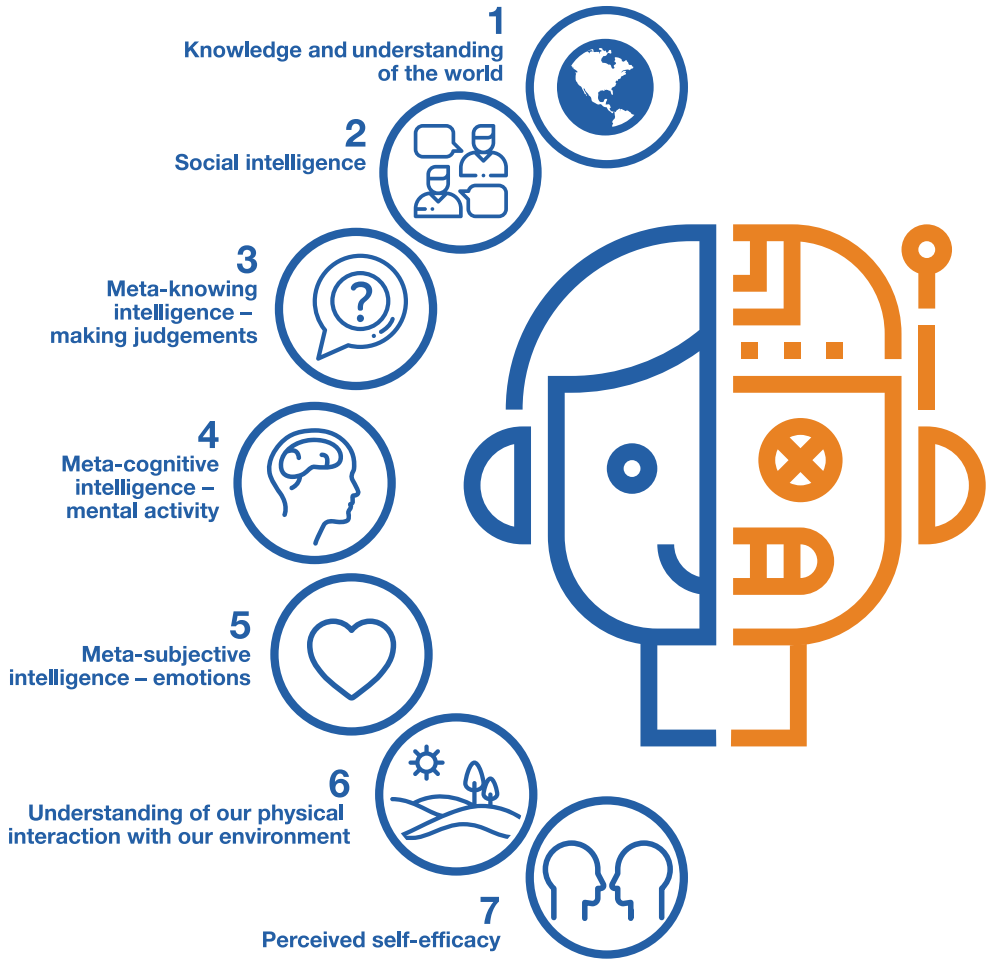
Byte-sized edtech research

AI Part 2 2019

Can machines learn?

The seven interwoven elements to human intelligence (Luckin, 2018a)



- Machine Learning (ML) is associated with machines' ability to learn from data, or one could say to 'improve with experience'.
- ML processes data. When data is changed, an ML algorithm 'learns'. If data is inaccurate, irrelevant, or insufficient, an ML application will not be able to learn meaningfully from it. This type of learning is called induction.
- 'Supervised' ML algorithms are heavily dependent on the humans and the annotation that is used to train them. They make decisions based on the biases in that annotation.
- AI and ML cannot solve problems to which they have not previously been exposed. Humans have the ability to reflect on learning and to process information to construct knowledge across a wide range of subjects.

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"Machine Learning is the study of computer algorithms that improve automatically through experience."

Mitchell, 1997

"[AI is the automation of] activities that we associate with human thinking. Activities such as decision-making, problem-solving, learning."

Bellman, 1978

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01 What is 'Machine Learning' (ML)?

ML is a sub-field of AI, associated with building software that enables machines to learn and to 'improve through experience'. Rather than following logic rules (as early AI systems did), ML processes data.

When data is changed, an ML algorithm 'learns'. For example: while a rule-based AI system may be programmed to administer a specific medicine if a patient's blood pressure falls within a set range under specified conditions, an ML application would process the table of all past patient records and infer prevalent statistical patterns. If the same system 'learns' from a different set of patient records, it is likely to induce a different set of probabilistic rules. If the data is inaccurate, irrelevant, or insufficient, an ML application will not be able to meaningfully induce rules from it. Further, ML by itself will not improve the ethics or biases already rooted within the data.

Conclusions: ML has uses in education and modern life, but it is bound by the scope, ethics and biases of the data it is trained on.

02 'Supervised' and 'unsupervised' algorithms

There are two types of commonly-used ML algorithms: supervised and unsupervised. Supervised ML algorithms are trained on a dataset that is selected by humans and that includes (usually human annotated) outcome labels.

To expand on the above example, whether past patients have responded well to a specific drug. Supervised ML algorithms may be heavily dependent on human annotation, and they make decisions based on the biases in that annotation. In contrast, unsupervised learning does not involve human guidance or supervision.

A third, less common type of ML is reinforcement learning. This uses feedback to learn the 'correct behaviour' but responds to a set of rewards and punishments, rather than an outcome value.

Conclusions: The key distinction between supervised and unsupervised algorithms is the level of human supervision inherent to the algorithm.

03 The differences between human and machine learning

Unlike the human brain, ML cannot solve problems to which it has not previously been introduced and trained to solve. Rose Luckin (2018a) named seven interwoven elements to human intelligence, which distinguish it from AI. These are:

1. Knowledge and understanding about the world.
2. Social intelligence.
3. 'Meta-knowing intelligence' – which is 'what it means to know something… and how to make judgements based on that.'
4. 'Meta-cognitive intelligence', which is the ability to 'interpret our own mental activity.'
5. 'Meta-subjective intelligence', which is about recognising emotions and regulating behaviours.
6. Our understanding of our physical interaction with our environment.
7. Accurate 'perceived self-efficacy', requiring 'an accurate, evidence-based judgement about ourselves.'

Conclusions: Luckin says the ability to reflect on learning, to socialise, feel emotions and develop sophisticated self-understanding and control are the core differences between human and machine cognitions.

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