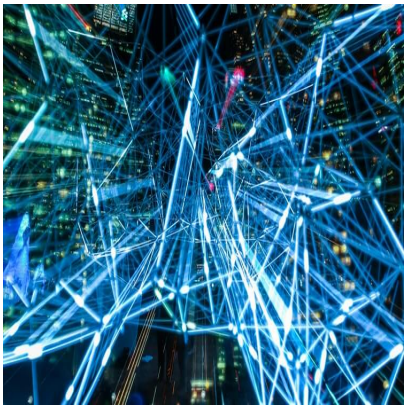

Description

This guest post is drafted by an expert team from MAGMA Learning. MAGMA Learning is a startup with the mission to enhance human learning with machine learning. Its personal AI tutor ARI 9000 helps companies and institutions consolidate the impact of learning on performance and innovation.

Have you ever had the feeling that your learning efforts are wasted? You've spent hours reading a book or article, only to realize one week later that you're incapable of recalling most of its interesting content. This forgetting phenomenon has been studied by experimental psychologists as early as 1885, when Hermann Ebbinghaus presented his "forgetting curve", which describes the exponential loss of information after learning. Although this state of affairs with human memory is rather discouraging, recent developments in artificial intelligence can come to the rescue.

Personalized spaced repetition

A well-established approach to fight exponential forgetting is to space out learning sessions. Researchers indeed showed that more information gets encoded into long-term memory by spaced repetition than by massed presentation. The idea is to wait until a concept has been almost forgotten before revising it, thus deepening each time its processing in memory and slowing down the forgetting rate.

This all sounds very well in theory, but how to know when a concept has been "almost forgotten" in practice? A number of rules of thumb has been proposed, such as doubling/halving the interval between revisions in case of successful/unsuccessful recall. However, such rules are very rigid and completely disregard the high variability in individual memory abilities. For example, if Alice has a passion for physics, she will learn physics much faster than others, as well as faster than herself in other subjects. Without taking into account these important variations, the revision schedule will quickly go offbeat and lose its effectiveness by repeating concepts too early (boring!) or too late (frustrating!).

A much better solution is made possible by artificial intelligence, or more precisely by machinelearning, whose algorithms are able to self-improve automatically with experience. The personal AItutor ARI 9000 developed by MAGMA Learning can indeed gradually build a representation of thememory of each learner. Through every interaction on the ARI 9000 app (for iPhone, Android, andweb), this representation becomes increasingly accurate, capturing not only knowledge levels for allconcepts learned, but also how fast they are being forgotten by the learner.

This personalized understanding of what learners know and how fast they are forgetting is precisely what is needed to provide them with optimal revision schedules: they get the right content at the right moment. The effectiveness of this intelligent spaced repetition has been demonstrated by several experiments are top institutions like EPFL, Harvard, Stanford, EHL, where students learning with ARI 9000 reached the top 15% in their cohorts.

Automatic question generation

The interactions between the personal AI tutor and the learner take the form of questions and puzzles of various types. One potential obstacle to the implementation of the intelligent spaced repetition outlined above is then the creation of a large enough pool of questions, which can laboriously take weeks or months by hand. Luckily, this task can also be automatized thanks to artificial intelligence. Cutting-edge natural language processing models are capable of analyzing learning material on any topic and to generate automatically a multitude of relevant questions about its key concepts and ideas. This implies that ARI 9000 can be deployed easily and rapidly, with no extra work for professors and trainers.

When learners start using the app, they select the learning programs in which they are enrolled and immediately get questions about their key points. Based on their performance, the personal AI tutor adapts the frequency and difficulty of the questions in order to keep learners engaged and challenged at just the right level. The benefits of adaptive learning kick in quite soon, typically after a few daily 5-minute sessions or a few weekly 20-minute sessions.

Two further principles of efficient learning are implemented in this approach: microlearning and active recall. Microlearning consists in decomposing complex ideas or procedures into bite-sized learning units so that they can be more usefully assimilated. The fact that the microlearning content is presented in the form of questions and puzzles is aligned with the principle of active learning, according to which actively stimulating memory during the learning process leads to better information retention.

Use cases are virtually unlimited. An academic researcher may use a personal AI tutor to help him quickly absorb key ideas from an article at the periphery of his expertise. A university student may use it whenever she has a break in her day to ensure that her knowledge is growing constructively throughout her studies and that she excels at her final exams. Employees in a company may use it to develop their soft skills and make sure their training efforts have a strong impact on their productivity.

Knowledge visualization

An additional benefit of learning with a personal AI tutor is that it can show you a visual representation

of your knowledge. This takes the form of a 3-dimensional constellation of points, called the Learnet (for “learning network”), where each point corresponds to a concept you’re learning. The concepts are spontaneously organized by subjects with AI techniques so that similar concepts appear as nearby points. The luminosity of each point represents your mastery of the corresponding concept, which allows you to get an immediate intuitive sense of the bright regions that you already master and of the dark regions that you still have to conquer.

The ability to visualize your knowledge at any time provides you with crucial feedback to motivate you to keep learning and to make you confident about your constructive progress. In fact, the usual lack of visibility on how well (or not) we are doing while learning should strike us as very disturbing: it’s rather like trying to learn to play the piano for a deaf person! This is why the Learnet plays such a crucial role in making learning more effective and transparent.

Content creators (professors, trainers, authors) also benefit from knowledge visualization. By averaging over Learnets, they can clearly identify where their learners are struggling more than anticipated and reformulate the corresponding content. Similarly, managers can globally visualize skills across their companies and get strategical insights to optimize competitiveness.

Making books alive

MAGMA Learning recently won the Vesalius Innovation Award, an international startup competition organized by Karger Publishers in Basel. In the context of publishing, the innovations described in this post can be understood as making books (and articles) personalized and interactive, or in a sense “alive”. The techniques used for automatic question generation can also be applied to produce summaries that are personalized to the knowledge levels of each reader. From that perspective, it is not readers that have to adapt to the unique content of a book, but rather books that adapt to the uniqueness of each reader! From an inert pile of printed paper, a book turns into an intelligent and dynamical experience that takes each reader into consideration.

Category

1. Industry News
2. Publishing News

Date Created
2021/01/19
Author
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